Strengthened Senior High School

DepED
DEPARTMENT OF EDUCATION

Lesson Exemplars for General Science

CORE SUBJECT



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If you have feedback on the LAS, please accomplish this form, which may be accessed through the following link: **https://bit.ly/Feedback_LE_LAS_Core**.

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Learning Title/Topic:	Chemical Reactions in Everyday Lives – Common Types of Chemical Reactions and Their Everyday Applications	Lesson Exemplar:	1

I. OBJECTIVES	
A. Content Standard	chemical reactions are part of human activities and present in the environment; and
B. Performance Standard	By the end of the quarter, learners apply research skills to discover how scientists have impacted our lives. They recognize the significant role of different agencies in the Philippines, such as DOST and DTI, in scientific innovation and development. They show critical thinking in explaining the different substances in household and personal care products, including their benefits and potential risks of using and disposing of them. They demonstrate appropriate and safe handling and use of chemicals. They explain that chemical reactions occur in human activities and the environment, and that several chemical solutions pose a threat to the community.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	learners in Grade 10 learned about several simple observations that indicate if a chemical reaction has taken place. They described the indicators for a chemical reaction as color change, the formation of a precipitate, the release of gas, and or odor, or a change in temperature with acids, bases, and salts. They also described important types of chemical reactions (combination, decomposition, single replacement, double replacement). Many types of chemical reactions are important in our daily lives and in the biotic and abiotic parts of the environment.
	1. explain some of the common types of chemical reactions and provide examples for the following: decomposition, acid on carbonates, acids on metals, and combustion; **2.** identify the type of chemical reactions that occur in our daily activities, including baking, cleaning, and burning;
II. REFERENCES and MATERIALS	BBC. 2021. “Reactions with Acids - Making Salts - GCSE Chemistry (Single Science) Revision - WJEC.” BBC Bitesize. BBC. 2021.

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	Sources of Activities: Helmenstine, Anne. “Chemical Equation for Baking Soda and Vinegar Reaction.” Science Notes and Projects, July 4, 2020. https://sciencenotes.org/chemical-equation-for-baking-soda-and-vinegar-reaction/. Svenja Lohner. “Vanishing Baking Soda.” Scientific American, August 17, 2017. https://www.scientificamerican.com/article/vanishing-baking-soda/. The Open University: Open Learn. “The Science of Alcohol.” The science of alcohol, n.d. https://www.open.edu/openlearn/mod/oucontent/view.php?id=83424§ion=2.2.1.Wade, Olin. “What Happens When You Mix Vinegar and Aluminum Foil?” Remodel Or Move, August 10, 2022. https://www.remodelormove.com/what-happens-when-you-mix-vinegar-and-aluminum-foil/. Wu, Steph. “Rusty Steel Wool Experiment.” www.kidspot.com.au, 2015. https://www.kidspot.com.au/parenting/things-to-do/rusty-steel-wool-experiment/news-story/a5106cb518eaa5c4103e71287debff2d. **Sources of Pictures:** Chemicalbook.com. (2024). Baking Powder And Vinegar Reaction_Chemicalbook. Chemicalbook.com. https://www.chemicalbook.com/article/baking-powder-and-vinegar-reaction.htm Evans, R. (2023, November 16). The Perfect Campfire: Using Kiln-Dried Wood for a Memorable Experience. Hillside Woodfuels. https://hswf.co.uk/blogs/burning-questions/perfect-campfire Helmenstine, Anne Marie. 2020. “Examples of Chemical Reactions Taking Place around You Every Day.” ThoughtCo. April 2, 2020. https://www.thoughtco.com/examples-of-chemical-reactions-in-everyday-life-604049. Zoom Drain Franchise. (2022, June 15). Will Vinegar And Baking Soda Unclog A Drain? Zoom Drain. https://www.zoomdrain.com/blog/2022/june/will-vinegar-and-baking-soda-unclog-a-drain-/

	Zulu, L. C., Kamoto, J. F. M., Djenontin, I. N. S., Jumbe, C. B. L., Pangapanga-Phiri, I., Richardson, R. B., Subakanya, M., Nzokou, P., & Makungwa, S. D. (2024). Promoting cleaner cooking technologies in urban Malawi: Assessing the acceptance of pellet-fed gasifier cookstoves from a pilot targeted distribution model. Energy for Sustainable Development, 83, 101570. https://doi.org/10.1016/j.esd.2024.101570 Presentation slides Materials for the magic tricks	
III. CONTENT *(Sequencing Content)*	Chemical Reactions in Everyday Lives – Common Types of Chemical Reactions and Their Everyday Applications	
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	Learners shall be able to: 1. Classify common chemical reactions—including decomposition, acids on carbonates, acids on metals, and combustion—using their reactants, products, and observable evidence. 2. Conduct a teacher-approved investigation and use recorded observations to identify evidence of a chemical reaction. 3. Identify chemical reactions in daily activities such as baking, cleaning, and burning, and explain their practical relevance.	
IV. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	***A.1. Activating Prior Knowledge***	
	Option 1: Gallery Walk	
	Materials/Resources Needed: • Displayed images or teacher-prepared visual prompts • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from

	Directions: Move through the assigned stations in order. Examine the information, image, evidence, or task at each station; record the required observations or responses; then use the lesson concepts to explain your conclusions. **Activity Proper:** Short review of the concept of chemical reactions and the indicators that a chemical reaction has occurred  Burning matchstick (Helmenstine, 2020) 	observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	 Acid-Base Reactions  For each picture, learners will record: a. the observed change, b. the possible evidence of chemical reaction, c. the possible reaction type, and d. the reason for their answer. The teacher should provide the learners with a mini organizer containing the guide questions. **Guide Questions:** 1. What observable change can you identify in the pictures? 2. What is common among all these pictures?	

	3. How do we know that a chemical reaction or a chemical change took place? 4. Are all reactions the same? Why or why not? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Teacher Demonstration: Evidence of a Chemical Reaction	
	Materials/Resources Needed: • 50 mL of 5% vinegar • 5 g of baking soda • one 250 mL flask • one balloon • tray • measuring tools • splash goggles **Directions:** Place the flask in a tray and add the vinegar. Put the baking soda inside the balloon, fit the balloon securely over the flask, and lift the balloon so the powder falls into the vinegar. Observe gas formation and any temperature change. Record observations before identifying the evidence of a reaction.	The activity targets Learning Objective 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

	Procedure: Safety: The teacher performs the demonstration. Wear goggles, keep learners at least 1 m away, prohibit tasting and direct smelling, clean spills with water, and dispose of the dilute mixture according to school rules. Do not use drain cleaner. **Guide Questions:** 1. What observations or evidence were most important in interpreting the result? 2. How do the results support or challenge the scientific concept investigated in the activity? **Expected Output/Product:** Recorded observations or data and an evidence-based conclusion supported by the activity results. **Assessment Criteria:** • Safe and correct performance of the procedure • Accuracy and completeness of observations or data • Scientific accuracy of the explanation or conclusion	**Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Essential Questions	
	Materials/Resources Needed: • meta cards or small pieces of paper • Markers or pens	The activity targets Learning Objectives 1 and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-

<table>
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Directions:
From the given purpose and goal of the lesson, give at least three terms and define or describe each term or provide examples related to it. Write your answers in a metacard. Post them in the appropriate column.

Activity Proper:
Building on the review, the teacher informs learners that subsequent lessons will focus on different types of chemical reactions, real-life examples, and their relevance to everyday life.
Introduce the activity to the learners. Ask them to write three words or terms related to the lesson on types of chemical reactions and describe each term by defining it or giving an example.

<table>
<tr><th>Terms</th><th>Meaning/Description/Example</th></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
<tr><td></td><td></td></tr>
</table>

For discussion purposes:
Once the table is complete, review all the vocabulary words together. Ask the learners to discuss the meanings of the words, share their ideas, and explain the importance of each word. Encourage active participation and provide clarification for any
</td>
<td>
Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.
</td>
</tr>
</table>

misconceptions, offering additional explanations or examples if necessary.

Guide Questions:

1. How do common types of chemical reactions, namely decomposition, combustion, reactions between acids and carbonates, and reactions between acids and metals, occur around us?
2. In what ways do chemical reactions shape our everyday lives/experiences?

Assessment Criteria:

• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

Option 2: Anticipation Guide

Materials/Resources Needed:

• Notebook or paper
• Pen or pencil

Directions:

Read each statement and mark whether you agree or disagree before the lesson. Revisit every statement after the activity and explain any response that changed.

Before Lesson	Statement	After Lesson
A	D	
[ ]	[ ]	1. Rusting on a car is actually a chemical reaction where two elements join together to make a completely new compound.

Activity Proper:
Introduce the anticipation guide to activate students' prior knowledge and build curiosity about the different types of chemical reactions, their real-life examples, and their relevance to everyday life. Learners should indicate whether they agree or disagree with the statements both before and after the instruction.

Guide Questions:
1. What did you observe, identify, or conclude from the activity?
2. How does your response connect to the scientific concept discussed in the lesson?

Assessment Criteria:
• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation

[ ]	[ ]	2. When an explosive or a firework detonates, matter is instantly destroyed and vanishes into nothing.
[ ]	[ ]	3. Digesting a sandwich and a car engine burning gasoline rely on the exact same broad category of chemical reaction.
[ ]	[ ]	4. Chemical reactions only happen inside science labs or industrial factories, not inside the human body or nature.
[ ]	[ ]	5. Batteries power our phones by using a reaction where elements swap places to release electrical energy.

[ ]	[ ]	6. When water boils and turns into steam on the stove, a chemical reaction has occurred.

The activity targets Learning Objectives 1 and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.

The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

Note to Teachers: Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

<table>
<tr><td rowspan="3">3. Instituting New Knowledge</td><td colspan="2">B.1. Presenting Examples</td></tr>
<tr><td colspan="2">Option 1: Reaction Stations</td></tr>
<tr><td>Materials/Resources Needed:
• Teacher-approved materials specified in the procedure
• Required safety equipment or personal protective equipment
• Notebook or paper
• Pen or pencil

Directions:
Move through each display or station, examine the provided evidence or task, record the required observations and answers, and explain each conclusion using the lesson concepts.

Procedure:
Divide the class into 5 groups. Each group will be assigned a station that represents a type of reaction. Each group will perform the experiment at each station within 7–10 minutes.

Station 1: (Synthesis)
Teacher-provided rusting time-lapse: Observe rust formation as an electrochemical redox process that commonly produces hydrated iron oxides. Do not classify rusting as a simple synthesis reaction.</td><td>The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.
The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.</td></tr>
</table>

	Station 2: (Decomposition) Hydrogen peroxide decomposed with yeast or potato catalyst (small-scale, with eye protection) Station 3: (Acid-Carbonate) React vinegar (acetic acid) with eggshell (calcium carbonate) to observe an acid-carbonate reaction. Station 4: (Acid-Metal) For a teacher-supervised acid–metal example, react a small piece of magnesium or zinc with dilute hydrochloric acid while wearing goggles and keeping all flames away. Vinegar or calamansi reacts too slowly with iron for a short station. Station 5: (combustion) Teacher demonstration of combustion: Place one tealight candle in a stable, fire-resistant tray and ignite it only if school safety rules permit. Keep learners at least 1 m away, tie back hair, remove flammable materials, provide a fire blanket or extinguisher, and extinguish the flame immediately after observation. Do not use alcohol-soaked cotton.	

After the experiment, the student will complete the table.

Station	Materials Used (reactants)	Observation	Product
1			
2			
3			
4			
5			

Science clarification: Rusting is a redox process that commonly forms hydrated iron oxides. Battery reactions depend on the cell chemistry and must not be described generally as elements 'swapping'.

Guide Question:
How do these changes help you identify the type of chemical reaction?

Assessment Criteria:
• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

Option 2: Predict–Observe–Explain

Materials/Resources Needed:

- Teacher-approved materials specified in the procedure
- Required safety equipment or personal protective equipment
- Notebook or paper
- Pen or pencil

Directions:

For each teacher-approved reaction, write a prediction, observe or conduct the safe procedure, record the evidence, and explain the reaction type using the observations.

Procedure:

Divide the class into 5 groups. Each group will be given the materials they need to design an experiment that represents a type of reaction. Each group will conduct a Predict–Observe–Explain (POE) activity using at least one safe, teacher-approved household experiment that demonstrates a type of chemical reaction, such as synthesis, decomposition, acid–carbonate, acid–metal, or combustion.

Experiment	Materials Used (provide description/ characteristics)	Predict the Product (Note the color, light, and type of material formed.)	Observation	Explain
1				
2				
3				
4				
5				

The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedures before the activity. Ask learners to explain the evidence behind each conclusion.

	Optional: To prepare the learners for the discussion of different types of reactions, the teacher may give a reading assignment about the different types of chemical reactions, focusing on the key concepts. **Guide Questions:** 1. How did the actual results compare to your predictions? What did you learn from this? 2. Why do you think the reaction happened the way it did? 3. Can you explain why your prediction was correct or incorrect? **Expected Output/Product:** Completed prediction–observation–explanation record containing the prediction, observed evidence, the identified reaction type, and the scientific explanation. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	B.2. Discussing New Concept	
	Option 1: Guided Analysis of Reaction Evidence	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies

	Directions: Use the results from the selected reaction activity to complete the organizer. Identify the reactants, products, observable evidence, reaction type, balanced equation, and one accurate everyday application. **Activity Proper:** Present the outputs of the activity (either option 1 or option 2). Discuss the answers to the questions on observed changes (color, temperature, gas released, and others). The teacher will identify the type or name of the reaction. Using the results of the experiment, guide the learners in verifying the identified type of chemical reaction through a graphic organizer. Use the questions under each column to help learners identify the reaction and provide a real-life example.	the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedures before the activity. Ask learners to explain the evidence behind each conclusion.

Reactants	Products	Observable Clues	Type of Reaction	Balanced Chemical equation	Real-Life Application
What substances were combined or used before the reaction?	What new substances were formed after the reaction?	What signs did you observe? (e.g., bubbles, temperature change, color change)	What type of reaction was observed?	What evidence shows that this is an acid–carbonate reaction, and what gas is produced? Write the balanced equation and identify the products.	Where can this type of reaction be found in daily life?
Vinegar and baking soda	Carbon dioxide (CO_2), water (H_2O), and sodium acetate	Bubbling/fizzing	Acid-Carbonate Reaction	$NaHCO_3 + CH_3COOH \rightarrow CO_2 + H_2O + NaC_2H_3O_2$	Classroom acid–carbonate example only; do not present the mixture as a reliable drain cleaner, and never combine it with commercial drain cleaners or other household chemicals

	Guide Questions: 1. What do you expect to see in the reactions? 2. What do you think will help you classify the experiment under each type of reaction? 3. What evidence supports the reaction? Write the balanced equation and identify the products. 4. How does understanding the general reaction form help you predict the products of similar reactions in real-life scenarios? 5. Which reactions are most common in our daily life? 6. Which of these could have environmental impacts? 7. Can you think of any safety concerns related to these reactions? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	B.3. Developing Mastery	
	Option 1: Matching Activity	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1 and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions.

	Directions: Match each item with the correct term, category, description, or process. Record each match and briefly explain the scientific basis for your answer. **Activity Proper:** Complete the task according to the directions and record the required observations, responses, or explanations. **Reaction scenarios:** • Rust forms on iron tools left in the rain. • Hydrogen peroxide is applied to a wound. • Bleach is used to clean a stain. • Silver jewelry tarnishes when left exposed to air. • A banana turns brown when left exposed to air. • Antacids react with stomach acid. • Eggshells (mostly calcium carbonate) are soaked in vinegar. • Fuel burns on a barbecue grill. • Food spoils over time. • Baking cakes or cookies releases carbon dioxide that helps the batter rise. • Vinegar reacts with basic deposits such as soap scum or hard-water scale. Classify each scenario as Synthesis, Decomposition, Acid–carbonate, Acid–metal, Combustion, or Other/Not one of the target reaction types. Do not force a scenario into a category when the evidence does not support that classification.	The pedagogical strategy used is formative assessment, supported by independent responses, brief justifications, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Guide Questions: 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Accuracy of responses • Completeness of the required answers	
	Option 2: Chem Feud	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Follow the stated game rules and respond when called. Give the scientifically correct answer and, when required, justify it using evidence or the relevant concept. **Activity Proper:** 1. Divide the class into teams. 2. The teacher will serve as the host and draw one reaction scenario card from a shuffled deck using the reaction scenarios provided in Option 1.	The activity targets Learning Objectives 1 and 3 by requiring learners to identify reaction types, cite evidence, and justify their classifications. It applies the Constructivist, Collaborative, and Interactive approaches because learners retrieve prior knowledge, discuss evidence with teammates, and respond to immediate feedback. The pedagogical strategy used is a game-based formative assessment, supported by team discussion, rapid classification, brief scientific justification, and corrective feedback. Literacy is integrated through listening to scenarios and explaining answers using accurate scientific terms. Numeracy is integrated through scoring and tallying team points. EdTech may be integrated through a digital buzzer or presentation when available, with non-digital alternatives.

	3. Each team will assign one representative per round. Team members must take turns serving as representatives. 4. After the host reads the scenario, the first representative to press the buzzer will be given the opportunity to answer. The representative must: a. identify the reaction type: synthesis, decomposition, acid-carbonate, acid-metal, or combustion; b. state the evidence presented in the scenario; and c. explain, within 10–20 seconds, why the scenario represents the identified reaction type. 5. A team may earn a maximum of three (3) points per scenario: a. one (1) point for identifying the correct reaction type; b. one (1) point for citing relevant evidence; and c. one (1) point for clearly explaining why the scenario represents the identified reaction type. 6. If the first team answers incorrectly or incompletely, the other teams may press the buzzer to attempt to answer the question. The team that provides the correct answer will receive the corresponding points. 7. The team with the highest total score at the end of the activity wins the Chem Feud. **Guide Questions:** 1. Which scientific concept was most important in determining the correct response?	**Note to Teachers:** Ensure that every team member serves as a representative at least once. Require an evidence-based justification and clarify misconceptions immediately after each round.

	2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
4. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Option 1: Reaction Detective: Chemical Reactions in Daily Life	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read or examine the assigned case or scenario. Identify the relevant evidence, apply the appropriate scientific concepts, answer the guide questions, and justify your conclusion. **Activity Proper:** Learners will analyze a household or personal care product to understand how its chemical ingredients work, identify household processes or activities that demonstrate the types of reactions involved, and examine their environmental implications. 1. Selection:	The activity targets Learning Objectives 1 and 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative.

	• Identify a common household/personal care product, such as: Shampoo, Toothpaste, Bleach, Vinegar, Air freshener, baking soda, Muriatic acid • Identify processes or activities at home (where the household/personal care product was used) that demonstrate the types of reactions 2. Task: • Read about the product to describe the process or activities at home where the product was used. • Guide Questions Answer the following: 3. Valuing Explain benefits and potential risks of using them (product) or doing them (process/activities) Checklist: Learners' output should include the product name, the ingredients or process involved, the possible reaction type, evidence or an explanation, a safety concern, an environmental implication, and the source used. Present the output to the class and discuss the guide questions. **Guide Questions:** 1. Reaction Detective: "Where do you see these reactions in daily life?" 2. What happens when we use this product? 3. What type of chemical reaction is involved in using the product (e.g., neutralization or decomposition)?	**Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	4. What is the importance of the activity/process that uses the product in our daily life? **Expected Output/Product:** A simple presentation with visuals or slides that contains the following: A. Selected Product; B. Household Process/Activity (with description). **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: Chemical Reaction Painting	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available) **Directions:** Create the specified visual output using accurate scientific information, clear labels or captions, and appropriate examples. Present or submit the output with a brief explanation of its main scientific message. **Activity Proper:** This activity will involve creating art using a chemical reaction. Learners will observe how acid-base reactions	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing

	can create visual effects and use these reactions to create artworks. Divide the class into groups and give each group an organizer for the art activity. Allow 20–30 minutes for the creation of their artwork. Post the outputs for a gallery walk. Gallery Walk (10 minutes): Have the groups post their output. Distribute to the groups sets of star stickers. Assign one member to introduce the output briefly to the viewers. The viewers may opt to give the output star stickers. **Guide Questions:** 1. How did the reaction affect your design? 2. How does understanding chemical reactions enhance creativity? **Expected Output/Product:** Completed chemical-reaction artwork with a brief explanation of the reaction and how it produced the observed visual effect. **Assessment Criteria:** • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedures before the activity. Ask learners to explain the evidence behind each conclusion.

	C.2. Making Generalization	
	Option 1: Question-and-Answer Synthesis	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Respond to each prompt using your prior knowledge and the lesson concepts. Discuss your reasoning with a partner or group, then refine your answer based on the evidence shared. **Activity Proper:** Ask the learners to write one question that reflects or summarizes what they have learned. Divide the class into 4 groups. Ask the learners to share the questions in the group. They may also try to answer the questions in the group. Let each group determine one question they would like to pose. When all the groups are ready, ask each group to pose their question in turn. Ask some volunteers to answer the questions. **Guide Questions:** 1. What is the most important scientific idea you developed from the activity? 2. What example or evidence best supports your explanation?	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Essential Questions	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Respond to each prompt using your prior knowledge and the lesson concepts. Discuss your reasoning with a partner or group, then refine your answer based on the evidence shared. **Activity Proper:** Complete the task according to the directions and record the required observations, responses, or explanations. **Guide Questions:** 1. How can you identify the type of chemical reaction occurring? 2. In what ways do chemical reactions play a role in everyday activities like cooking, cleaning, or using personal care products? 3. How does understanding chemical reactions help us in solving everyday problems or making better choices?	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

Assessment Criteria:
• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

C.3. Evaluating Learning

Option 1: Anticipation Guide Revisit

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Read each statement and mark whether you agree or disagree before the lesson. Revisit every statement after the activity and explain any response that changed.

Activity Proper:
Use the same anticipation guide. Ask learners to answer the 'after' part and verify with them what changes occurred in their responses.
Justify changes:
After answering the 'after' column, learners will choose two statements in which their answer changed and explain why their understanding changed.

Guide Questions:
1. What did you observe, identify, or conclude from the activity?

Before Lesson	Statement	After Lesson
A	D	
[ ]	[ ]	1. Rusting on a car is actually a chemical reaction where two elements join together to make a completely new compound.
[ ]	[ ]	2. When an explosive or a firework detonates, matter is instantly destroyed and vanishes into nothing.
[ ]	[ ]	3. Digesting a sandwich and a car engine burning gasoline rely on the exact same broad

<table>
<tr>
<td></td>
<td>2. How does your response or result connect to the scientific concept discussed in the lesson?

Assessment Criteria:
• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation</td>
<td>
<table>
<tr><td></td><td></td><td>category of chemical reaction.</td></tr>
<tr><td>[ ]</td><td>[ ]</td><td>4. Chemical reactions only happen inside science labs or industrial factories, not inside the human body or nature.</td></tr>
<tr><td>[ ]</td><td>[ ]</td><td>5. Batteries power our phones by using a reaction where elements swap places to release electrical energy.</td></tr>
<tr><td>[ ]</td><td>[ ]</td><td>6. When water boils and turns into steam on the stove, a chemical reaction has occurred.</td></tr>
</table>

The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.
</td>
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		The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Option 2: Exit Ticket: Quick Check	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it.	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate

	Activity Proper: Answer the following before leaving class: Identify and differentiate the different types of chemical reactions. **Guide Questions:** 1. What gas is released when vinegar reacts with baking soda? 2. What is a sign that combustion is occurring? 3. Which reaction involves a metal reacting with acid? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.
	C.4. Additional Activities	
	Option 1: ChemVlog	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil • Computer, tablet, or other available digital device, if needed **Directions:** Plan and record the required vlog. Present the selected real-life example, identify the relevant scientific process or reaction, explain the observable evidence, and follow all stated safety and group-contribution requirements.	The activity targets Learning Objectives 1 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading

	Activity Proper: Learners will analyze a household product to understand how its chemical ingredients work, identify household processes or activities that demonstrate the types of reactions involved, and examine their environmental implications. Selection: Observe three activities at home (e.g., cooking, cleaning, or heating). Describe what happens and identify the type of chemical reaction involved. **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea? **Expected Output/Product:** Recorded vlog that communicates the required scientific ideas clearly and accurately.	procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

Demonstrating Knowledge and Skills

Rubric

Criteria	4 – Excellent	3 – Proficient	2 – Developing	1 – Beginning
Scientific Accuracy	All scientific ideas are accurate, complete, and well explained.	Scientific ideas are mostly accurate with minor gaps.	Some correct ideas are present, but important errors or omissions remain.	Scientific content is largely inaccurate or incomplete.
Required Content and Evidence	Includes all required elements and supports the message with relevant evidence/ examples.	Includes most required elements and appropriate supporting evidence.	Includes some required elements; evidence is limited or weakly connected.	Many required elements are missing; little supporting evidence is provided.
Communication and Organization	Message is exceptionally clear, logical, and appropriate for the audience.	Message is clear and generally well organized.	Message is partly clear but organization is uneven.	Message is unclear, disorganized, or difficult to follow.
Presentation/Design Quality	Presentation or design strongly supports understanding and is purposeful and polished.	Presentation or design supports understanding with minor weaknesses.	Presentation or design only partly supports understanding.	Presentation or design does not support understanding.

Option 2: Video Creation

Materials/Resources Needed:

- Computer, tablet, or teacher presentation device
- Projector or display, when needed
- Speakers, when audio is needed

Directions:

Plan and produce the required video output. Include the specified scientific content, use clear narration or captions, and explain how the examples or evidence support the lesson concept.

The activity targets Learning Objectives 1 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based

	Activity Proper: Create a 3–5-minute vlog that includes: • Activity observed • Demonstration or reenactment of the chosen type of reaction in a relevant real-life setting, such as housekeeping, healthcare, or fire protection, if safe and appropriate. (If safe and possible; you may include members of the family). • Explanation of the type of chemical reaction observed • Description of the visible signs that helped you identify the type of reaction If done as a group, provide a report of the roles and contributions of the members of the group together with the video. Mention the assigned role such as researcher, videographer, presenter, scriptwriter. Show how the group worked together to plan, film, and edit the video. Tips: Creative visuals, props, or analogies to aid understanding Safety measure: Handle household chemicals like vinegar, baking soda and other carefully. Keep sharp objects like nails, knives and others away from children. Perform only teacher-approved, small-scale reactions in the designated laboratory area with goggles and appropriate ventilation. Never mix household cleaners, and keep ignition sources away from flammable liquids and hydrogen-producing reactions.	questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

Guide Questions:
1. What scientific idea is communicated most clearly in your output?
2. How does the evidence, example, or design feature in your output support that scientific idea?

Expected Output/Product:
Completed video-based output that communicates the required scientific ideas clearly and accurately.

Rubric:

Criteria	Highly Effective (4)	Developing / Meeting (3)	Emerging (2)	Ineffective (1)	Total
Chemistry Accuracy & Content	All chemical concepts, terms, equations, and explanations are completely accurate. Complex ideas are translated correctly for a general audience.	Most concepts are accurate. Contains 1–2 minor scientific errors or misconceptions that do not derail the main message.	Contains several scientific errors or noticeably misuses chemistry terminology. Explanations are confusing.	Major scientific inaccuracies throughout. Demonstrates a fundamental misunderstanding of the topic.	____
Real-World Relevance & Connections	Clearly and creatively connects the chemistry concept to	Connects the chemistry concept to everyday life, but the	Mentions a real-world application but fails to explain the actual	No real-world connection is made. The video presents only a	____

		everyday life. Explains why the audience should care with vivid examples.	connection is somewhat forced, generic, or superficial.	chemistry connecting the concept to the example.	static, textbook-style definition.	
	Engagement & Vlog Style	Highly engaging and uses a natural, conversational tone. Uses visual hooks, humor, or strong storytelling to keep the audience watching.	Engaging and clear. Sounds enthusiastic, but relies too heavily on reading from a script rather than talking to the camera.	Delivery is flat or monotone. The vlog feels like a formal classroom presentation rather than a dynamic video.	Delivery lacks energy or relies on reading the screen word for word and does not sustain audience attention.	____
	Production Quality (Video & Audio)	Audio is consistently clear, and the video is well lit and stable. Transitions are smooth. On-screen graphics, text, and B-roll effectively support the	Audio and video are clear, with minor issues (e.g., occasional background noise or slight framing issues). Text/graphics are helpful.	Audio is difficult to hear in parts, or video is blurry/shaky. Visual aids are distracting, cluttered, or poorly timed.	Audio is frequently unclear, or the video is difficult to view. The work shows little evidence of editing or purposeful framing.	____

		chemistry lesson.				
	Safety & Digital Citizenship	(If performing a demo) Perfect lab safety shown (goggles, gloves, etc.). All digital assets (music, images) are properly credited/copyright-free.	Safety gear is worn, but missing one element, or credit for external media is provided but incomplete.	Major safety violation during a demonstration, OR completely copied media/assets without any attribution.	Shows serious disregard for laboratory safety rules or uses copied video or script elements without attribution.	____
	Total Score					**____ / 20**
V. ASSESSMENT *(Assessing Learnings)*	• **Five-item multiple-choice assessment** Refer to the figure for questions 1–2.  Figure 2. Baking soda and vinegar (Chemicalbook.com, 2024)					

1. A spoonful of baking soda was placed into a glass with vinegar. Which type of chemical reaction occurs when vinegar and baking soda are combined?
   A. Combustion
   B. Acid–Carbonate Reaction
   C. Single Replacement
   D. Decomposition

2. Which of the following balanced chemical equations represents the reaction between vinegar and baking soda?
   A. $HCl + NaOH \rightarrow NaCl + H_2O$
   B. $CH_3COOH + NaHCO_3 \rightarrow CH_3COONa + CO_2 + H_2O$
   C. $Na + Cl_2 \rightarrow NaCl$
   D. $CH_4 + O_2 \rightarrow CO_2 + H_2O$

3. At a campsite, a hiker lights a dry piece of wood on fire. As the fire burns, the wood turns black, releases heat and light and produces smoke. (Figure 3) Which observation best indicates that a chemical reaction has taken place?
   A. The wood remains the same color and temperature
   B. The fire gives off heat, light, and smoke
   C. The wood cools down over time
   D. The mass of the fire increases



Figure 3. wood burning in the camp (Evans, 2023)

4. A family is considering vinegar and baking soda for a clogged kitchen sink (Figure 4). Which statement is scientifically accurate?

A. It produces electricity
B. It generates light
C. It is an acid–carbonate reaction that releases CO_2 gas.
D. It creates strong adhesives



Figure 4. Vinegar and baking soda to unclog kitchen sink (Zoom Drain Franchise, 2022)

5. You are part of a community project addressing the harmful effects of traditional combustion-based cooking (e.g., using wood or charcoal). Which of the following options best reflects a scientifically sound and sustainable recommendation for reducing harmful emissions while maintaining efficiency, and why?

A. Switch to electric stoves powered by coal plants, as they eliminate smoke inside the home.
B. Use kerosene stoves, because kerosene burns faster and produces less soot than wood.
C. Use a clean electric or solar cooker where feasible; a properly designed biogas stove can reduce household smoke, but it still produces combustion gases and its life-cycle impact depends on the fuel system.
D. Continue using wood but ensure it's dry, since dry wood burns more easily and with a hotter flame.



Figure 5. Cooking using wood or charcoal (Zulu et al., 2024)

Investigating Chemical Reactions

Complete the table.

Practical Scenario	**Reactants**	**Product**	**Observable Change**	**Type of Reaction**	**Balanced Chemical Equation**
Vehicle that runs on gasoline					
Formation of ammonia in manufacturing fertilizer					
Laboratory acid–metal reaction: zinc with dilute hydrochloric acid ($Zn + 2HCl \rightarrow ZnCl_2 + H_2$); acid rain is mainly associated with sulfuric and nitric acids, not hydrochloric acid.					

	Constructed-Response Item: Choose one daily activity such as baking, cleaning, or burning. Identify the type of chemical reaction involved and explain the evidence that a reaction occurred. **Assessment specification:** Use the heading 'Five-item multiple-choice assessment.' Number all items consecutively and retain only options that answer the stem. Scoring: Items 1–5 = 1 point each. For a constructed response, award 5 points: 2 points for the correct reaction type, 2 points for two relevant observations, and 1 point for a clear explanation.
VI. REFLECTION *(Feedback and Continuous Improvement)*	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery. 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? 6. What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take full responsibility for the content of this LE.

Learning Title/Topic:	Chemical Reactions in Everyday Lives – Chemical Equations in Biological and Environmental Processes	Lesson Exemplar:	2

I. OBJECTIVES	
A. Content Standard	chemical reactions are part of human activities and present in the environment; and
B. Performance Standard	By the end of the quarter, learners apply research skills to discover how scientists have impacted our lives. They recognize the significant role of different agencies in the Philippines, such as DOST and DTI, in scientific innovation and development. They show critical thinking in explaining the different substances in household and personal care products, including their benefits and potential risks of using and disposing of them. They demonstrate appropriate and safe handling and use of chemicals. They explain that chemical reactions occur in human activities and the environment, and that several chemical solutions pose a threat to the community.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	Note: learners should have foundational or prior knowledge of the following concepts for them to be able to grasp the given competency easily: ✓ Basic chemistry (atoms, molecules, chemical reactions), ✓ Life science (cell structure, energy processes), ✓ Environmental science (ecosystems, carbon cycle, impact of human activities), ✓ Mathematical reasoning (balancing equations and recognizing patterns). *Prior to lesson objectives, have a description of the assumed prior knowledge and skills that learners have acquired in the previous grade level, which are essential for their successful engagement with the current lesson. These assumptions can also serve as a basis for designing diagnostic assessments.*
	6. use chemical equations to show biological and environmental processes such as photosynthesis and respiration;

II. REFERENCES and MATERIALS (*Selecting Resources and Materials*)	• Video: *Photosynthesis and Respiration* • *https://www.youtube.com/watch?v=BsVIPnIeYFs* • Simulation: Carbon cycle visualization (e.g. NASA Climate Kids, Amoeba sisters) • https://science.nasa.gov/kids/earth/what-is-the-carbon-cycle/?utm_source=copilot.com • Graphic organizers, anchor charts, and visual aids • Case studies (e.g., Amazon deforestation, ocean acidification) • Online quiz tools (Kahoot, Quizizz, Google Forms, or any available online quiz platform) • Slide Decks or any Interactive digital notebooks • Other relevant materials	
III. CONTENT *(Sequencing Content)*	Chemical Reactions in Everyday Lives – Chemical Equations in Biological and Environmental Processes	
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	Learners shall be able to: 1. Identify the reactants, products, coefficients, and other key components of a chemical equation. 2. Write and analyze balanced equations for photosynthesis and aerobic respiration. 3. Use the equations to explain how atoms are rearranged and how chemical energy is transferred during these processes. 4. Apply the equations to explain dynamic carbon cycling and changing carbon reservoirs in biological and environmental contexts.	
IV. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	***A.1. Activating Prior Knowledge***	
	Option 1: Brainstorming & Word Association	
	Materials/Resources Needed: • Whiteboard/Chalkboard or chart paper • Markers/Chalk	The activity targets Learning Objectives 1 and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective,

	• Digital tool (optional: interactive whiteboard or word cloud generator)
	• Prepared term list (energy, molecules, photosynthesis, metabolism)
	
	Directions:
	List the required lesson terms, define each in your own words, give an accurate example or connection, and share or post the responses as instructed.
	
	Activity Proper:
	1. Introduce the Prompt
	  • Engage prior knowledge with a guiding question.
	  • Allow brief individual reflection
	  • Encourage everyday examples like rusting, digestion, and photosynthesis
	2. Facilitate Word Association
	  • Connect scientific terms through shared ideas.
	  • Ask students to share associated words.
	  • Record responses on the board or on a digital tool (optional).
		and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis.
		The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative.
		
		Note to Teachers: Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

	• Highlight links among energy, molecules, photosynthesis, and metabolism. • Clarify misconceptions and reinforce vocabulary. 3. Synthesize and Transition • Summarize associations to bridge into the lesson. • Group related terms (energy transfer, biological processes) • Emphasize connections to lesson objectives. • Use synthesis as a transition to chemical reactions in living systems. **Guide Question:** Write: "What do you know about chemical reactions in nature?" on the board. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

	Option 2: Matching Activity	
	Materials/Resources Needed: • Word cards with terms • definition/example cards • board/chart for group review **Directions:** Match each item with the correct term, category, description, or process. Record each match and briefly explain the scientific basis for your answer. **Activity Proper:** 1. Introduce the Task Write the key terms (reactants, products, and coefficients) on the board. Explain that students will match each term with its definition or a real-world example of a chemical reaction. 2. Facilitate Matching Distribute cards with terms and definitions/examples. Guide students to pair them correctly, encouraging discussion of why each match makes sense. Record correct matches visibly (board or chart).	The activity targets Learning Objectives 1 and 2 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	3. Synthesize and Transition Summarize the matched pairs, clarifying misconceptions and reinforcing accurate vocabulary. Connect the terms to the upcoming lesson objectives on chemical reactions in living systems. **Guide Questions:** 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Chemical Equation Puzzle Match	
	Materials/Resources Needed: • Pre-cut cards with equation components • definition/label cards (Reactant, Product, Coefficient) • board/chart for group review	The activity targets Learning Objectives 1 and 2 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions.

	• Sample Cards:
	• Cards for the Photosynthesis Equation
	  • Card 1: "6 CO_2"
	  • Card 2: "6 H_2O"
	  • Card 3: "$C_6H_{12}O_6$"
	  • Card 4: "6 O_2"
	• Cards for the Cellular Respiration Equation
	  • Card 6: "$C_6H_{12}O_6$"
	  • Card 7: "6 O_2"
	  • Card 8: "6 CO_2"
	  • Card 9: "6 H_2O"
	  • Card 10: "ATP" (optional, to indicate the energy currency generated)
	
	Directions:
	Match each term, example, process, equation component, or scenario with the correct category or description. Record every match and justify it using the lesson concepts.
	
	Activity Proper:
	1. Introduce the Task - Students will recognize and define reactants, products, and coefficients. Display sample cards (e.g., 6CO_2, Reactant,
		The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print.
		
		Note to Teachers: Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Product, Coefficient). Explain that pairs will match components with correct labels. Highlight the goal: reconstructing a complete equation 2. Facilitate Matching - Guide students to pair cards and rebuild equations. Distribute pre-cut cards for photosynthesis and respiration. Have pairs match terms with definitions/examples. Encourage discussion of why each match is correct. Record correct matches on the board or chart 3. Synthesize and Transition - Summarize matches and connect to lesson objectives. Clarify misconceptions and reinforce vocabulary. Emphasize links to upcoming objectives on chemical reactions in living systems. Science clarification: Keep the balanced molecular equation for aerobic respiration separate from the energy statement. Glucose and oxygen are rearranged into carbon dioxide and water; part of the released chemical energy is transferred to ATP and other forms. ATP is not an	

	ordinary product in the molecular equation. **Guide Question:** Review as a class with the prompt: "What makes an equation complete and balanced?" **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	
	Option 2: Real-Life Chemistry Connection	
	Materials/Resources Needed: • Materials with examples of everyday chemical reactions • research materials (textbooks, internet access) • board/chart for recording equations • Sample materials: • Sample list sheet: A list providing a few common reactions with short descriptions Examples include: • Rusting of Iron: An iron oxidation process that occurs slowly when exposed to oxygen and water	The activity targets Learning Objectives 3 and 4 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative.

	• Combustion of Methane (Burning Fuel): A reaction that yields carbon dioxide and water upon burning of methane in air
	• Digestion of Food: A simplified account of how enzymes assist in the breakdown of food molecules (optional, if simplified to a key reaction)
	• Internet-enabled device, if available
	• Writing and diagramming notebooks or electronic devices
	
	Directions:
	Select the assigned real-life process, identify its reactants and products, write and balance the appropriate chemical equation, and explain what the equation represents.
	
	Activity Proper:
	1. Motivation with Everyday Reactions
	  • Briefly connect chemical equations to familiar daily processes.
	  • Provide displayed or teacher-provided prompt with examples (rusting, combustion, digestion)
		Note to Teachers: Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	• Use these only as quick motivation • Transition to biological focus 2. Photosynthesis and Respiration: A Quick Focus • Guide students to research and write equations for key biological processes. • Assign pairs to study photosynthesis or respiration • Identify reactants, products, and coefficients • Write balanced equations highlighting components 3. Class Presentation and Discussion • Let learners present findings to reinforce biological and environmental relevance. • Clarify misconceptions and emphasize balanced equations. • Synthesize by linking to the dynamic carbon cycling and changing carbon reservoirs and energy flow. Science clarification: Keep the balanced molecular equation for aerobic respiration separate from the energy statement. Glucose and oxygen	

<table>
<tr><td></td><td>are rearranged into carbon dioxide and water; part of the released chemical energy is transferred to ATP and other forms. ATP is not an ordinary product in the molecular equation.

Guide Question:
Prompt with: “Where do we see these reactions in daily life?”

Assessment Criteria:
• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation</td><td></td></tr>
<tr><td rowspan="3">B. Instituting New Knowledge</td><td colspan="2">B.1. Presenting Examples</td></tr>
<tr><td colspan="2">Option 1: Interactive Simulation (Carbon Cycle in Agricultural & Forest Ecosystems)</td></tr>
<tr><td>Materials/Resources Needed:
• Carbon cycle simulation tool
• Computers/tablets with internet access
• Board/Chart for recording findings

Directions:
Run or examine the specified simulation, change only the assigned variable or condition, record the</td><td>
<table>
<tr><td>Change in CO_2</td><td>Cause</td><td>Observation</td><td>Explanation</td></tr>
<tr><td>Increase</td><td>Slash-and-burn (Kaingin)</td><td>Higher CO_2 levels recorded</td><td>Burning releases stored carbon into the atmosphere</td></tr>
</table>
</td></tr>
</table>

	results, and explain the observed pattern using the lesson concept. Use the printed alternative when digital access is unavailable. **Activity Proper:** Alternative (No Computers/Internet): Printed diagrams of the carbon cycle in forests, rice paddies, and mangroves, Scenario cards describing practices (forest clearing or burning, reforestation, soil conservation, and reduced-open-burning farming practices), Group organizer for predicting CO_2 changes and discussing impacts. The teacher may use the following videos as supplementary resources. The first video explains how agriculture impacts the carbon cycle, while the second provides a broad overview of matter cycling in ecosystems (carbon, nitrogen, oxygen, and water). Under the teacher's guidance, students adjust variables like slash-and-burn agriculture (kaingin), reforestation activities, and organic	<table><tr><td>Decrease</td><td>Reforestation</td><td>Lower CO_2 levels observed</td><td>Trees absorb CO_2 during photosynthesis</td></tr><tr><td>Stable</td><td>Organic farming</td><td>Minimal CO_2 fluctuation</td><td>Sustainable practices reduce excess emissions</td></tr></table> The activity targets Learning Objectives 3 and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	agricultural practices to monitor CO_2 variations. The discussion aims to connect the findings to local agricultural methods and their impact on carbon uptake and release. **Guide Questions:** 1. https://www.youtube.com/watch?v=2gYEhUBk9mk 2. https://www.youtube.com/watch?v=hwt3gzUdAEg 3. Students use a carbon cycle simulation (https://www.youtube.com/watch?v=-wSqQiihf7c) tailored to rural environments, highlighting CO_2 levels in forests, rice paddies, and mangrove coastlines. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

Option 2: Lab Activity (Photosynthesis & Respiration in Agricultural Crops & Native Plants)

Materials/Resources Needed:

- Items needed for the CO_2 indicator test
- Aquatic Plant Sample: Obtain healthy aquatic plants from local irrigation canals or paddy fields
- CO_2 Indicator Solution: Bromothymol Blue is widely used due to its ability to change color following pH changes induced by the dissolution of CO_2
- Clear containers
- Sealable Vessels: Tiny glass or plastic bottles (one for test, one for control)
- Dropper or Pipette: To precisely measure the indicator
- Aluminum Foil or Dark Cover: (Optional) To produce a dark environment that prevents photosynthesis
- Timer/Clock: To track the testing time
- Notebook and Pen: For note-taking of observations (or digital observation devices)

CO_2 Change	Cause/ Condition	Observation (Color/ Indicator)	Explanation (Process)
Increase	Dark cover (respiration)	Bromothymol Blue turns yellow	Respiration can release CO_2, which may lower pH.
Decrease	Sunlight exposure	Bromothymol Blue turns blue	Photosynthesis can consume CO_2, which may raise pH.
Stable	Control setup (no plant)	No color change	The no-plant control does not contain the selected aquatic plant, but microorganisms may still affect dissolved carbon dioxide. Use clean, teacher-prepared materials and interpret the

Directions:
Follow the teacher-approved procedure and all safety instructions. Make the required observations or measurements, record the results accurately, and explain what the evidence shows about the scientific concept being investigated.

Procedure:
Leaf Collection & Photosynthesis Test
Collect fresh leaves from local crops (banaba, rice, coconut, banana).
Group leaves by sunlight exposure and water availability.
Place in sealed containers under different light conditions.
Record leaf color and moisture only as observations of leaf condition; they are not direct indicators of photosynthesis. To compare photosynthetic activity, use a validated classroom method such as a leaf-disk flotation assay or a supervised starch test with an appropriate control.
Record findings.
CO_2 Indicator Respiration Test

			comparison cautiously.
Variable	Different crop leaves are used	Mixed color changes	Photosynthesis/ respiration rates vary by crop

The activity targets Learning Objectives 2, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.
The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Collect aquatic plants from irrigation canals/paddies. Fill two vessels with water samples; add Bromothymol Blue. Place one in light and one in dark (foil cover). Record bromothymol-blue color and interpret it only as an indirect pH change associated with dissolved carbon dioxide. A color change alone does not prove that photosynthesis or respiration occurred; include equal volumes, a no-plant control, fixed exposure time, and replicate samples. Data Analysis & Comparison Compare leaf photosynthesis rates and CO_2 shifts in aquatic plants. Relate findings to rain-fed vs. irrigated farming practices. Discussion & Reflection Discuss how sunlight, water, and the environment affect photosynthesis/respiration. Propose sustainable farming practices (e.g., crop placement, irrigation strategies). Science clarification: Keep the balanced molecular equation for aerobic respiration separate from the	

	energy statement. Glucose and oxygen are rearranged into carbon dioxide and water; part of the released chemical energy is transferred to ATP and other forms. ATP is not an ordinary product in the molecular equation. Required investigation protocol: Use teacher-prepared 0.04% bromothymol blue, 10 mL per labeled transparent container, equal sample volumes, a no-treatment control, a fixed exposure time, goggles, and teacher-managed disposal. The color is an indirect indicator of pH change associated with dissolved carbon dioxide; it is not a direct carbon-dioxide measurement. Mouth pipetting is prohibited. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson?	

	Expected Output/Product: Recorded observations or data and an evidence-based conclusion based on the activity results. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	B.2. Discussing New Concept	
	Option 1: Interactive Diagram – Ecosystem Breathing Cycle	
	Materials/Resources Needed: • Chart paper/board or digital drawing tool • markers or symbols for arrows • sample equation cards • Optional EdTech Tools: digital diagramming tools or interactive flowchart apps **Directions:** Construct the required diagram or flowchart, label all essential parts or stages, show the relationships accurately, and add a brief scientific	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative.

	explanation of how the system or process works. **Activity Proper:** • Students work in groups to draw or create a flowchart linking photosynthesis, respiration, and carbon movement. • Each group must represent energy flow using arrows and symbols (e.g., plants as photosynthesizers and respirers, and animals as respirers; both plants and animals carry out cellular respiration). • The groups should present their models and explain how disrupting one part affects the entire cycle. Sample flowchart explanation: Plants take in atmospheric CO_2 during photosynthesis. Using light energy, plants convert carbon dioxide and water into glucose and oxygen. The glucose supports growth and cellular functions, while oxygen is released into the atmosphere. lants and animals use oxygen in cellular respiration, during which energy from glucose is captured in ATP, while	**Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	carbon dioxide and water are produced. Some of the released carbon dioxide returns to the atmosphere and can be used again in photosynthesis. [Atmospheric CO_2] │ ▼ [Photosynthesis in Plants] ($6CO_2 + 6H_2O$ + light → $C_6H_{12}O_6 + 6O_2$) │ ▼ [Glucose & Oxygen] │ │ │ ▼ │ [Oxygen Released to │ the Atmosphere] │ ▼ [Plants Use Glucose for Growth & Cellular Respiration] │ ▼ [Respiration in Plants] ($C_6H_{12}O_6 + 6O_2$ → $6CO_2 + 6H_2O$ + energy (captured in ATP and released as heat))	

	| ▼ [CO_2 Released Back to Air] | ▼ [Atmospheric CO_2] **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea? **Expected Output/Product:** Completed labeled diagram or flowchart with accurate relationships and a brief scientific explanation. **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	

	Option 2: Real-World Analogies – "Earth Breathes Through Trees"	
	Materials/Resources Needed: • Open classroom space for role-play • Cue cards for roles (trees, animals) **Directions:** Use the assigned analogy or class demonstration to trace carbon uptake and release, identify the process represented by each role, and explain both the value and limits of the analogy. **Activity Proper:** 1. Discussion Prompt: Compare Earth's carbon cycling to the exchange of gases involved in breathing, using photosynthesis and respiration as examples. 2. Analogy: Trees act as lungs; human activities disrupt balance, just as pollution affects human lungs. 3. Interactive Demonstration: Half the class represents trees "inhaling" CO_2, half represents animals "exhaling" CO_2. Reduce "trees" to show deforestation's impact.	The activity targets Learning Objectives 3 and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Guide Questions: 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • • Clarity of explanation	
	B.3. Developing Mastery	
	Option 1: Peer Teaching through Carbon Cycle Storytelling	
	Materials/Resources Needed: • Paper/markers or digital tools for storytelling • Cue cards for narration prompts **Directions:** Prepare and present the assigned role-play, story, relay, or monologue so that the sequence and scientific relationships are accurate. Explain the concept represented after presenting.	The activity targets Learning Objectives 1, 3, and 4 by engaging learners in modeling interactions among components and explaining how the represented system works. It applies the Constructivist, Collaborative, and Interactive approaches because learners take roles, negotiate meaning with peers, and connect the model to scientific explanations. The pedagogical strategy used is guided simulation or role-play, supported by assigned roles, observation prompts, debriefing, and teacher questioning. Literacy is integrated by using scientific terms in oral explanations and written debriefing responses. Numeracy is integrated through tracking sequences, quantities, or response patterns when these are part of the model. EdTech is integrated through an animation or digital model when available, with an equivalent physical model.

	Activity Proper: Students work in pairs or small groups to create a narrative about the journey of a carbon atom. They should integrate scientific concepts such as photosynthesis, respiration, combustion, and ocean absorption to tell the story. The narration may include illustrations, role-playing, or digital storytelling to illustrate the movement of carbon through different ecosystems. Finally, each group presents its carbon cycle story to the class. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson?	**Note to Teachers:** State the limits of the model and correct any analogy that learners may interpret literally. Debrief the activity using evidence-based questions.

Instituting New Knowledge

Rubric

Criteria	4 – Excellent	3 – Proficient	2 – Developing	1 – Beginning
Scientific Accuracy	All scientific ideas are accurate, complete, and well explained.	Scientific ideas are mostly accurate with minor gaps.	Some correct ideas are present, but important errors or omissions remain.	Scientific content is largely inaccurate or incomplete.
Required Content and Evidence	Includes all required elements and supports the message with relevant evidence/examples.	Includes most required elements and appropriate supporting evidence.	Includes some required elements; evidence is limited or weakly connected.	Many required elements are missing; little supporting evidence is provided.
Communication and Organization	Message is exceptionally clear, logical, and appropriate for the audience.	Message is clear and generally well organized.	Message is partly clear but organization is uneven.	Message is unclear, disorganized, or difficult to follow.
Presentation/Design Quality	Presentation or design strongly supports understanding and is purposeful and polished.	Presentation or design supports understanding with minor weaknesses.	Presentation or design only partly supports understanding.	Presentation or design does not support understanding.

Option 2: Graphic Organizers (Cause & Effect Chart)

Materials/Resources Needed:
• Chart paper or digital organizer tools
• Markers for cause-effect mapping

The activity targets Learning Objectives 2, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the

	Directions: Study the graph, chart, or data set carefully. Identify the relevant patterns or trends, support each interpretation with specific evidence from the data, and answer the guide questions. **Activity Proper:** Students construct a visual map showing cause-and-effect relationships between photosynthesis, respiration, and ecological disruptions. Examples: How deforestation can reduce photosynthetic activity and affect local oxygen and carbon cycling How burning fossil fuels increases atmospheric CO_2 How reduced photosynthesis and primary production can affect food chains Learners should present their findings through group discussions or gallery walk activities, reinforcing conceptual connections. Sample Visual Map:	Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

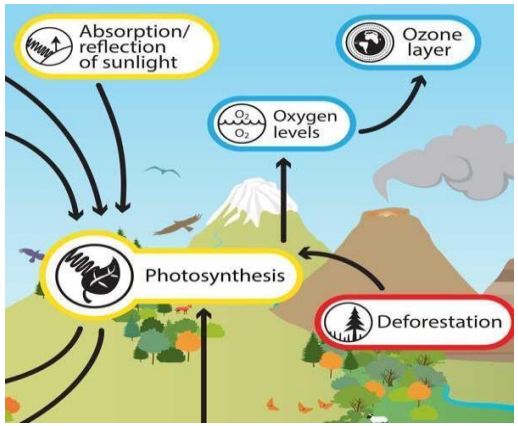


Photo taken from: https://ugc.berkeley.edu/background-content/photosynthesis/

Guide Questions:

1. What pattern, trend, or relationship is shown by the data?
2. What specific evidence from the data supports your interpretation?

Assessment Criteria:

- Scientific accuracy and relevance of ideas
- Completeness or depth of response
- Clarity of explanation

<table>
<tr><td rowspan="3">C. Demonstrating Knowledge and Skills</td><td colspan="2">C.1. Finding Practical Application</td></tr>
<tr><td colspan="2">Option 1: Role-Playing Activity (Carbon Cycle Simulation)</td></tr>
<tr><td>Materials/Resources Needed:
• Cue cards with roles (tree, animal, decomposer, ocean, factory, fossil fuel)
• Red cards to symbolize excess CO_2
• Open classroom space for movement-based interactions
• Computer, tablet, or other available digital device, if needed

Directions:
Participate in the assigned simulation or performance according to your role. Represent the scientific process or relationship accurately, then explain what your role or sequence demonstrates.

Activity Proper:
Learners are assigned roles representing different components in the carbon cycle (e.g., tree, animal, decomposer, ocean, factory, fossil fuel).
Each role includes movement-based interactions: The trees "inhale" CO_2</td><td>The activity targets Learning Objectives 3 and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.
The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.</td></tr>
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	and release oxygen through a hand gesture or breathing action. The animals "release" CO_2 to represent cellular respiration through pretend respiration movements. As a human intervention scenario unfolds (e.g., deforestation, industrialization), students adjust their movements accordingly to reflect ecosystem disruptions. Discussion & Debriefing: • Learners should reflect on changes during the activity. • The teacher should prompt these questions for analysis: **Guide Questions:** 1. What happened when trees were removed from the cycle? 2. How did the increase in CO_2 affect the environment?	

<table>
<tr>
<td>Demonstrating Knowledge and Skills</td>
<td>
Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>Accurate and complete; no misconceptions.</td><td>Mostly accurate; minor gaps.</td><td>Partly accurate; important gaps remain.</td><td>Limited or inaccurate understanding.</td></tr>
<tr><td>Completeness</td><td>All required elements are present and fully developed.</td><td>Most required elements are present.</td><td>Some required elements are incomplete.</td><td>Many required elements are missing.</td></tr>
<tr><td>Application/ Evidence</td><td>Uses relevant evidence and applies the concept effectively.</td><td>Uses appropriate evidence with minor limitations.</td><td>Evidence or application is limited.</td><td>Little or no relevant evidence/application.</td></tr>
<tr><td>Clarity</td><td>Response/output is clear, logical, and easy to follow.</td><td>Generally clear and organized.</td><td>Some parts are unclear or disorganized.</td><td>Unclear or difficult to follow.</td></tr>
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Option 2: Climate Action Challenge (Designing Sustainability Projects)
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<tr>
<td>Materials/Resources Needed:
• Chart paper or digital slides for project design
• Markers for brainstorming visuals

Directions:
Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles,</td>
<td>The activity targets Learning Objectives 3 and 4 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product.
The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is</td>
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	and a way to evaluate the result. Present and justify the proposal. **Activity Proper:** Learners should brainstorm and design small-scale projects that promote sustainability (e.g., carbon reduction strategies). Possible initiatives are: Urban school settings: Designing vertical gardens to offset CO_2. Rural schools: Advocating agroforestry, mangrove restoration, or another locally appropriate sustainability initiative. Community-driven projects: Creating awareness campaigns on reducing carbon footprints. The groups showcase their project concepts and outline the steps for implementation. Implementation & Reflection: • Learners should assess the feasibility and effectiveness of solutions. • Learners should write personal reflections based on these questions:	integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Guide Questions:

1. How does this project help reduce human impact on the carbon cycle?
2. What challenges might arise when implementing these solutions?

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Contains major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little relevant evidence or provides unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				**____ / 15**

	C.2. Making Generalization	
	Option 1: Interactive Class Discussion (Guided Peer Dialogue)	
	Materials/Resources Needed: • Prompt cards with scenarios/questions • Board/Chart for recording key ideas • Cue cards for group spokespersons **Directions:** Respond to each prompt using your prior knowledge and the lesson concepts. Discuss your reasoning with a partner or group, then refine your answer based on the evidence shared. **Activity Proper:** Activity Description: Opening Prompt: Learners form initial responses and share ideas in small groups before engaging in a whole-class discussion. Discussion Rotation: The class should be divided into groups, with each group addressing a specific question related to photosynthesis, respiration, or human impact on the carbon cycle.	The activity targets Learning Objectives 3 and 4 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Each group rotates its spokesperson, ensuring diverse perspectives are shared. Socratic Questioning & Debate: Students defend their reasoning using scientific evidence. **Guide Questions:** 1. The teacher presents a thought-provoking scenario (e.g., "Imagine a world with severe loss of forests and other photosynthetic organisms—how would primary production, habitats, carbon uptake, and the oxygen–carbon cycles change? Note that atmospheric oxygen would not disappear immediately because it is a very large reservoir."). 2. The teacher introduces opposing viewpoints (e.g., "Some argue human activity disrupts the carbon cycle beyond repair, while others claim nature adapts. What do you think?"). **Assessment Criteria:** • Scientific accuracy and relevance of ideas	

	• Completeness or depth of response • Clarity of explanation	
	Option 2: Peer-to-Peer Review & Journaling (Collaborative Writing-Based Assessment)	
	Materials/Resources Needed: • Science journals or notebooks • Feedback prompts • cue cards for guiding peer review **Directions:** Write the required journal response, exchange it with a partner, use the criteria to provide specific feedback, and revise the explanation before submission. **Activity Proper:** Activity Description: Carbon Cycle Journaling: Learners keep a personal science journal recording insights from class discussions, diagrams, and research findings. Each entry includes a question or thought-provoking statement to ensure reflective writing. Journal Exchange & Feedback: he teacher should pair learners to exchange journals, review their peers'	The activity targets Learning Objectives 3 and 4 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	work, and provide feedback on interpretations and explanations. Suggested feedback prompts: Final Revision & Summary: After the peer review, learners refine their journal entries, ensuring clarity of concepts and deeper engagement. **Guide Questions:** 1. What part of this entry resonated most with you? 2. Can you suggest a more detailed explanation for this concept? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	C.3. Evaluating Learning	
	Option 1: Poster/Infographic Designing	
	Materials/Resources Needed: • Poster paper or digital infographic tools • Markers • Coloring materials • Reference materials on respiration	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

	• Human impacts **Directions:** Study the graph, chart, or data set carefully. Identify the relevant patterns or trends, support each interpretation with specific evidence from the data, and answer the guide questions. **Activity Proper:** Learners design a visual representation (poster/infographic) explaining the carbon cycle, its balance through photosynthesis and respiration, and human impacts on it. **Guide Questions:** 1. What pattern, trend, or relationship is shown by the data? 2. What specific evidence from the data supports your interpretation? **Expected Output/Product:** Completed infographic with accurate scientific content, clear visual organization, and a brief explanation or presentation.	The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Rubric

Criteria	Full Credit	Partial Credit	Minimal Credit	Total
Accuracy	10 points — Information is scientifically accurate and free of misconceptions.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Clarity	10 points — Ideas are organized and easy for the intended audience to understand.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Relevance	10 points — Content directly addresses the assigned scientific process or issue.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Visual Appeal	10 points — The layout and visual elements support comprehension.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Real-life Connection	10 points — Explains a specific and scientifically accurate connection to everyday life or the community.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Maximum Score				____ / 50

	Option 2: Capstone Project	
	Materials/Resources Needed: • Chart paper or digital slides for project design • Markers for visuals **Directions:** Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal. **Activity Proper:** • Students propose, design, and present a real-life solution to reduce carbon emissions in the school or community, integrating science concepts and technology. • Possible initiatives: • School-based projects (e.g., vertical gardens, waste segregation systems). • Community-based projects (e.g., agroforestry, mangrove restoration, awareness campaigns).	The activity targets Learning Objectives 3 and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	• Groups showcase their project concepts and outline implementation steps. Learners should make a capstone project based on this: “Our Carbon Solution.” • Learners should propose, design, and present a real-life solution to reduce carbon emissions in the school or community, integrating science concepts and technology. • Rubrics will include the following: • Required task specifications: State the group size, time allocation, required deliverable, evidence requirements, checkpoints, individual responsibilities, and submission format before learners begin. **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea?	

Rubric

Criteria	Full Credit	Partial Credit	Minimal Credit	Total
Problem Framing	10 points — Clear identification of the carbon-related issue in the school/community.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Investigation	10 points — Use of research, data gathering, or observation to understand the problem.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Data Analysis	10 points — Logical interpretation of findings to support the proposed solution.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Solution Design	10 points — Creativity, feasibility, and scientific accuracy of the proposed intervention.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Communication	10 points — Clarity, organization, and effectiveness in presenting the project.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____

Maximum Score				____ / 50
Criteria	**Full Credit**	**Partial Credit**	**Minimal Credit**	**Total**

C.4. Additional Activities

Option 1: Extension Research: Investigate Alternative Solutions to Climate Challenges

Materials/Resources Needed:

- Chart paper or digital tools for infographics
- Markers or design software
- Video tools for multimedia outputs

Directions:

Read or examine the assigned source, identify its main claim and supporting evidence or data, answer the guide questions, and cite the source in the required output.

Activity Proper:

Activity Description:

Research Exploration: Learners choose a climate challenge to investigate, such as:

Renewable energy advancements (solar, wind, hydropower in the Philippines)

The activity targets Learning Objectives 3 and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Strategies for deforestation mitigation (reforestation projects, agroforestry techniques) Carbon sequestration efforts (mangrove restoration, carbon capture technology) Learners should gather data from scientific sources, government policies, and ongoing sustainability projects. Data Analysis & Presentation: • Learners should summarize key findings into an infographic, short report, or video presentation. • They explain the science behind the solution and evaluate its effectiveness in addressing climate issues. • Classroom Discussion & Reflection: • The learners share their insights, debating the practicality and feasibility of these environmental solutions.	

<table>
<tr><td></td><td>A reflection prompt encourages deeper thinking:

Guide Questions:
1. How can local communities contribute to global climate efforts?
2. What challenges prevent the widespread adoption of certain climate solutions?</td><td></td></tr>
<tr><td>Demonstrating Knowledge and Skills</td><td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>Accurate, complete, and free of misconceptions.</td><td>Mostly accurate; minor gaps only.</td><td>Partly accurate; important gaps or misconceptions.</td><td>Limited or inaccurate scientific content.</td></tr>
<tr><td>Evidence and Sources</td><td>Uses relevant, credible evidence and integrates it effectively.</td><td>Uses appropriate evidence with minor limitations.</td><td>Uses limited or weakly connected evidence.</td><td>Provides little or no usable evidence.</td></tr>
<tr><td>Analysis and Application</td><td>Explains relationships clearly and applies evidence insightfully.</td><td>Explains major relationships and applies evidence appropriately.</td><td>Shows partial analysis or weak application.</td><td>Shows little analysis or application.</td></tr>
<tr><td>Organization and Communication</td><td>Well organized, concise, and clear for the intended audience.</td><td>Generally clear and organized.</td><td>Somewhat unclear or unevenly organized.</td><td>Difficult to follow or incomplete.</td></tr>
</table></td></tr>
</table>

V. ASSESSMENT *(Assessing Learnings)*	**Summative test:** - Administer a multiple-choice assessment (the type of test varies depending on the teacher who will administer the test) covering all the topics discussed, presented in a traditional paper-and-pencil format, a Google Forms digital quiz, or an interactive online game such as Kahoot. - Here's the sample test: - ➢ **Multiple Choice (sample questions)** 1. Which of the following is a reactant in photosynthesis? a. ATP b. carbon dioxide c. glucose d. oxygen Answer: b) carbon dioxide 2. What is the main purpose of cellular respiration? a. To produce glucose c. To store sunlight energy b. To release energy from glucose d. To absorb oxygen Answer: b) To release energy from glucose 3. The chemical equation for photosynthesis is: a. $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ c. $H_2O + CO_2 \rightarrow O_2 + C_6H_{12}O_6$ b. $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + energy d. $CO_2 + O_2 \rightarrow H_2O$ + Glucose c. (captured in ATP and released as heat) Answer: a) $6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6O_2$ 4. The products of cellular respiration include: a. Oxygen and glucose c. Sunlight and oxygen b. ATP, carbon dioxide, and water d. Nitrogen and glucose Answer: b) ATP, carbon dioxide, and water 5. Which of the following is TRUE about dynamic carbon cycling and changing carbon reservoirs? a. Photosynthesis produces oxygen, which animals need for respiration. b. Respiration consumes oxygen, reducing carbon levels in the atmosphere. c. Both photosynthesis and respiration remove carbon from the atmosphere. d. Plants do not play a role in regulating atmospheric CO_2. Answer: a) Photosynthesis produces oxygen, which animals need for respiration.

	➢ **Short Answer (Sample Questions)** 1. Explain how cellular respiration and photosynthesis are complementary processes in ecosystems. Answer: Photosynthesis stores light energy in organic molecules and releases oxygen. Plants, animals, fungi, and many microbes carry out cellular respiration, returning carbon dioxide and water while transferring chemical energy to ATP and heat. Matter cycles, whereas energy flows through the system. 2. Describe two ways human activities disrupt the carbon cycle. Answer: Deforestation removes trees that absorb CO_2, increasing atmospheric carbon levels. Fossil fuel combustion releases excess CO_2, contributing to climate change. 3. Write the balanced chemical equation for cellular respiration. Answer: $C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$ + energy (captured in ATP and released as heat) 4. Why is maintaining dynamic carbon cycling and changing carbon reservoirs important in regulating atmospheric CO_2? Answer: Photosynthesis, respiration, decomposition, combustion, and ocean exchange influence carbon and oxygen concentrations; these concentrations are dynamic rather than fixed, and human emissions can disrupt the carbon balance. 5. How can renewable energy sources help mitigate the effects of excessive CO_2 emissions? Answer: They reduce dependence on fossil fuels, lower carbon emissions, and promote sustainability through alternative energy generation like solar and wind power. **Assessment specification:** Provide the complete 20-item test, answer key, one point per item, and the stated total score. Verify that each item measures the listed learning objectives and uses the corrected photosynthesis and respiration equations.
VI. REFLECTION *(Feedback and Continuous Improvement)*	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery. 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least?

	3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? 6. What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT in order to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

Learning Title/Topic:	Chemical Reactions in Everyday Lives – Metabolism: Chemical Reactions in Body Cells	Lesson Exemplar:	3

I. OBJECTIVES	
A. Content Standard	Chemical reactions are part of human activities and present in the environment; and
B. Performance Standard	By the end of the quarter, learners apply research skills to discover how scientists have impacted our lives. They recognize the significant role of different agencies in the Philippines, such as DOST and DTI, in scientific innovation and development. They show critical thinking in explaining the different substances in household and personal care products, including their benefits and potential risks of using and disposing of them. They demonstrate appropriate and safe handling and use of chemicals. They explain that chemical reactions occur in human activities and the environment, and that several chemical solutions pose a threat to the community.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	1. Describe the basic structure and functions of cells, particularly the role of cells in carrying out life processes. 2. Explain that food contains nutrients such as carbohydrates, proteins, and fats that are needed by the body for energy, growth, and repair. 3. Identify the major organs involved in digestion and describe how food is broken down and absorbed by the body. 4. Recognize that chemical reactions involve the transformation of substances into new products and occur in both living and non-living systems. 5. Relate the functions of the digestive, circulatory, and respiratory systems in supplying cells with the materials needed for energy production.
	6. Describe the chemical reactions that take place in our body cells, which are referred to as metabolism, and explain their significance.

II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	Gumaru, Michael. n.d. "Nutritional Guidelines for Filipinos: a prescription to good nutrition." FNRI Website. https://www.fnri.dost.gov.ph/index.php/publications/writers-pool-corner/57-food-and-nutrition/204-nutritional-guidelines-for-filipinos-a-prescription-to-good-nutrition. University of Colorado Boulder. 2025. PhET Interactive Simulation: Cellular Respiration. https://phet.colorado.edu/en/simulation/legacy/cellular-respiration Health Chronicle. 2016. *How the Digestive System Works.* YouTube video, 3:36. June 3, 2016. https://www.youtube.com/watch?v=_T_vmcLyTzI OpenStax. 2016. Biology 2e. Houston, TX: OpenStax, Rice University. https://openstax.org/details/books/biology-2e Khan Academy. 2023. "Introduction to Metabolism." Khan Academy. https://www.khanacademy.org/science/biology/energy-and-enzymes/metabolism/a/introduction-to-metabolism National Institute of General Medical Sciences (NIGMS). 2019. "Inside the Cell: Metabolism." Bethesda, MD: U.S. Department of Health and Human Services. https://www.nigms.nih.gov/education/fact-sheets/Pages/inside-the-cell.aspx
III. CONTENT *(Sequencing Content)*	Chemical Reactions in Everyday Lives – Metabolism: Chemical Reactions in Body Cells
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	Learners shall be able to: 1. Define metabolism as the set of chemical reactions that occur within living cells to sustain life. 2. Differentiate anabolic and catabolic reactions and cite examples of each in the human body. 3. Explain how carbohydrates, proteins, and fats provide reactants for metabolic processes. 4. Distinguish nutrient monomers from products of cellular respiration and nitrogen metabolism. 5. Explain how metabolism supports growth, repair, movement, and other life processes. 6. Analyze how nutrition, physical activity, sleep, substance use, medicines, and health conditions may influence metabolic health.

	7. Recommend evidence-based practices that support metabolic health, including balanced nutrition, physical activity, adequate sleep, and appropriate medical guidance.	
IV. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	***A.1. Activating Prior Knowledge***	
	Option 1: Think–Pair–Share	
	Materials/Resources Needed: • Paper or notebook • pen or pencil • timer (optional) **Directions:** Think independently about the prompt and write an initial response. Discuss it with a partner, agree on an evidence-based answer, and share the conclusion with the class. **Activity Proper:** Ask learners to think silently for 2–3 minutes and answer the following questions: Instruct learners to write brief responses in their notebooks. Pair each learner with a classmate and allow them to discuss their answers for 3–5 minutes. Encourage pairs to identify similarities and differences in their responses and formulate a common explanation of how the body obtains energy. Invite selected pairs to share their ideas with the class. Record key terms and phrases on the board such as: energy	The activity targets Learning Objectives 1 and 5 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print.

	food digestion nutrients movement body processes cells Facilitate a brief discussion by asking: Use learners' responses as a bridge to the lesson on metabolism as the chemical processes that occur within living cells to sustain life. Check learners' responses using these criteria: gives at least two daily activities requiring energy, explains why energy is needed, connects food or nutrients to energy production, and uses at least one science term such as cells, digestion, nutrients, or metabolism. **Guide Questions:** 1. What are your daily activities that require energy or physical effort? 2. Why is energy important in performing these activities? 3. What do you think happens inside your body that provides the energy needed for these activities? 4. How do you think the food we eat becomes the energy we use every day? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	**Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Option 2: Video Clip Screening	
	Materials/Resources Needed: • TV • projector • laptop • speakers • observation sheet or notebook • pen or pencil • Video Resource: "How the Digestive System Works" by Health Chronicle **Directions:** Watch the assigned video or film segment attentively. Record the key scientific ideas or evidence, then answer the guide questions and relate the information to the lesson concept. **Activity Proper:** Inform learners that they will watch a short video showing how food travels through the digestive system. Before viewing, ask learners to focus on: the organs involved in digestion, the changes food undergoes, and how these changes help the body obtain nutrients and energy. Distribute an observation organizer or ask learners to prepare a three-column table with the headings:	The activity targets Learning Objectives 1, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

Organ/ System	What Happens to the Food?	Why Is This Important?

Play the video.
While watching, instruct learners to record:
the sequence of organs food passes through,
physical and chemical changes that occur,
nutrients released from food,
and any mention of energy production.
After viewing, ask learners to answer the following guide questions:
Facilitate a short class discussion and consolidate learners' responses on the board.
Conclude by emphasizing that digestion supplies absorbable molecules used in cellular metabolism. Metabolic reactions rearrange matter and transfer chemical energy, including energy used to regenerate ATP; cells do not create energy.

Guide Questions:

1. What changes did you observe as food moved through the digestive system?
2. Which organs were involved in these changes?
3. Why is it important for food to be broken down before it can be used by the body?
4. How might these processes be related to the body's production of energy?

	Expected Output/Product: Completed observation organizer with accurate responses to the guide questions. **Assessment Criteria:** • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Food Beyond Energy: Freedom Wall	
	Materials/Resources Needed: • Sticky notes or index cards • Manila paper or whiteboard • Markers • Tape or adhesive • Alternative: Digital collaborative platforms such as Padlet • Shared digital board • Google Slides • or similar applications may be used in technology-integrated classrooms **Directions:** Write one or two sentences explaining what food does for the body beyond providing energy, post the response on the Freedom Wall, and compare it with classmates' ideas.	The activity targets Learning Objectives 1 and 5 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the

	Activity Proper: Introduce the activity by asking the class: Provide each learner with a sticky note or index card. Instruct learners to write one or two sentences answering the question based on their current understanding. Ask learners to post their responses on the designated Freedom Wall. Allow learners to read several responses posted by their classmates. After grouping the responses, explain that metabolism supports these body functions by converting nutrients into energy and materials needed for growth, repair, regulation, and maintenance of body processes. Facilitate a brief discussion and group similar responses into categories such as: energy growth tissue repair disease prevention body regulation waste elimination survival Ask the class: Guide learners toward the understanding that food provides materials and energy needed for various life processes. Conclude the activity by introducing metabolism as the set of chemical reactions that enables the body to convert nutrients into energy and substances needed to sustain life.	product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	Guide Questions: 1. Aside from giving us energy, what else does food do for our body? 2. What common idea connects all these functions of food? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: Why Metabolism Matters: A Guided Class Discussion	
	Materials/Resources Needed: • Prepared guide questions • whiteboard or projector • markers **Directions:** Respond to each prompt using your prior knowledge and the lesson concepts. Discuss your reasoning with a partner or group, then refine your answer based on the evidence shared. **Activity Proper:** Display the following guiding question: Allow learners one to two minutes to think silently and write brief responses in their notebooks. Invite volunteers to share their answers with the class.	The activity targets Learning Objectives 1, 5, and 7 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through

	Learners will complete this sentence in their notebook: Understanding metabolism can help me make healthier choices because _____. Facilitate a guided discussion using the following follow-up questions: Record significant learner responses on the board. Organize responses into themes such as: energy production growth and development tissue repair disease prevention overall health and wellness Ask learners to identify the common idea connecting all the responses. Synthesize the discussion by emphasizing that metabolism is responsible for transforming nutrients into energy and materials needed to support life processes. End the activity by stating: “Understanding metabolism helps us appreciate how our bodies use food to stay alive, grow, repair damaged tissues, and maintain overall health.” Case-study safeguard: Treat the case as fictional and multifactorial. Do not infer a diagnosis or attribute body composition or fatigue to personal choices alone; sleep, diet, activity, health conditions, medicines, stress, and other factors may contribute. Learner privacy: Learners may answer using the fictional case. Personal disclosure about food, body composition, medicines, or health is optional and must not be required for assessment.	presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	Guide Questions: 1. "How does understanding what happens to food inside the body help us stay healthy?" 2. What happens if a person eats too much or too little food? 3. How can food choices affect a person's health and energy level? 4. Why is proper nutrition important for growth and body repair? 5. How can understanding metabolism help people make healthier lifestyle choices? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Option 1: What's Happening in Their Body? A Case Study	
	Materials/Resources Needed: • Printed or projected case scenario • guide questions • writing materials • Case Scenario • Liam and Jordan are both 17-year-old Grade 11 students	The activity targets Learning Objectives 2, 3, 5, and 6 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

	Directions: Read or examine the assigned case or scenario. Identify the relevant evidence, apply the appropriate scientific concepts, answer the guide questions, and justify your conclusion. **Activity Proper:** Liam follows a balanced lifestyle. He eats regular meals containing fruits, vegetables, lean proteins, and whole grains. He exercises regularly, gets adequate sleep, and drinks enough water. As a result, he has good stamina, healthy body composition, and sufficient energy for daily activities. Jordan frequently skips meals, consumes sugary drinks and processed foods, sleeps late, and rarely exercises. He often feels tired and has difficulty concentrating. During a short-term energy shortage, his body relies mainly on stored glycogen and fat. Substantial muscle-protein breakdown is more likely during a prolonged or severe energy deficiency. Divide the class into small groups of 3–5 learners. Provide each group with a copy of the case scenario. Ask learners to read and discuss the situation carefully. Instruct each group to answer the following guide questions: Allow groups to record their answers on an organizer. Invite groups to share their findings with the class. Facilitate a discussion highlighting the role of nutrients, metabolism, and healthy lifestyle practices in maintaining energy balance and overall health. Introduce the concepts of anabolism and catabolism using examples identified by learners from the case study.	The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Case-study safeguard: Treat the case as fictional and multifactorial. Do not infer a diagnosis or attribute body composition or fatigue to personal choices alone; sleep, diet, activity, health conditions, medicines, stress, and other factors may contribute. Learner privacy: Learners may answer using the fictional case. Personal disclosure about food, body composition, medicines, or health is optional and must not be required for assessment. **Guide Questions:** 1. What differences can you identify between Liam's and Jordan's lifestyles? 2. Which metabolic processes are likely occurring in Liam's body? 3. Which metabolic processes are likely occurring in Jordan's body? 4. What nutrients serve as reactants in these metabolic processes? 5. How do lifestyle choices influence metabolism and overall health? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

	Option 2: Catabolic vs. Anabolic Reactions: Venn Diagram	
	Materials/Resources Needed: • Venn diagram • manila paper or chart paper • markers • activity strips or flashcards containing examples of metabolic processes **Directions:** Construct the required diagram or flowchart, label all essential parts or stages, show the relationships accurately, and add a brief scientific explanation of how the system or process works. **Activity Proper:** Review the concepts of metabolism, anabolism, and catabolism introduced in the previous activity. Provide learners with a Venn diagram template labeled: Anabolic Reactions Catabolic Reactions Similarities Present examples of metabolic processes such as: Sample cards may include: digestion of starch, cellular respiration, protein synthesis, muscle growth, bone growth, muscle breakdown, tissue repair, fat breakdown, and glycogen formation. digestion of food cellular respiration protein synthesis	The activity targets Learning Objectives 2, 3, and 4 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	muscle growth bone growth muscle breakdown tissue repair Ask learners to classify each process into the appropriate section of the Venn diagram. Instruct learners to identify characteristics unique to each reaction type and characteristics shared by both. Guide learners in answering the following discussion questions: Allow learners to compare answers with their classmates. Conduct a class discussion and synthesize the responses by emphasizing that metabolism consists of both anabolic and catabolic reactions that work together to sustain life and maintain homeostasis. **Guide Questions:** 1. How are anabolic and catabolic reactions different? 2. How are they similar? 3. Why are both reactions necessary for survival? 4. What would happen if one process occurred without the other? **Expected Output/Product:** Completed labeled diagram or flowchart with accurate relationships and a brief scientific explanation.	

	Assessment Criteria: • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	
	B.2. Discussing New Concept	
	Option 1: Interactive Simulation – From Nutrients to ATP	
	Materials/Resources Needed: • Laptop • Tablet or mobile device (if available) • Internet connection or downloaded simulation/video • Writing materials **Directions:** Run or examine the specified simulation, change only the assigned variable or condition, record the results, and explain the observed pattern using the lesson concept. Use the printed alternative when digital access is unavailable. **Activity Proper:** Introduce the activity by asking: Explain that learners will explore a simulation or educational video that demonstrates how nutrients are broken down and converted into energy through metabolic processes. If devices or internet are not available, use a printed flow diagram showing nutrients → digestion → absorption →	The activity targets Learning Objectives 3, 4, and 5 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital

cellular respiration → ATP, carbon dioxide, and water.
Learners will label the reactants, process, and products.
Provide each learner or group with an activity organizer containing the following questions:

Guide Questions	Observations
What nutrient is being broken down?	
What process is occurring?	
Where does this process occur in the cell?	
What products are formed?	
How does ATP help the body?	

Allow learners to explore the simulation or observe the video.
Instruct learners to record their observations and identify:
reactants involved,
metabolic processes occurring,
products formed,
and the role of ATP.
After the activity, facilitate a class discussion using the following guide questions:
Synthesize the discussion by emphasizing that metabolism converts nutrients into usable energy and substances necessary for growth, repair, movement, and maintenance of body functions.

timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Guide Questions: 1. How does the food we eat become usable energy for the body? 2. Why are nutrients needed by the body? 3. What happens to nutrients during metabolic reactions? 4. Why is ATP considered the energy currency of the cell? 5. How do metabolic products support life processes? 6. After completing the organizer, learners will answer: Why is metabolism important for growth, repair, movement, and maintaining life? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Concept Check Challenge (Kahoot, Quizizz, or Quiz Bee Style)	
	Materials/Resources Needed: • Kahoot • Quizizz • PowerPoint quiz • flashcards • or printed question cards • Computer, tablet, or other available digital device **Directions:** Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it.	The activity targets Learning Objectives 1, 2, 3, and 4 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading

	Activity Proper: Note to Teachers: Ensure the quiz includes at least one item each for defining metabolism, identifying reactants, identifying products, differentiating anabolism and catabolism, and explaining ATP. Inform learners that they will participate in a short concept review challenge to reinforce their understanding of metabolism. Present questions one at a time using a digital platform or quiz bee format. Encourage learners to answer individually or in teams. Use questions that require application and reasoning rather than simple recall. Sample Questions a. Anabolism b. Catabolism c. Synthesis d. Replication a. Digestion of starch into glucose b. Breakdown of fats for energy c. Formation of muscle proteins after exercise d. Cellular respiration a. It stores genetic information. b. It transports oxygen in the blood. c. It provides usable energy for cellular activities. d. It breaks down nutrients in the digestive system. After each question, discuss: the correct answer, the reasoning behind it,	each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	and common misconceptions. Encourage learners to explain their answers rather than simply identifying the correct option. Conclude the activity by summarizing the key concepts: metabolism involves chemical reactions in cells, nutrients serve as reactants, ATP is an immediately usable cellular energy carrier. It is continually regenerated using energy released by catabolic pathways and consumed by cellular work; anabolic pathways generally require energy input. anabolic and catabolic reactions work together to sustain life. **Guide Questions:** 1. A student eats a banana before participating in a sports competition. Which metabolic process allows the body to release energy from the nutrients in the banana? 2. Which situation is the best example of an anabolic reaction? 3. Why is ATP important in metabolic processes? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	

B.3. Developing Mastery

Option 1: Matching Type – Nutrients, Functions, and Metabolic Products

Materials/Resources Needed:
- Matching Activity
- pens or pencils
- answer cards (optional)
- projector or board

Directions:
Match each item with the correct term, category, description, or process. Record each match and briefly explain the scientific basis for your answer.

Activity Proper:
Review the major nutrients discussed in the lesson:
carbohydrates
proteins
fats
Present the following matching activity:

Nutrient	Function	Digestive Products and Metabolic Fates
A. Carbohydrates	1. Muscle repair and growth	a. Amino acids; excess amino nitrogen can be converted to urea, while carbon skeletons

The activity targets Learning Objectives 3 and 4 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product.
The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative.

Note to Teachers: Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

		enter metabolism
B. Proteins	2. Immediate energy supply	b. Monosaccharides (mainly glucose); aerobic oxidation yields CO_2 and H_2O, with energy captured in ATP and released as heat
C. Fats	3. Long-term energy storage and insulation	c. Fatty acids and glycerol; oxidation yields CO_2 and H_2O with energy captured in ATP. Substantial ketone production is context-dependent.

	Ask learners to match each nutrient with its corresponding function and metabolic fate. After completing the matching task, instruct learners to answer the following analysis questions: Allow learners to compare answers with a partner. Conduct a brief discussion to clarify misconceptions and reinforce the role of nutrients as reactants in metabolic processes. Synthesize the activity by emphasizing that different nutrients participate in metabolism in different ways but all contribute to maintaining life and energy balance. **Guide Questions:** 1. Why are carbohydrates commonly used as a readily available source of energy? 2. How do proteins contribute to growth and tissue repair? 3. Why are fats important even when they are not the body's immediate source of energy? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: Metabolic Reaction Sort – Guided Worksheet	
	Materials/Resources Needed: • printed diagrams • writing materials	The activity targets Learning Objectives 2, 3, and 4 by asking learners to classify examples, justify their choices, and demonstrate understanding of

	Directions: Sort each item into the correct category based on the scientific characteristics provided. Record your classifications and justify any item that could be confused with another category. **Activity Proper:** Review the concepts of: metabolism anabolic reactions catabolic reactions reactants products enzymes Distribute the activity organizer containing the following diagrams: Diagram 1: Muscle Growth **Component** **Answer** Reactants _____ Key enzyme(s) or process _____ Product _____ Reaction Type _____ Diagram 2: Digestion of Starch	the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Answer **Component** Reactants _____ Key enzyme(s) or process _____ Product _____ Reaction Type _____ Instruct learners to analyze each process and complete the missing information. After completing the organizer, ask learners to answer the following guide questions: Allow learners to discuss their answers with a partner or small group. Facilitate a class discussion and ask learners to justify their classifications. Summarize the activity by emphasizing that metabolism consists of interconnected anabolic and catabolic reactions that depend on nutrients, enzymes, and energy to support cellular functions. Formative Check Before ending the activity, ask learners: **Guide Questions:** 1. Which reaction involves building complex molecules? 2. Which reaction involves breaking down complex molecules?	

	3. Why are enzymes important in metabolic reactions? 4. How do anabolic and catabolic reactions work together to maintain life? 5. Can a person survive if only anabolic reactions occur? What if only catabolic reactions occur? Explain your answer. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Option 1: Agency Explorer – Promoting Metabolic Health in the Community	
	Materials/Resources Needed: • interview guide (optional) • manila paper or digital presentation tools • writing materials **Directions:** Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal. **Activity Proper:** Divide learners into groups of 3–5 members. Assign or allow each group to select one of the following:	The activity targets Learning Objectives 5, 6, and 7 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and

<table>
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<td></td>
<td>Department of Health (DOH)
Department of Science and Technology (DOST-FNRI)
Barangay Health Center
Local Nutrition Office
Other local health initiatives
Instruct learners to investigate how their assigned agency promotes:
proper nutrition,
healthy eating habits,
disease prevention,
physical activity,
metabolic health.
Ask learners to organize their findings using the following guide:

<table><tr><th>Agency</th><th>Program or Initiative</th><th>Connection to Metabolism</th><th>Benefit to the Community</th></tr></table>
Instruct groups to prepare a brief infographic, poster, or presentation summarizing their findings.
Allow groups to present their work.
Facilitate a discussion using the following guide questions:
Conclude by emphasizing the role of science and public health agencies in improving community wellness and metabolic health.
Case-study safeguard: Treat the case as fictional and multifactorial. Do not infer a diagnosis or attribute body composition or fatigue to personal choices alone; sleep, diet,</td>
<td>explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.</td>
</tr>
</table>

	activity, health conditions, medicines, stress, and other factors may contribute. Learner privacy: Learners may answer using the fictional case. Personal disclosure about food, body composition, medicines, or health is optional and must not be required for assessment. **Guide Questions:** 1. How do these agencies help people maintain healthy metabolism? 2. Why is scientific knowledge important in designing health programs? 3. How can young people benefit from these initiatives? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Food Energy and You	
	Materials/Resources Needed: • Notebook or paper for recording the nutrient tracker • sample food guides • writing materials • calculator (optional)	The activity targets Learning Objectives 5, 6, and 7 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence,

Directions:
Examine each food item, identify its dominant nutrient, relate that nutrient to its metabolic role or product, and explain how food choices affect energy balance.

Activity Proper:
Ask learners to recall the foods they consumed during the previous day.
Distribute a Food and Energy Tracker similar to the table below:

Food Consumed	Main Nutrient	Purpose in the Body	Physical Activities Performed

Instruct learners to identify the dominant nutrient in each food item:
carbohydrates
proteins
fats
Ask learners to relate the nutrients consumed to the activities they performed throughout the day.
Guide learners in answering the following reflection questions:
Allow learners to share insights with a partner or small group.
Facilitate a class discussion highlighting the relationship among:
food intake,
energy use,
metabolism,
overall health.

compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Conclude by emphasizing that balanced nutrition, regular physical activity, adequate sleep, and healthy lifestyle choices support healthy metabolic function. **Guide Questions:** 1. Which nutrient did you consume most frequently? 2. Do your eating habits support your daily energy needs? 3. How might your current lifestyle affect your metabolism? 4. What changes can you make to improve your metabolic health? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	C.2. Making Generalization	
	Option 1: Concept Web	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available) **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown.	The activity targets Learning Objectives 1, 2, 3, 4, and 5 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer,

	Activity Proper: Divide learners into small groups of 3–5 members. Write the word METABOLISM at the center of the board. Ask each group to create a concept web connecting metabolism to: nutrients anabolic reactions catabolic reactions ATP energy production growth repair health lifestyle practices Encourage learners to use arrows and linking phrases to show relationships among concepts. Allow groups to present their concept webs. Facilitate a synthesis discussion using the following guide questions: Summarize key ideas generated by the class. **Guide Questions:** 1. What is metabolism? 2. How do nutrients support metabolism? 3. Why are anabolic and catabolic reactions both important? 4. How does metabolism affect health and wellness?	individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

	Expected Output/Product: Completed concept map showing the required concepts and scientifically accurate relationships. **Assessment Criteria:** • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	
	Option 2: Metabolism Tweet	
	Materials/Resources Needed: • Paper • notebook • or digital device **Directions:** Write a concise, scientifically accurate social-media-style explanation of metabolism within the stated word or character limit, then add one relevant example. **Activity Proper:** Ask learners to imagine they are posting on social media to explain metabolism to other students. Instruct them to write a message of 280 characters or less that answers: Encourage learners to use accurate scientific terms while keeping the explanation simple and understandable. Invite selected learners to share their tweets.	The activity targets Learning Objectives 1, 5, 6, and 7 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a

	Conduct a readiness check by asking: Use learner responses to determine readiness for the evaluation activity. **Guide Questions:** 1. What is metabolism? 2. Why is it important? 3. How can people support healthy metabolism? 4. Based on what you have learned today, what is the single most important thing people should understand about metabolism? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.
	C.3. Evaluating Learning	
	Option 1: Scientific Literacy Quiz	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Read each situation carefully and choose the best answer.	The activity targets Learning Objectives 1, 2, 3, 4, 5, and 6 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions.

	Activity Proper: a. Anabolism b. Catabolism c. Diffusion d. Replication a. Catabolism b. Digestion c. Anabolism d. Excretion a. It stores genetic information. b. It provides usable energy for cellular activities. c. It transports oxygen in the blood. d. It protects cells from infection. a. Skipping meals regularly b. Sleeping only four hours per night c. Balanced nutrition and regular physical activity d. Avoiding all carbohydrates a. It only helps digest food. b. It allows the body to grow, repair tissues, and produce energy. c. It controls weather conditions. d. It prevents aging. **Guide Questions:** 1. After a long-distance run, Mia's body begins breaking down stored nutrients to provide energy. Which metabolic process is occurring?	The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	2. A teenager follows a balanced diet and strength-training program. Which metabolic process helps build new muscle tissue? 3. Why is ATP important to living organisms? 4. Which lifestyle habit best supports healthy metabolism? 5. Why is metabolism essential for life? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	
	Option 2: Reflection Essay	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation. **Activity Proper:** Prompt: In 5–7 sentences, explain how your current lifestyle—including your diet, physical activity, hydration, and sleep habits—may affect your metabolism. Use concepts learned in class to answer:	The activity targets Learning Objectives 5, 6, and 7 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through

Guide Questions:

1. Which habits support healthy metabolism?
2. Which habits may negatively affect metabolism?
3. What realistic improvement can you make to promote better metabolic health?

Expected Output/Product:
Completed written essay that addresses the prompt using accurate scientific concepts and relevant evidence.

presentation, design, video, or shared-document tools when available, with a non-digital alternative.

Note to Teachers: Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Contains major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little relevant evidence or provides unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				**____ / 15**

	C.4. Additional Activities	
	Option 1: Video Review Task	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed **Directions:** Watch the assigned video or film segment attentively. Record the key scientific ideas or evidence, then answer the guide questions and relate the information to the lesson concept. **Activity Proper:** Assign learners to watch an approved metabolism video. Ask learners to create one of the following: infographic flowchart concept map visual summary Their output should include: definition of metabolism, anabolic and catabolic reactions, ATP, importance of metabolism. Allow learners to submit the activity as enrichment or remediation work.	The activity targets Learning Objectives 1, 2, 3, 4, and 5 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish

	Guide Questions: 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Expected Output/Product:** Completed video-based output that communicates the required scientific ideas clearly and accurately. **Assessment Criteria:** • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	observation, inference, correlation, and causation.
	Option 2: Metabolic Health Action Plan	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal. **Activity Proper:** The plan should include:	The activity targets Learning Objectives 5, 6, and 7 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through

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<td>healthy eating goals,
physical activity goals,
sleep goals,
hydration goals.
Require learners to explain how each action supports metabolism.
Ask learners to write a short reflection answering:
Encourage learners to revisit their plan after one week and evaluate their progress.

Guide Question:
“Which habit will be the easiest to maintain and which will be the most challenging?”

Expected Output/Product:
Completed action plan with clear steps, responsibilities or actions, and a scientific rationale.</td>
<td>summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative.

Note to Teachers: Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.</td>
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<tr>
<td>Demonstrating Knowledge and Skills</td>
<td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>Design decisions are fully consistent with accurate scientific principles.</td><td>Design is scientifically sound with minor gaps.</td><td>Design shows partial understanding with some inaccuracies.</td><td>Design is poorly supported by scientific principles.</td></tr>
<tr><td>Functionality/Feasibility</td><td>Solution is coherent, realistic, and</td><td>Solution is workable and addresses most task requirements.</td><td>Solution addresses the task only partly</td><td>Solution is incomplete, unrealistic, or does</td></tr>
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<tr><td></td><td>directly addresses the task.</td><td></td><td>or has feasibility problems.</td><td>not address the task.</td></tr>
<tr><td>Evidence and Justification</td><td>Every major design choice is clearly justified with relevant evidence.</td><td>Most design choices are justified with appropriate evidence.</td><td>Some design choices are justified; evidence is limited.</td><td>Design choices are largely unsupported.</td></tr>
<tr><td>Completeness and Clarity</td><td>All required elements are complete, labeled/organized, and easy to understand.</td><td>Most required elements are complete and clear.</td><td>Several elements are incomplete or unclear.</td><td>Many required elements are missing or unclear.</td></tr>
</table>
</td></tr>
<tr><td>V. ASSESSMENT
(Assessing Learnings)</td><td>Part A. Scientific Literacy Multiple-Choice Test (5 Points)
Directions: Read each situation carefully and choose the letter of the best answer.
1. During a long-distance run, Carla's body breaks down stored glycogen to provide energy for her muscles. Which metabolic process is primarily occurring?
a. Anabolism
b. Catabolism
c. Diffusion
d. Osmosis
2. After several weeks of strength training and proper nutrition, Joshua develops stronger muscles. Which metabolic process is mainly responsible for this change?
a. Digestion
b. Catabolism
c. Anabolism
d. Excretion</td></tr>
</table>

3. Why is ATP important in living organisms?
   a. It stores genetic information.
   b. It transports nutrients throughout the body.
   c. It provides usable energy for cellular activities.
   d. It protects the body from disease.
4. Which nutrient is most commonly used by the body as its primary source of immediate energy?
   a. Vitamins
   b. Proteins
   c. Fats
   d. Carbohydrates
5. Which statement best explains the importance of metabolism?
   a. It only helps digest food.
   b. It supports energy production, growth, repair, and other life processes.
   c. It only occurs during physical activity.
   d. It only happens in the digestive system.

Part B. Scenario Analysis (5 Points)

Directions: Study the information below and answer the questions that follow.

Lifestyle Habit	Observation
Frequently skips breakfast	Often feels tired during morning classes
Sleeps only 4–5 hours each night	Experiences fatigue and difficulty concentrating
Rarely participates in physical activities	Easily becomes tired during school activities
Frequently consumes sugary drinks	Experiences sudden energy crashes

Guide Questions:

1. Identify two habits that may negatively affect the learner's metabolism.
2. Explain how these habits may influence energy production and overall health.
3. Recommend one improvement that can help support healthy metabolism.

Scoring Guide (5 points):

Criteria	Full Credit	Partial Credit	Minimal Credit	Total
Correct identification of habits	2 points — Meets the stated criterion completely and accurately.	1 point — Partly meets the criterion; minor gaps or inaccuracies remain.	0 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Scientific explanation	2 points — Meets the stated criterion completely and accurately.	1 point — Partly meets the criterion; minor gaps or inaccuracies remain.	0 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Appropriate recommendation	1 point — Meets the stated criterion completely and accurately.	1 point — Partly meets the criterion; minor gaps or inaccuracies remain.	0 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Maximum Score				____ / 5

Part C. Health Recommendation Task (5 Points)
Directions: Read the situation below and answer the question.
A Grade 11 learner wants to improve his metabolic health but often stays up late, skips meals, and spends most of his free time using gadgets.

Using concepts learned about metabolism, write a short response recommending three healthy practices that can help improve metabolic health. Explain how each practice supports the body's metabolic processes.
Scoring Rubric (5 points):

Criteria	5 points	3 points	1 point	Total
Scientific Accuracy	Recommendations are scientifically accurate and clearly connected to metabolism.	Minor misconceptions are present.	Recommendations show limited understanding of metabolism.	____
Explanation	Explanations are clear, complete, and supported by scientific concepts.	Explanations are partially developed.	Explanations are unclear or incomplete.	____
Application	Recommendations are realistic and appropriate for the situation.	Recommendations are somewhat appropriate.	Recommendations are unrealistic or unrelated to the situation.	____
Total Score				**____ / 15**

Assessment specification: For the performance task, use three criteria worth a maximum of 5 points each. Total score = Scientific accuracy (5) + Evidence/application (5) + Clarity/completeness (5) = 15 points.

VI. REFLECTION *(Feedback and Continuous Improvement)*

Feedback and Continuous Improvement

A. Number of learners who earned 80% in the evaluation.
B. Number of learners who require additional activities for remediation.
C. Did the remedial lessons work? Number of learners who have caught up with the lesson.
D. Number of learners who continue to require remediation.

	E. Which of my teaching strategies worked well? Why did these work? F. What difficulties did I encounter which my principal or supervisor can help me solve? G. What innovation or localized materials did I use/discover which I wish to share with other teachers? Additional Reflection Guide for Teachers: • Which concepts did learners understand most easily (e.g., metabolism, ATP, anabolic reactions, catabolic reactions)? • Which misconceptions persisted despite classroom discussions and activities? • Which activities generated the highest level of learner engagement and participation? • Were learners able to connect metabolism to their personal health practices and lifestyle choices? • How effective were the practical application activities in helping learners understand the relevance of metabolism in daily life? • What adjustments can be made to improve learner understanding during future implementation of this lesson?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT in order to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

APPENDIX

Answers to Multiple Choice Questions (Assessment)

Item No.	Key Answer	Explanation
1	B	Catabolism breaks larger molecules into smaller molecules and releases energy.
2	C	Anabolism uses smaller units and energy to build larger molecules needed for growth and repair.
3	C	ATP is the cell's immediately usable energy carrier; it is continually regenerated and consumed.
4	D	Carbohydrates are digested mainly to monosaccharides such as glucose, a common fuel for cellular respiration.
5	B	Metabolism supplies energy and materials for maintenance, growth, repair, and other life processes.

Learning Title/Topic:	Solutions in the Environment – Characteristics and Applications of Solutions	Lesson Exemplar:	4

I. OBJECTIVES	
A. Content Standard	Chemicals should be handled safely, and solutions can have beneficial and harmful environmental effects.
B. Performance Standard	By the end of the quarter, learners apply research skills to discover how scientists have impacted our lives. They recognize the significant role of different agencies in the Philippines, such as DOST and DTI, in scientific innovation and development. They show critical thinking in explaining the different substances in household and personal care products, including their benefits and potential risks of using and disposing of them. They demonstrate appropriate and safe handling and use of chemicals. They explain that chemical reactions occur in human activities and the environment, and that several chemical solutions pose a threat to the community.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	Prerequisite Knowledge and Skills: Properties of matter; pure substances and mixtures; homogeneous and heterogeneous mixtures. Observing and describing materials, classifying mixtures, identifying components of mixtures, and safely handling common substances.
	Explain the characteristics of solutions and their examples in household products, industry, and environmental science;
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	BYJU'S. 2025. "True Solution." Accessed May 7, 2025. https://byjus.com/chemistry/true-solution/. Khan Academy. n.d. "States of Matter and Intermolecular Forces." Khan Academy. https://www.khanacademy.org/science/chemistry/states-of-matter-and-intermolecular-forces. CK-12 Foundation. n.d. "Mixtures – CK-12 Chemistry Concepts Intermediate." https://flexbooks.ck12.org/cbook/ck-12-chemistry-concepts-intermediate/section/2.13/primary/lesson/mixtures-chem-int/. BBC Bitesize. n.d. "What Are Solutions and Solvents?" https://www.bbc.co.uk/bitesize/topics/zcvv4wx/articles/zggsfrd.

	LibreTexts. 2020. "Properties of Solutions." Chem LibreTexts. August 15, 2020. https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Solutions_and_Mixtures/Solutions/Properties_of_Solutions. Helmenstine, Anne Marie. 2020. "Examples of Solutions, Suspensions, and Colloids." ThoughtCo. February 5, 2020. https://www.thoughtco.com/solution-suspension-colloid-examples-609435. Byju's. n.d. "Colloids and Suspensions." Accessed June 11, 2026. https://byjus.com/chemistry/colloids-and-suspensions/. Science Notes. 2021. "Saturated Solution Definition and Examples." September 3, 2021. https://sciencenotes.org/saturated-solution-definition-and-examples/. Chem4Kids. n.d. "Solutions: Solute + Solvent = Solution." Accessed June 11, 2026. http://www.chem4kids.com/files/matter_solution.html (chem4kids.com in Bing). Mr. Kirkman's Class. n.d. "Mr. Kirkman Demonstrates the Tyndall Effect." YouTube video. Accessed June 11, 2026. https://www.youtube.com/watch?v=sZ0iFoJP4mo. Royal Coffee. 2017. "Understanding Extraction." December 27, 2017. https://royalcoffee.com/understanding-extraction/ (royalcoffee.com in Bing)
III. CONTENT *(Sequencing Content)*	Solutions in the Environment – Characteristics and Applications of Solutions
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	1. *Define what a solution is and explain how it differs from other types of mixtures.* 2. *Differentiate solutions from non-solutions based on their solute–solvent combinations through a simple experiment.* 3. *Explain the characteristics of solutions and their applications in household products, industrial processes, and environmental settings.*

<table>
<tr><th colspan="2">IV. PROCEDURES</th><th>ANNOTATIONS</th></tr>
<tr><td>A. Activating Prior Knowledge</td><td colspan="2">A.1. Activating Prior Knowledge</td></tr>
<tr><td></td><td colspan="2">Option 1: Image or Object Analysis (individual activity)</td></tr>
<tr><td></td><td>Materials/Resources Needed:
• Displayed images or teacher-prepared visual prompts
• Notebook or paper
• Pen or pencil

Directions:
Examine the image or visual carefully. Record the relevant observations, distinguish observation from inference, and answer the guide questions using scientific evidence.

Activity Proper:
Learners complete the table using observations from teacher-provided samples or images of mixtures.
<table>
<tr><th>(Specify whether it is a solution, colloid, or suspension.)</th><th>Characteristics</th><th>Homogeneous or Heterogeneous mixture?</th></tr>
<tr><td>1. e.g. Alcohol</td><td>uniform composition throughout; dissolved particles pass through ordinary filter paper and do not settle, no residues/precipitate</td><td>homogeneous</td></tr>
</table></td><td>The activity targets Learning Objectives 1 and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.</td></tr>
</table>

	2.		
	3.		

Guide Questions:
1. What evidence in the case or scenario is most relevant to the problem?
2. Which scientific concept best explains the situation, and why?

Assessment Criteria:
• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Option 2: Recall, think and note (group activity)

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Work with your group to examine the teacher-provided seawater, floodwater, and rainwater examples. Complete the table by classifying each as homogeneous or heterogeneous, listing possible components, and explaining the observable evidence for each classification.

Activity Proper:
Learners work collaboratively to examine teacher-provided examples of seawater, river water, and rainwater. They

The activity targets Learning Objectives 1 and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and

describe each sample's observable appearance and listed components in the table.

Mixtures in the environment	Label if homogeneous or heterogeneous mixture	Possible components /content of the mixture created	Explain why you classified it as homogeneous or heterogeneous.
1. Sea water			
2. Flood water			
3. Oil spill			

Once the learners have completed the table, the teacher will invite volunteers to share their responses. Additional input may be requested from students with differing answers. This activity allows the teacher to quickly gather general insights into students' baseline knowledge and address any misconceptions based on their responses.

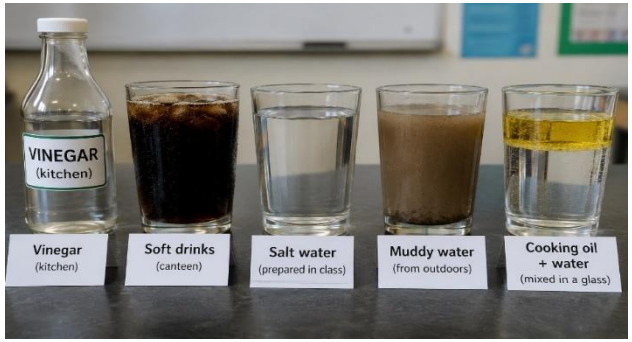
Process Questions:
Safety requirement: Use teacher-prepared model samples only. Do not collect, touch, smell, or drink environmental water. All filtered output is NOT FOR DRINKING.

writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Guide Questions: 1. What type of mixture is each material or substance listed in the table? 2. For each mixture, how can you tell if the substances are evenly distributed or not? 3. What observations (appearance, settling, clarity, etc.) help you decide the type of mixture? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Short answer (individual or group activity)	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read each situation carefully. Explain how knowing about solutions and mixtures helps us deal with these everyday problems. **Activity Proper:** Real-Life Situations For each situation, answer the following questions: State how solutions and mixtures are involved.	The activity targets Learning Objective 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is

	Safety requirement: Use teacher-prepared model samples only. Do not collect, touch, smell, or drink environmental water. All filtered output is NOT FOR DRINKING. **Guide Questions:** 1. Cleaning up spilled oil – How can we separate oil from water? 2. Making river water safe – How can we remove dirt and harmful substances from water? 3. Checking sugar in milk tea – How can we measure how sweet a drink is? 4. Tasting soup saltiness – How do we know if the salt has dissolved evenly? 5. Measuring alcohol in drinks – How can we find out how strong a drink is? 6. Explain why understanding those situations is important in solving the problems? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.
	Option 2: Solutions seekers activity	
	Materials/Resources Needed: • (Concrete & Contextual)	The activity targets Learning Objectives 1 and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because

	Directions: Examine the teacher-provided substances or images, describe their observable properties, classify each mixture accurately, record the evidence in the table, and share the conclusions. **Activity Proper:** 1. Provide pictures or samples of common substances provided by the teacher (vinegar, soft drinks, salt water, muddy water, cooking oil and water, detergent solution, and air). The teacher provides real or familiar samples: Vinegar (kitchen) Soft drinks (canteen) Salt water (prepared in class) Muddy water (from outdoors)  Cooking oil + water (mixed in a glass)	learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	2. In pairs, discuss the following questions: Propose a way industries can reduce harmful mixtures released into the environment. 3. Record the observations and ideas in student's notebook. 4. Share the answers with the class. **Guide Questions:** 1. Which samples look uniform throughout? 2. What property distinguishes a solution from other types of mixtures? 3. How are they similar as solutions, and how are they different? 4. Which solution do you think is most useful in everyday life? Why? 5. Why is it important to understand solutions and their uses in everyday life, industrial processes, and environmental systems? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Option 1: Matching type Activity	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper	The activity targets Learning Objectives 1 and 2 by asking learners to classify examples, justify their choices, and demonstrate understanding of the

	• Pen or pencil **Directions:** Match each item with the correct term, category, description, or process. Record each match and briefly explain the scientific basis for your answer. **Activity Proper:** Terms to fully grasp: Soluble Solute Solvent Solution Suspension Pure substance Mixture Homogeneous Heterogeneous Dissolution Colloids	stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent responses, brief justifications, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

Column A - Description	Write your answer here	Column B - Term
1. Able to dissolve in a solvent.		A. Soluble
2. The substance that is dissolved in a solution.		B. Solute

3. The substance that dissolves the solute.		C. Dissolution	
4. A homogeneous mixture of solute and solvent.		D. Solvent	
5. A mixture in which intermediate-sized particles remain dispersed and do not settle under normal conditions.		E. Homogeneous	
6. A material with a fixed and uniform composition, consisting of an element or a compound.		F. Mixture	
7. A combination of two or more substances that are physically combined and retain their individual properties.		G. Pure substance	
8. A homogeneous mixture has a uniform		H. Heterogeneous	

composition throughout and appears as one phase.		
9. Refers to a mixture in which the components can be visibly distinguished.		I. Solution
10. The process of dissolving a solute in a solvent.		J. Colloids
11. A mixture where small particles remain evenly dispersed and do not settle.		K. Suspension

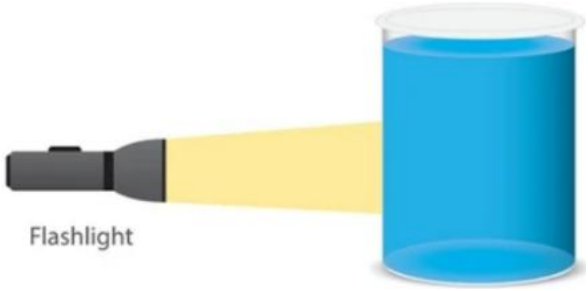
Guide Questions:

1. Which scientific concept was most important in determining the correct response?
2. What evidence or characteristic helped you distinguish the correct answer from the alternatives?

Assessment Criteria:

• Accuracy of responses
• Completeness of required answers

	Option 2: Making Drinks Activity	
	Materials/Resources Needed: • Teacher-approved materials specified in the procedure • Required safety equipment or personal protective equipment • Notebook or paper • Pen or pencil **Directions:** Prepare the labeled mixtures using the stated measurements, stir each sample consistently, observe settling, filtration, and light scattering as directed, and classify each mixture from the evidence. **Procedure:** 1. Prepare the following materials: instant coffee powder, salt, milk powder, powdered juice, soil, vinegar, oil, distilled water (clean and clear tap water may be used in the absence of distilled water), a spoon, beakers, filter paper (another filtering agent may be used, but filter paper is highly encouraged), and a flashlight or a teacher-operated, low-power laser directed away from all eyes (a flashlight with a narrow beam may be used in the absence of a laser pointer). 2. Measure 1 tablespoon of each of the following: instant coffee powder, salt, milk powder, powdered juice, soil, vinegar, and oil.	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	3. Label the beakers with the following terms: coffee-water mixture, salt-water mixture, milk-water mixture, juice-water mixture, soil-water mixture, vinegar-water mixture, and oil-water mixture. Fill the labeled beakers with 200 ml of distilled water. Add each spoonful to the corresponding beaker containing 200 mL of distilled water. Stir, observe, and fill in Column 2 of Table 1. 4. Using a flashlight or a teacher-operated, low-power laser directed away from all eyes, illuminate each beaker as shown in Figure 1 below.  5. Using filter paper, filter each mixture (refer to Figure 2 below), observe the results, and fill in Column 4 of Table 1. Afterwards, fill in Columns 5 and 6 of Table 1. Clear your workstations and dispose of the materials properly.	

6. Lastly, answer the guide questions found below.

1 Mixture	2 Uniform in appearance (yes/no)	3 Does not visibly scatter a light beam (based on the Tyndall effect) (yes/no)	4 Cannot be separated by filtration (yes/no)	5 Type of Mixture (Homogeneous/ heterogeneous)
A				
B				
C				
D				
E				
F				
G				

Mixture Solute - Solvent
coffee- water mixture
salt-water mixture
milk-water mixture
juice-water mixture
soil-water mixture
vinegar-water mixture
oil-water mixture

	7. Identify the type of mixture that was made: whether it was a homogeneous mixture or a heterogeneous mixture. 8. Based on the experiment conducted, infer the characteristics of a solution **Guide Questions:** 1. First determine which samples are true solutions. Identify solute(s) and a solvent only for a homogeneous solution. For a suspension, colloid, or immiscible-liquid mixture, identify the dispersed and continuous phases instead. 2. Which of the following mixtures are solutions? **Expected Output/Product:** Recorded observations or data and an evidence-based conclusion based on the activity results. **Assessment Criteria:** • Safe and correct performance of the procedure • Accuracy and completeness of observations or data • Scientific accuracy of the explanation or conclusion	
	B.2. Discussing New Concept	
	Option 1: Discussion on the characteristics of the solution	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and

	Directions: Respond to each prompt using your prior knowledge and the lesson concepts. Discuss your reasoning with a partner or group, then refine your answer based on the evidence shared. **Activity Proper:** Presenting an example of everyday situations to students: 1. Cooking saltwater pasta → Ask learners why salt dissolves evenly and how it affects flavor. 2. Making iced tea → Discuss why sugar dissolves but ice doesn't count as a solution. 3. Cleaning with detergent → Explore why detergent solution is stable and effective. 4. Pharmaceuticals → Explain how medicines are often prepared as solutions for faster absorption. 5. Soft drink production → Show how gas dissolves in liquid to make carbonated drinks. To know more what is a solution, there are certain characteristics they need to satisfy, these are the following: Homogeneous Mixture- the composition is uniform throughout the solution such as saltwater that is evenly dissolved in water. Stable Mixture – where solute particles cannot be seen by the naked eye and do not settle out over time like sugar in tea remains mixed unless physically altered.	Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Small Particle Size – Solute particles are at the molecular or ionic level (less than 1 nanometer) and are too small to scatter light, so the Tyndall effect is not observed. An example is sodium and chloride ions dissolved in water. Single Phase where even if made from substances in different phases (solid, liquid, gas), a solution appears as a single phase. An example is carbonated soft drinks (gas in liquid). Cannot be Separated by Filtration happens when particles are too small to be filtered out or arecompletely dissolved, such as acetic acid in water cannot be filtered, in the case of vinegar. BYJU'S. "True Solution." Accessed May 7, 2025. https://byjus.com/chemistry/true-solution/ In a true solution, solute particles are distributed at the molecular or ionic level and cannot be seen with the naked eye. They do not settle out or produce visible Tyndall scattering, although the solution may absorb selected wavelengths of light. Observing whether a light beam is visibly scattered can therefore help distinguish a solution from a colloid. Watch “Mr. Kirkman Demonstrates the Tyndall Effect” by Mr. Kirkman’s Class: https://www.youtube.com/watch?v=sZ0iFoJP4mo Safety requirement: Use teacher-prepared model samples only. Do not collect, touch, smell, or drink environmental water. All filtered output is NOT FOR DRINKING. Science clarification: Simple filtration may reduce suspended particles but does not reliably remove dissolved chemicals or	

	pathogens. Potable water requires appropriate treatment, disinfection, testing, and official guidance. **Guide Questions:** 1. What is the most important scientific idea you developed from the activity? 2. What example or evidence best supports your explanation? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Solution detective activity: What makes the solution?	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read or examine the assigned case or scenario. Identify the relevant evidence, apply the appropriate scientific concepts, answer the guide questions, and justify your conclusion. **Activity Proper:** Instructions to Students: Form groups of 4–5 members. Observe the teacher's demonstration or provided samples (salt + water, sugar + water, sand + water, oil + water).	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms.

Complete the observation table by noting:
Substances mixed
Appearance (uniform or non-uniform)
Visibility of particles
Stability after standing

Mixture	**Appearance (Uniform /Non-uniform)**	**Particles Visible?**	**Stable After Standing ?**	**Solution or Not?**
Salt + Water				
Sugar + Water				
Sand + Water				
Oil + Water				

Discuss guide questions within your group.
Read the short information sheet on solutions and their characteristics.
Create a concept map showing:
Definition of a solution
Solute and solvent
Characteristics of solutions
Examples in household, industry, and environment

Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Present your concept map to the class and explain the importance of solutions in daily life and environmental processes. **Guide Questions:** 1. Which mixtures formed solutions? Why? 2. What are the solutes and solvents in each solution? 3. How are solutions different from non-solutions? 4. What characteristics do all solutions have in common? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	B.3. Developing Mastery	
	Option 1: Matching Type Activity	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Match each item with the correct term, category, description, or process. Record each match and briefly explain the scientific basis for your answer.	The activity targets Learning Objectives 1 and 3 by asking learners to classify solution examples and connect the composition of each solution with household, industrial, and environmental uses. It applies the Constructivist, Collaborative, and Interactive approaches because learners complete the matrix and discuss their classifications. The pedagogical strategy used is guided classification and discussion. Literacy is integrated by using scientific terms accurately and explaining classifications. Numeracy is integrated

Activity Proper:
Study the substances in the Material Pool. Substances of the same phase can form solid, liquid, or gaseous solutions when one component dissolves uniformly in another. For each combination, identify the solute and solvent, enter them in the appropriate columns in Table 1, and indicate whether the resulting solution occurs in a household, industrial, or environmental context. You may use a substance more than once.

Material Pool

Solid: gold, zinc, tin, copper

Gas at room conditions: hydrogen chloride (HCl);
Liquids: acetic acid, isopropyl alcohol, and water. An aqueous solution of HCl is hydrochloric acid.

Gas: oxygen, nitrogen, helium, methane, butane

Solution	Solute	Solvent	Product	Where are these solutions found?		
				Household	Industrial	Environment
Solid-Solid solution			Gold jewelry			
			Bronze			
			Steel			

through interpreting the stated solution concentration and comparing categories. EdTech is integrated through an optional digital response form or presentation, with a paper-based alternative.

Note to Teachers: Clarify solute, solvent, homogeneous mixture, and gaseous solution before learners complete the matrix.

Liquid-liquid solution			Muriatic acid			
			70% isopropyl alcohol in water			
			Vinegar			
Gas-gas solution			Air			
			Diver's air			

Guide Questions:

1. What are some common examples of solutions found in household, industrial, and environmental settings?
2. Which characteristics of solutions are illustrated by products such as gold jewelry, 70% isopropyl alcohol in water, and natural air?
3. How do key characteristics of solutions, such as being homogeneous, having very small particles, and being transparent to light, make them versatile for use in household, industrial, or environmental applications?

Assessment Criteria:

• Accuracy of responses
• Completeness of required answers

	Option 2: My Solution Analysis Worksheet	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Examine each listed mixture, identify the solute and solvent when applicable, describe its observable characteristics, and justify whether it is a solution or another type of mixture. **Activity Proper:** Instructions to Students: Individually complete the organizer provided by the teacher. Study the list of mixtures below: Salt water Sugar dissolved in water Vinegar Soft drink Oil and water Sand and water Air	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

- Seawater

Mixture	Solution or Non-Solution?	Solute	Solvent	Characteristic Supporting Answer	Example of Use Context
Salt water	Solution	Salt	Water	Homogeneous, particles invisible	Cooking pasta, seawater
Sugar dissolved in water	Solution	Sugar	Water	Stable, particles don't settle	Sweetened drinks, syrups
Vinegar	Solution	Acetic acid	Water	Transparent, cannot be filtered	Household cleaning, food seasoning
Soft drink	Solution	Carbon dioxide + sugar	Water	Single phase (gas in liquid)	Beverage industry
Oil and water	Non-Solution	Oil	Water	Non-uniform, separates into layers	Kitchen waste, environmental spi
Sand and water	Non-Solution	Sand	Water	Particles visible, settle over time	Construction, muddy water
Air	Solution	Oxygen, carbon dioxide, etc.	Nitrogen	Homogeneous gas mixture	Breathing, atmosphere
Seawater	Solution	Salt + minerals	Water	Stable, homogeneous	Marine environment, salt production

For each mixture, fill in the table with the following information:
Identify the solute and solvent (if applicable).
State one characteristic that supports your answer.
Give one example of where it is used or found in a household, industrial, or environmental setting.
After completing the table, answer the following reflection questions:
Review the answers before submitting the organizer

	Guide Questions: 1. Is it a solution or a non-solution? 2. What characteristics are common among all solutions? 3. How are solutions different from other types of mixtures? 4. Why are solutions important in everyday life and environmental processes? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Option 1: Investigate Physical Water Treatment Process	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Follow the teacher-approved procedure and safety rules, measure or observe as directed, record the data in the required table, and explain the result using scientific evidence. **Procedure:** According to DENR Administrative Order No. 2016-08, titled Water Quality Guidelines and General Effluent Standards of 2016, Total Suspended Solids (TSS) and Oil & Grease are	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms.

	among the water quality parameters specified. These parameters can be associated with heterogeneous mixtures in water and may be reduced through appropriate physical separation processes. Students will conduct online research on the water treatment process or perform an experiment using the following materials: Teacher-prepared, nonpathogenic simulated kitchen wastewater Beaker Stirrer Funnel Filter paper Adsorbents (e.g. hair, coco husk, dried leaves, etc.) Use only teacher-prepared simulated kitchen wastewater. Never collect sewage or actual wastewater. The treated sample remains nonpotable and must not be tasted. 1. Place the teacher-prepared simulated wastewater in a beaker and stir it carefully. Record the mixture's appearance; do not touch, smell, or taste the sample. 2. Ask learners to remove as much oil as possible from the water using adsorbent materials such as cut hair, coconut husk, and other materials available in the locality. 3. After partially removing the oil, learners will continue by removing the food particles. 4. Let the fine food residues settle at the bottom of the beaker, then transfer the water to a different beaker or container.	Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	5. Pass the sample through filter paper and observe whether visible suspended particles or turbidity decrease. Filtration does not guarantee removal of dissolved substances or microorganisms, and the output is nonpotable. Science clarification: Simple filtration may reduce suspended particles but does not reliably remove dissolved chemicals or pathogens. Potable water requires appropriate treatment, disinfection, testing, and official guidance. **Guide Questions:** 1. What type of mixture is created in the experiment (e.g. water and oil, water and food waste)? For heterogeneous oil–water and food–water mixtures, identify the continuous and dispersed phases; use solute and solvent only for a true solution. 2. What is the most efficient process for removing the oil and dirt from the water? **3.** How can we prevent chemicals or contaminants such as oil, grease, and dirt from polluting the environment (e.g., bodies of water)? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

Option 2: Solutions in my Daily Life Activity

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Identify three solutions encountered at home, in the community, or in the environment. Complete the table by naming the solute, solvent, location or use, and importance of each example.

Activity Proper:
Instructions to Students:
Individually identify three examples of solutions that you commonly encounter at home, in the community, or in the environment.
Complete the table below in your notebook:

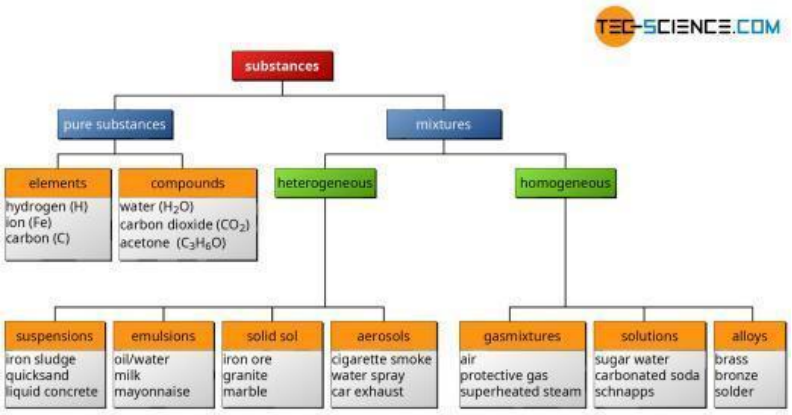
Example Solution	Solute	Solvent	Where It Is Used/Found	Why is it Important

For each example, explain how its characteristics as a solution make it useful in everyday life, industrial activities, or environmental processes.
Choose one example from the table and write a short paragraph (3–5 sentences) describing:
How it benefits people or the environment

The activity targets Learning Objectives 1 and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies Constructivist, Inquiry-Based, and Reflective approaches by requiring learners to analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	What might happen if that solution were not available or properly used Share the answer with the class during the discussion. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	C.2. Making Generalization	
	Option 1: Learning Organizer Activity	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Create or complete the required organizer or diagram, label all relevant parts or stages, show the relationships accurately, and add a brief evidence-based explanation.	The activity targets Learning Objectives 1 and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation,

	Activity Proper: Solutions can be found everywhere, in products we use at home, in industry, and in the environment. The only pure substances are those in the periodic table of elements and the combinations of them that are bounded/combined chemically, such as NaCl (table salt), CO_2, $C_{12}H_{22}O_{11}$, and H_2O among others.  **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Expected Output/Product:** Completed organizer showing accurate classifications, comparisons, or relationships.	data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Assessment Criteria: • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: What I Have Learned about Solutions:	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences. **Activity Proper:** Instructions to Students: Individually reflect on the activities, discussions, and experiments conducted during the lesson. Complete the following statements in your notebook using your own words: A solution is _____. A solution differs from other mixtures because _____. The two main components of a solution are _____ and _____. The characteristics of a solution include _____.	The activity targets Learning Objectives 1 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

	Examples of solutions found at home are _____. Solutions are important in industries because _____. Solutions play a role in the environment by _____. Using your completed statements, write a 3–5 sentence generalization summarizing the key concepts learned about solutions. Be prepared to share the generalization with the class **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	**Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.
	C.3. Evaluating Learning	
	Option 1: Solution Identification Quiz	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1 and 2 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and

	Directions: Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** Instructions to Students: Read each item carefully. Identify whether the given example is a solution or a non-solution. If it is a solution, identify the solute and solvent. Write your answers on a separate sheet of paper. Examples: Salt dissolved in water Oil mixed with water Vinegar Sand mixed with water Air **Guide Questions:** 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Option 2: Applications of Solution Challenge	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Analyze each situational question in the table, identify how solutions are involved, and write an evidence-based explanation of the appropriate application or response. **Activity Proper:** Instructions to Students: Individually answer the following situational questions included on the table.	The activity targets Learning Objectives 1 and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Scoring: Use a rubric that assesses accuracy, completeness, and clarity of explanation.

Scenario	Problem / Situation	Guiding Question	Actionable Output
Vinegar at home	A student notices vinegar looks clear and uniform when cleaning the kitchen.	Why is vinegar considered a solution, and how is it useful in the household?	Write a short explanation + give one household use (e.g., cleaning, cooking).
Water treatment	A community faces dirty water supply. Engineers use solutions in purification.	How are solutions important in water treatment and environmental management?	Explain in 2–3 sentences how solutions help keep water safe.
Industrial soft drinks	A factory produces soft drinks by dissolving sugar and carbon dioxide in water.	Give one example of a solution used in industry and describe its purpose.	Identify the solute + solvent, and explain why uniformity matters.
Daily usefulness	A student wonders why sugar dissolves in tea but sand does not.	How do the characteristics of solutions make them useful in everyday life?	Connect one characteristic (homogeneous, stable, transparent) to a daily task.
Solution vs non-solution	A science fair project compares salt water and oil + water.	Differentiate a solution from a non-solution using one example of each.	Provide one clear comparison + real-world context.

Total points: 15

Guide Questions:

1. Which scientific concept was most important in determining the correct response?
2. What evidence or characteristic helped you distinguish the correct answer from the alternatives?

Assessment Criteria:

- Scientific accuracy
- Completeness of the required task
- Clarity of response or explanation

	C.4. Additional Activities	
	Option 1: Guided Learning Activity	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Mix the teacher-approved soil sample with water using the stated quantities, observe settling and filtration, record the dissolved and suspended fractions, and classify each resulting mixture from the evidence. **Activity Proper:** As part of the applied learning experience, students will explore the concept of mixtures using iron-rich soil (reddish soil or any other soil available in the locality). They will begin by mixing a small amount of soil with water and distinguishing dissolved, colloidal, and suspended fractions and observing the resulting mixture. From this, students will create and analyze various types of mixtures, solutions, suspensions, and colloids based on the composition and behavior of the soil particles in water. This activity emphasizes that soil contains both soluble substances (such as minerals and salts) and insoluble materials (like sand and clay). This means that different mixtures may form depending on the method of mixing and the proportion of components. Students will then classify the mixtures accordingly, identifying which samples represent a true	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	solution, a suspension, or a colloid. To extend the activity, students will investigate practical separation techniques such as filtration, coagulation, and precipitation to remove dirt and impurities from the water. These methods mirror real-world practices used in water treatment and other industrial processes, thereby helping learners make connections between classroom concepts and industry applications. This hands-on investigation not only reinforces students' understanding of mixture types and their properties but also introduces them to environmental and industrial approaches to resource management and purification. Science clarification: Simple filtration may reduce suspended particles but does not reliably remove dissolved chemicals or pathogens. Potable water requires appropriate treatment, disinfection, testing, and official guidance. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	

Option 2: Question for Enrichment:

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Answer the enrichment question in a complete paragraph, use a relevant water-treatment or environmental example, and explain how the example demonstrates the concept of solutions.

Activity Proper:

Chemicals in the home/industry/environment	Harm it may cause to humans and environment	Suggestion on proper handling of solute/pollutant/ chemicals
Soap		
Used Oil		
Spoiled food /food waste		
Expired medicine		
Muriatic acid		

Complete the task according to the directions and record the required observations, responses, or explanations.

The activity targets Learning Objectives 2 and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.
The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

Note to Teachers: Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Guide Questions: 1. How can understanding the concept of solutions in the environment help us better understand water treatment processes? 2. Cite other solutes/chemicals that become contaminants in the environment particularly in a water body. How to handle these chemicals properly to prevent them from contaminating the environment? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
V. ASSESSMENT *(Assessing Learnings)*	**1. What best describes a homogeneous mixture?** A. A mixture where components can be easily separated B. A mixture with uneven composition C. A mixture with visibly distinct substances **D. A mixture with uniform composition throughout** **2. Which of the following is a characteristic of a solution?** A. The solute particles can be filtered out B. The solute particles settle at the bottom over time **C. The solute particles are too small to be seen and remain evenly distributed** D. The solution scatters light and appears cloudy **3. In which mixture are the particles large enough to settle over time?** A. Solution B. Colloid **C. Suspension** D. Homogeneous mixture	

	4. Which mixture type exhibits the Tyndall effect and appears cloudy? A. Solution **B. Colloid** C. Suspension D. Homogeneous mixture **5. What is the particle size range of a solution?** A. Greater than 1000 nm **B. Less than 1 nanometer** C. Between 1–1000 nm D. More than 10,000 nm **6. Which of the following best illustrates a true solution?** A. Oil in water **B. Sugar dissolved in tea** C. Milk D. Sand in water **7. What best describes a saturated solution?** A. A solution that contains no solute B. A solution in which the solute is completely evaporated **C. A solution that cannot dissolve any more solute at a given temperature** D. A solution where the solute settles immediately without mixing **8. Why can't the solute in a solution be filtered out?** A. It is too dense B. It is a gas **C. The particles are too small and completely dissolved** D. It is heavier than the solvent

	9. What happens when a beam of light passes through a solution? A. It reflects off the solute particles B. It gets absorbed by the solution C. It is scattered in different directions **D. It passes through without scattering** **10. Which of the following real-world settings best demonstrates the relevance of understanding solutions and mixtures in the environment?** A. Mixing paints to create new colors in an art class B. Measuring the length of a wooden plank for carpentry C. Learning how to use a calculator for basic math operations **D. Treating wastewater to remove dissolved and suspended pollutants** **Assessment specification:** For the Tyndall-effect item, state that a true solution does not visibly scatter the beam, although it may absorb selected wavelengths. Include the answer key and total score.
VI. REFLECTION *(Feedback and Continuous Improvement)*	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery. 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? 6. What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT in order to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

Learning Title/Topic:	Solutions in the Environment – Safe Handling, Storage, and Disposal of Chemicals	Lesson Exemplar:	5

I. OBJECTIVES	
A. Content Standard	Chemicals should be handled safely, and solutions can have beneficial and harmful environmental effects.
B. Performance Standard	By the end of the quarter, learners apply research skills to discover how scientists have impacted our lives. They recognize the significant role of different agencies in the Philippines, such as DOST and DTI, in scientific innovation and development. They show critical thinking in explaining the different substances in household and personal care products, including their benefits and potential risks of using and disposing of them. They demonstrate appropriate and safe handling and use of chemicals. They explain that chemical reactions occur in human activities and the environment, and that several chemical solutions pose a threat to the community.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	Learners know common household and school chemicals, basic hazard symbols and safety labels, simple safety practices, and the importance of responsible actions in protecting human health and the environment.
	9. apply best practices in the proper handling, storage, and disposal of chemicals;
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	• U.S. Environmental Protection Agency. "Learn the Basics of Hazardous Waste." Last modified April 15, 2025. https://www.epa.gov/hw/learn-basics-hazardous-waste. • U.S. Environmental Protection Agency. "Hazardous Waste." Last modified May 5, 2025. https://www.epa.gov/hw. • U.S. Occupational Safety and Health Administration. "Hazard Communication Standard Pictograms." Accessed June 24, 2026. https://www.osha.gov/hazcom/pictograms. • Republic of the Philippines. Republic Act No. 6969: An Act to Control Toxic Substances and Hazardous and Nuclear Wastes, and for Other Purposes. July 26, 1990. Official Gazette of the Republic of the Philippines. https://www.officialgazette.gov.ph/1990/07/26/republic-act-no-6969/.

<table>
<tr><td></td><td>

- Department of Health. “Health Care Waste Management Manual.” Manila: Department of Health, Philippines. Accessed June 24, 2026. https://doh.gov.ph.
- Department of Education. “Policy Guidelines on Safe and Supportive Learning Environment.” Pasig City: Department of Education, Philippines. Accessed June 24, 2026. https://www.deped.gov.ph.

</td></tr>
<tr><td>III. CONTENT
(Sequencing Content)</td><td>Solutions in the Environment – Safe Handling, Storage, and Disposal of Chemicals</td></tr>
<tr><td>IV. OBJECTIVES
(Setting Clear Objectives and Analyzing the Tasks)</td><td>1. Explain the importance of proper handling, storage, and disposal of chemicals in preventing health and environmental hazards.
2. Apply appropriate safety practices in the handling, storage, and disposal of common household and school chemicals by analyzing situations and proposing correct actions.
3. Demonstrate responsibility and environmental stewardship by developing advocacy materials (e.g., posters, infographics, or slogans) that promote safe chemical use and proper waste disposal practices.</td></tr>
<tr><td colspan="2">IV. PROCEDURES</td><td>ANNOTATIONS</td></tr>
<tr><td rowspan="3">A. Activating Prior Knowledge</td><td colspan="2">A.1. Activating Prior Knowledge</td></tr>
<tr><td colspan="2">Option 1: Safe or Unsafe? (Think-pair- share)</td></tr>
<tr><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil
Directions:
Recall common chemical products found in your home. Complete the table by describing how each product is usually stored and disposed of.
Activity Proper:</td><td>
<table>
<tr><th>Chemical/ Product</th><th>Storage</th><th>Disposal</th><th>Safe or Unsafe?</th></tr>
<tr><td>Bleach</td><td>Stored in original container, away from children</td><td>Follow label instructions; do not pour into waterways</td><td>Safe if stored properly</td></tr>
</table>
</td></tr>
</table>

Recall common chemical products found in your home. Complete the table by describing how each product is usually stored and disposed of. Then, determine whether the practice is safe or unsafe and explain your answer. After completing the table, discuss your responses with a partner.

Chemical/ Product	**How is it usually stored at home?**	**How is it usually disposed of?**	**Is the practice safe or unsafe? Why?**
Bleach			
Expired or unwanted medicine — Store it safely and dispose of it through an approved pharmaceutical-waste or take-back program; expiration alone does not define its intrinsic chemical hazard			
Used cooking oil			

Safety requirement: Use photographs or clean, residue-free, teacher-supplied labels only. Learners must not collect, open, rinse, smell, or repurpose

Expired or unwanted medicine— handle through an approved pharmaceuti cal-waste or take-back program; expiration alone does not define its intrinsic chemical hazard	Kept in designated storage until disposal	Returned to collection centers or disposed of according to local guidelines	Safe if disposed properly
Used Cooking Oil	Stored in sealed container	Collected for recycling or disposed of properly, not poured down drains	Safe if disposed properly

The activity targets Learning Objective 1 by requiring learners to interpret information from a table and connect the evidence to safe chemical storage and disposal practices.

It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information,

<table>
<tr><td></td><td>bleach, pesticide, insecticide, medicine, battery, or other hazardous-product containers.

Guide Questions:
1. Which practices are considered safe? Why?
2. Which practices may pose risks to human health or the environment?
3. What should be done to improve unsafe practices?

Assessment Criteria:
• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation</td><td>identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.</td></tr>
<tr><td></td><td colspan="2">Option 2: Read Before You Use</td></tr>
<tr><td></td><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Examine each provided case, scenario, image, or sample. Identify the relevant evidence, answer every guide question, and explain the conclusion using the lesson concepts.

Activity Proper:
Prior to the class, learners will bring a photograph or teacher-approved, clean, residue-free label or</td><td>
<table>
<tr><td>Chemical/Product</td><td>Hazard Symbol/Warning Found</td><td>Safety Precaution Indicated</td><td>How should it be handled, stored, or disposed of properly?</td></tr>
<tr><td>Bleach</td><td>Corrosive / Irritant</td><td>Avoid contact with skin and eyes. Do not mix with other cleaners.</td><td>Wear gloves when handling, keep in original container, store away from children, and dispose of according to local waste guidelines.</td></tr>
<tr><td>Rubbing Alcohol</td><td>Flammable</td><td>Keep away from heat, sparks, and open flames.</td><td>Store in a cool, well-ventilated place and tightly close the container after use.</td></tr>
</table>
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packaging from a household or personal care product. Work with your group and examine the household product labels or empty containers brought by the members.
Identify the hazard symbols, warning labels, and precautionary statements found on each product.
Analyze the information indicated on the label and determine the proper way to handle, store, and dispose of the product.
Complete the table provided and be prepared to share your findings with the class.

Chemical/ Product	Hazard Symbol/Warning Found	Safety Precaution Indicated	How should it be handled, stored, or disposed of properly?

Safety requirement: Use photographs or clean, residue-free, teacher-supplied labels only. Learners must not collect, open, rinse, smell, or repurpose bleach, pesticide, insecticide, medicine, battery, or other hazardous-product containers.

Insecticide	Toxic / Harmful	Do not inhale. Avoid contact with skin and food.	Use in a well-ventilated area, store away from children and pets, and dispose of empty containers according to label instructions.
Drain Cleaner	Corrosive	Avoid direct contact with skin and eyes.	Wear protective gear when handling, store securely, and never mix with other chemicals.
Battery	Environmental Hazard	Do not dispose of in regular trash.	Bring to designated collection or recycling centers for proper disposal.

The activity targets Learning Objective 1 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concept in the objective. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or

Guide Questions:

1. What information can be found on product labels?
2. Why is it important to read warning labels before using chemical products?
3. How can labels help prevent accidents and environmental pollution?

Assessment Criteria:

• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

A.2. Establishing the Purpose of the Lesson

Option 1: What Went Wrong?

Materials/Resources Needed:

• Notebook or paper
• Pen or pencil

Directions:

Read or examine the assigned case or scenario. Identify the relevant evidence, apply the appropriate scientific concepts, answer the guide questions, and justify your conclusion.

Activity Proper:

Study the situations presented by your teacher. Identify what was done incorrectly and predict the possible consequences of each action.

Situation A: A student mixed bleach with another household cleaner without reading the label.

Situation	Unsafe Practice	Possible Consequences	Proper Practice
A. Mixing bleach with another cleaner	Mixing chemicals without reading labels	Release of toxic fumes, poisoning, respiratory problems	Read labels and never mix chemicals unless instructed
B. Throwing expired medicines into a river	Improper disposal of medicines	Water contamination, harm to aquatic organisms, health risks	Follow proper disposal guidelines or return to collection centers

	Situation B: An individual disposed of expired medicines by throwing them into a nearby river. Situation C: A bottle of insecticide was left open and within reach of children. Safety requirement: Use photographs or clean, residue-free, teacher-supplied labels only. Learners must not collect, open, rinse, smell, or repurpose bleach, pesticide, insecticide, medicine, battery, or other hazardous-product containers. Disposal requirement: Follow the current product label and authorized LGU, DENR, or collection-program guidance. Never reuse pesticide containers, pour pesticides into drains, or mix household hazardous wastes. **Guide Questions:** 1. What unsafe practice was observed in each situation? 2. What risks could result from these actions? 3. How could these situations have been prevented? 4. Why is it important to learn the proper handling, storage, and disposal of chemicals? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	C. Leaving insecticide open and within reach of children | Unsafe storage | Accidental poisoning, exposure to toxic substances | Store in a secure place away from children and pets The activity targets Learning Objective 1 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

Option 2: Which One Would You Choose?

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Examine each provided case, scenario, image, or sample. Identify the relevant evidence, answer every guide question, and explain the conclusion using the lesson concepts.

Activity Proper:
Read each pair of situations and choose which practice is safer. Explain your answer.

Situation A	**Situation B**
Store bleach in its original container with a label.	Transfer bleach to an unlabeled soft drink bottle.
Bring used batteries to a collection center.	Throw used batteries in regular trash bins.
Read the product label before using a chemical.	Use the product without reading the label.

Disposal requirement: Follow the current product label and authorized LGU, DENR, or collection-program guidance. Never reuse pesticide containers, pour pesticides into drains, or mix household hazardous wastes.

Situation A	Situation B	Correct Answer
Store bleach in its original container with a label.	Transfer bleach to an unlabeled soft drink bottle.	Situation A
Read the product label before using a chemical.	Use the product without reading the label.	Situation A

The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.
The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

<table>
<tr><td></td><td>Guide Questions:
1. Which practice is safer in each pair?
2. What makes the practice safer?
3. How can proper decisions prevent accidents and environmental harm?

Assessment Criteria:
• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation</td><td>Note to Teachers: Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.</td></tr>
<tr><td rowspan="3">B. Instituting New Knowledge</td><td colspan="2">B.1. Presenting Examples</td></tr>
<tr><td colspan="2">Option 1: Game Ka Na Ba? Safe or Hazardous?</td></tr>
<tr><td>Materials/Resources Needed:
• Displayed or teacher-prepared prompts/cards, as needed
• Notebook or paper
• Pen or pencil

Directions:
Follow the stated game rules and respond when called. Give the scientifically correct answer and, when required, justify it using evidence or the relevant concept.

Activity Proper:
Direction
As the teacher shows pictures of common household and school chemicals (e.g., bleach, alcohol,</td><td>
<table>
<tr><td>Product</td><td>Classification</td></tr>
<tr><td>Bleach</td><td>Hazardous</td></tr>
<tr><td>Muriatic Acid</td><td>Hazardous</td></tr>
<tr><td>Insecticide</td><td>Hazardous</td></tr>
<tr><td>Expired or unwanted medicine—handle through an approved pharmaceutical-waste or take-back program; expiration alone does not define</td><td>Hazardous</td></tr>
</table>
</td></tr>
</table>

	dishwashing liquid, muriatic acid, expired medicine, batteries, insecticide), move to the "Hazardous" or "Non-Hazardous" side of the room based on your answer. Learners who choose correctly will explain why the product belongs to the category and identify one safety practice related to its handling, storage, or disposal. Disposal requirement: Follow the current product label and authorized LGU, DENR, or collection-program guidance. Never reuse pesticide containers, pour pesticides into drains, or mix household hazardous wastes. **Guide Questions:** 1. Which products require special care when handling? 2. Why do some chemicals pose greater risks than others? 3. What safety practices should be observed when using these products? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	<table><tr><td>its intrinsic chemical hazard</td><td></td></tr><tr><td>Alcohol</td><td>Hazardous (flammable)</td></tr><tr><td>Dishwashing Liquid</td><td>Dishwashing liquid is generally lower hazard when used as directed, but it may irritate the eyes or skin and must not be ingested.</td></tr></table> The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

Option 2: Spot the Safe Practice

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Examine each provided case, scenario, image, or sample. Identify the relevant evidence, answer every guide question, and explain the conclusion using the lesson concepts.

Activity Proper:
Study each picture or scenario presented by the teacher. Determine whether the practice shown is Safe or Unsafe. Raise the appropriate card or move to the designated area. Explain your answer and suggest the correct safety practice if the action is unsafe.
Sample Scenarios

1. A bottle of bleach is stored in its original labeled container.
2. A child can easily reach a container of insecticide.
3. Used batteries are thrown into a regular trash bin.
4. A student reads the warning label before using a cleaning product.
5. Chemicals are stored near food items.

SCENARIO	ANSWER
Bleach stored in original labeled container	Safe
Insecticide within reach of children	Unsafe
Batteries thrown in regular trash	Unsafe
Reading warning labels before use	Safe
Chemicals stored near food	Unsafe

The activity targets Learning Objectives 1 and 2 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product.

The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative.

	Guide Questions: 1. Which practices help prevent accidents? 2. What dangers may result from unsafe practices? 3. Why is proper handling, storage, and disposal important? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	**Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.
	B.2. Discussing New Concept	
	Option 1: Spot the Safe Practice	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Examine each provided case, scenario, image, or sample. Identify the relevant evidence, answer every guide question, and explain the conclusion using the lesson concepts. **Activity Proper:** The teacher discusses the following concept: “Hazardous" means dangerous or risky, especially to health, safety, or the environment. In scientific and legal contexts (such as environmental science, chemistry, or occupational health), hazardous refers	The activity targets Learning Objectives 1 and 2 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or

	to substances, materials, or situations that can cause: Injury or harm to people (e.g., toxic chemicals), Damage to property (e.g., flammable liquids), Negative effects on the environment (e.g., corrosive waste or pollutants). Examples of Hazardous Materials: Toxic substances (e.g., mercury, lead) Flammable materials (e.g., gasoline, alcohol) Corrosive chemicals (e.g., sulfuric acid) Reactive substances (e.g., sodium, which reacts violently with water) Biological or infectious hazards (for example, infectious medical waste) are distinct from chemical properties, although both may occur in the same workplace. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Option 2: Definition and examples of hazardous vs. non-hazardous chemicals	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Review the definitions and examples, classify each substance by its relevant hazard, and explain the handling, storage, or disposal precaution indicated by its label and intended use. **Activity Proper:** In the Philippines, Republic Act 6969 defines hazardous substances in relation to their risks to human health and the environment, especially during handling, storage, and disposal. Use this to help students understand which substances are flammable, corrosive, reactive, or toxic versus lower-hazard products such as baking soda or vinegar when used as directed; lower hazard does not mean risk-free. https://www.epa.gov/hw/learn-basics-hazardous-waste Environmental Protection Agency (EPA) – Hazardous Substances https://www.epa.gov/hw/learn-basics-hazardous-waste Chemical hazard symbols and their meanings Risks of improper storage and disposal	The activity targets Learning Objectives 1 and 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	DOH/DepEd safety protocols and environmental guidelines Discuss the differences between hazardous chemicals (e.g., bleach, muriatic acid, insecticides) and lower-hazard products (e.g., baking soda or vinegar when used as directed), the types of chemical hazards (flammable, corrosive, reactive, and toxic), hazard symbols and their meanings, risks of improper chemical management, and DOH/DepEd safety guidelines. Suggested Video Clip (3–5 minutes) Show a short video depicting: A person mixing bleach with an acid or ammonia cleaner, which can release toxic chlorine or chloramine gases. Improper disposal of chemicals into waterways and its impact on aquatic life. Proper storage of chemicals away from children and food items. Correct disposal practices for household chemical products. Facilitating Questions Scope and safety: Chemical hazards and biological or infectious hazards are distinct, although both may occur in a workplace. Use only teacher-selected labels and safety data sheets; do not use live chemicals, clinical waste, or improvised spill simulations.	

Guide Questions:

1. What characteristics make a chemical hazardous?
2. How can you determine whether a product presents a higher or lower hazard under the stated conditions of use?
3. What information do hazard symbols provide to consumers?
4. What could happen if chemical products are mixed without reading the label?
5. Why should chemicals be stored properly and kept away from children?

Assessment Criteria:

• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

B.3. Developing Mastery

Option 1: Chemical Safety Sorting Challenge (Revised)

Materials/Resources Needed:

• Displayed or teacher-prepared prompts/cards, as needed
• Notebook or paper
• Pen or pencil

Directions:

Sort each item into the correct category based on the scientific characteristics provided. Record your

Chemical	Classification
Bleach	Hazardous
Alcohol	Hazardous (Flammable)
Dishwashing Liquid	Lower hazard when used as directed
Expired or unwanted medicine—handle through an approved	Hazardous; Special Disposal

	classifications and justify any item that could be confused with another category. **Activity Proper:** Direction Work with a partner. Examine the chemical cards and sort them according to the categories provided. After sorting, explain why each chemical belongs to its category and identify the appropriate safety practice for handling, storage, or disposal. Categories A. Hazardous / Non-Hazardous B. Safe Storage / Unsafe Storage C. Regular Disposal / Special Disposal Sample Cards Bleach Alcohol Dishwashing Liquid Expired or unwanted medicine—handle through an approved pharmaceutical-waste or take-back program; expiration alone does not define its intrinsic chemical hazard Used Batteries Insecticide Paint Used Cooking Oil Extension Task Draw a situational card and decide the best action to take.	<table><tr><td>pharmaceutical-waste or take-back program; expiration alone does not define its intrinsic chemical hazard</td><td></td></tr><tr><td>Batteries</td><td>Hazardous; Special Disposal</td></tr><tr><td>Insecticide</td><td>Hazardous</td></tr><tr><td>Used Cooking Oil</td><td>Special Disposal/Recycling</td></tr></table> The activity targets Learning Objectives 1 and 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

<table>
<tr><td></td><td>Examples:
For a small bleach spill, isolate and ventilate the area, use label-recommended protective equipment, and follow the label or safety data sheet. Never add another cleaner. For a large spill or strong fumes, leave and seek adult or emergency help.

Guide Questions:
1. What should you do with expired medicine?
2. How should batteries be disposed of?
3. What should you do before using a chemical product?

Assessment Criteria:
• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation</td><td>Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.</td></tr>
<tr><td></td><td colspan="2">Option 2: Safety Inspector Challenge</td></tr>
<tr><td></td><td>Materials/Resources Needed:
• Displayed or teacher-prepared prompts/cards, as needed
• Notebook or paper
• Pen or pencil
Directions:
Examine each chemical-safety scenario, identify the unsafe practice, state the possible risk, and recommend the correct handling, storage, or disposal action in the table.</td><td>
<table>
<tr><td>Scenario</td><td>Unsafe Practice Observed</td><td>Recommended Safety Action</td></tr>
<tr><td>Bleach stored in an unlabeled soft drink bottle</td><td>Improper storage</td><td>Keep in original labeled container</td></tr>
<tr><td>Expired medicines thrown into a river</td><td>Improper disposal</td><td>Follow proper disposal guidelines or collection programs</td></tr>
</table>
</td></tr>
</table>

Activity Proper:

Direction

Study each scenario carefully. As a "Chemical Safety Inspector," identify the unsafe practice and recommend the correct action.

Scenario	Unsafe Practice Observed	Recommended Safety Action
Bleach stored in an unlabeled soft drink bottle		
Expired medicines thrown into a river		
Chemicals stored beside food products		
A student reads the product label before using a cleaner		
Used batteries placed in a recycling collection box		

Guide Questions:

1. What risks may result from the unsafe practices?
2. How can these risks be prevented?
3. Which safety practices should always be followed?

Chemicals stored beside food products	Unsafe storage	Store chemicals separately from food
Student reads the product label	None (Safe Practice)	Continue following label instructions
Batteries placed in collection box	None (Safe Practice)	Continue proper disposal practice

The activity targets Learning Objectives 1 and 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Assessment Criteria:
• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

C. Demonstrating Knowledge and Skills

C.1. Finding Practical Application

Option 1: Community Chemical Safety Audit

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
In groups, discuss how chemicals such as paints, batteries, expired medicines, insecticides, and cleaning products are commonly handled, stored, and disposed of in your home or barangay. Record your observations on manila paper and post them around the classroom.

Activity Proper:
In groups, discuss how chemicals such as paints, batteries, expired medicines, insecticides, and cleaning products are commonly handled, stored, and disposed of in your home or barangay. Record your observations on manila paper and post them around the classroom. Visit each station, examine the responses of other groups, and write recommendations for safer practices using sticky notes.

Chemical/Product	Common Practice Observed	Safe/Unsafe	Recommendation
Expired medicines	Thrown in regular trash	Unsafe	Follow local disposal guidelines or collection programs
Used batteries	Mixed with household waste	Unsafe	Bring to designated collection or recycling centers
Bleach and cleaners	Stored in original containers with labels	Safe	Continue proper storage practices
Insecticides	Stored out of reach of children	Safe	Continue safe storage practices
Paints and solvents	Poured into drains	Unsafe	Dispose of according to local hazardous waste regulations

<table>
<tr>
<td></td>
<td>Metacognitive Question:

Guide Questions:
1. How are chemical products commonly disposed of in your community?
2. Which practices are safe and which need improvement?
3. What environmental or health risks may result from improper disposal?
4. What actions can community members take to promote chemical safety?
5. If I were responsible for chemical waste management in my community, what practices would I improve and why?

Assessment Criteria:
• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation</td>
<td>The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.
The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.</td>
</tr>
<tr>
<td></td>
<td colspan="2">Option 2: Chemical Safety Action Plan (Think-Pair-Share)</td>
</tr>
<tr>
<td></td>
<td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil</td>
<td>
<table>
<tr><td>Chemical Safety Issue</td><td>Possible Risks</td><td>Recommended Action</td><td>Expected Benefit</td></tr>
<tr><td>Batteries disposed of</td><td>Soil and water contamination</td><td>Establish a battery collection box in school</td><td>Reduced environmental pollution</td></tr>
</table>
</td>
</tr>
</table>

Directions:
Think independently about the prompt and write an initial response. Discuss it with a partner, agree on an evidence-based answer, and share the conclusion with the class.

Activity Proper:
Imagine that you are a member of your school Environmental Protection Committee. Identify one chemical safety issue that may occur at home, in school, or in the community (e.g., improper disposal of batteries, unsafe storage of cleaning agents, improper handling of pesticides). Work with a partner to develop a simple action plan that promotes safe handling, storage, or disposal practices.

Complete the Organizer:

Chemical Safety Issue	**Possible Risks**	**Recommended Action**	**Expected Benefit**

Metacognitive Question:
Guide Questions:
1. What chemical safety issue did you identify?
2. Why should this issue be addressed?
3. How will your proposed action help protect people and the environment?
4. How can I apply what I learned today to improve chemical safety practices in my own home?

in regular trash			
Expired medicines thrown into garbage	Accidental ingestion, water contamination	Promote proper medicine disposal drives	Improved community safety
Chemicals stored near food products	Poisoning or contamination	Store chemicals separately and label containers properly	Reduced health risks
Insecticides within reach of children	Accidental poisoning	Store in locked cabinets	Increased household safety

The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis.
The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-

	Expected Output/Product: Completed action plan with clear steps, responsibilities or actions, and a scientific rationale. **Assessment Criteria:** • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	C.2. Making Generalization	
	Option 1: Complete the Safety Code	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Complete all five safety statements using the lesson concepts. Then answer the synthesis question in a complete sentence that states the most important rule for handling, storing, and disposing of chemicals. **Activity Proper:** Complete the statements below using the concepts learned in the lesson. 1. Chemicals should always be handled _____. 2. Hazardous chemicals must be stored _____.	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or

	3. Before using any chemical product, I should _____. 4. Improper disposal of chemicals may cause _____. 5. Responsible chemical use helps protect _____ and _____. Synthesis Question: **Guide Questions:** Based on your answers, what is the most important rule everyone should remember when handling, storing, and disposing of chemicals? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Option 2: -2-1 Chemical Safety Reflection	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Complete the 3-2-1 chart below. **Activity Proper:** 3 Things I Learned 2 Safety Practices I Will Apply 1 Commitment I Will Make	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated

<table>
<tr><td></td><td>After completing the chart, share your responses with a partner and formulate one class statement that summarizes the lesson.

Guide Questions:
1. What is the most important scientific idea you developed from the activity?
2. What example or evidence best supports your explanation?

Expected Output/Product:
Completed written reflection that connects the activity to the relevant scientific concepts.

Assessment Criteria:
• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation</td><td>through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative.

Note to Teachers: Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.</td></tr>
<tr><td></td><td colspan="2">C.3. Evaluating Learning</td></tr>
<tr><td></td><td colspan="2">Option 1: Chemical Safety Scenario Analysis</td></tr>
<tr><td></td><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil
Directions:
Read or examine the assigned case or scenario. Identify the relevant evidence, apply the appropriate scientific concepts, answer the guide questions, and justify your conclusion.</td><td><table><tr><td>Situation</td><td>Unsafe Practice</td><td>Appropriate Safety Action</td></tr><tr><td>Bleach in soft drink bottle</td><td>Improper storage and labeling</td><td>Keep in original labeled container</td></tr></table></td></tr>
</table>

Activity Proper:
Read each situation carefully. Identify the unsafe practice and explain the appropriate action that should be taken.

Situation	Unsafe Practice	Appropriate Safety Action
A bottle of bleach is transferred to an unlabeled soft drink container.		
Expired medicines are thrown into a nearby creek.		
Insecticides are stored within reach of children.		
Used batteries are mixed with regular household waste.		
A student reads the label before using a cleaning product.		

Guide Questions:

1. What evidence in the case or scenario is most relevant to the problem?
2. Which scientific concept best explains the situation, and why?

Medicines in creek	Improper disposal	Follow proper disposal procedures
Insecticides accessible to children	Unsafe storage	Store in secure location
Batteries in household trash	Improper disposal	Bring to collection/recycling center
Reading label	None (safe practice)	Continue following instructions

The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.
The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	**Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Option 2: Design a Chemical Safety Advocacy Poster	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available) **Directions:** Create the specified visual output using accurate scientific information, clear labels or captions, and appropriate examples. Present or submit the output with a brief explanation of its main scientific message. **Activity Proper:** Create an infographic or advocacy poster promoting responsible chemical use in the home, school, or community. Your output must: Include at least three safety practices for handling chemicals. Include proper storage and disposal practices. Incorporate relevant hazard symbols or warning signs. Present a simple life cycle of a chemical product from acquisition to disposal.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Include a slogan encouraging responsible chemical use.

Guide Questions:
1. What scientific idea is communicated most clearly in your output?
2. How does the evidence, example, or design feature in your output support that scientific idea?

Expected Output/Product:
Completed poster with accurate scientific content, clear visuals, and an appropriate message.

Rubric

Criteria	Full Credit	Partial Credit	Minimal Credit	Total
Accuracy of Safety Information	5 points — Presents accurate safety information based on product labels and credible guidance.	3 points — Partly meets the criterion; minor gaps or inaccuracies remain.	1 point — Shows limited evidence; major gaps or inaccuracies remain.	____
Application of Proper Handling, Storage, and Disposal Practices	5 points — Applies appropriate handling, storage, and disposal practices to the selected products.	3 points — Partly meets the criterion; minor gaps or inaccuracies remain.	1 point — Shows limited evidence; major gaps or inaccuracies remain.	____
Use of Hazard Symbols and Labels	5 points — Correctly interprets	3 points — Partly meets the criterion;	1 point — Shows limited evidence;	____

	relevant hazard symbols, warnings, and label instructions.	minor gaps or inaccuracies remain.	major gaps or inaccuracies remain.	
Creativity, Organization, and Clarity	5 points — Presents the output clearly, logically, and effectively for the intended audience.	3 points — Partly meets the criterion; minor gaps or inaccuracies remain.	1 point — Shows limited evidence; major gaps or inaccuracies remain.	____
Maximum Score				____ / 20

C.4. Additional Activities

Option 1: Safety First or Safety Risk?

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Read each statement carefully. Write Safety First if the practice promotes proper handling, storage, or disposal of chemicals. Write Safety Risk if the practice may cause harm to people or the environment.

Activity Proper:
Keeping bleach in its original labeled container.
_____

The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated

	Throwing used batteries in a regular trash bin. _____ Reading the product label before using a chemical. _____ Storing insecticides within reach of children. _____ Disposing of expired medicines according to local guidelines. _____ Mixing cleaning chemicals without reading instructions. _____ Wearing gloves when handling corrosive substances. _____ Keeping chemicals away from food and drinks. _____ Pouring used paint into a drainage canal. _____ Following the safety precautions indicated on product labels. _____ **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Option 2: What Should You Do?	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read each chemical-safety situation, select or write the safest action, and explain how the action follows proper handling, storage, or disposal practice. **Activity Proper:** Read each situation carefully. Choose the best action that demonstrates proper chemical handling, storage, or disposal. Write the letter of the correct answer. A. Throw it into a river. B. Follow proper disposal guidelines. C. Leave it on a table. D. Store in cabinet 2. Before using a household cleaner, you should: A. Read the label and safety instructions. B. Mix it with another cleaner. C. Remove the label. D. Use it immediately A. Near food items. B. Within reach of children. C. In a secure place away from children and pets. D. Within the reach of everyone	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	A. Place them in a designated collection or recycling center. B. Throw them in any trash bin. C. Burn them. D. Store in plastics A. To identify hazards and safety precautions. B. To make containers look attractive. C. To save storage space D. To save time 5: Description: Outstanding understanding of chemical safety practices 4: Description: Very Good understanding 3: Description: Satisfactory understanding 2: Description: Needs Improvement 0–1: Description: Requires Further Support **Guide Questions:** 1. Where should insecticides be stored? 2. What is the best way to dispose of used batteries? 3. Why is it important to label chemical containers properly? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	

V. ASSESSMENT
(Assessing Learnings)

Assessment Activity: Profiling the Life Cycle of a Chemical/Product

Scenario:

Imagine that you are a Chemical Safety Inspector assigned to evaluate commonly used household or workplace products. Your task is to examine a product and determine whether it is being handled, stored, and disposed of safely. You will analyze the information found on the product label and identify potential risks to human health and the environment if proper safety practices are not followed.

Directions: Read each chemical-safety situation, select or write the safest action, and explain how the action follows proper handling, storage, or disposal practice.

1. Choose or examine a household, school, hospital, or industrial chemical product assigned by your teacher (e.g., bleach, alcohol, insecticide, detergent, disinfectant, paint thinner).
2. Read the product label carefully and identify its properties (toxic, flammable, reactive, corrosive, infectious, or others).
3. Determine where the product is commonly found or used.
4. Describe how the product should be properly stored, including the type of container, labeling requirements, and safety precautions.
5. Identify the safety measures that should be observed when handling or using the product.
6. Explain the proper disposal method and the appropriate clean-up procedures in case of accidental spills.
7. Describe the possible harmful effects on humans, animals, and the environment if the product is improperly handled, stored, disposed of, or spilled.
8. Complete the table and be prepared to present your findings to the class.

Chemical/Product	Properties indicated in the container labels (Toxic, Flammable, Reactive, Infectious, others)	Found at (home, hospital/industry)	Describe storage (Stored in appropriate container?) (Properly labelled/precautions provided?)	Precautions in handling/use of the product	Describe proper disposal (include clean-up protocols in case of spill)	Describe the harmful effects of a chemical or product if it is stored, handled, or disposed of improperly, both on humans/animals and on the environment (e.g., in cases of spills

						into the environment or contamination of body parts such as the skin, eyes, or mouth).

Criteria	**Level 4 (91–100)**	**Level 3 (86–90)**	**Level 2 (81–85)**	**Level 1 (75–80)**	**Total**
Chemical or product profile	Provides a comprehensive, accurate description of the product profile, storage, handling, disposal, and spill-management practices.	Provides an adequate description of most required elements, with only minor omissions.	Provides a partial description of the required elements, with several omissions or unclear details.	Provides little or no accurate information about the required elements.	____
Total Score					**____ / 4**

Assessment specification: Provide the answer key and total score. Assess chemical hazards separately from biological or infectious hazards, and base disposal answers on the current product label and authorized local guidance.

<table>
<tr><td></td><td>Rubric
<table>
<tr><th>Criteria</th><th>5 points</th><th>3 points</th><th>1 point</th><th>Total</th></tr>
<tr><td>Scientific accuracy</td><td>Accurate and complete; contains no scientific misconceptions.</td><td>Mostly accurate; minor errors do not affect the main explanation.</td><td>Major errors, unsupported claims, or misconceptions.</td><td>____</td></tr>
<tr><td>Evidence and application</td><td>Uses relevant evidence and applies concepts appropriately.</td><td>Uses some relevant evidence; application is partly developed.</td><td>Uses little evidence or gives unsupported applications.</td><td>____</td></tr>
<tr><td>Clarity and completeness</td><td>Clear, organized, and complete.</td><td>Generally clear but partly incomplete.</td><td>Unclear, disorganized, or substantially incomplete.</td><td>____</td></tr>
<tr><td>Total Score</td><td></td><td></td><td></td><td>____ / 15</td></tr>
</table></td></tr>
<tr><td>VI. REFLECTION
(Feedback and Continuous Improvement)</td><td>After implementation, reflect on learner performance, activity effectiveness, assessment results, needed enrichment or remediation, and improvements for future lessons.
1. How many learners successfully demonstrated the learning objectives based on the assessment results?
2. Which activity helped learners understand the lesson the most? Which activity helped the least?
3. Which part of the lesson was easiest for learners? Which part was most difficult?
4. How many learners needed enrichment? How many needed remediation?
5. What did the assessment results show about learners' understanding of the lesson?
6. What improvement would you make if you taught this lesson again?</td></tr>
<tr><td>VII. USE OF GENERATIVE AI</td><td>In preparing this Learning Exemplar (LE), the author(s) used ChatGPT in order to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.</td></tr>
</table>

Learning Title/Topic:	Solutions in the Envi*ronment – Effects of Salt Concentration on Plant Growth	Lesson Exemplar:	6

I. OBJECTIVES	
A. Content Standard	chemicals should be handled safely, and solutions can have beneficial and harmful environmental effects.
B. Performance Standard	By the end of the quarter, learners apply research skills to discover how scientists have impacted our lives. They recognize the significant role of different agencies in the Philippines, such as DOST and DTI, in scientific innovation and development. They show critical thinking in explaining the different substances in household and personal care products, including their benefits and potential risks of using and disposing of them. They demonstrate appropriate and safe handling and use of chemicals. They explain that chemical reactions occur in human activities and the environment, and that several chemical solutions pose a threat to the community.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	1. Understand the essential needs of plants (water, light, nutrients) and how external factors affect growth. 2. Express concentration as the relative amount of solute compared to solvent in a solution.
	10. investigate how much salt dissolved in water will prevent the growth of a simple garden plant; and
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	Atta, Kousik, Saptarshi Mondal, Shouvik Gorai, Aditya Singh, Amrita Kumari, T K Ghosh, Avijit Roy, et al. 2023. "Impacts of Salinity Stress on Crop Plants: Improving Salt Tolerance through Genetic and Molecular Dissection." Frontiers in Plant Science 14 (September). https://doi.org/10.3389/fpls.2023.1241736. Craker, Lyle E. 2021. "4 Plant Growth Factors That Affect All Plants." Journal of Soil Science & Plant Health 5 (3). https://www.scitechnol.com/peer-review/4-plant-growth-factors-that-affect-all-plants-NahO.php?article_id=14728. Hao, Shanhu, Yiran Wang, Yunxiu Yan, Yuhang Liu, Jingyao Wang, and Su Chen. 2021. "A Review on Plant Responses to Salt Stress and Their Mechanisms of Salt Resistance." Horticulturae 7 (6): 132. https://doi.org/10.3390/horticulturae7060132.

	Ludwiczak, Agnieszka, Monika Osiak, Stefany Cárdenas-Pérez, Sandra Lubińska-Mielińska, and Agnieszka Piernik. 2021. "Osmotic Stress or Ionic Composition: Which Affects the Early Growth of Crop Species More?" Agronomy 11 (3): 435. https://doi.org/10.3390/agronomy11030435. **Materials:** mung bean seeds or other fast-germinating garden plant seeds, small plastic cups or pots, potting soil or cotton/tissue germination medium, table salt (NaCl), water, measuring cup or graduated cylinder, weighing scale or measuring spoon, stirring rod or spoon, labeled containers for 0%, 0.25%, 0.50%, 1.00%, and 2.00% NaCl solutions, ruler, masking tape, marker, data recording sheets, graphing paper or spreadsheet software, laptop and projector/TV, images of healthy and salt-stressed plants, paper towels, waste container	
III. CONTENT *(Sequencing Content)*	Solutions in the Environment – Effects of Salt Concentration on Plant Growth	
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	1. Explain how different salt concentrations may affect plant growth by limiting water absorption and causing stress to the plant. 2. Formulate a testable hypothesis and design a controlled experiment to investigate the effects of varying salt concentrations on plant growth. 3. Systematically collect, analyze, and interpret data to estimate, for the tested species and conditions, the lowest tested concentration at which growth is clearly lower than the 0% control.	
IV. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	***A.1. Activating Prior Knowledge***	
	Option 1: Nature's Recipe	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objective 1 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific

	Directions: Identify the factors needed for plant growth, explain the role of each factor, and create the required visual growth recipe using accurate labels and examples. **Activity Proper:** Learners will identify key elements for plant growth—light, water, carbon dioxide, mineral nutrients, suitable temperature, and oxygen for respiration; soil often supplies anchorage and minerals but is not required by every plant-growing system—while also considering environmental factors like temperature and space. Learners will then create a visual "growth recipe," such as a recipe card, infographic, or diagram, labeling each component according to its role in plant development. Controlled-investigation protocol: Use one NaCl treatment series: 0%, 0.25%, 0.50%, 1.00%, and 2.00% mass/volume. Prepare 100 mL of each treatment with 0, 0.25, 0.50, 1.00, or 2.00 g NaCl, respectively, and add water to a final volume of 100 mL. Use at least three independently treated containers per treatment; seeds within one container are subsamples. Specify the plant species and seed source, growing medium, sowing depth, container size, seeds per container, light and temperature conditions, solution volume and schedule, observation days, response variables, PPE, cleanup, and disposal. Report variability and describe the task as a controlled NaCl-irrigation model rather than a complete model of field soil salinity. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity?	concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: Green Quest	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Find the plant-growth terms in the word grid, list each term, and write one scientifically accurate sentence explaining how that factor supports plant growth. **Activity Proper:** Learners complete a word hunt in a letter grid to find essential plant growth terms such as sunlight, water, soil, and nutrients. For each term, they write one sentence explaining how the factor supports plant growth. They also state what may happen when the factor is excessive or lacking. The activity ends with a group discussion on how the absence of any element could affect plant development. Discussion Points (Option 1 and Option 2): Controlled-investigation protocol: Use one NaCl treatment series: 0%, 0.25%, 0.50%, 1.00%, and 2.00% mass/volume. Prepare 100 mL of each treatment with 0, 0.25, 0.50, 1.00, or 2.00 g NaCl, respectively, and add	The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is

	water to a final volume of 100 mL. Use at least three independently treated containers per treatment; seeds within one container are subsamples. Specify the plant species and seed source, growing medium, sowing depth, container size, seeds per container, light and temperature conditions, solution volume and schedule, observation days, response variables, PPE, cleanup, and disposal. Report variability and describe the task as a controlled NaCl-irrigation model rather than a complete model of field soil salinity. **Guide Questions:** 1. What plant-growth factors did you identify and how does each factor help the plant grow? 2. How can an imbalance, such as too much or too little water or salt in the water, affect plant growth? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Salty Situations	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objective 1 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based

	Directions: Examine the multimedia explanation of how sodium chloride dissolves in water, record the key ion and water-potential ideas, and explain how salinity can reduce water uptake by plant roots. **Activity Proper:** The teacher will display multimedia resources explaining the chemistry of salt, including its ionic structure, how sodium chloride dissolves and dissociates into sodium (Na^+) and chloride (Cl^-) ions in water. The visuals will also illustrate how the resulting saline solution lowers the water potential outside the roots, which can reduce water uptake by plants, sometimes causing harm. Learners will walk around to view and reflect on the multimedia. The teacher will conclude with a guided discussion to reinforce these concepts and set the stage for further exploration. The teacher may use the provided video links as references. Discussion Points: Controlled-investigation protocol: Use one NaCl treatment series: 0%, 0.25%, 0.50%, 1.00%, and 2.00% mass/volume. Prepare 100 mL of each treatment with 0, 0.25, 0.50, 1.00, or 2.00 g NaCl, respectively, and add water to a final volume of 100 mL. Use at least three independently treated containers per treatment; seeds within one container are subsamples. Specify the plant species and seed source, growing medium, sowing depth, container size, seeds per container, light and temperature conditions, solution volume and schedule, observation days, response variables, PPE, cleanup, and disposal. Report variability and describe the task as a controlled NaCl-irrigation model rather than a complete model of field soil salinity.	approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Guide Questions: 1. Chemistry of Salt (NaCl) – NBC News Learn https://www.youtube.com/watch?v=euAxX4yGEKs 2. Structure of Sodium Chloride (NaCl) – Scholarswing https://www.youtube.com/watch?v=v8g3CK5kke0 3. The Geometry of Table Salt | Structure of NaCl – Chemistry Knowledge https://www.youtube.com/watch?v=U_CvcyTWLlk 4. Mechanism of Water Absorption in Plants – Pay Attention https://www.youtube.com/watch?v=BVZaUnMiOwM 5. What do you notice about the structure of salt (NaCl)? 6. What changes do you see in the water when salt dissolves in it? 7. When comparing plants watered with saltwater and pure water, what differences do you observe? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Defining Plant Stress Language	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Define each assigned plant-stress term in your own words, match it with an observable example, and explain how the vocabulary helps describe salt effects on plants.	The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences,

	Activity Proper: Learners will explore key vocabulary related to the effects of salt on plant growth, including terms such as salt stress, osmotic stress, and ion toxicity. Students will then develop both conceptual and operational definitions for each term. Finally, students will discuss the importance of these vocabulary terms in understanding how salt influences plant health and development. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Option 1: Salty Harvest	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objective 1 by requiring learners to conduct or analyze a guided investigation, record

	Directions: Read and annotate the narrative, identify the observed signs of salt stress, and explain the signs using osmosis, ion toxicity, or nutrient-uptake concepts. **Activity Proper:** Learners will read a short AI-generated narrative illustrating how saltwater intrusion in rice fields causes yellowing leaves, stunted growth, and overall crop decline, and then discuss the scientific reasons behind these effects—using terms like osmosis, ion toxicity, and nutrient uptake. In the coastal fields of the Philippines, where the gentle sea breezes mix with the lush green of rice paddies, local farmers have witnessed dramatic changes in their crops. Mang Tomas, a seasoned rice farmer, recalls how, over recent dry seasons, saltwater has begun to creep into his fields. "I noticed the leaves starting to yellow, almost like warning flags against the relentless tide," he explains. His observations reveal that as excess saltwater infiltrates the soil, the rice plants struggle to take up necessary nutrients, leading to stunted growth and a worrying decline in overall crop health. Nearby, Aling Maria, another long-time farmer, shares similar concerns. The familiar rhythmic swaying of rice plants now appears uneven, with many plants showing signs of stress, such as slower growth and diminished vigor. "The salt makes its way up from the tides, and before you know it, what was once a thriving field becomes difficult to manage," she says. Faced with these challenges, both farmers and their communities have begun to explore adaptive strategies. Some are experimenting with improved drainage systems and discovering salt-tolerant rice varieties to counter the detrimental effects of salt intrusion.	observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity.

	These personal accounts offer a window into how an age-old practice like rice farming adapts in the face of environmental stress and underscore the urgency of understanding salt's impact on plant physiology. Source note: Treat named farmer statements as fictional composites unless an exact, verifiable source is supplied. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	Ask learners to explain the evidence behind each conclusion.
	Option 2: A Tale of Two Plants	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Study images of healthy vs. salt-stressed plants, annotating differences like chlorosis, leaf-edge burn or necrosis, wilting, and stunted growth to compare how salinity impacts plant health.	The activity targets Learning Objective 1 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

	Activity Proper: Learners study images of healthy vs. salt-stressed plants, annotating differences like chlorosis/yellowing, leaf-edge burn or necrosis, wilting, and stunted growth to compare how salinity impacts plant health. You may use these images as references for class. Feel free to use them as provided or modify them as needed to best support your lesson. Image Source: https://www.researchgate.net/profile/Prodipto-Bishnu-Angon/publication/371082687/figure/fig1/AS:11431281162335306@1685260924364/Detrimental-sides-of-drought-and-salinity-stress-on-plants.png Image Source: https://discovery.kaust.edu.sa/wp-content/uploads/2023/02/58f461cacd6fc62f2f8b4601.jpg Discussion Points (Option 1 and Option 2): **Guide Questions:** 1. How does excess salt in soil interfere with plant growth and water absorption? 2. What visible symptoms indicate that a plant is experiencing salt stress? 3. Why do salt-affected plants struggle to absorb water even when moisture is present in the soil? 4. How does osmotic stress contribute to dehydration and reduced plant vigor? 5. What harmful ions accumulate in saline soils, and how do they affect plant metabolism? 6. What signs of ion toxicity can be observed in stressed plants?	The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	B.2. Discussing New Concept	
	Option 1: Salt Trials: Hypothesize, Experiment, Grow!	
	Materials/Resources Needed: • Teacher-approved materials specified in the procedure • Required safety equipment or personal protective equipment • Notebook or paper • Pen or pencil **Directions:** Follow the teacher-approved procedure and all safety instructions. Make the required observations or measurements, record the results accurately, and explain what the evidence shows about the scientific concept being investigated. **Procedure:** Learners develop a testable hypothesis and use one controlled water source for all treatments. Prepare 0%, 0.25%, 0.50%, 1.00%, and 2.00% NaCl solutions by mass/volume (m/v): for 100 mL of each treatment, dissolve 0, 0.25, 0.50, 1.00, or 2.00 g NaCl and add water to a final volume of 100 mL. Use at least three replicate containers and at least five seeds per container. Keep plant type, solution volume, soil, light, container size, and observation period constant. Record plant height, leaf number, and leaf color daily for at least one week.	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring

Preparation of NaCl solutions: Use the same 0%, 0.25%, 0.50%, 1.00%, and 2.00% mass/volume series throughout the investigation. For 100 mL of each solution, dissolve 0, 0.25, 0.50, 1.00, or 2.00 g NaCl and add water to a final volume of 100 mL. Label every container and apply the same solution volume to each plant.

Table 1. Mean Plant Height (cm) / Mean Number of Leaves / Mean Leaf Color Observation

Treatment Group	**Day**						
	1	**2**	**3**	**4**	**5**	**6**	**7**
0% NaCl control (same water source)							
0. 25% NaCl							
0. 50% NaCl							
1. 00% NaCl							
2. 00% NaCl							

Guide Questions:

1. What observations or evidence were most important in interpreting the result?
2. How do the results support or challenge the scientific concept investigated in the activity?

Expected Output/Product:

Recorded observations or data and an evidence-based conclusion based on the activity results.

quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Assessment Criteria: • Safe and correct performance of the procedure • Accuracy and completeness of observations or data • Scientific accuracy of the explanation or conclusion	
	Option 2: Salt Stress	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Watch the demonstration, record visible signs of plant stress, compare them with the control, and explain how the observations show growth inhibition caused by salinity. **Activity Proper:** Learners will watch a video demonstration showing how salt impacts plant growth. They will record observations of stress signs such as wilting, discoloration, or slowed growth and connect these visible responses to the concept of growth inhibition. Discussion Points (Option 1 and Option 2): **Guide Questions:** 1. What differences are visible between the control and salt-treated plants? 2. How does salt concentration affect water absorption and plant tissues? 3. Which observations best show osmotic stress, ion toxicity, or growth inhibition?	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.
	B.3. Developing Mastery	
	Option 1: Plant Performance	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Study the provided data display, identify the variables and pattern, make the required comparisons or calculations, and state an evidence-based conclusion without assuming causation. **Activity Proper:** This activity builds on the daily observations recorded in "Salt Trials: Hypothesize, Experiment, Grow!" and shifts the focus to data visualization and analysis. Learners will create graphs or charts to compare plant growth under various salt concentrations, allowing them to identify trends or patterns and determine the salt concentration at	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured

	which growth first shows a clear decline compared with the 0% salt control. Specific Visualization Outputs: Prepare a line graph for plant height over time, a bar graph for mean number of leaves per treatment, and a color-coded table or stacked bar for leaf color/wilting ratings. Each graph must include a title, labeled axes, units, legend, and short interpretation. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.
	Option 2: Graphing Growth	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Study the graph, chart, or data set carefully. Identify the relevant patterns or trends, support each interpretation with specific evidence from the data, and answer the guide questions.	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based

	Activity Proper: In this activity, learners analyze data from scientific studies on plant growth over 7 days, which includes metrics such as average plant height, leaf color, and leaf count at the same salt concentrations used in the class investigation (e.g., 0%, 0.25%, 0.50%, 1.00%, and 2.00% NaCl by mass). They then create graphs or charts to compare these measurements, identify trends, and use evidence to determine the concentration at which plant growth is clearly lower than the 0% control; use "statistically significant" only if an appropriate statistical test is performed. Discussion Points (Option 1 and Option 2): **Guide Questions:** 1. What trends do you observe in plant height, leaf color, and leaf count as the salt concentration increases? 2. At what salt concentration is plant growth clearly lower than in the 0% control? Use the term "statistically significant" only if an appropriate statistical test has been performed. 3. Based on your graph, at which salt concentration did plant growth first show a clear decrease? What data support your answer? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

<table>
<tr><td rowspan="3">C. Demonstrating Knowledge and Skills</td><td colspan="2">C.1. Finding Practical Application</td></tr>
<tr><td colspan="2">Option 1: Irrigation Insights</td></tr>
<tr><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Analyze the provided salt-concentration data or graph, compare plant responses, identify the best-supported pattern, and write an evidence-based recommendation or conclusion.

Activity Proper:
Learners will analyze experimental data showing how different salt concentrations affect plant growth. Working in small groups, learners will determine which water source or salt concentration produced the best plant growth.
Each group will use evidence from the data to justify its choice. Learners will then write a brief, data-based recommendation on a shared organizer and present their findings to the class.
Source note: Treat named farmer statements as fictional composites unless an exact, verifiable source is supplied.

Guide Questions:
1. Which water source or salt concentration resulted in the best plant growth?
2. What data or evidence supports your answer?
3. Based on the results, what recommendation would your group give to farmers or gardeners?</td><td>The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.
The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers,</td></tr>
</table>

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.
	Option 2: Selecting Survivors	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Analyze the provided salt-concentration data or graph, compare plant responses, identify the best-supported pattern, and write an evidence-based recommendation or conclusion. **Activity Proper:** Learners will analyze a data set and accompanying graphs showing how different crops, including rice, corn, coconut, banana, and sugarcane, respond to varying salt concentrations. They will examine trends in yield, biomass, and physiological responses to determine which crops are most tolerant to salt stress. Using evidence from the data, learners will identify the crop or treatment that performed best under the given environmental condition. They will then justify their selection and propose a crop or water-management recommendation based on their findings.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and

	Guide Questions: 1. Which crop or treatment performed best under salt stress? 2. What evidence from the graph or table supports your answer? 3. What crop or water-management recommendation can be made for the given environmental condition? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.
	C.2. Making Generalization	
	Option 1: Mapping the Salt Story	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown. **Activity Proper:** This activity allows learners to synthesize their experimental findings by visually mapping out the connections between salt stress and plant	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

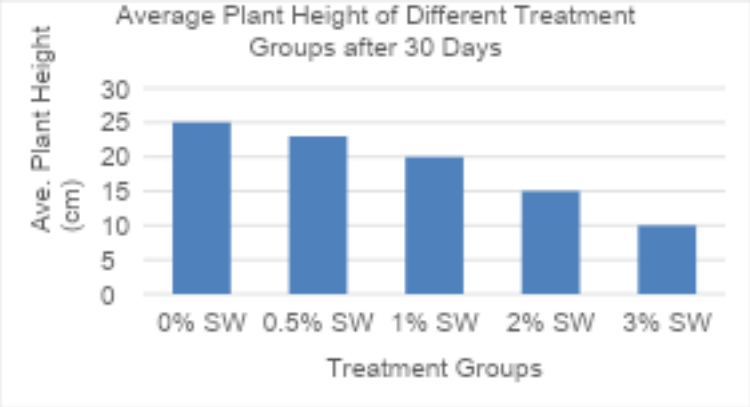
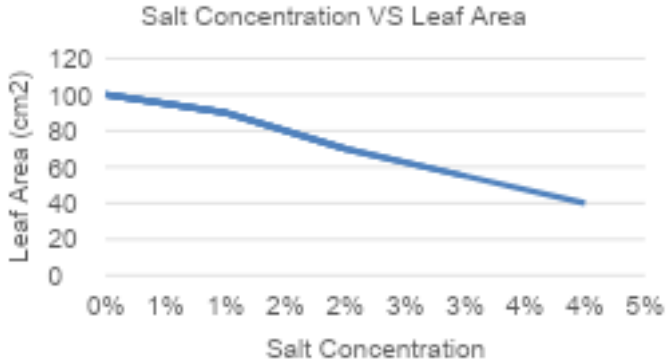
	responses. By creating a concept map, they link key ideas—such as causes and effects, plant responses, and adaptation strategies—and discuss how these interrelationships explain the impact of salinity on plant growth. This process reinforces critical thinking and data-driven reasoning by connecting concrete experimental observations to broader scientific and agricultural concepts. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Expected Output/Product:** Learners may present their synthesis as a concept map, mind map, cause-and-effect chain, flow map, or systems map. They may use paper-based mapping or educational technology tools such as Microsoft Whiteboard, PowerPoint SmartArt, Canva, Coggle, or similar teacher-approved tools. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.
	Option 2: Water Wars	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record

	Directions: Complete the Venn diagram by comparing saltwater and freshwater effects on plant growth, place shared and distinct effects correctly, and write a data-based generalization. **Activity Proper:** Learners will use a Venn diagram to compare and contrast the effects of saltwater and freshwater on plant growth. This activity allows them to visually organize their observations and make generalizations based on experimental data. As an extension, learners can write a short paragraph summarizing their insights and connecting the visual data to broader implications in agriculture and environmental management. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	C.3. Evaluating Learning	
	Option 1: Term Tangle	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** List the required lesson terms, define each in your own words, give an accurate example or connection, and share or post the responses as instructed. **Activity Proper:** In this activity, learners will receive three lists: one containing potential causes of salt stress in plants, one with the corresponding effects on plant growth, and one with key terms that describe the mechanisms behind these changes. Their task is to match each cause with its corresponding effect and identify the key term that best represents the relationship. **Key Term** — **Cause** — **Effect** 1 ion toxicity — A. elevated salt disrupts metabolic activities — A. damage to cellular structures, appearing as leaf burn or chlorosis	The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

	2 growth inhibition 3 osmotic stress 4 ion imbalance 5 nutrient deficiency	B. high salt levels interfere with nutrient absorption C. excess salt in the soil increases solute concentration D. salt accumulation enters plant tissues E. disrupted nutrient uptake	B. reduced photosynthesis and overall diminished plant growth and yield C. reduced water uptake leading to dehydration and osmotic stress D. development of nutrient deficiencies, causing stunted growth E. imbalanced ion uptake weakens root development	**Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Guide Questions: 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Eco-Logical Choices	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Analyze the provided salt-concentration data or graph, compare plant responses, identify the best-supported pattern, and write an evidence-based recommendation or conclusion. **Activity Proper:** For each multiple-choice question, read the scenario and analyze the accompanying chart, graph, or table. Select the best answer and be ready to cite the data pattern that supports your choice.	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures,

	 Plant height increases with higher salt concentration Plant height shows little change until a sudden drop at high salt levels. Plant height remains constant until salt concentration exceeds 1%. Plant height decreases gradually, then more sharply as salt concentration increases.  Leaf area increases with higher salt concentration. Leaf area decreases steadily as salt concentration increases. Leaf area remains constant until it drops dramatically after 2% salt. Leaf area peaks at an intermediate salt concentration before decreasing.	recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

Salt Concentration	Average Biomass (g)
0%	50
1%	45
2%	40
3%	35
4%	30

Plant biomass increases as salt concentration increases.
Plant biomass remains unchanged across different salt concentrations.
Plant biomass decreases in a linear fashion as salt concentration increases
Plant biomass is highest at moderate salt concentrations and lower at both low and high concentrations.

Guide Questions:

1. A group of learners conducted an experiment measuring the height of garden plants after 30 days using varying salt concentrations. What can you infer from the chart regarding the effect of increasing salt concentration on plant height?
2. A learner investigates how salt concentration affects the leaf area of garden plants. The graph shows a downward trend. Which of the following statements best explains the graph?
3. In a separate experiment, a learner measured the overall plant biomass at various salt concentrations. Which of the following statements can be derived from the table below?

Assessment Criteria:

• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

	C.4. Additional Activities	
	Option 1: Garden Oasis	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Design a garden for saline soil, select appropriate plants and salinity-management practices, label the plan, and justify every design choice using evidence from the lesson. **Activity Proper:** In this activity, learners act as urban planners designing a garden in an area with salty soil. They apply their understanding of how salt affects plant growth to develop practical strategies for reducing soil salinity. Each learner creates a simple garden plan by selecting plants that can thrive in salty soil, proposing straightforward methods to mitigate the salt problem, and explaining why their ideas are effective, all using clear and simple language. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson?	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or

		presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Rubric

Criteria	4 – Excellent	3 – Satisfactory	2 – Developing	1 – Beginning	Total
Understanding of Soil Salinity and Plant Growth	Clearly explains how salty soil affects plant growth using accurate scientific ideas.	Explains how salty soil affects plant growth with mostly accurate ideas.	Shows limited understanding, with some unclear or inaccurate ideas.	Shows little or no understanding of how salty soil affects plant growth.	____
Selection of Suitable Plants	Selects plants that are highly appropriate for salty soil and explains why each plant can survive or grow well.	Selects mostly appropriate plants and gives a simple explanation for the choices.	Selects some plants that may not be suitable, with limited explanation.	Selects plants without considering salty soil conditions or gives no explanation.	____
Strategies to Reduce Soil Salinity	Proposes practical and effective methods to reduce or manage soil salinity.	Proposes appropriate methods, but explanations may lack detail.	Proposes limited or somewhat unclear methods for reducing soil salinity.	Gives impractical, incorrect, or no methods for reducing soil salinity.	____
Garden Plan Design and Organization	Garden plan is clear, organized, creative, and easy to understand.	Garden plan is organized and understandable, with minor missing details.	Garden plan is somewhat organized but lacks clarity or	Garden plan is incomplete, unclear, or poorly organized.	____

			important details.		
Explanation and Communication	Explains ideas clearly using simple, accurate, and appropriate language.	Explains ideas understandably with minor errors in clarity or word choice.	Explanation is brief or unclear, with several errors in language or organization.	Explanation is difficult to understand or mostly incomplete.	____
Total Score					**____ / 20**

Option 2: Salt and Growth

Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Create an infographic showing how increasing salt concentration affects plant growth, include the required data or observations, and state a supported conclusion. **Activity Proper:** In this activity, learners examine how salt affects a simple garden plant by creating an infographic. The lesson begins with a teacher-led demonstration using clear visuals to explain the effects of different salt concentrations. Learners then analyze a simulated dataset or images showing changes in plant growth. Finally, they use a guided template to compile key observations using simple bullet points and scientific terms, translated as needed, onto an infographic. Learners will share their infographics with the class to reinforce their understanding.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures,

<table>
<tr>
<td></td>
<td>Guide Questions:
1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?</td>
<td>recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.</td>
</tr>
<tr>
<td>Demonstrating Knowledge and Skills</td>
<td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>Accurate and complete; no misconceptions.</td><td>Mostly accurate; minor gaps.</td><td>Partly accurate; important gaps remain.</td><td>Limited or inaccurate understanding.</td></tr>
<tr><td>Completeness</td><td>All required elements are present and fully developed.</td><td>Most required elements are present.</td><td>Some required elements are incomplete.</td><td>Many required elements are missing.</td></tr>
<tr><td>Application/ Evidence</td><td>Uses relevant evidence and applies the concept effectively.</td><td>Uses appropriate evidence with minor limitations.</td><td>Evidence or application is limited.</td><td>Little or no relevant evidence/ application.</td></tr>
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	Clarity	Response/output is clear, logical, and easy to follow.	Generally clear and organized.	Some parts are unclear or disorganized.	Unclear or difficult to follow.
V. ASSESSMENT *(Assessing Learnings)*	**Multiple Choice:** Read each question carefully and choose the best answer. 1. Which of the following is a fundamental requirement for healthy plant growth? A. excess salt B. overwatering C. adequate sunlight D. chemical fertilizers 2. When salt (NaCl) is added to water, which process describes its separation into sodium and chloride ions? A. oxidation B. dissociation C. precipitation D. polymerization 3. How does a high concentration of salt in the soil primarily affect plant health? A. by enhancing photosynthesis B. by making the soil more fertile C. by increasing nutrient absorption D. by creating osmotic stress that reduces water uptake 4. In an experiment assessing the effects of salt on plant growth, why is it important to control variables other than salt concentration? A. to make the experiment more challenging B. to allow all factors to vary simultaneously C. to increase the number of variables tested D. to ensure that the effect observed is due to the salt concentration only 5. Which of the following symptoms is commonly observed in plants suffering from salt stress? A. rapid flowering B. increased leaf toughness C. enhanced root development				

	D. yellowing leaves and stunted growth 6. Why is data visualization, such as creating graphs or charts, an important step in analyzing experiments related to plant growth? A. It hides inconsistencies in the data. B. It complicates the data analysis process. C. It replaces the need for a detailed report. D. It helps identify trends and determine threshold effects. 7. What is a hypothesis in the context of scientific experiments on plant responses to salt? A. a confirmed fact B. a random guess with no basis C. a testable prediction based on prior knowledge D. a detailed description of the experimental procedure 8. How does replicating an experiment contribute to the scientific process in studies about salt effects on plants? A. It reduces the amount of data collected. B. It eliminates the need for a control group. C. It introduces more variables into the experiment. D. It ensures that the results are consistent and reliable. 9. Understanding the effects of salt on plant growth can have real-world applications in which of the following areas? A. urban planning only B. designing indoor recreational spaces C. developing fast-growing ornamental plants D. crop management and agricultural practices 10. What is one key learning outcome for learners engaging in experiments that analyze plant responses to varying salt concentrations? A. focusing solely on chemical formulas B. memorizing scientific terminology without application C. recognizing real-world applications of scientific principles D. disregarding experimental data in favor of anecdotal evidence

Performance Task: Use the data from the fair test to prepare a 2–3-page report. Identify trends in plant height, leaf number, and color across salt concentrations. Use accurate terms such as osmosis, ion toxicity, nutrient imbalance, and nutrient uptake, but state that visible symptoms alone do not diagnose a specific mechanism. Support each conclusion with measured data and discuss the investigation's limitations.

Assessment Criteria:

Criteria	4 – Excellent	3 – Proficient	2 – Basic	1 – Needs Improvement	Total
Data Interpretation & Accuracy	Accurately identifies all key trends in the dataset; uses specific, correct values to support observations (e.g., exact changes in height or health ratings).	Identifies most key trends; uses several correct examples from the data.	Identifies some trends; examples are present but may be partially inaccurate or vague.	Trends are unclear or incorrect; minimal or no data cited.	____
Conceptual Explanation & Scientific Reasoning	Provides an accurate, well-integrated explanation of plant responses using concepts such as osmosis, ion toxicity, nutrient	Uses appropriate scientific concepts and vocabulary with mostly correct explanations; shows good understanding.	Uses limited vocabulary or explanations; understanding is basic or partially incorrect.	Minimal use of scientific reasoning or incorrect explanations.	____

		imbalance, and nutrient uptake; distinguishes observations from inferred mechanisms.				
	Use of Specific Examples	Provides multiple, specific data examples (e.g., exact height changes at 0.50% (w/w) NaCl) that effectively support analysis.	Uses some specific data examples that generally support claims.	Few or vague examples; examples do not always clearly support conclusions.	Lacks data examples or examples are irrelevant.	____
	Organization, Clarity, and Writing Quality	Report is well-organized, coherent, and within 2–3 pages; language is clear, concise, and free of errors.	Mostly clear and organized; minor errors in language or format.	Organization is uneven; several writing errors that affect clarity.	Poor organization or significant grammar/spelli ng issues; report is confusing or off-length.	____
	Total Score					**____ / 16**

	Use the provided rubric to give detailed written feedback on data interpretation, conceptual explanations (e.g., correctly linking osmosis, ion toxicity), and overall clarity. Highlight excellent examples and provide targeted comments to improve weak areas. Before final submission, have learners exchange draft reports with peers using the same rubric. Facilitate guided peer review sessions where learners discuss specific examples from their data and suggest improvements. **Assessment specification:** Score conclusions according to the tested species and conditions. Require the control mean, treatment means, variability, and the lowest tested concentration at which growth is clearly lower than the 0% control.
VI. REFLECTION *(Feedback and Continuous Improvement)*	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery. 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? *6.* What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT in order to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

APPENDIX

Answers to Multiple Choice Questions (Assessment)

Item No.	Key Answer	Explanation
1	C	Healthy plant growth depends on a balance of elements including light, water, carbon dioxide, mineral nutrients, suitable temperature, and oxygen for respiration; soil often supplies anchorage and minerals but is not required by every plant-growing system. Sunlight is essential as it drives photosynthesis.
2	B	Salt dissociates into sodium and chloride ions, a process that plays a key role in how it affects the water's properties and, consequently, plant absorption.
3	D	High salt levels decrease the soil's water potential, making it more difficult for plant roots to absorb water, thus leading to osmotic stress.
4	D	Controlling variables helps isolate the specific impact of salt on plant growth, ensuring that other factors do not confound the results.
5	D	Excess salt typically leads to visual symptoms such as yellowing leaves and reduced plant growth, indicating stress.
6	D	Graphs and charts provide a clear visual representation of data, making it easier to pinpoint patterns, trends, and specific points where salt concentration begins to inhibit growth.
7	C	A hypothesis is a statement that can be tested through experimentation and observation, offering a possible explanation for how salt affects plant growth.
8	D	Replication helps estimate variability and assess whether effects are reproducible rather than due to chance; it improves confidence but does not guarantee reliability.
9	D	Insights into salt stress help farmers and agricultural planners develop strategies (such as improved irrigation and soil management) to ensure better crop productivity in saline conditions.
10	C	Learners gain a practical understanding of how experimental data can inform solutions to real-world challenges, such as managing salt stress in agricultural settings.

Defining Plant Stress Language

Effect of salt stress	Conceptual definition	Operational definition (how to observe/measure it)
Osmotic stress	The reduced ability of a plant to absorb water because high salt concentration around the roots lowers the soil water potential, creating a drought-like condition even when soil seems moist.	Possible observations consistent with osmotic stress include wilting despite moist soil, slower height increase, reduced leaf expansion, and lower fresh mass or turgidity compared with the control.
Ion toxicity	Injury caused by excessive accumulation of salt ions—especially Na^+ and Cl^-—in plant tissues, which disrupts normal cell metabolism and damages leaves and other organs.	Possible observations consistent with ion toxicity include leaf tip burn, marginal necrosis (leaf-edge burning), chlorosis, leaf curling, premature leaf death, or—if measured—high Na^+/Cl^- in tissues.
Nutrient imbalance/ nutrient deficiency	A condition in which excess salts interfere with the uptake and transport of essential nutrients such as K, Ca, Mg, Fe, Zn, and P, causing deficiency-like symptoms and weaker plant function.	In a salt-treated plant, nutrient imbalance is indicated by poor vigor, chlorosis, uneven growth, weak stems, poor root growth, or—if tested—a high $Na^+:K^+$ ratio or reduced levels of key nutrients in roots/shoots compared with the control.
Oxidative stress	Damage caused when salt stress leads to excessive production of reactive oxygen species (ROS) that injure lipids, proteins, DNA, and cell membranes.	Possible observations consistent with oxidative stress include accelerated yellowing or tissue injury. Visible symptoms alone are not diagnostic; laboratory markers, such as reactive-oxygen-species or lipid-peroxidation measurements, are needed for a firm conclusion.
Photosynthesis inhibition	A decrease in photosynthetic performance due to stomatal closure, pigment loss, and damage to the photosynthetic machinery under saline conditions.	In a salt-treated plant, photosynthesis inhibition is indicated by leaf yellowing, reduced greenness, lower chlorophyll content, smaller leaf area, and slower biomass gain than in the control. If measured, photosynthetic rate, stomatal conductance, and transpiration are lower.

Effect of salt stress	Conceptual definition	Operational definition (how to observe/measure it)
Growth suppression/ stunting	The overall reduction of plant growth and development caused by the combined effects of osmotic stress, ion toxicity, nutrient imbalance, and reduced photosynthesis.	In a salt-treated plant, growth suppression is indicated by shorter roots and shoots, fewer leaves, smaller leaves, lower fresh/dry mass, delayed organ formation, and general stunting compared with the control.
Poor germination and weak seedlings	Salt stress delays or reduces seed germination because seeds absorb water more slowly and may also suffer ionic and oxidative damage during early development.	In a salt-treated setup, this effect is indicated by lower germination percentage, longer time to germinate, weaker seedlings, shorter radicles/plumules, and lower seedling vigor than in the control.
Leaf injury and premature senescence	Salt stress accelerates aging and damage of leaves as toxic ions accumulate and water relations worsen, especially in older leaves.	In a salt-treated plant, this is indicated by leaf-edge scorch, chlorosis, curling, early leaf drop, drying of older leaves, and earlier senescence than in untreated plants.
Reduced flowering, fruiting, and yield	Salt stress lowers reproductive success and yield by reducing assimilate production, disturbing water relations, and impairing reproductive organs and grain/fruit filling.	In a salt-treated plant or crop, this effect is indicated by fewer flowers, fewer fruits/pods/seeds, lighter grains/fruits, and lower total yield or harvest weight compared with the control.

Learning Title/Topic:	Solutions in the Environment – Effects of Saltwater and Wastewater on Local Ecosystems	Lesson Exemplar:	7

I. OBJECTIVES	
A. Content Standard	Chemicals should be handled safely, and solutions can have beneficial and harmful environmental effects.
B. Performance Standard	By the end of the quarter, learners apply research skills to discover how scientists have impacted our lives. They recognize the significant role of different agencies in the Philippines, such as DOST and DTI, in scientific innovation and development. They show critical thinking in explaining the different substances in household and personal care products, including their benefits and potential risks of using and disposing of them. They demonstrate appropriate and safe handling and use of chemicals. They explain that chemical reactions occur in human activities and the environment, and that several chemical solutions pose a threat to the community.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	1. Explain what ecosystems are and identify examples of local ecosystems such as rivers, mangroves, and gardens. 2. Describe common local environmental problems such as pollution, deforestation, and water contamination.
	Create a table to show how solutions of saltwater and wastewater can affect local ecosystems and recommend ways to minimize their negative impact on the environment.
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	Duxbury, Alyn C, Fred T Mackenzie, and Robert Howard Byrne. 2018. "Seawater | Composition, Salinity, Distribution, & Facts." In Encyclopædia Britannica. https://www.britannica.com/science/seawater. "Effects of Improper Waste Disposal on the Environment." 2024. Safelec. April 10, 2024. https://safelec.co.uk/effects-of-improper-waste-disposal-on-the-environment/. Nathanson, Jerry A, and Archis Ambulkar. 2018. "Wastewater Treatment | History, Methods, Systems, & Technologies." In Encyclopædia Britannica. https://www.britannica.com/technology/wastewater-treatment.

	Orloff, Whitney. 2025. "Saltwater Intrusion: A Slow-Onset Climate Crisis Jeopardizing America's Coastal Farms | Article | EESI." Eesi.org. April 22, 2025. https://www.eesi.org/articles/view/saltwater-intrusion-a-slow-onset-climate-crisis-jeopardizing-americas-coastal-farms. Sharma, Kabita. 2023. "Characteristics of Wastewater: Physical Chemical, Biological." Science Info. August 17, 2023. https://scienceinfo.com/characteristics-of-wastewater/#physical-characteristics-of-waste-water. USGS. 2022. "Why Is the Ocean Salty? | U.S. Geological Survey." Www.usgs.gov. March 14, 2022. https://www.usgs.gov/faqs/why-ocean-salty. Materials: photos, diagrams, or videos on saltwater intrusion and wastewater disposal; Manila paper or cartolina; markers; bond paper; pens; sticky notes; masking tape; laptop/projector; internet access; seeds or seedlings; soil; small pots or recycled containers; clean water; salt; measuring cups/spoons; labels; ruler; gloves; plastic bottles; sand; gravel; cotton/cloth or filter paper; activated charcoal; cups/beakers; and simulated dirty water.
III. CONTENT *(Sequencing Content)*	Solutions in the Environment – Effects of Saltwater and Wastewater on Local Ecosystems
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	1. Differentiate saltwater from wastewater by analyzing their physical properties, sources, and chemical compositions. 2. Describe how saltwater intrusion and improper wastewater disposal impact local ecosystems. 3. Gather, organize, and analyze real-life data or case studies on the effects of saltwater intrusion and improper wastewater disposal, evaluating outcomes such as plant die-off, water pollution, and soil degradation in ecosystems like mangroves, farmland, and rivers. 4. Develop and assess scientifically grounded strategies to mitigate the negative environmental impacts, including methods such as water treatment, proper waste management, and rainwater harvesting.

<table>
<tr><th colspan="2">IV. PROCEDURES</th><th>ANNOTATIONS</th></tr>
<tr><td rowspan="3">A. Activating Prior Knowledge</td><td colspan="2">A.1. Activating Prior Knowledge</td><td rowspan="3">The activity targets Learning Objectives 1 and 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.</td></tr>
<tr><td colspan="2">Option 1: Waters Apart</td></tr>
<tr><td colspan="2">Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Complete the comparison table for saltwater and wastewater using their properties, sources, contents, and ecosystem effects, then explain the evidence for each comparison.

Activity Proper:
Learners will create a comparison table listing their observations and evidences about the physical properties, contents, sources, and environmental impacts of saltwater and wastewater. The activity will help learners compare the composition, origin, and ecological effects of the two types of water through guided discussion and peer collaboration.
This table outlines concise expected responses regarding the properties of saltwater and wastewater.

<table>
<tr><th>Property</th><th>Saltwater</th><th>Wastewater</th></tr>
<tr><td>Color</td><td>Clear or colorless in small samples; may appear blue-green in large bodies</td><td>Grey, brown, black, cloudy, or turbid depending on pollutants</td></tr>
</table>
</td></tr>
</table>

Odor	Odorless or with a slight salty or marine odor.	Unpleasant, musty, or sewage-like odor	**Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.
Temperature	Varies with location, depth, season, sunlight, and currents	Varies depending on domestic, industrial, or environmental discharge	
Salinity	Average seawater salinity is about 3.5% or 35 ppt, but may vary	Usually lower than seawater, but variable depending on source	
Contents	Dissolved salts and ions such as sodium, chloride, magnesium, calcium, and sulfate	Organic matter, nutrients, suspended solids, chemicals, detergents, oils, and possible pathogens	
Sources	Oceans and seas; estuaries contain brackish water influenced by seawater	Domestic, industrial, agricultural, and stormwater runoff sources	
Environmental Impacts	Supports marine ecosystems; saltwater intrusion may cause soil salinization, freshwater contamination, reduced crop yield, and coastal habitat changes	Untreated wastewater may cause eutrophication, oxygen depletion, disease transmission, toxicity to aquatic organisms, habitat degradation, and water pollution	

	Science clarification: Saltwater and wastewater are not mutually exclusive, and wastewater may be clear or have little odor. Never taste any water sample. Do not treat detergent and fertilizer as equivalent forms of wastewater. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Charting the Waters	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Study the graph, chart, or data set carefully. Identify the relevant patterns or trends, support each interpretation with specific evidence from the data, and answer the guide questions.	The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based

	Activity Proper: Learners will complete a KWH Chart to organize their understanding of saltwater and wastewater, beginning with what they already know, followed by what they want to learn about differences and environmental impacts, and concluding with how they can find answers through research, case studies, or hands-on investigations. Discussion Points (Option 1 and Option 2): Science clarification: Saltwater and wastewater are not mutually exclusive, and wastewater may be clear or have little odor. Never taste any water sample. Do not treat detergent and fertilizer as equivalent forms of wastewater.	questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

What do I know about saltwater and wastewater?	**What do I want to know about saltwater intrusion and improper wastewater disposal?**	**How do I find out about the environmental impacts of saltwater intrusion and improper wastewater disposal?**

	Guide Questions: 1. What differences do you observe between saltwater and wastewater? 2. How might the origins or uses of these waters explain what you see? 3. In what ways do you think these differences could affect the surrounding ecosystem? 4. What additional questions do these observations raise that you would like to explore further? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Connecting Personal Experiences	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Answer the guiding questions in complete sentences, discuss the responses with peers, and support the final answer with an accurate example or scientific evidence. **Activity Proper:** Learners will share their personal experiences of visiting beaches, rivers, or lakes. They will describe the condition of	The activity targets Learning Objectives 2 and 4 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and

	the water, whether it was clear, murky, salty, or polluted, and relate these observations to their prior knowledge about water and the environment. Science clarification: Saltwater and wastewater are not mutually exclusive, and wastewater may be clear or have little odor. Never taste any water sample. Do not treat detergent and fertilizer as equivalent forms of wastewater. **Guide Question:** They will also respond to the question: How might saltwater intrusion or wastewater discharge affect a nearby river, farm, fishpond, mangrove, or garden in their community? Based on their discussion, learners will propose practical ideas on how they can help address these environmental issues. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Option 2: Learning from Local Initiatives	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Examine the assigned local water or ecosystem initiative, identify the problem and actions taken, evaluate the available evidence of effectiveness, and summarize the lessons for the community.	The activity targets Learning Objectives 2 and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from

	Activity Proper: Learners will explore local environmental initiatives focused on water conservation, pollution prevention, or ecosystem restoration by examining firsthand accounts from community projects, such as clean-up drives, mangrove rehabilitation, or wastewater treatment programs, and connecting these efforts to broader environmental concepts. Additionally, learners will identify the key local concerns these initiatives address, the specific problems impacting their communities, and assess the current outcomes of each initiative. Discussion Points (Option 1 and Option 2): **Guide Questions:** 1. What have you observed about water quality in the places you've visited or in your local community? 2. How do human activities, such as tourism, industry, or urban development, affect water conditions? 3. How might saltwater intrusion or improper wastewater discharge affect a nearby river, farm, fishpond, mangrove, or garden in our community? 4. How can personal experiences and local initiatives help us better understand broader environmental issues? 5. What actions can individuals and communities take to improve water quality and promote sustainability? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

B. Instituting New Knowledge

B.1. Presenting Examples

Option 1: Environmental Headlines

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Read or examine the assigned source, identify its main claim and supporting evidence or data, answer the guide questions, and cite the source in the required output.

Activity Proper:
The teacher will provide curated news articles on local pollution challenges, such as wastewater overflow in coastal areas or saltwater intrusion affecting agriculture, and then guide learners with targeted questions to help them identify key issues, analyze causes, and assess consequences.
The teacher may refer to the following materials as valuable references.
MCWD: Cebu City's Freshwater Faces Growing Saltwater Contamination
https://cebudailynews.inquirer.net/605935/mcwd-cebu-citys-freshwater-faces-growing-saltwater-contamination.
2Businesses Dumping Untreated Wastewater into Manila Bay: DENR | ABS-CBN News https://www.abs-cbn.com/news/01/09/19/businesses-releasing-enormous-volume-of-untreated-wastewater-into-manila-bay-denr.

	Cause	Effect
Saltwater Intrusion	excessive groundwater pumping, sea level rise	salinized freshwater and soil, declining crop yields, vegetation shifts, and inland migration of wetlands where space and sediment allow
Improper Wastewater Disposal	untreated or poorly treated discharges, sewer leaks, industrial effluent, and agricultural runoff	eutrophicatio n, oxygen depletion, pathogen exposure, toxicity, and habitat degradation; effects depend on pollutant type and dose

	The Philippines Is Shutting down This Resort Island because of Water Pollution https://www.globalcitizen.org/en/content/philippines-boracay-environment-waste-water-pollut/ **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	The activity targets Learning Objective 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Option 2: Tracing Water's Impact on Ecosystems	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Examine the provided media and case information, trace how saltwater or wastewater changes the ecosystem, and record the cause, biological response, and consequence. **Activity Proper:** The teacher will provide curated multimedia resources, such as images, videos, diagrams, and case study summaries, on the impacts of saltwater intrusion and improper wastewater disposal, and then guide learners with targeted questions to help them explain how these challenges affect local ecosystems. The teacher may refer to the following materials as valuable references. Video Shows Waste from Drainage Pipe Flowing out into Boracay's Beach Waters https://www.gmanetwork.com/news/topstories/regions/643553/video-shows-waste-from-drainage-pipe-flowing-out-into-boracay-s-beach-waters/story/.	The activity targets Learning Objective 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Discussion Points (Option 1 and Option 2):

Guide Questions:

1. Ilegal Na Wastewater Dumping, Banta Sa Kalusugan? | Reporter's Notebook https://www.youtube.com/watch?v=tGm2MoYKVpY.
2. What are the main environmental challenges related to saltwater intrusion and improper wastewater disposal?
3. How do these issues affect local ecosystems?

Assessment Criteria:

• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

B.2. Discussing New Concept

Option 1: Eco Experiment

Materials/Resources Needed:

• Teacher-approved materials specified in the procedure
• Required safety equipment or personal protective equipment
• Notebook or paper
• Pen or pencil

Directions:

Follow the teacher-approved procedure and all safety instructions. Make the required observations or measurements, record the results accurately, and explain what the evidence shows about the scientific concept being investigated.

Group	Observable Results
Saltwater Intrusion Group	wilting; stunted growth; fewer, yellowed leaves; delayed development
Wastewater Contaminants Group	leaf discoloration; drooping or curling; slower or erratic growth
Control Group	robust growth; vibrant, healthy leaves; uniform development

Procedure:

Learners will conduct experiments to investigate how saltwater intrusion and wastewater contaminants affect plant growth and soil health. They will design the experiment using diagrams or tables and run it for at least a week, making daily observations on plant height, leaf count, and leaf color. The data collected will be systematically recorded and later analyzed to explore the underlying ecological processes and real-world environmental implications.

Table 1. Plant Results of the Different Treatment Groups.

Treatments: a 0% control, a 3% NaCl solution, a very dilute detergent solution, and a low-concentration fertilizer solution. Prepare each treatment separately with clean, teacher-supplied materials. Never use bleach or actual wastewater. Analyze detergent and fertilizer treatments separately because their compositions and effects are not interchangeable

	Replicate	Plant Height (cm)	Number of Leaves	Leaf Color	Soil pH	Additional Observations
T1: Control (Tap Water)	R1					
	R2					
	R3					
T2: Saltwater (3% NaCl)	R1					
	R2					
	R3					

The activity targets Learning Objective 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

T3: Wastewater Contaminant	R1					
	R2					
	R3					

Table 2. Comparative Analysis of the Mean Results of Different Treatment Groups

Treatment	**Mean Plant Height (cm)**	**Mean No. of Leaves**	**General Leaf Condition**	**Mean Final Soil pH**
T1: Control (Tap Water)				
T2: Saltwater (3% NaCl)				
T3: Wastewater Contaminant				

Controlled-investigation protocol: Use one safe model contaminant with an exact concentration and recipe. Specify the species, growing medium, independent experimental units, at least three containers per treatment, control, solution volume and schedule, measurements, PPE, cleanup, and disposal. Describe outcomes as possible observations, not guaranteed results; pH alone cannot identify a contaminant or establish its cause.

	Guide Questions: 1. How did T1, T2, and T3 differ in plant height, number of leaves, and leaf condition? 2. How did final soil pH vary among the treatment groups? 3. What relationship can you identify between soil pH and plant growth indicators? Use evidence from the data. 4. What conclusions can you draw from the results about the effects of saltwater and the selected contaminant model on plant growth, and what strategies could help reduce similar environmental impacts? **Expected Output/Product:** Recorded observations or data and an evidence-based conclusion based on the activity results. **Assessment Criteria:** • Safe and correct performance of the procedure • Accuracy and completeness of observations or data • Scientific accuracy of the explanation or conclusion	
	Option 2: The Withering Harvest	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read and annotate the story, identify evidence of saltwater or wastewater effects, answer the reflection questions, and write a brief group summary.	The activity targets Learning Objective 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

	Activity Proper: Learners are expected to read the AI-generated story "The Withering Harvest" and annotate key details regarding the environmental impacts of saltwater intrusion and improper wastewater contamination. They will then answer the reflection questions and work in small groups to create a brief summary of the main points of the story. In Mar del Sol, a coastal farming village, generations had thrived on fertile fields that are now in decline. Maria, a seasoned farmer, observed her carefully tended crops showing stunted growth as the once-rich soil turned barren. Rising sea levels allowed saltwater to infiltrate irrigation channels, saturating the land with salt and disrupting nutrient balance. This intrusion triggered osmotic stress, causing leaves to wilt and plants to suffer. Adding to the crisis, untreated wastewater from nearby households seeped into fields and waterways, contaminating them with toxic chemicals, excess nutrients, and pathogens. Clear streams turned murky, and aquatic life dwindled as the natural balance of the ecosystem crumbled. Faced with these dual threats to crops and freshwater habitats, wildlife began to decline. Troubled by these changes, Maria convened a community meeting under an ancient mango tree. Farmers, scientists, and residents gathered to share their observations and fears. They discussed how excessive salt and pollutants were stripping the land's fertility and poisoning their environment, challenges emblematic of a broader environmental crisis endangering both their livelihood and the balance of nature. Discussion Points (Option 1 and Option 2):	The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Guide Questions: 1. How do saltwater intrusion and wastewater contamination affect ecosystems, habitats, and species populations over time? 2. How does increased salt concentration affect plant water uptake, plant roots, and freshwater organisms? 3. How can wastewater affect oxygen levels, water quality, soil health, and organisms living in rivers or coastal areas? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	B.3. Developing Mastery	
	Option 1: Field Notes & Findings	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Conduct the approved field or virtual observation or interview, record evidence in field notes, compare the affected sites, and summarize the ecosystem findings. **Procedure:** Learners will conduct field visits (or virtual field visits) or expert interviews to assess how saltwater intrusion and improper wastewater disposal affect local mangroves, farmlands, and rivers. After gathering data, they will compare	The activity targets Learning Objective 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and

	observations to understand how these stressors change ecosystem conditions. You may use these videos with the provided links to show examples of salt-intruded farms and wastewater-polluted water bodies. Guide Questions for Field Visits Guide Questions for Expert Interviews Fieldwork requirement: Obtain school approval and guardian consent when applicable, provide adult supervision and a site risk assessment, prohibit contact and sample collection, specify PPE and weather or transport contingencies, and offer an equivalent classroom dataset. **Guide Questions:** 1. Saltwater Intrusion on Maryland's Eastern Shore Farmland (2024) https://www.youtube.com/watch?v=Bgla42liN0c 2. Sewage scandal: The dirty secret polluting England and Wales • FRANCE 24 English https://www.youtube.com/watch?v=IvqnKyKI6Aw 3. What visible signs of environmental stress (e.g., discoloration, erosion, stunted growth) do you notice around mangroves, farmlands, and rivers? 4. How do water conditions differ in areas impacted by saltwater intrusion or improper wastewater disposal? 5. Which indicators do you use to assess the effects of saltwater intrusion and improper wastewater disposal on local ecosystems? 6. Can you describe the ecological changes observed in mangroves, farmlands, and rivers due to these stressors?	explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Research & Reality	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil • Internet-enabled device, if available **Directions:** Gather information from credible sources, record the source and environmental evidence, compare saltwater and wastewater effects, and write a supported conclusion. **Activity Proper:** Learners will gather environmental data on saltwater intrusion and improper wastewater disposal from offline or online sources such as news articles, scientific studies, and community initiatives. They will then organize and analyze their findings to understand how each factor affects local ecosystems. Guide Questions for Environmental Report Analysis Discussion Points (Option 1 and Option 2): Required deliverables: State the required length, schedule, accessible source set, checkpoints, credibility criteria, final deliverables, and abstract requirement before learners begin.	The activity targets Learning Objective 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the

	Guide Questions: 1. What key details in the report highlight changes in plant, animal, and soil health in affected areas? 2. How are trends like rising salinity or pollutant levels recorded and compared across different ecosystems? 3. What patterns or trends did you observe in the data you collected? Are certain areas more affected than others? Why might this be the case? 4. Based on the observed data, what potential consequences do you foresee for local ecosystems, and which adaptation or mitigation strategies seem most justified by your findings? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	activity. Ask learners to explain the evidence behind each conclusion.
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Option 1: Designing DIY Filtration Systems	
	Materials/Resources Needed: • Teacher-approved materials specified in the procedure • Required safety equipment or personal protective equipment • Notebook or paper • Pen or pencil **Directions:** Develop the required design, plan, or proposal using the activity criteria. Show how each major feature addresses the	The activity targets Learning Objective 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

problem and justify your choices using accurate scientific concepts or evidence.

Procedure:
Learners design, build, and test four-layer water-filter prototypes using teacher-approved materials. Compare each prototype's ability to reduce visible turbidity or suspended particles in teacher-prepared simulated wastewater. The model does not demonstrate removal of dissolved salts, microorganisms, or all contaminants; the output is nonpotable and must not be tasted. Connect the results to the additional processes required in real water treatment.

Guide Questions:
1. What observations or evidence were most important in interpreting the result?
2. How do the results support or challenge the scientific concept investigated in the activity?

Expected Output/Product:
Recorded observations or data and an evidence-based conclusion based on the activity results.

The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Rubric

Criteria	4 – Excellent	3 – Proficient	2 – Developing	1 – Beginning	Total
Design and Structure of Filtration Prototype	Prototype has a clear, well-planned structure and follows the	Prototype has a clear structure and follows the four-layer limit, with mostly	Prototype has an incomplete or unclear structure, or the layers are not	Prototype lacks a clear structure and does not follow the	____

		required limit of four distinct layers. Materials are arranged logically to improve filtration.	appropriate arrangement of materials.	well organized. The four-layer limit may not be fully followed.	required layer limit.	
	Selection and Use of Materials	Uses appropriate natural or household materials that strongly support particle separation, adsorption, and reduction of visible turbidity and suspended particles; the model does not demonstrate removal of dissolved salts, microorganisms, or all contaminants. A detailed list of	Uses mostly appropriate materials that support filtration. A list of materials is provided with minor missing details.	Uses some appropriate materials, but material choices are not fully connected to filtration purposes. Material list is incomplete.	Uses inappropriate or limited materials, with little or no explanation or material list.	____

		materials is provided.				
	Application of Science Concepts	Clearly explains how the filtration system demonstrates particle separation, adsorption, and reduction of visible turbidity and suspended particles; the model does not demonstrate removal of dissolved salts, microorganisms, or all contaminants. Connections to water treatment concepts are accurate and well-developed.	Explains the main science concepts with mostly accurate connections to the filtration process.	Shows limited understanding of the science concepts; explanations are incomplete or partly inaccurate.	Shows little or no understanding of the science concepts involved in filtration.	____
	Testing and Evaluation of Effectiveness	Carefully tests the prototype and provides clear	Tests the prototype and provides observations	Testing is done but observations are limited, unclear, or lack	Testing is incomplete or not done. Evaluation of	____

		observations or evidence comparing water quality before and after filtration. Evaluation is thoughtful and data-based.	about its effectiveness. Evaluation is generally clear.	enough evidence.	effectiveness is missing or unclear.	
	Collaboration and Teamwork	Group members work cooperatively, share responsibilities equally, and communicate effectively throughout the activity.	Group members work together with minor issues in participation or communication.	Some group members participate, but teamwork and task sharing are uneven.	Group shows limited cooperation, poor communication, or lack of shared responsibility.	____
	Real-World Connection and Sustainability	Strongly connects the prototype to real-world water treatment and sustainable solutions for polluted communities. Explanation is	Connects the prototype to real-world water treatment and sustainability with adequate explanation.	Makes a limited or general connection to real-world water treatment or sustainability.	Provides little or no connection to real-world application or sustainability.	____

	relevant and insightful.				
Total Score					**____ / 24**

Option 2: Water Wise

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Create the required awareness material on water conservation or proper wastewater disposal, use accurate scientific information and practical actions, and explain the intended audience and message.

Activity Proper:
Learners create educational materials, such as infographics, posters, or videos, that promote rainwater harvesting, proper wastewater disposal, and freshwater conservation. By creatively presenting these key concepts, they not only raise community awareness but also strengthen their critical thinking, creativity, and civic engagement to drive meaningful environmental change.

Guide Questions:
1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

The activity targets Learning Objective 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

		Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Rubric

Criteria	4 – Excellent	3 – Proficient	2 – Developing	1 – Beginning	Total
Content Accuracy and Relevance	Educational material presents accurate, complete, and relevant information about rainwater harvesting, proper wastewater disposal, and freshwater conservation.	Educational material presents mostly accurate and relevant information about the key water-wise concepts, with minor gaps.	Educational material includes some relevant information, but explanations are incomplete or contain minor inaccuracies.	Educational material shows limited or inaccurate information about the water-wise concepts.	____
Clarity of Message	Main message is very clear, focused, and easy to understand. The material effectively promotes	Main message is clear and understandable, with only minor areas needing improvement.	Main message is somewhat clear but may be vague, confusing, or not well organized.	Main message is unclear, incomplete, or difficult to understand.	____

		responsible water practices.				
	Creativity and Visual/Media Design	Material is highly creative, visually appealing, and appropriate for the chosen format, such as infographic, poster, or video. Design strongly supports the message.	Material is creative and generally attractive. Design supports the message with minor issues in layout or presentation.	Material shows limited creativity. Design is simple or somewhat disorganized and only partly supports the message.	Material lacks creativity, organization, or visual appeal. Design does not support the message.	____
	Community Awareness and Civic Engagement	Material strongly encourages community awareness and action toward meaningful environmental change. Call to action is clear and convincing.	Material encourages awareness and includes a clear call to action, though it may need stronger impact.	Material gives a general reminder about water issues but has a weak or unclear call to action.	The material provides limited or no support for community awareness or civic engagement.	____
	Organization and Presentation	Information is well organized, logical, and engaging. Text,	Information is organized and mostly easy to follow. Minor	Information is somewhat organized but may be difficult	Information is poorly organized and difficult to follow.	____

	visuals, or audio/video elements are balanced and easy to follow.	improvements are needed in flow or presentation.	to follow in some parts.		
Teamwork and Participation	Group members work cooperatively, share responsibilities fairly, and demonstrate active participation throughout the task.	Group members work together with generally fair participation and minor issues in cooperation.	Participation is uneven; some members contribute more than others. Teamwork needs improvement.	Group shows limited cooperation, poor communication, or lack of shared responsibility.	____
Total Score					**____ / 24**

C.2. Making Generalization

Option 1: Mapping Cause-and-Effect

Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown.	The activity targets Learning Objective 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product.

	Activity Proper: In this Fishbone Diagram activity, learners will work in groups to map the cause-and-effect relationships between saltwater intrusion, improper wastewater disposal, and their impacts on local ecosystems; each group will draw a fishbone diagram where the "head" represents the overall impact on ecological health and each "bone" represents a category of effects, such as changes in biodiversity, habitat stability, osmotic stress in plants, toxic exposure in animals, and soil degradation, and then detail specific causal factors along these bones, culminating in a presentation that explains the key connections and real-world significance of their findings. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.
	Option 2: Ecosystem Patterns	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objective 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the

	Directions: Compare the listed ecosystem effects, group similar responses, identify the recurring pattern, and write a generalization supported by the provided evidence. **Activity Proper:** Learners will analyze common patterns in the effects of saltwater intrusion and improper wastewater disposal on ecosystems, focusing on their impacts on local ecosystems. As a class, they will first list observable effects, such as osmotic stress, habitat degradation, and biodiversity shifts. Using concept maps or flowcharts, groups will visually organize cause-and-effect relationships, helping them recognize environmental trends. Finally, each group will formulate generalizations based on their observations, identifying recurring ecosystem responses and discussing their broader implications for conservation and sustainability. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

C.3. Evaluating Learning

Option 1: Charting the Waters Again

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Study the graph, chart, or data set carefully. Identify the relevant patterns or trends, support each interpretation with specific evidence from the data, and answer the guide questions.

Activity Proper:
Learners will complete an Exit Ticket using the LAQ chart. They will first summarize key insights about saltwater intrusion and improper wastewater disposal, describing their effects on plants, animals, and soil within ecosystems. Next, learners will identify practical actions they can take, whether personal, community-based, or policy-driven, to address water-related environmental challenges. Finally, they will formulate inquiry-based questions that encourage deeper exploration of ecosystem impacts and sustainability solutions.

What have I learned about the effects of saltwater intrusion and wastewater disposal?	What actions will I take?	What new questions do I have?

The activity targets Learning Objectives 1, 2, 3, and 4 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions.
The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print.

Note to Teachers: Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Guide Questions: 1. What pattern, trend, or relationship is shown by the data? 2. What specific evidence from the data supports your interpretation? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	
	Option 2: Multiple Choice	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** Provide learners with multiple-choice questions that challenge their understanding of the environmental impacts of saltwater intrusion and improper wastewater disposal and explore potential solutions. Enhanced crop growth and improved moisture retention Plant die-off and decreased soil fertility Increased soil organic matter and vigorous plant growth Greater water penetration and reduced erosion Increasing industrial discharge to dilute the contaminants	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital

	Adding extra nutrients to balance the river's chemistry Diverting wastewater directly into coastal areas to disperse the load Constructing advanced treatment facilities to remove pollutants Soil salinization resulting in reduced fertility and crop health. Implement improved irrigation practices to flush salts from the soil and select salt-tolerant crops. Water pollution from wastewater discharge affecting crop quality. Increase the use of chemical fertilizers to counteract nutrient loss. Enhanced soil nutrients leading to overgrowth. Reduce irrigation frequency to prevent nutrient overload. Natural adaptation of the ecosystem yielding healthier soil. Continue current practices, as the ecosystem is self-regulating. Fieldwork requirement: Obtain school approval and guardian consent when applicable, provide adult supervision and a site risk assessment, prohibit contact and sample collection, specify PPE and weather or transport contingencies, and offer an equivalent classroom dataset. **Guide Questions:** 1. During a field visit, John Paul observes that crops near the coast appear withered and the soil is hard and crusty along the edges. In his table on saltwater intrusion, which entry would best describe this observation?	timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	2. During an interview, an environmental specialist explains that untreated wastewater discharged into a river often causes excessive nutrient buildup, which in turn depletes oxygen levels in the water. If Maria were to organize this data in her table on wastewater disposal, which mitigation strategy should she recommend? 3. A photograph from a coastal field visit shows farmland with white salt crusts visible on the soil surface and crops exhibiting stunted, yellowing growth. Which of the following best describes the negative impact observed and an effective mitigation strategy? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	
	C.4. Additional Activities	
	Option 1: Sustainable Design Challenge	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Develop the required design, plan, or proposal using the activity criteria. Show how each major feature addresses the problem and justify your choices using accurate scientific concepts or evidence.	The activity targets Learning Objective 4 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback.

Activity Proper:
Learners design a model for a water-resilient city that integrates green infrastructure, desalination technologies, and wastewater treatment systems. They use simulations or physical models to demonstrate how urban areas can adapt to saltwater intrusion and pollution, focusing on innovative solutions such as permeable pavements, biofilters, and constructed wetlands.

Guide Questions:
1. What scientific idea is communicated most clearly in your output?
2. How does the evidence, example, or design feature in your output support that scientific idea?

Expected Output/Product:
Completed design or model with labels and an evidence-based explanation of how its parts or features function.

Rubric:

Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative.

Note to Teachers: Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Rubric

Criteria	4 – Excellent	3 – Proficient	2 – Developing	1 – Beginning	Total
Water-Resilient City Design	The model presents a highly comprehensive and realistic water-resilient city design that clearly	The model presents a clear water-resilient city design that addresses saltwater intrusion and	The model presents a basic city design, but the connection to water resilience, saltwater intrusion, or	The model lacks a clear water-resilient city design and does not adequately address the stated problems.	____

		addresses saltwater intrusion and pollution.	pollution with minor gaps.	pollution is limited.		
	Integration of Sustainable Technologies	Effectively integrates green infrastructure, desalination technologies, and wastewater treatment systems in a logical and innovative way.	Integrates most required technologies appropriately, with some explanation of how the systems work together.	Includes some sustainable technologies, but integration is incomplete or not clearly explained.	Shows little or no integration of sustainable technologies.	____
	Innovation and Practicality of Solutions	Uses creative and practical solutions such as permeable pavements, biofilters, constructed wetlands, or other appropriate innovations. Solutions are feasible and well justified.	Uses appropriate solutions that are mostly practical and relevant to urban water challenges.	Uses limited or common solutions with weak explanation of practicality or relevance.	Solutions are unclear, unrealistic, or not connected to the water-resilience challenge.	____

	Use of Simulation or Physical Model	Simulation or physical model clearly demonstrates how the city adapts to saltwater intrusion and pollution. Model is detailed, organized, and easy to understand.	Simulation or physical model demonstrates the main adaptation strategies with adequate detail and organization.	Simulation or physical model is present but lacks detail, clarity, or strong connection to the design challenge.	Simulation or physical model is incomplete, unclear, or does not demonstrate the intended concept.	____
	Scientific Explanation and Concept Application	Provides accurate and well-developed explanations of how the design addresses pollution, saltwater intrusion, water treatment, and urban adaptation.	Provides mostly accurate explanations of the science concepts involved, with minor gaps.	Provides limited or partly accurate explanations of the science concepts.	Provides little or no scientific explanation related to the design.	____
	Presentation and Communication	Presents the model clearly and confidently using organized	Presents the model clearly with generally organized	Presentation is somewhat clear but lacks organization,	Presentation is unclear, disorganized, or	____

	explanations, appropriate labels, and effective visual or verbal communication.	explanations and understandable labels.	labels, or sufficient explanation.	difficult to understand.	
Total Score					**____ / 24**

Option 2: Eco Solutions

Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Create the required brochure comparing saltwater and wastewater, including the specified properties and ecosystem impacts, and conclude with practical evidence-based solutions. **Activity Proper:** This activity requires learners to create an informative brochure where they research the properties of saltwater and wastewater, including aspects like color, odor, temperature, and salinity, and compare their impacts on local ecosystems. The brochure is structured with an introduction, a detailed comparative table, and a conclusion featuring practical adaptation or mitigation strategies such as improved treatment methods and sustainable water management practices. Structured peer review and teacher feedback are	The activity targets Learning Objective 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or

integrated throughout the process to reinforce skills in data organization, visual communication, and practical problem-solving in environmental science.

Guide Questions:

1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Rubric

Criteria	4 – Excellent	3 – Proficient	2 – Developing	1 – Beginning	Total
Content Accuracy and Completeness	Brochure presents accurate, complete, and well-researched information about the properties of saltwater and wastewater, including color, odor, temperature, and salinity.	Brochure presents mostly accurate information about saltwater and wastewater, with minor gaps in details.	Brochure includes some correct information, but explanations are incomplete or partly inaccurate.	Brochure contains very limited, unclear, or inaccurate information about saltwater and wastewater.	____
Comparison of Saltwater and Wastewater	Comparative table clearly and thoroughly shows	Comparative table shows clear comparison with	Comparative table is present but lacks enough detail,	Comparative table is missing, unclear, or does not effectively	____

		similarities and differences between saltwater and wastewater and their impacts on local ecosystems.	mostly relevant details and minor missing information.	organization, or clear comparison.	compare saltwater and wastewater.	
	Discussion of Environmental Impacts	Clearly explains how saltwater and wastewater affect local ecosystems, using relevant examples and strong environmental connections.	Explains the main impacts on local ecosystems with mostly clear and relevant information.	Provides limited explanation of environmental impacts, with weak or general connections to ecosystems.	Shows little or no understanding of how saltwater and wastewater affect ecosystems.	____
	Mitigation Strategies and Practical Solutions	Conclusion presents practical, realistic, and sustainable mitigation strategies, such as improved treatment methods and responsible	Conclusion presents appropriate mitigation strategies that are mostly practical and connected to the issue.	Conclusion includes limited or general strategies, but these are not fully explained or clearly connected to the problem.	Conclusion provides little or no practical mitigation strategy.	____

	water management practices.				
Brochure Organization and Required Parts	Brochure is well structured with a clear introduction, detailed comparative table, and strong conclusion. Information flows logically and is easy to follow.	Brochure includes the required parts and is generally organized, with minor issues in flow or clarity.	Brochure includes some required parts, but organization is weak or incomplete.	Brochure lacks the required structure and is difficult to follow.	____
Visual Communication and Creativity	Brochure is visually appealing, creative, and effectively uses layout, images, headings, and design elements to support the message.	Brochure is neat and visually clear, with design elements that generally support the message.	Brochure has limited visual appeal or creativity; layout may be crowded, plain, or confusing.	Brochure lacks creativity, visual organization, or effective design.	____
Total Score					**____ / 24**

V. ASSESSMENT *(Assessing Learnings)*	**Multiple Choice:** Read each question carefully and choose the best answer. 1. Which property best describes saltwater? A. low in dissolved salts B. dark color with a strong odor C. rich in organic contaminants D. high salinity with a clear or bluish appearance 2. What is a distinguishing characteristic of wastewater compared to saltwater? A. clear and odorless B. high natural salinity C. originating from oceans and estuaries D. presence of chemicals, organics, and pathogens 3. What is one major environmental impact of saltwater intrusion? A. enhanced water clarity B. improvement in soil fertility C. increased biodiversity in wetlands D. soil salinization leading to reduced crop yields 4. Improper wastewater disposal can lead to which of the following impacts on local ecosystems? A. increased soil fertility B. enhanced growth of native plants C. natural purification of water bodies D. decline in water quality and habitat destruction 5. Which sustainable solution is most effective in reducing the negative impact of wastewater on the environment? A. mixing wastewater with saltwater B. allowing wastewater to evaporate naturally C. building advanced wastewater treatment facilities D. increasing the volume of untreated wastewater discharge 6. What is a primary goal of comparing saltwater and wastewater in environmental studies? A. create a uniform water type for industrial use B. understand their distinct effects on ecosystems

	C. increase the overall water volume of ecosystems D. promote the mixing of the two for aesthetic benefits 7. Which method can help in reducing the impact of saltwater intrusion in affected areas? A. ignoring soil degradation issues B. increasing the discharge of saltwater C. implementing rainwater harvesting systems D. promoting unregulated groundwater extraction 8. What is a key element in designing an effective water filtration prototype for wastewater treatment? A. avoiding any form of physical filtration B. focusing solely on increasing water pressure C. using a single, undifferentiated filtration layer D. creating a multi-layered system with natural or household materials 9. Which urban strategy can help reduce water pollution from improper wastewater disposal? A. expanding impermeable surfaces in cities B. cutting down vegetation near water bodies C. encouraging unregulated industrial activities D. developing green infrastructures such as constructed wetlands 10. Why is creating a comparative table of saltwater and wastewater impacts useful for environmental studies? A. It obscures details to simplify the data. B. It is used solely for memorization of facts. C. It minimizes the need for further research. D. It visually organizes differences to reveal patterns and guide mitigation strategies. **Performance Task: Short Literature Review on Saltwater Intrusion and Improper Wastewater Disposal** Learners will conduct a short literature review on the environmental impacts of saltwater intrusion and improper wastewater disposal, focusing exclusively on environmental studies conducted in the Philippines within the past 10 years.

	The review will examine how saltwater intrusion and wastewater affect local ecosystems such as coastal wetlands, agricultural lands, mangrove areas, fishponds, rivers, and urban waterways. Learners will identify key cause and effect relationships discussed in the literature and synthesize their findings through a comparative analysis. As part of the literature review, learners must create a table showing how saltwater and wastewater affect one local ecosystem. The table must include the following components: source, composition, observed or possible effect, affected organisms, and recommended action. The table should clearly compare the effects of saltwater and wastewater on the selected ecosystem and should be supported by evidence from the reviewed literature. **Required Structure of the Literature Review** **1. APA 7th Edition Title Page** Begin with a title page following APA 7th edition format. Include the title of the paper, learner's name, institution, course/subject, teacher's name, and date. **2. Abstract** An abstract is optional. If included, it should be 150–250 words and briefly summarize the topic, purpose, method, major findings, and recommendations of the literature review. **3. Introduction** In the introduction, learners must clearly state the research question, explain the local focus of the review, explain the temporal focus limited to studies from the past 10 years, and present the inclusion criteria such as publication date, study type, geographical relevance to the Philippines, and relevance to saltwater intrusion, wastewater disposal, or ecosystem impacts. **4. Methodology** Include a brief methodology section describing how the literature was selected. This section should mention the primary databases or search platforms used, keywords used in the search, Boolean operators used such as AND, OR, and NOT, date filters applied, and criteria for including or excluding sources.

5. Review of Related Literature / Main Body

Organize the main body into thematic groups that highlight important findings and trends in the literature. Possible themes may include effects of saltwater intrusion on coastal and agricultural ecosystems; effects of improper wastewater disposal on rivers, waterways, and coastal areas; impacts on plants, animals, soil, water quality, and human communities; comparison of ecosystem responses to saltwater and wastewater; and sustainable responses or interventions.

6. Comparative Analysis Table

Include a table showing how saltwater and wastewater affect one selected local ecosystem. The table must clearly show correct comparison of saltwater and wastewater, accurate ecosystem effects, evidence from reviewed sources, practical recommendations, and clear and organized presentation.

Water Type	Source	Composition	Observed or Possible Effect	Affected Organisms	Recommended Action
Saltwater					
Wastewater					

7. Sustainable Solution Proposal

After the table, learners must propose one sustainable solution, which may be community-based, such as clean-up drives, wastewater awareness campaigns, mangrove rehabilitation, or local water monitoring; or technological, such as wastewater treatment systems, constructed wetlands, filtration systems, or salinity monitoring tools. The proposal should explain how the solution will be implemented, who will be involved, what resources may be needed, what benefits are expected, and how the solution addresses the identified environmental issue.

8. Conclusion

Conclude the review by summarizing the key insights from the literature, explaining the major patterns and differences in ecosystem responses, and outlining directions for future inquiry or further research.

	9. Limitations of the Review Learners must transparently state the limitations of the review, including time constraints, narrow focus on recent Philippine studies, possible search strategy biases, and limited availability of local studies or data. **10. References** End with a reference list following APA 7th edition format. All sources cited in the paper must appear in the reference list. **Formatting Requirements** • Length: Approximately 1500–2000 words • Page estimate: About 6–8 pages • Spacing: Double-spaced • Font: Times New Roman, 12-point • Margins: 1 inch on all sides • Citation style: APA 7th edition • Focus: Environmental studies conducted in the Philippines within the past 10 years **Final Output Requirement** 1. APA 7th edition title page 2. Optional abstract 3. Introduction 4. Methodology 5. Thematically organized literature review 6. Comparative analysis table on saltwater and wastewater effects 7. Sustainable solution proposal 8. Conclusion 9. Limitations 10. APA 7th edition references

Assessment Criteria:

Criteria	Weight	4 – Exceeds Expectations	3 – Meets Expectations	2 – Approaches Expectations	1 – Needs Improvement	Total
Research & Analysis	30%	Uses a comprehensive set of credible Philippine sources from the past 10 years. Clearly defines the research question, scope, and inclusion criteria, and provides accurate, well-supported analysis of saltwater intrusion, wastewater impacts, affected organisms,	Uses relevant, credible, and recent Philippine sources. Clearly defines the research question and scope and accurately connects evidence to the ecosystem impacts of saltwater intrusion and improper wastewater disposal.	Uses generally relevant sources and states the research question and scope. Explains the main environmental impacts, but the evidence, affected organisms, or ecosystem responses need further development.	Uses few, weak, or off-topic sources. The question or scope is unclear, and the analysis is superficial, inaccurate, or unsupported by evidence from the selected ecosystem.	____

			and ecosystem responses.				
	Organization & Structure	25%	Includes all required sections in a clear, logical sequence. The comparative table is accurate, complete, and effectively integrated into the literature review.	Includes the required sections in a coherent sequence. The comparative table is complete, clear, and appropriately placed.	Includes most required sections and follows a generally logical sequence, but transitions or development need improvement. The comparative table is present but partly incomplete.	Omits several required sections or lacks a logical sequence. The comparative table is missing, inaccurate, confusing, or disconnected from the review.	____
	Synthesis & Comparative Analysis	20%	Synthesizes multiple sources into clear themes and insightfully compares patterns, differences,	Synthesizes relevant sources into clear themes and compares key patterns, differences, affected organisms,	Identifies some trends and comparisons, but the synthesis lacks depth or overlooks important	Mainly summarizes sources without meaningful synthesis or comparison. Patterns and ecosystem	____

			affected organisms, ecosystem responses, and recommended actions. The comparative table is accurate and strongly supported by evidence.	ecosystem responses, and recommended actions for a selected local ecosystem.	relationships. The comparative table needs clearer explanation or stronger evidence.	responses are unclear, and the comparative table is incomplete, inaccurate, or unsupported.	
	Sustainable Solution Proposal	15%	Proposes a practical, specific, innovative, and sustainable solution. Clearly explains implementation, stakeholders, resources, benefits, and a strong evidence-	Proposes a practical and sustainable solution. Explains the implementation steps, stakeholders, resources, benefits, and connection to evidence from the literature review.	Proposes a viable solution and gives a basic explanation of implementation and benefits, but its connection to the evidence or ecosystem effects needs stronger justification.	Provides little detail about the proposed solution. The proposal is vague, unrealistic, or not clearly connected to the environmental impacts discussed in the review.	——

			based connection to the identified environmenta l issue.				
	Writing Quality & Citation Format	10%	Writes clearly, concisely, and coherently with minimal language errors. Consistently follows the required length, format, and APA 7th edition conventions and states the review's limitations clearly.	Writes clearly and coherently, follows the required length and format, applies APA 7th edition conventions with only minor lapses, and states the review's limitations.	Writes in a generally readable manner with minor language or formatting errors. Some APA requirements are inconsistent, and the limitations need clearer explanation.	Frequent language errors reduce readability. Required formatting and APA conventions are inconsistent or missing, and the limitations are absent or poorly stated.	____
	Weighted Total						**____ / 100%**

	Assessment specification: Include an answer key, acceptable-response notes, and the exact total score. Do not treat pH alone as proof of a contaminant or its source.
VI. REFLECTION *(Feedback and Continuous Improvement)*	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery. 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? *6.* What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take full responsibility for the content of this LE.

APPENDIX

Answers to Multiple Choice Questions (Assessment)

Item No.	Key Answer	Explanation
1	D	Saltwater has a high concentration of dissolved salts. Wastewater composition varies by source and may contain organic matter, nutrients, pathogens, salts, suspended solids, oils, detergents, or other chemicals. Appearance alone cannot identify either sample, and tasting is prohibited.
2	D	Wastewater is characterized by the presence of organic matter, industrial chemicals, and pathogens, which differentiates it from saltwater that is mostly composed of dissolved salts.
3	D	Saltwater intrusion often causes soil salinization that degrades soil quality and limits plant growth, thereby reducing agricultural productivity.
4	D	When wastewater is improperly disposed of, it releases contaminants that pollute water bodies and damage habitats, endangering both aquatic and terrestrial life.
5	C	Advanced wastewater treatment facilities help remove harmful contaminants before the water is discharged, thereby minimizing its environmental impact.
6	B	Comparing saltwater and wastewater helps researchers identify how each type uniquely affects soil, plant life, and aquatic systems, which is essential for developing targeted mitigation strategies.
7	C	Rainwater harvesting can provide alternative freshwater sources, reducing reliance on saline water and helping to mitigate the adverse effects of saltwater intrusion on agriculture and ecosystems.
8	D	A multi-layered filtration system, often using common, accessible materials, allows for better separation of contaminants through various mechanisms like adsorption and sedimentation.
9	D	Green infrastructure, including constructed wetlands, can naturally filter out pollutants from water, improving water quality in urban environments.
10	D	A comparative table helps in visually summarizing the distinct properties and impacts of each water type, making it easier to identify patterns and devise effective solutions.

Learning Title/Topic:	Unifying Themes of Life Science – Living Organisms as Systems of Interrelated Parts	Lesson Exemplar:	8

I. OBJECTIVES	
A. Content Standard	All levels of life have systems of related parts;
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	The learners understand levels of biological organization and how organisms interact within ecosystems. They recognize cell division as a basis for growth, explain digestion and the importance of nutrition, and show awareness of conserving food-related species. They have basic knowledge of body systems and technologies in improving plant and animal traits
	Explain using photographs or videos of simple plants or animals as examples how life forms operate as systems of related parts working together;
II. RFERENCES and MATERIALS (*Selecting Resources and Material*)	Department of Education. *Earth and Life Science Quarter 2 – Module 2: Unifying Themes in the Study of Life*. 2021. Studocu. "Lesson 1: Unifying Themes of Life – Earth & Life Science Q2." Accessed June 11, 2026. https://www.studocu.com. Lingcol, R. "Unifying Themes in the Study of Life." Presentation. SlideShare. Accessed June 11, 2026. https://www.slideshare.net/slideshow/unifying-themes-in-the-study-of-life/241817637. Wikimedia Commons contributors. "Diagram of the Human Heart (Cropped)." Wikimedia Commons. Accessed June 11, 2026. https://commons.wikimedia.org/wiki/File:Diagram_of_the_human_heart_(cropped).svg.

	Wikimedia Commons contributors. “Respiratory System Complete.” Wikimedia Commons. Accessed June 11, 2026. https://commons.wikimedia.org/wiki/File:Respiratory_system_complete_en.svg. Wikimedia Commons contributors. “Digestive System Diagram.” Wikimedia Commons. Accessed June 11, 2026. https://commons.wikimedia.org/wiki/File:Digestive_system_diagram_en.svg. Wikimedia Commons contributors. “Plant Anatomy.” Wikimedia Commons. Accessed June 11, 2026. https://commons.wikimedia.org/wiki/Category:Plant_anatomy. GraphDiagram. “Human Body Digestive System Diagram.” Accessed June 11, 2026. https://graphdiagram.com/human-body-digestive-system-diagram/. Bing Images. “Flowering Plant Labeled Diagram.” Accessed June 11, 2026. https://www.bing.com/images. Pathwayz. “Cross Section of a Leaf (Basic).” Accessed June 11, 2026. https://www.pathwayz.org/Tree/Plain/CROSS+SECTION+OF_A_LEAF_%5BBASIC%5D. ScienceFacts. “Parts of a Plant.” Accessed June 11, 2026. https://www.sciencefacts.net/parts-of-a-plant.html Bryce, Emma. “What Do the Lungs Do?” TED-Ed. Accessed June 11, 2026. https://ed.ted.com/lessons/what-do-the-lungs-do-emma-bryce. YouTube. “Educational Videos on Circulatory, Digestive, and Plant Systems.” Accessed June 11, 2026. https://www.youtube.com Innerbody. “Digestive System Overview.” Accessed June 11, 2026. https://www.innerbody.com/image/digeov.html. Encyclopaedia Britannica. “Human Respiratory System: Images and Videos.” Accessed June 11, 2026. https://www.britannica.com/science/human-respiratory-system/images-videos. Encyclopaedia Britannica. “Human Cardiovascular System: Images and Videos.” Accessed June 11, 2026. https://www.britannica.com/science/human-cardiovascular-system/images-videos. Encyclopaedia Britannica. “Root (Plant): Images and Videos.” Accessed June 11, 2026. https://www.britannica.com/science/root-plant/images-videos. Healthdirect Australia. “Digestive System.” Accessed June 11, 2026. https://www.healthdirect.gov.au/digestive-system.

II. CONTENT *(Sequencing Content)*	Unifying Themes of Life Science – Living Organisms as Systems of Interrelated Parts	
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	1. Identify the major parts or systems of simple plants and animals shown in photographs or videos. 2. Describe how the different parts of plants and animals work together to sustain life. 3. Explain how plants and animals operate as systems of related parts working together using photographs or videos of simple plants and animals as examples.	
IV. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	***A.1. Activating Prior Knowledge***	
	Option 1: System Match-Up and Life-Link Reflection	
	Materials/Resources Needed: • Printed or digital cards with names of systems and components (e.g., "Circulatory System – Heart," "Root System – Xylem") **Directions:** Match each item with the correct term, category, description, or process. Record each match and briefly explain the scientific basis for your answer. **Activity Proper:** Step-by-Step Activity: The teacher may access images from the following sites. https://commons.wikimedia.org/wiki/File:Diagram_of_the_human_heart_(cropped).svg https://commons.wikimedia.org/wiki/File:Respiratory_system_complete_en.svg https://commons.wikimedia.org/wiki/File:Digestive_system_diagram_en.svg	The activity targets Learning Objective 1 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated

	https://commons.wikimedia.org/wiki/Category:Plant_anatomy A curated set of images or short video clips showing plant and animal systems in action (e.g., blood flow, photosynthesis, nutrient transport). The teacher may access videos or images from the following sources. https://ed.ted.com/lessons/what-do-the-lungs-do-emma-bryce "Life Link" reflection sheets. 1. Warm-Up Prompt (5 min) Let them brainstorm individually or in pairs. Encourage metaphors (e.g., "Roots are like water pipes"). 2. System Match-Up Challenge (10 min) Distribute shuffled cards with system names and their components. In groups, students: Match each system to its correct components. Categorize cards into "Plant Systems" and "Animal Systems." Predict how at least one plant and one animal system might interact with others to sustain life. Extension: Include "mystery cards" with functions (e.g., "transports nutrients") and ask students to match them to the correct system. The teacher may access images for the cards from the list of links provided in the materials. 3. Visual Decode (10 min) Show selected images or short clips (e.g., root absorption, heart pumping, leaf cross-section). For each:	through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

	Encourage students to annotate or sketch the system and label components. 4. Life Link Reflection (5 min) Each student completes a short reflection: Analogy limitation: Name the actual organisms, organs, and systems compared. Xylem occurs throughout vascular plant organs. Treat xylem or phloem versus circulation, transpiration versus excretion, and tropism versus nervous response only as limited functional analogies, and state where each analogy breaks down. Science clarification: Describe regulation as maintaining internal conditions within changing ranges, not as keeping a perfectly fixed 'balance'. Claim numeracy only when learners calculate, graph, measure, or interpret quantitative data. **Guide Questions:** 1. https://www.youtube.com/watch?v=kYe2O_YyV4I 2. https://www.youtube.com/watch?v=K57qjYYjgIY 3. https://www.youtube.com/watch?v=qGiPZf7njqY 4. https://www.youtube.com/watch?v=PSGKRd7Bbl0 5. https://www.youtube.com/watch?v=Yxm-WMYEpHg 6. Ask learners: "Imagine your body or a plant as a city. What systems keep it alive and running smoothly? Jot down any systems or parts you remember." 7. Ask: "What system is shown? What parts are working together?"	

	8. "Choose one system from today's activity. How does it remind you of something in your own life—your routines, relationships, or responsibilities?" **Expected Output/Product:** Completed written reflection that connects the activity to the relevant scientific concepts. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Differentiated System Identification and Analysis	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Complete the task assigned for your readiness level: identify and label system parts, explain how the parts work together, or analyze media showing a system in action. Submit the required labeled output. **Activity Proper:** 1. For Emerging Learners (Basic Identification) 2. Task: Identify major systems (e.g., digestive, respiratory, circulatory in animals; root and shoot systems in plants) and label their parts.	The activity targets Learning Objectives 1, 2, and 3 by guiding learners to extract scientific information from visual media and connect it to the lesson concepts. It applies the Constructivist, Inquiry-Based, and Interactive approaches because learners observe closely, answer guiding questions, and discuss evidence from the media. The pedagogical strategy used is guided multimedia analysis, supported by a viewing guide, pause points, peer discussion, and teacher questioning. Literacy is integrated through identifying key ideas, evaluating statements, and summarizing evidence from the media. Numeracy is integrated through interpreting any scales, time series, quantities, or comparisons shown.

	3. For Developing Learners (Understanding Functions) Task: Describe how parts of a system (e.g., heart, blood vessels, blood) work together to keep an organism alive. For Proficient Learners (Application and Analysis) Activity: Picture/video analysis Task: Explain how a shown image or video (e.g., plant water transport or human digestion) demonstrates a system of interrelated parts working together. The teacher may visit the following links to access the videos or images needed for the activity. https://www.innerbody.com/image/digeov.html https://www.britannica.com/science/human-respiratory-system/images-videos https://www.britannica.com/science/human-cardiovascular-system/images-videos https://www.britannica.com/science/root-plant/images-videos https://www.twinkl.com.ph (search: "body systems labeling" or "plant parts diagram") Science clarification: Describe regulation as maintaining internal conditions within changing ranges, not as keeping a perfectly fixed 'balance'. Claim numeracy only when learners calculate, graph, measure, or interpret quantitative data **Guide Questions:** 1. What evidence in the case or scenario is most relevant to the problem?	EdTech is integrated through a cited video, animation, or presentation when available, together with an accessible offline alternative. **Note to Teachers:** Preview the media for scientific accuracy and accessibility. Clarify that a video or animation is not an interactive simulation unless learners can manipulate variables.

	2. Which scientific concept best explains the situation, and why? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Picture This: Systems at Work	
	Materials/Resources Needed: • Printed pictures or short video clips of: • A flowering plant (roots, stem, leaves, flowers visible) • https://www.bing.com/images/search?q=flowering+plant+labeled+diagram+roots+stem+leaves+photo+link&form=M365C&first=1 • A human body system diagram (e.g., circulatory, respiratory) https://graphdiagram.com/human-body-digestive-system-diagram • Optional: short video of plant tropism or animal respiration • https://www.youtube.com/watch?v=ZMRDPzSo8PY • https://www.youtube.com/watch?v=LFV-DfLsLPc • Chart paper with guiding questions • Markers or pens	The activity targets Learning Objective 1 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital

	Directions: Examine the image or visual carefully. Record the relevant observations, distinguish observation from inference, and answer the guide questions using scientific evidence. **Activity Proper:** Instructions for Students Step 1: Observe (5 minutes) • Look closely at the provided picture or video of either a plant or an animal system. • Note down the major system(s) you see and label their components (e.g., roots, xylem, lungs, heart). Step 2: Analyze (10 minutes) • In pairs or small groups, discuss: Step 3: Apply (10 minutes) • On chart paper or your organizer, complete the following questions: 1. System Identified: _____ 2. Main Components: _____ 3. How They Work Together: _____ 4. Life Need Addressed: _____ 5. Comparison (Plant vs. Animal): _____ Step 4: Share (5 minutes) • Each group presents one key insight: • A surprising similarity or difference between plant and animal systems, OR • A practical application of this knowledge in real life.	timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Analogy limitation: Name the actual organisms, organs, and systems compared. Xylem occurs throughout vascular plant organs. Treat xylem or phloem versus circulation, transpiration versus excretion, and tropism versus nervous response only as limited functional analogies, and state where each analogy breaks down. Science clarification: Describe regulation as maintaining internal conditions within changing ranges, not as keeping a perfectly fixed 'balance'. Claim numeracy only when learners calculate, graph, measure, or interpret quantitative data. **Guide Questions:** 1. How do these components work together as a system? 2. What basic need of life does this system address (nutrients, gas exchange, reproduction, waste removal, response to stimuli)? 3. How is this similar or different from the way the other kingdom (plant vs. animal) meets the same need? 4. Real-Life Application: How does understanding this system help us in daily life, health, or environmental care? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

Option 2: System Showdown: Plants vs. Animals

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Work with your group to complete the plant-versus-animal comparison chart, match each life function with the responsible system, and explain one important similarity and one difference.

Activity Proper:
Step 1: Warm Up Brainstorms (5-10 minutes)
Learners list basic needs (e.g., water, nutrients, gas exchange, reproduction) and the systems that meet those needs (e.g., roots, leaves, digestive system, circulatory system).
Step 2: Group Analysis (15–20 minutes)
Divide learners into small groups. Each group receives a comparison chart with categories like:

Function	Plant System	Animal System
Nutrient Transport	Xylem transports water and mineral ions; phloem transports assimilates, mainly sucrose, from source	Circulatory System

The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.
The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

Note to Teachers: Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	tissues to sink tissues	
Gas Exchange	Stomata	Lungs, gills
Reproduction	Flowers, seeds	Reproductive organs
Response to stimuli	Tropism	Nervous System
Waste Removal	Leaf drop can remove some stored substances. Transpiration is water-vapor loss that helps drive xylem transport and can cool leaves; it is not primarily a waste-removal process.	Excretory system

Task:

- Fill in the chart using prior knowledge, textbook, or visual aids
- Highlight similarities (e.g., both transport nutrients)
- Note differences in structure and complexity

Step 3: Class Discussion (15 minutes)

Facilitate a whole-class discussion using guiding questions:

• Encourage learners to defend their comparisons and ask questions across groups.

	Step 4: Values Connection (Optional Extension) Ask learners to reflect: They can share insights like: • "Even simple systems have complex roles." • "Balance is essential—whether in a leaf or a lung." • Each part has one or more biological functions that contribute to the system. Describe functions without implying that biological structures were consciously designed for a purpose. **Guide Questions:** 1. What functions are common to both plants and animals? 2. How do their systems achieve these functions differently? 3. Which system surprised you the most? 4. What does this tell us about how life adapts to different environments? 5. What can we learn from plant and animal systems about balance, cooperation, and adaptation? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

<table>
<tr><td rowspan="3">B. Instituting New Knowledge</td><td colspan="2">B.1. Presenting Examples</td></tr>
<tr><td colspan="2">Option 1: Systems of Life in Action</td></tr>
<tr><td>Materials/Resources Needed:
• Pictures/videos of:
• Digestive system (animal) https://bit.ly/3PTfglv
• Circulatory system https://www.britannica.com/science/circulatory-system
• Plant transport system (xylem & phloem) https://bit.ly/4usddmm
• Leaf structure (photosynthesis). https://bit.ly/49MYRWu
• Ecosystem interactions https://bit.ly/4v7b7tm

Directions:
Examine the assigned pictures or video, identify the system components and their interactions, and produce the required explanation or concept map showing how the system sustains life.

Activity Proper:
Activity Overview
Students analyze pictures or short video clips of plant and animal systems, then present examples showing:
System components
Interactions
Life-sustaining functions</td><td>The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.</td></tr>
</table>

	Outputs are differentiated based on learner readiness and complexity Task cards (per level) Graphic organizers Level 1: Foundational (Guided Identification) Focus: Objective 1 (Identify systems & components) Task: Learners receive a labeled or partially labeled image and complete the tasks that follow. Identify the system Label major parts State basic function Presentation Output: Short oral explanation (1–2 minutes) Labeled diagram Example: “This is the digestive system. The stomach breaks down food and helps in digestion.” Level 2: Developing (Explaining Interactions) Focus: Objectives 1 & 2 Task: Students analyze a clear image or short video clip and: Identify system components Explain how parts work together Presentation Output: Poster / 3–5 slide presentation	

	Example: “In the circulatory system, the heart pumps blood while vessels distribute it. This allows oxygen and nutrients to reach all cells.” Identification of System: 4: Correctly identifies system confidently | 3: Correct but hesitant | 2: Partially correct | 1: Incorrect or no answer Labeling of Parts: 4: All major parts accurately labeled | 3: Most parts correct (1–2 errors) | 2: Some correct labels | 1: Few or no correct labels Function Explanation: 4: Clear and accurate function stated | 3: Function mostly correct | 2: Incomplete explanation | 1: Incorrect or missing Oral Explanation: 4: Clear, confident, within time | 3: Understandable with minor issues | 2: Some difficulty explaining | 1: Unclear or incomplete Identification of Components: 4: All components correctly identified | 3: Minor errors | 2: Several missing/incorrect | 1: Mostly incorrect Explanation of Interactions: 4: Clearly explains how parts work together | 3: Explanation mostly clear | 2: Basic explanation only | 1: No clear interaction explained	

	Understanding of Roles: 4: Each part's role clearly described | 3: Most roles explained | 2: Limited explanation | 1: Roles unclear or missing Life-Sustaining Function: 4: Strong, clear connection to survival | 3: General explanation | 2: Weak connection | 1: No connection Presentation Quality (poster: 4: Organized, neat, visually clear | 3: Mostly organized | 2: Some clutter/confusion | 1: Disorganized) Communication Skills: 4: Clear, confident speaking | 3: Generally clear | 2: Some difficulty Analogy limitation: Name the actual organisms, organs, and systems compared. Xylem occurs throughout vascular plant organs. Treat xylem or phloem versus circulation, transpiration versus excretion, and tropism versus nervous response only as limited functional analogies, and state where each analogy breaks down. **Guide Questions:** 1. What system is shown? 2. What are its main parts? 3. What is its main function? 4. How do the parts interact? 5. What role does each part play? 6. How does the system help sustain life?	

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little evidence or gives unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				**____ / 15**

Option 2: Analyzing System Function from Media

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Examine the assigned pictures or video, identify the system components and their interactions, and produce the

The activity targets Learning Objectives 1 and 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence,

	required explanation or concept map showing how the system sustains life. **Activity Proper:** Focus: Objectives 2 & 3 Task: Students watch a more complex video or image sequence (e.g., photosynthesis, digestion, transpiration) and: Explain system processes Describe interactions and outcomes Presentation Output: Concept map + explanation Short video analysis report Example: "The video shows transpiration where water moves from roots to leaves. If roots cannot absorb water, the plant cannot survive." Level 4: Advanced (Integrating Multiple Systems) Focus: All 3 Objectives Task: Students analyze a complex scenario or ecosystem video and: Identify multiple interacting systems Explain interdependence Connect to real-world situations Presentation Output: Case study presentation Infographic or mini research talk Creative explanation (animation, skit)	compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Challenge Questions: Example: “Plants use the transport system to move water for photosynthesis, while animals rely on circulatory systems to distribute nutrients. Both show how systems sustain life through interaction.” **Guide Questions:** 1. What processes are happening? 2. How do parts depend on each other? 3. What would happen if a part fails? 4. How do multiple systems interact? 5. How does one system affect another? 6. What happens under environmental stress? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	B.2. Discussing New Concept	
	Option 1: Discovering Life Systems Through Guided Discussion	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Respond to each prompt using your prior knowledge and the lesson concepts. Discuss your reasoning with a partner	The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from

	or group, then refine your answer based on the evidence shared. **Activity Proper:** Activity Overview This is a guided discovery discussion where students analyze visual stimuli (images/videos) and collaboratively build understanding of biological systems. The teacher facilitates progressive questioning, while students engage through differentiated discussion tasks. Phase 1: Engage (Motivation through Media) – 5–7 minutes Teacher Action: Show: A set of images (digestive system, leaf cross-section, root system) https://www.healthdirect.gov.au/digestive-system https://www.pathwayz.org/Tree/Plain/CROSS+SECTION+OF+A+LEAF+%5BBASIC%5D Prompt Questions: Phase 2: Guided Discussion of New Concepts Core Strategy: Think–Pair–Share + Differentiated Questioning Level 1 (Support Group) Task: Identify system and label parts using an activity organizer Teacher Support: Provide word banks (e.g., heart, roots, leaves) Provide partially labeled diagrams Level 2 (Advanced Group)	observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Focus: All Objectives – Integration of Systems Task: Identify multiple systems and explain interconnections Predict outcomes if one part fails Challenge Questions: **Guide Questions:** 1. A short video (e.g., blood circulation or plant transport) https://www.youtube.com/watch?v=woAbgRZGX3I 2. https://www.youtube.com/watch?v=DhyYtT1K844&t=39s 3. https://www.youtube.com/watch?v=F1KhtFnfDSg 4. "What do you observe?" 5. "What parts can you identify?" 6. "What do you think is happening?" 7. What system is shown? 8. What are the main parts? 9. What is its main function? 10. How do systems depend on each other? 11. What would happen if one component stops functioning? 12. How does this relate to real-life issues (e.g., disease, drought)? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

	Option 2: Whole-Class Concept Building	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Construct the required design or model, label its important parts, show how the parts or steps work together, and justify the design using accurate scientific principles. **Activity Proper:** Teacher-Led Synthesis: Create a concept map on the board: Life Systems → Components → Interactions → Sustaining Life Guide the discussion toward key ideas: Systems are made of interdependent parts Structure relates to function Systems maintain balance (homeostasis) Plants and animals both rely on organized systems Quick Presenting Examples Each group shares: Identified system Components How it works Evidence from image/video Part A: Whole-Class Participation (Concept Building) Contribution to Discussion: 4: Actively contributes relevant and insightful ideas | 3: Participates with relevant ideas | 2: Limited participation | 1: Does not participate	The activity targets Learning Objectives 1 and 2 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

	Understanding of Key Concepts (systems: 4: Demonstrates strong understanding of all key ideas | 3: Shows good understanding with minor gaps | 2: Basic understanding | 1: Little or no understanding) Connection of Ideas (: 4: Clearly connects all ideas logically | 3: Makes general connections | 2: Limited connections | 1: No clear) **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	B.3. Developing Mastery	
	Option 1: Systems in Action: Mastering Life's Unifying Themes	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Complete the assigned mastery level by matching and labeling system components, explaining their functions and interactions, and submitting the required organizer or written explanation.	The activity targets Learning Objectives 1 and 2 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.

	Activity Proper: Level 1: Guided Mastery (Reinforcement) Focus: Objective 1 (Identify systems & components) Task: "Match, Label, and Identify" Students match: Systems → components → functions Label diagrams (plant & animal systems) Material: Labeled/partially labeled images **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Expected Output/Product:** Completed organizer. Guide Prompts: What system is shown? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Option 2: Analytical Mastery: Explain the System in Action	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1 and 2 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the

	Directions: Analyze the assigned video or complex diagram, identify the process and interacting parts, cite specific evidence from the media, and explain what would happen if one part failed. **Activity Proper:** Level 3: Analytical Mastery Task: "Explain the System in Action" Students analyze: A short video OR A complex diagram Then explain: How the system works Evidence from the media **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Expected Output/Product:** Short written explanation OR concept map. Guide Prompts: What process is being shown? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

<table>
<tr><td rowspan="3">C. Demonstrating Knowledge and Skills</td><td colspan="2">C.1. Finding Practical Application</td></tr>
<tr><td colspan="2">Option 1: Concept Web and Values Reflection</td></tr>
<tr><td>Materials/Resources Needed:
• Paper, cartolina, or Manila paper
• Pen or pencil
• Markers or colored pencils (if available)

Directions:
Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown.

Activity Proper:
Step 1: Concept Web (10 minutes)
1. Making Generalization
Step 2: Generalization Statement (15 minutes)
Each group writes a generalization that captures the core idea of the lesson. You can guide them with sentence starters:
• “All living things are made up of parts that…”
• “When one part of a system fails…”
• “Life depends on the cooperation of…”
Example:
“All living organisms are systems where each part has a role. These parts must work together to keep the organism alive, just like people in a community.”</td><td>The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis.
The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative.

Note to Teachers: Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.</td></tr>
</table>

	Guide Questions: 1. Learners work in pairs or small groups. From their analyzed picture or video clip, learners will create a concept web that answers the central question: "How do the parts of a living organism work together as a system?" **Expected Output/Product:** Completed concept map showing the required concepts and scientifically accurate relationships. **Assessment Criteria:** • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	
	Option 2: Life Systems in Real Life	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Analyze each real-life plant or animal situation, identify the affected biological system and parts, explain the interaction involved, and recommend a scientifically supported response when required.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning.

	Activity Proper: Activity Overview Students apply what they have learned by solving real-world scenarios involving plant and animal systems. Tasks are differentiated by complexity, allowing learners to demonstrate understanding through practical applications. Activity Structure: Real-Life Scenarios Students are given authentic situations such as: A person feeling dizzy after dehydration A plant wilting under heat Blocked blood flow in the heart Lack of nutrients in soil They analyze and connect these situations to biological systems. Differentiated Tasks Level 1: Basic Application (Guided Real-Life Connection) Task: "Identify It in Real Life" Students examine a simple scenario + picture Identify: The system involved The main parts affected Example: "A wilting plant involves the transport system. The roots and leaves are affected." Level 2: Functional Application Task: "Explain What's Happening"	Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Students analyze a real-life situation and: Identify the system Explain how parts interact Optional Output Choices (Student Choice) Oral presentation Poster or infographic Short video explanation Written analysis Identification of System: 4: Correctly identifies the system with confidence | 3: Correct but unsure | 2: Partially correct | 1: Incorrect or missing Identification of Parts: 4: Clearly identifies all key parts | 3: Identifies most parts | 2: Identifies few parts | 1: No correct parts Description of Situation: 4: Clearly explains what is happening | 3: Basic explanation | 2: Limited explanation | 1: No clear explanation Clarity of Response (oral: 4: Clear, complete, and understandable | 3: Mostly clear | 2: Some confusion | 1: Unclear or Identification of System: 4: Accurate and clearly stated | 3: Mostly correct | 2: Partially correct | 1: Incorrect) Explanation of Interactions: 4: Clearly explains how parts work together | 3: General explanation | 2: Limited explanation | 1: No clear explanation Understanding of Importance: 4: Strong explanation of why the process is important | 3: General explanation | 2: Basic idea | 1: No explanation	

	Connection to Life-Sustaining Function: 4: Clearly connects to survival/health | 3: Some connection | 2: Weak connection | 1: No connection Organization (paragraph/flowchart): 4: Well-organized and logical | 3: Mostly organized | 2: Some confusion Explanation of Processes: 4: Accurate and detailed explanation | 3: Mostly accurate | 2: Basic explanation | 1: Incorrect or unclear Analysis of System Interdependence: 4: Clearly explains how parts depend on each other | 3: General explanation | 2: Limited understanding | 1: No clear explanation Use of Evidence (image/video): 4: Strong, specific evidence supports explanation | 3: Evidence mentioned | 2: Limited evidence | 1: No evidence used Cause-and-Effect Reasoning: 4: Insightful explanation of effects | 3: Reasonable explanation | 2: Basic idea | 1: No reasoning Organization (concept map/case analysis): 4: Clear, logical, well-structured | 3: Mostly organized | 2: Some confusion | 1: Disorganized Identification of Systems Involved: 4: Accurately identifies multiple systems | 3: Identifies most systems | 2: Identifies few systems | 1: Incorrect or missing Analysis of System Interactions: 4: Deep and clear explanation | 3: Good explanation | 2: Basic understanding | 1: Weak explanation Understanding of Problem Impact: 4: Clearly explains how the issue disrupts systems | 3: General explanation | 2: Limited explanation | 1: No clear understanding	

Proposed Solution: 4: Practical, realistic, and well-explained solution | 3: Reasonable solution | 2: Basic or unclear solution | 1: No solution
Use of Evidence/Reasoning: 4: Strong reasoning supported by evidence | 3: Some support | 2: Limited support | 1: No support
Creativity & Presentation Quality: 4: Highly engaging and well-organized | 3: Clear and organized | 2: Some effort shown

Guide Questions:
1. What system is involved?
2. What parts are shown?
3. What is happening?

Expected Output/Product:
Short written response or oral explanation Paragraph explanation or flowchart 💬 Guide Questions:

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and	Uses some relevant evidence;	Uses little evidence or gives	____

	applies concepts appropriately.	application is partly developed.	unsupported applications.	
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				**____ / 15**

C.2. Making Generalization

Option 1: Generalization Statement

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences.

Activity Proper:
Each group writes a generalization that captures the core idea of the lesson. You can guide them with sentence starters:
• "All living things are made up of parts that…"
• "When one part of a system fails…"
• "Life depends on the cooperation of…"

The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis.
The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document

	Example: "All living organisms are systems where each part has a role. These parts must work together to keep the organism alive, just like people in a community." **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	Option 2: Differentiated Generalization Activities	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning.

	Activity Proper: Level 1: Guided Summary "A biological system is made up of _____." "Examples of systems include _____." "Each part helps the organism _____." The teacher synthesizes responses into one key idea: Example: "Living things are made of interconnected systems whose parts work together to maintain balance and sustain life." **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Expected Output/Product:** Sentence completion Level 2: Concept Organizer Activity: "Build the System Idea." Students complete a graphic organizer: **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	C.3. Evaluating Learning	
	Option 1: Values Reflection: What Does This Teach Us About Life?	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation. **Activity Proper:** Reflect on how this lesson connects to your life, relationships, or community. Answer one or more of the prompts below. Reflection Prompts: • When humans intervene in biological systems (e.g., through medicine, agriculture, or technology), what values should guide those actions to ensure respect for life? **Guide Questions:** 1. How does understanding the interconnected systems within living organisms influence your sense of responsibility toward environmental and human health? 2. In what ways does the complexity of biological systems inspire you to value diversity, balance, or resilience in your own life or community?	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

	Expected Output/Product: Completed written reflection that connects the activity to the relevant scientific concepts. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Making Sense of Life Systems	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Complete the partially filled concept map from system to components, interactions, and function, then write a generalization explaining how the parts support the whole organism. **Activity Proper:** Activity Overview Students consolidate their learning by generalizing key ideas about life systems through differentiated synthesis tasks. Structured Understanding Focus: Objectives 1 & 2 Task: “Finish the Concept Map”	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document

	Students complete a partially filled concept map: System → Components → Interaction → Function **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Expected Output/Product:** Concept map with explanations. Guide Prompt: "What is the relationship between parts and the whole system?" **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	C.4. Additional Activities	
	Option 1: Create a Quote or Slogan	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available) **Directions:** Create the specified visual output using accurate scientific information, clear labels or captions, and appropriate	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence,

	examples. Present or submit the output with a brief explanation of its main scientific message. **Activity Proper:** Write a short quote or slogan that captures the heart of today's lesson. **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.
	Option 2: Visual Analysis and Reflection Exit Slip	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available) **Directions:** Write the required response in your own words. Use accurate scientific concepts, address every part of the	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions.

prompt, and support your main idea with an appropriate example or explanation.

Activity Proper:

Visual Analysis (Individual or Pair Work – 10 minutes)

Instructions for learners: Look at the provided images or videos of a simple plant and a simple animal. Identify and describe how their parts work together as systems.

Organism	**Part**	**Function**	**How it Supports the System**
Plant			
Animal			

Reflection Exit Slip (5 minutes)

Learners write a short reflection:

Guide Question:

"What did I learn about how life forms function as systems—and how does this apply to how I live, learn, or work with others?"

Expected Output/Product:

Completed written reflection that connects the activity to the relevant scientific concepts.

The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print.

Note to Teachers: Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

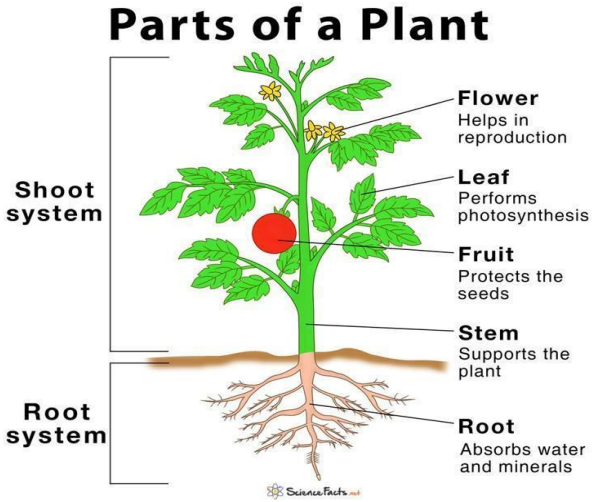
	Assessment Criteria: • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
V. ASSESSMENT *(Assessing Learnings)*	**Part I: Multiple Choice (Knowledge & Understanding – 5 items)** **Directions**: Choose the best answer. 1. Which part of a plant is primarily responsible for absorbing water? A. Leaf B. Stem C. Root D. Flower 2. What system in animals is most similar to the plant's xylem and phloem? A. Digestive system B. Circulatory system C. Respiratory system D. Nervous system 3. Stomata in plants are responsible for: A. Nutrient transport B. Water absorption C. Gas exchange D. Reproduction 4. Which of the following best describes a system in biology? A. A group of unrelated parts B. A single organ performing all functions C. A set of parts working together to maintain life D. A random collection of cells 5. Tropism in plants is a response to: A. Light and gravity B. Temperature and humidity	

C. Sound and vibration
D. Pressure and motion

Part II: Matching Type (Systems & Functions – 5 items)
Directions: Match the plant or animal part in Column A with its function in Column B.

Column A	Column B
1. Leaf	a. Absorbs water and minerals
2. Root	b. Responds to stimuli
3. Flower	c. Site of photosynthesis
4. Brain	d. Reproduction in plants
5. Lungs	e. Gas exchange in animals

Part III: Diagram Interpretation (Application – 2 items)
Directions: Study the diagram of a plant system. Answer the questions that follow.



https://www.sciencefacts.net/parts-of-a-plant.html

	1. Identify three parts in the plant diagram and explain how they work together to support survival. 2. Compare the transport systems in the plant and animal diagrams. How are they similar and different? **Part IV**: Constructed Response (Analysis & Values Integration – 2 items) Directions: Answer the questions in complete sentences. 1. Explain how the failure of one part of a biological system (e.g., roots, lungs, heart) can affect the entire organism. 2. Reflect: What can we learn from biological systems about teamwork and shared responsibility in our daily lives? **Part V:** Performance Task (Optional Extension) Task: Create a concept map or visual poster showing how a plant or animal functions as a system. Include: • At least 4 parts • Their functions • Arrows showing interactions • A short caption: "This organism survives because…" **The answer key and rubrics for Part V of the assessment can be accessed by scanning the QR code. Make sure to use your DepEd email account.**

Assessment specification: Use A–D for multiple-choice options, complete every question stem, and include an answer key and model response. Assess only the organisms, organs, systems, and limits of analogy taught in the lesson.

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little evidence or gives unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				**____ / 15**

VI. REFLECTION *(Feedback and Continuous Improvement)*	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery.

	1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? *6.* What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. he author(s) take full responsibility for the content of this LE.

Learning Title/Topic:	Unifying Themes of Life Science – Structure and Function in Biological Systems	Lesson Exemplar:	9

I. OBJECTIVES	
A. Content Standard	Structures and functions are related at all levels of the organization of life;
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	The learners should know how to explain using photographs or videos of simple plants or animals as examples how life forms operate as systems of related parts working together;
	Create a diagram to show the relationship between the structural components of a biological system and their functions;
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	Department of Education. (2021). Earth and Life Science Quarter 2 – Module 2: Unifying Themes in the Study of Life. Lingcol, R. (n.d.). Unifying themes in the study of life [Presentation]. SlideShare. https://www.slideshare.net/slideshow/unifying-themes-in-the-study-of-life/241817637 Studocu. (n.d.). Lesson 1: Unifying Themes of Life – Earth & Life Science Q2.
III. CONTENT *(Sequencing Content)*	Unifying Themes of Life Science – Structure and Function in Biological Systems

<table>
<tr><td>IV. OBJECTIVES
(Setting Clear Objectives and Analyzing the Tasks)</td><td colspan="2">1. Explain the structural components and functions of a selected biological system (cells, tissues, organs, organ systems).
2. Analyze how each component contributes to the overall function of a biological system.
3. Develop a diagram showing the relationship between the structural components of a biological system and their functions</td></tr>
<tr><td colspan="2">IV. PROCEDURES</td><td>ANNOTATIONS</td></tr>
<tr><td rowspan="3">A. Activating Prior Knowledge</td><td colspan="2">A.1. Activating Prior Knowledge</td></tr>
<tr><td colspan="2">Option 1: From Cell to System: A Body of Connections</td></tr>
<tr><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Respond to the hunger prompt, arrange the identified structures from cell to tissue to organ to organ system, and explain how the levels work together in the body's response.

Activity Proper:
Warm-Up Prompt (5 mins):
Let learners jot down quick thoughts individually or in pairs.
Sequencing
Learners will arrange their answers from cell to tissue to organ to organ system and explain how the levels are connected.
Science clarification: A tissue is an organized group of cells and extracellular components that work together to perform a function; some tissues contain several cell types.</td><td>The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.
The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or</td></tr>
</table>

	Guide Question: Ask learners: "Think of a time when your body responded to hunger. What parts of your body were involved—from the smallest unit to the whole system?" **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Option 2: Group Sorting Challenge	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Sort each item into the correct category based on the scientific characteristics provided. Record your classifications and justify any item that could be confused with another category. **Activity Proper:** In small groups, learners receive a shuffled set of cards labeled with terms related to a biological system (e.g., smooth muscle cell, smooth muscle tissue, stomach, digestive system). • Their task: Sort the cards into four categories: Cells → Tissues → Organs → Organ System	The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or

	• Then, draw arrows to show how each level connects to the next, adding functions beside each component. Science clarification: A tissue is an organized group of cells and extracellular components that work together to perform a function; some tissues contain several cell types. **Guide Questions:** 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	A.2. Establishing the Purpose of the Lesson	
	Option 1: From Cells to Systems: Why Every Part Matters	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Select a biological system and create a labeled diagram showing its cells, tissues, organs, and organ-system function. Use arrows and a short explanation to show the structure-function relationships.	The activity targets Learning Objectives 1 and 2 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer

	Activity Proper: Today, learners will create a diagram that shows how the structures of a selected biological system support its functions. Part 1: The Hierarchy of Life (2 minutes) Main points of the discussion: • Cells are the basic units of life—each with a specific job. Think of them as individual workers. • Tissues are groups of similar cells working together—like departments in a company. • Organs are made of multiple tissues that perform a focused task—like a machine built from different parts. • Organ Systems are networks of organs that collaborate to keep you alive—like a team completing a mission. ("This hierarchy is not random: organization and specialization can support efficient, resilient function, without implying that biological systems were intentionally designed.") Science clarification: A tissue is an organized group of cells and extracellular components that work together in a function; some tissues contain several cell types. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson?	consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Assessment Criteria:
• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation

Option 2: Interdependence in Action

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Read the explanation and example of biological interdependence, identify how a change at one level can affect the others, and answer the closing reflection using a specific system example.

Activity Proper:
Every level supports the next. A damaged cell can affect a tissue. A failing organ can disrupt an entire system.
Example: In the digestive system, epithelial cells absorb nutrients, muscle tissue moves food, and organs such as the stomach and intestines coordinate digestion. The circulatory system then distributes absorbed molecules, and cells transfer chemical energy through metabolic reactions.
("Just like in a community, when one part struggles, others feel the impact. That's interdependence.")
Why It Matters (1–2 minutes)
Understanding this structure helps us care for our bodies—through nutrition, rest, and awareness.

Tool	Purpose
Oral responses or journal entries	Gauge conceptual understanding and personal insight
Exit slip (optional)	Ask: "What's one thing you learned about systems today that applies to life outside biology?"
Observation	Note engagement, attentiveness, and connections made during discussion

The activity targets Learning Objective 1 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions.
The pedagogical strategy used is formative assessment, supported by independent response,

	It also teaches us a deeper lesson: every part has value, and collaboration leads to function. "Whether you're a cell in a tissue or a person in a team, your role matters. Biology isn't just science—it's a mirror of how life works." Closing Reflection Prompt Science clarification: Digestion breaks food into absorbable molecules; absorption moves nutrients into internal transport; circulation distributes substances; cells rearrange molecules and transfer chemical energy during metabolism. Qualification: The outcome of cell damage depends on the cell type, number of cells affected, location, tissue redundancy, and capacity for repair. **Guide Question:** "Take a moment to reflect: What part of the system do you relate to most today—and why? Are you absorbing, supporting, moving, or coordinating?" **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Option 1: Inside-Out: Modeling a Living System	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1 and 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources

	Directions: Construct the required design or model, label its important parts, show how the parts or steps work together, and justify the design using accurate scientific principles. **Activity Proper:** Activity Overview Learners will work in small groups to create a 3D model or interactive diagram of a selected biological system, accompanied by a brief oral presentation and a function map that explains how each component contributes to the system's overall function. I. Materials Needed Recyclable materials (boxes, tubes, paper, string, etc.) or digital tools (e.g., Canva, Google Slides) Manila paper or poster board Markers, glue, scissors Optional: tablets or laptops for digital diagrams II. Procedures 1. System Selection & Research (15–20 mins) a. Each group selects a biological system (or is assigned one). b. Learners research and list its key components: cells, tissues, organ, and the overall system. c. They identify each part's function and how it supports the system.	and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Guide Questions:

1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little evidence or gives unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				____ / **15**

Option 2: Model or Diagram Creation

Materials/Resources Needed:

- Paper, cartolina, or Manila paper
- Pen or pencil
- Markers or colored pencils (if available)

The activity targets Learning Objectives 1 and 2 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative

	Directions: Construct the required diagram or flowchart, label all essential parts or stages, show the relationships accurately, and add a brief scientific explanation of how the system or process works. **Activity Proper:** a. Groups build a 3D model or interactive diagram showing: b. Structural hierarchy (cells → tissues → organs → system) c. Functional relationships (e.g., arrows, color coding, labels) d. Include a function map: a written or visual explanation of how each part contributes to the system's function. Presentation & Peer Review (15–20 mins) a. Each group presents their model/diagram to the class. b. Peers ask questions and give feedback using a structured form (e.g., "I learned…", "I wonder…"). **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea? **Expected Output/Product:** Completed labeled diagram or flowchart with accurate relationships and a brief scientific explanation.	approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Contains major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little relevant evidence or provides unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				**____ / 15**

B.2. Discussing New Concept

Option 1: Design a Bio-Pump

Materials/Resources Needed:

- (Per Group)
- 1 Plastic cup or small plastic bottle (acts as the heart chamber)
- 2 Balloons (one to act as the muscle, one for backup)
- 2 Flexible plastic drinking straws (act as blood vessels)
- Tape (masking or duct tape)
- Scissors

The activity targets Learning Objective 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

	• A tray or large bowl (to catch spills) • Water colored with red food dye (the "blood") **Directions:** Develop the required design, plan, or proposal using the activity criteria. Show how each major feature addresses the problem and justify your choices using accurate scientific concepts or evidence. **Activity Proper:** Learners will apply their understanding of biological levels of organization by designing and building a functional physical model of a heart chamber to see how physical structure directly determines pumping function. Step-by-Step Instructions Step 1: Brainstorming & Hypothesis (10 Mins) Before touching the materials, have each group look at the Organ Level of the diagram. Learners must write down a one-sentence hypothesis predicting how changing a structure (e.g., the width of the straw/vessel) will affect the function (how fast or far water pumps). Step 2: Building the Model (20 Mins) 1. Fill the plastic cup about halfway with the red water. Place the cup inside the tray.	The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	2. Cut the neck off one balloon. Stretch the wide part of the balloon tightly over the top of the cup to create a flat, rubbery "lid." Secure it tightly with tape around the rim. 3. Carefully poke two small, separate holes through the balloon lid using scissors. 4. Push one straw through each hole so they sit in the water. This represents the structural entry/exit vessels of the heart. 5. Optional challenge: Use a tiny piece of tape or a finger to act as a "valve" on one straw to see if they can get water to move in only one direction when they press down on the balloon lid. Step 3: Testing the Function (10 Mins) Have learners gently press up and down on the rubber balloon lid (mimicking the cardiac muscle tissue contracting). The Structure Modification: Have learners add a standardized outflow restriction and press the lid again. This models increased resistance; it does not reproduce a specific blocked artery, closed valve, or high-blood-pressure diagnosis. Wrap-Up & Discussion Questions (10 Mins) Have each group present their model and answer the following questions to tie back to the hierarchical diagram: Relationship prompts: Qualification: The outcome of cell damage depends on the cell type, number of cells affected, location, tissue redundancy, and capacity for repair.	

<table>
<tr><td></td><td>Guide Questions:
1. Observe how the water behaves. Does it shoot out of both straws? Does it create a vacuum?
2. Cellular to Tissue Level: What did the rubber balloon lid represent? How did its elasticity (a structural trait) allow it to perform its job (a functional trait)?
3. Organ Level: What happened when resistance was added to the model? Which observations are useful, and what cannot this simplified model represent about blood vessels, valves, pressure regulation, or disease?
4. Organism Level: If your model heart fails to pump water effectively, how would that lack of oxygen transport impact the rest of the organism?
5. How does each part help the whole system work? What happens to the system if this part is damaged or removed?

Expected Output/Product:
Completed design or model with labels and an evidence-based explanation of how its parts or features function.</td><td></td></tr>
<tr><td>Instituting New Knowledge</td><td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>Design decisions are fully consistent with accurate scientific principles.</td><td>Design is scientifically sound with minor gaps.</td><td>Design shows partial understanding with some inaccuracies.</td><td>Design is poorly supported by scientific principles.</td></tr>
<tr><td>Functionality/Feasibility</td><td>Solution is coherent, realistic, and directly addresses the task.</td><td>Solution is workable and addresses most task requirements.</td><td>Solution addresses the task only partly or has feasibility problems.</td><td>Solution is incomplete, unrealistic, or does not address the task.</td></tr>
</table></td></tr>
</table>

Evidence and Justification	Every major design choice is clearly justified with relevant evidence.	Most design choices are justified with appropriate evidence.	Some design choices are justified; evidence is limited.	Design choices are largely unsupported.
Completeness and Clarity	All required elements are complete, labeled/organized, and easy to understand.	Most required elements are complete and clear.	Several elements are incomplete or unclear.	Many required elements are missing or unclear.

Rubric

Criteria	Highly Effective (4)	Meeting Standards (3)	Emerging (2)	Ineffective (1)	Total
Structure-Function Alignment	The physical design perfectly mirrors the biological counterpart. Every component (valves, chambers, tubing) has a clear, accurate anatomical equivalent that works exactly as it does in nature.	The design represents the biological system well. Most components have accurate anatomical equivalents, though 1–2 parts lack a clear functional explanation.	The model pumps fluid, but structural elements do not align well with the biological organ/system. The connection to actual anatomy is weak.	Little to no connection between the physical model and biological structures. The model does not mimic a biological pump.	____
Engineering & Functionality	The pump is highly efficient, leak-free, and consistently	The pump is functional and moves fluid, but experiences	The pump moves fluid minimally or requires	The pump does not function. It cannot move fluid or	____

		moves fluid in the intended direction (e.g., unidirectional flow). The mechanisms (valves/pistons) function smoothly.	minor leaks, structural instability, or occasional backflow.	constant manual adjustments/repairs to prevent total failure.	completely collapses under pressure.	
	Data Collection & Iteration	The design blueprint shows clear evidence of the engineering cycle. Includes detailed data on flow rates/pressures and documents at least two distinct modifications made to improve efficiency.	The blueprint documents the build process and data collection well. Includes at least one modification based on testing data, but the reasoning is superficial.	The data are incomplete or disorganized. The team made changes during the build, but they were random trial-and-error rather than data-driven adjustments.	No data collected, no blueprint provided, or no modifications were made to the initial failed prototype.	____
	Material Innovation & Constraints	Masterful, creative use of everyday or recycled materials within the project constraints. Every material was chosen deliberately for its physical	Good use of allowed materials. The model respects all project constraints (budget, size, or material limits), but choices are standard rather than innovative.	The team stayed within the constraints but chose materials poorly (e.g., using absorbent paper where water-resistant plastic was needed),	Violated project constraints (used forbidden materials, exceeded size limits) or relied entirely on pre-fabricated toy kits.	____

	properties (e.g., flexibility, rigidity).		hindering performance.		
Communication & Defense	The team delivers a flawless pitch justifying their design choices using precise biological and engineering terminology. They seamlessly explain how their pump handles pressure and fluid dynamics.	The presentation is clear and accurate. The team explains their model well but relies on generic terms (e.g., "the tube") instead of proper terminology ("the vessel/aorta").	The presentation is disorganized. The team can explain how the pump works but struggles to explain the science behind why they designed it that way.	The team cannot explain their design choices or defense lacks any scientific basis. Presentation is incomplete.	____
Total Score					**____ / 20**

Option 2: The Biological Domino Effect

Materials/Resources Needed: • Large sheets of poster board or butcher paper • Colored markers • Index cards • Glue sticks • Printable "Scenario Cards" (created by the teacher ahead of time—see examples below) • Optional: A standard deck of dominoes for a physical demonstration	The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

	Directions: Create or complete the required organizer or diagram, label all relevant parts or stages, show the relationships accurately, and add a brief evidence-based explanation. **Activity Proper:** Learners will create a physical or visual "chain reaction" showing how a specific structural change at the microscopic level alters the function of every single level above it. Step-by-Step Instructions Step 1: Scenario Assignment (5 Mins) Divide the class into groups and hand each group a Scenario Card. Each card introduces a tiny structural change in a biological system. Example Scenarios: Scenario A (The Sickle Cell): A specific amino-acid substitution in beta-globin produces hemoglobin S; when deoxygenated, hemoglobin S can polymerize and distort red blood cells into a sickle shape. Scenario B (The Plant Drought): During drought, water loss reduces vacuole volume and turgor pressure; the vacuole is not simply destroyed by heat. Scenario C (The Coral Bleaching): High ocean temperatures cause coral polyps to structurally expel the microscopic algae living inside their tissues.	The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Step 2: Mapping the Chain Reaction (30 Mins) On their poster board, students must draw 8 large blocks or "dominoes" in a row, representing the 8 levels of organization seen in the original diagram: 1. Molecular ➔ 2. Cellular ➔ 3. Tissue ➔ 4. Organ ➔ 5. Organ System ➔ 6. Organism; add population, community, ecosystem, or biosphere effects only when evidence supports each additional link Using their assigned scenario, the group must figure out the exact structure and function breakdown at every single level. They write the "Structure" on the left side of the block and the "Function Failure" on the right side. Step 3: Example of What a Finished Chain Looks Like If a group has Scenario A (Sickle Cell), their chain will look like. Step 4: The Presentation & "Topple" (15 Mins) Each group presents their poster to the class. To make it memorable, they can set up a short row of physical dominoes on their table. As they explain their poster, they knock over the first domino ("The Molecular Change") and watch it crash into the rest, symbolizing a proposed causal chain from a molecular change to organism-level effects; include wider ecological levels only when evidence supports those links.	

	Guide Question: If you were a doctor or scientist trying to fix this domino effect, at which level of organization would it be most effective to apply a treatment? Why? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	B.3. Developing Mastery	
	Option 1: The Biological Blueprint Challenge	
	Materials/Resources Needed: • Large sheets of drawing paper or grid paper • Colored pencils • markers • or drafting pens • "Environmental Constraint Cards" (created by the teacher) • The original "Levels of Organization" diagram **Directions:** Design a functional organ system for a fictional organism adapted to an extreme environment, explicitly mapping out how their custom-designed molecules, tissues, and organs physically interact to achieve a vital life function. **Activity Proper:** Learners will design a functional organ system for a fictional organism adapted to an extreme environment, explicitly	The activity targets Learning Objective 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through

	mapping out how their custom-designed molecules, tissues, and organs physically interact to achieve a vital life function. Give each group an Environmental Constraint Card describing a harsh planet or ecosystem. The organism living there needs a brand-new organ system to survive. **Guide Questions:** 1. What environmental conditions on your imagined planet could act as selection pressures on the cells or tissues you designed? Explain why those conditions would favor the proposed structures without claiming that the environment dictates one exact form. 2. Every structural adaptation costs energy to build. What did your organism have to 'give up' or compromise on in its design to make this specific system work so perfectly? **Expected Output/Product:** Completed design or model with labels and an evidence-based explanation of how its parts or features function.	presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Contains major errors, unsupported claims, or misconceptions.	____

Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little relevant evidence or provides unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				**____ / 15**

Option 2: The Evolutionary Redesign Panel

Materials/Resources Needed:

- Access to research devices (tablets, laptops, or desktop computers)
- Poster paper
- Colored markers

Directions:

Participate in the assigned simulation or performance according to your role. Represent the scientific process or relationship accurately, then explain what your role or sequence demonstrates.

Activity Proper:

Learners compare two organisms that share a survival need and analyze how different evolved structures can perform a similar biological function. Do not describe the structures as engineered by the environment.

The activity targets Learning Objectives 1 and 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions

<table>
<tr>
<td></td>
<td>Guide Questions:
1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Expected Output/Product:
Oral or group presentation supported by accurate scientific explanations and relevant evidence.</td>
<td>shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.</td>
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<tr><td>Evidence and Justification</td><td>Every major design choice is clearly justified with relevant evidence.</td><td>Most design choices are justified with appropriate evidence.</td><td>Some design choices are justified; evidence is limited.</td><td>Design choices are largely unsupported.</td></tr>
<tr><td>Completeness and Clarity</td><td>All required elements are complete, labeled/organized, and easy to understand.</td><td>Most required elements are complete and clear.</td><td>Several elements are incomplete or unclear.</td><td>Many required elements are missing or unclear.</td></tr>
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<table>
<tr><td rowspan="3">C. Demonstrating Knowledge and Skills</td><td colspan="2">C.1. Finding Practical Application</td></tr>
<tr><td colspan="2">Option 1: Reflective Monologue</td></tr>
<tr><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation.

Activity Proper:
Reflective Monologue. Write a short monologue (5–7 sentences) from the point of view of the biological system. Let it explain its parts, how they work together, and why each one matters.

Guide Questions:
1. What is the most important scientific idea you developed from the activity?
2. What example or evidence best supports your explanation?

Expected Output/Product:
Completed monologue that accurately represents the assigned biological system or process.</td><td>The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.
The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

Note to Teachers: Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.</td></tr>
</table>

	Assessment Criteria: • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: Concept Map with a Message	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available) **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown. **Activity Proper:** Concept Map with a Message: "Create a concept map showing the hierarchy (cells → tissues → organs → system) and add a central message that captures what the system wants us to understand about its function and unity." **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea?	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative.

<table>
<tr><td></td><td>Expected Output/Product:
Completed concept map showing the required concepts and scientifically accurate relationships.

Assessment Criteria:
• Scientific accuracy
• Completeness of required content
• Clarity and organization
• Appropriate use of evidence, examples, labels, or visuals</td><td>Note to Teachers: Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.</td></tr>
<tr><td></td><td colspan="2">C.2. Making Generalization</td></tr>
<tr><td></td><td colspan="2">Option 1: The System Speaks: A Reflective Synthesis</td></tr>
<tr><td></td><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Choose a biological system and create either a five-to-seven-sentence first-person monologue or a concept map. Identify its major parts, explain how they interact, and show why each part is important to the function of the system.

Activity Proper:
Activity Description
Learners will write a short reflective piece or create a concept map that synthesizes their learning by imagining the biological system as a speaking entity. This metaphorical approach encourages systems thinking, personal insight, and values integration.</td><td><table><tr><td>Tool</td><td>Purpose</td></tr><tr><td>Reflective Monologue or Concept Map</td><td>Assess synthesis, systems thinking, and creativity</td></tr><tr><td>Teacher Observation</td><td>Monitor depth of insight and engagement</td></tr><tr><td>Optional Peer Feedback</td><td>Encourage appreciation and respectful critique of others' work</td></tr></table>The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas</td></tr>
</table>

	1. Prompt Introduction (3 mins) 2. Student Task (10–15 mins) Choose one of the following formats: Option A: Reflective Monologue. Write a short monologue (5–7 sentences) from the point of view of the biological system. Let it explain its parts, how they work together, and why each one matters. **Guide Question:** Say: You've explored the parts of a biological system—how they're built, how they work, and how they connect. Now, imagine the system could speak. What would it say about its structure, its teamwork, and its purpose? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	Option 2: Concept Map with a Message	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available)	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis.

	Directions: Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown. **Activity Proper:** Concept Map with a Message: Create a concept map showing the hierarchy (cells → tissues → organs → system) and add a central message that captures what the system wants us to understand about its function and unity. **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea? **Expected Output/Product:** Completed concept map showing the required concepts and scientifically accurate relationships. **Assessment Criteria:** • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

	C.3. Evaluating Learning	
	Option 1: System Check: Performance Task and Reflection	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation. **Activity Proper:** System Check: Performance Task & Reflection Task Briefing (10 mins) Present the task: You'll demonstrate your learning by creating a clear, accurate diagram of a biological system, explaining each part's function, and reflecting on how the system works as a whole—and why that matters. **Guide Questions:** 1. What is the most important scientific idea you developed from the activity? 2. What example or evidence best supports your explanation? **Expected Output/Product:** Completed written reflection that connects the activity to the relevant scientific concepts.	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Student Work Time	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Complete the cells-to-system diagram, the component-function table, and all reflection questions. Use labels and arrows to show how the components depend on one another. **Activity Proper:** Learners complete the following: Diagram: Cells → Tissues → Organs → System (with labels and arrows showing relationships) Function Table: A chart listing each component and its role Reflection Questions: **Guide Questions:** 1. How do the components of this system depend on each other? 2. What happens when one part fails? 3. Why is it important to understand this system in real life?	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	**Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.
	C.4. Additional Activities	
	Option 1: Peer Review or Self-Assessment	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Use the activity criteria to evaluate the completed output, identify one scientifically strong part and one needed improvement, and revise the work before submission. **Activity Proper:** Learners exchange work or use a rubric to assess their own performance. Prompts: **Guide Questions:** 1. Is my diagram complete and accurate? Did I explain each function clearly? 2. Did I show how the parts connect? 3. Did I reflect on the system's real-life relevance? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Option 2: Independent Diagram Revision	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available) **Directions:** Individually revise the biological-system diagram using peer or teacher feedback. Submit the final diagram together with a 3–5-sentence revision note explaining one structure–function relationship that you improved and the evidence supporting the change. **Activity Proper:** Complete the task according to the directions and record the required observations, responses, or explanations. **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea? **Expected Output/Product:** Completed labeled diagram or flowchart with accurate relationships and a brief scientific explanation. **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

V. ASSESSMENT
(Assessing Learnings)

Part 1: Knowledge & Understanding (Written Response)

Instructions: Choose one biological system (e.g., circulatory, nervous, plant transport, immune). Answer the following:

1. List and describe at least **five key components** of the system.
2. Explain how these components **work together** to maintain balance and function.
3. Identify one **feedback mechanism** or regulatory process within the system.

Part 2: Systems Thinking (Diagram Construction)

I**nstructions**: Create a labeled diagram of your chosen biological system. Your diagram should:

- Show the components and their functions
- Use arrows or symbols to illustrate interrelationships
- include brief annotations explaining flow, regulation, or collaboration

Suggested Rubrics

Criteria	Highly Effective (4)	Meeting Standards (3)	Emerging (2)	Ineffective (1)	Total
Scientific Accuracy	Every illustrated component, relationship, and mechanism is entirely accurate. There are zero scientific misconceptions or errors present.	The diagram is mostly accurate. Contains 1–2 minor scientific errors, but they do not alter or compromise the core scientific concept.	Contains several noticeable scientific inaccuracies or flawed conceptual representations.	The diagram demonstrates a fundamental misunderstanding of the scientific concept or is entirely inaccurate.	____
Correct Labels	All essential components, structures, or stages are accurately and	Most components are labeled correctly. A few minor terms	Labels are frequently missing, incorrectly matched with	Little to no labels are present, or the labels provided are entirely	____

		precisely labeled using correct scientific terminology. Label lines point directly and clearly to the target.	may be missing, or 1–2 label lines are slightly ambiguous/misplaced.	structures, or use vague, non-scientific vocabulary.	incorrect and misleading.	
	Structure-Function Relationship	The visual layout clearly demonstrates how the physical structure dictates its biological or physical function. The connection between what it is and what it does is immediately obvious.	The structure and function are both represented well, but the visual connection between them is somewhat subtle or requires some inference to understand.	The diagram shows structures and lists functions, but fails to visually connect how the specific shape or placement allows the function to happen.	The diagram completely isolates structure from function. There is no attempt to visually link the two concepts.	____
	Completeness of Components	Every required part, layer, organelle, or phase specified in the prompt is present. No critical pieces of the system are missing.	Missing one minor component or layer, but the system or cycle as a whole remains complete and recognizable.	Missing several key components, leaving gaping holes in the overall structure or process being illustrated.	The diagram is mostly incomplete, missing the vast majority of critical components required to	____

					represent the system.	
	Organization & Presentation	The layout is exceptionally clean, uncluttered, and easy to read. Lines do not cross over awkwardly. Colors/symbols are used purposefully to categorize information.	The layout is organized and neat. The diagram is fully readable, though minor cluttering or crossing lines make it slightly harder to trace at a first glance.	The layout is disorganized, messy, or cramped. It is difficult to follow the flow of information, and color choices/symbols are chaotic or distracting.	Extremely disorganized, illegible, or incomplete. The presentation obscures the scientific content entirely.	____
	Written/Oral Explanation	The accompanying summary provides a masterful, detailed explanation of the diagram. It seamlessly connects all components to explain the overarching process using flawless	The explanation is clear and covers the main points well, but leaves out a minor step in the process or relies on surface-level descriptions for complex parts.	The explanation is overly brief, fragmented, or merely lists the parts without explaining the broader process or mechanism connecting them.	No explanation is provided, or the written summary is completely incoherent and scientifically invalid.	____

<table>
<tr><td></td><td>
<table>
<tr><td></td><td>scientific reasoning.</td><td></td><td></td><td></td><td></td></tr>
<tr><td>Total Score</td><td></td><td></td><td></td><td></td><td>____ / 24</td></tr>
</table>

Assessment specification: Include an answer key, acceptable-response notes, criterion maxima, and exact total score. Assess only the taught levels of organization and system interactions unless additional systems have been explicitly taught with guided examples.
</td></tr>
<tr><td>VI. REFLECTION
(Feedback and Continuous Improvement)</td><td>Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery.
1. How many learners successfully demonstrated the learning objectives based on the assessment results?
2. Which activity helped learners understand the lesson the most? Which activity helped the least?
3. Which part of the lesson was easiest for learners? Which part was most difficult?
4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support?
5. What did the assessment results show about learners' understanding of the lesson?
6. What improvement would you make if you taught this lesson again?</td></tr>
<tr><td>VII. USE OF GENERATIVE AI</td><td>In preparing this Learning Exemplar (LE), the author(s) used ChatGPT to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the content. The author(s) take full responsibility for the content of this LE.</td></tr>
</table>

Learning Title/Topic:	The Importance of Cells in Living Things – Cellular Nutrition and Energy Conversion	Lesson Exemplar:	10

I. OBJECTIVES	
A. Content Standard	Cells carry out functions that enable organisms to survive;
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	Key Topics Learned in the Previous Grade Level: 1. **Grade 7 (Life Science):** Characteristics of living things; the cell as the basic unit of life; organisms require nutrients, water, and energy to survive. 2. **Grade 8 (Biology):** Parts of the cell and their functions (nucleus, cell membrane, cytoplasm) in regulating and supporting cellular activities. 3. **Grade 9 (Biology):** Photosynthesis and respiration; plants photosynthesize and also respire; animals obtain organic nutrients from food and carry out cellular respiration; energy flow in ecosystems. These foundational topics from Grades 7–9 serve as scaffolding for this lesson. In this lesson, grade 11 learners *describe how cells obtain nutrients from food and transfer part of their chemical energy to ATP and other forms through cellular processes to sustain life in plants and animals*. At this stage, learners deepen their understanding by focusing on how cells obtain nutrients and convert them into usable energy (ATP) through cellular processes such as photosynthesis and cellular respiration. Teachers should connect these prior learnings to highlight continuity and avoid redundancy.

	Describe how cells obtain nutrients from food and convert them into energy through cellular processes to sustain life in plants and animals;
II. REFERENCES and MATERIALS (*Selecting Resources and Materials*)	Department of Education. *Senior High School Curriculum Guide: General Science (MATATAG Curriculum).* DepEd Central Office, 2024. Campbell, Neil A., Lisa A. Urry, Michael L. Cain, Steven A. Wasserman, Peter V. Minorsky, and Jane B. Reece. *Biology: A Global Approach.* 12th ed. Pearson, 2021. Alberts, Bruce, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, and Peter Walter. *Molecular Biology of the Cell.* 7th ed. Garland Science, 2022. Amoeba Sisters. "Photosynthesis and Cellular Respiration." *YouTube Video,* 2017. https://youtu.be/2f7YwCtHcgk. Philippine Science Teacher Journal. Recent issues on biology teaching strategies. Instructional Materials: presentation slides and laboratory/activity materials.
III. CONTENT *(Sequencing Content)*	The Importance of Cells in Living Things – Cellular Nutrition and Energy Conversion
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	Learners shall be able to: **1.** Describe how cells absorb nutrients and transfer chemical energy through cellular processes that sustain life in plants and animals. **2.** Explain how animals obtain and transport nutrients and how plants use light energy, carbon dioxide, and water to synthesize carbohydrates. **3.** Explain how cellular respiration rearranges fuel molecules and transfers part of their chemical energy to regenerate ATP for cellular work.

<table>
<tr><th colspan="2">IV. PROCEDURES</th><th>ANNOTATIONS</th></tr>
<tr><td rowspan="3">A. Activating Prior Knowledge</td><td colspan="2">A.1. Activating Prior Knowledge</td></tr>
<tr><td colspan="2">Option 1: Cell Sprint: An Interactive Quiz</td></tr>
<tr><td>Materials/Resources Needed:
• Quizizz platform
• Student devices
• Prepared quiz link

Directions:
Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it.

Activity Proper:
Learners join the Quizizz game with 15 questions of varying difficulty. The leaderboard motivates students and highlights recall gaps. Suggested link for the quiz:
https://tinyurl.com/2nk8bhdw
Sample Questions from the provided link:
a) skeletal system c) nervous system
b) respiratory system d) circulatory system
Answer: d) circulatory system
The organelle that transports proteins from the site of protein synthesis to the site of modification
a) vacuole c) golgi apparatus
b) ribosomes d) endoplasmic reticulum
Answer: d) endoplasmic reticulum
a) lysosome c) golgi apparatus
b) mitochondrion d) endoplasmic reticulum</td><td>The activity targets Learning Objective 1 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions.
The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print.

Note to Teachers: Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.</td></tr>
</table>

	Answer: a) lysosome (a digestive/recycling organelle, not a complete cellular excretory system) a) ribosome – site of energy production b) golgi bodies – storage of excess water c) mitochondria – carry out later aerobic stages of fuel oxidation and capture much of the released energy in ATP d) cell wall – converts sunlight energy to glucose Answer: c) mitochondria – carry out later aerobic stages of fuel oxidation and capture much of the released energy in ATP a) Both contain cell walls. b) Both contain a nucleus. c) Both contain ribosomes. d) Both contain membrane-bound organelles. Answer: c) Both contain ribosomes Analogy limitation: Use organelle-to-organ-system comparisons only as limited analogies. Include transport vesicles when describing movement from the endoplasmic reticulum to the Golgi apparatus. **Guide Questions:** 1. Which organ system has a similar function to the endoplasmic reticulum? 2. Which organelle digests and recycles many macromolecules and worn cellular components? 3. Which organelle is correctly paired with its function? 4. How are prokaryotic and eukaryotic cells similar? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	

Option 2: KWL Chart

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Fill in the columns below before, during, and after the lesson.

Activity Proper:
- Students fill in the K (Know) and W (Want to know) parts before and during the lesson, focusing specifically on nutrient absorption and transport.
- The L (Learned) part is completed at the end of the lesson to consolidate understanding.

K (What I Know)	W (What I Want to Know)	L (What I Learned)

Science clarification: Give the serving mass, source, and realistic range for food-energy values. Cells rearrange fuel molecules and transfer part of their chemical energy to regenerate ATP; atoms are conserved and rearranged into products. The body can use stored fuels when a meal is skipped.

Guide Question:
Prompt question: Include at least one entry that relates nutrient absorption and transport to your daily life (e.g., "How does the food I eat give me energy for sports or studying?").

The activity targets Learning Objective 2 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.
The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

Note to Teachers: Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Motivational Question – Food & Energy Connection	
	Materials/Resources Needed: • Printed prompts or board notes and Markers/pens for student responses **Directions:** Answer the food-and-energy prompt, share the response, and explain how cells obtain nutrients and transfer part of their chemical energy to ATP. **Activity Proper:** If needed, guide with follow-up prompts (breakfast, rice/bread for energy, athletes eating before activity). Students share responses; teacher links answers to the idea that cells obtain nutrients and transfer part of their chemical energy to ATP and other forms. Science clarification: Give the serving mass, source, and realistic range for food-energy values. Cells rearrange fuel molecules and transfer part of their chemical energy to regenerate ATP; atoms are conserved and rearranged into products. The body can use stored fuels when a meal is skipped. **Guide Question:** The teacher asks: "Why do you feel weak when you skip meals?"	The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	**Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Option 2: Framing the Goal – Personal Learning Connection	
	Materials/Resources Needed: • Chart paper for writing goals • Pens **Directions:** Write one personal learning goal linked to nutrient absorption, transport to cells, photosynthesis, cellular respiration, or ATP production, and state how you will show that the goal was achieved. **Activity Proper:** The teacher presents objectives in student-friendly terms. The learners write a personal learning goal that connects directly to one of the target processes: nutrient absorption, transport to cells, photosynthesis, cellular respiration, or ATP production. • Example (Animals): "I want to understand how nutrients from food are absorbed and transported to my cells for energy." • Example (Plants): "I want to learn how plants use sunlight, water, and carbon dioxide to produce glucose for energy." The teacher collects or shares a few goals to highlight relevance and reinforce alignment with the competency. Science clarification: Give the serving mass, source, and realistic range for food-energy values. Cells rearrange fuel molecules and	The activity targets Learning Objective 2 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

	transfer part of their chemical energy to regenerate ATP; atoms are conserved and rearranged into products. The body can use stored fuels when a meal is skipped. Science clarification: Photosynthesis is a process, not a cycle. Plants use light energy to synthesize carbohydrates from carbon dioxide and water. Show cytosolic glycolysis before mitochondrial stages, show decomposers acting across trophic levels, and label the displayed equation as aerobic respiration. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	**Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Option 1: Food Journey Story Map	
	Materials/Resources Needed: • Manila paper or • Markers/pens • printed scenario prompt **Directions:** Create or complete the required organizer or diagram, label all relevant parts or stages, show the relationships accurately, and add a brief evidence-based explanation.	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.

	Activity Proper: • The teacher presents a "food journey" scenario. Learners create a flow chart showing how food is digested, absorbed, transported, and used by cells. Sample Scenario: "Miguel, a Grade 11 basketball player, is preparing for his championship game in the afternoon. At lunch, he eats a plate of rice (~200 kcal), fried chicken (~300 kcal), and drinks a glass of orange juice (~100 kcal), totaling about 600 kcal. As the food is digested, the carbohydrates from rice provide glucose as the main energy source, the protein from chicken helps repair and build his muscles, and the vitamins from orange juice support overall metabolic processes. During the game, Miguel sprints across the court and maintains focus, burning approximately 500–700 kcal through intense activity. This shows how nutrients are absorbed, transported, and converted into energy (ATP) by his cells, with math practice reinforcing the balance between energy intake and energy expenditure." • Use this guide to support students who may struggle in constructing the flow chart, providing step-by-step prompts: **Guide Questions:** 1. Step 1: Digestion – How are carbohydrates and proteins digested to absorbable units such as monosaccharides and amino acids, and how are lipids, vitamins, minerals, and water absorbed? 2. Step 2: Absorption – In which part of the body are these nutrients absorbed into the bloodstream?	The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant. Otherwise, numeracy is not a primary focus of the activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	3. Step 3: Transport – How do the absorbed nutrients travel through the blood to reach the muscle cells? 4. Step 4: Cellular energy transfer—How are fuel molecules broken down? Glycolysis occurs in the cytosol, later aerobic stages occur mainly in mitochondria, and part of the released chemical energy is transferred to regenerate ATP. Matter is rearranged; it is not converted into energy. **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: Plant Energy Pathway Demo	
	Materials/Resources Needed: • Leaf cut-outs or drawings • Arrows labeled sunlight • CO_2 • H_2O • markers/pens **Directions:** Observe the demonstration, arrange and label the sunlight, carbon dioxide, and water inputs and the glucose and oxygen outputs, then explain how photosynthesis produces glucose and oxygen for plant cells.	The activity targets Learning Objectives 1 and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated

	Activity Proper: The teacher demonstrates how inputs (sunlight, CO_2, H_2O) enter the leaf using cut-outs/drawings and arrows. Learners explain how these inputs are used during photosynthesis to produce glucose and oxygen. The teacher reinforces the connection to plant survival and energy storage, highlighting how photosynthesis uses light energy to produce glucose that can be used by plant cells. Note: This activity connects the inputs and outputs of photosynthesis. Photosynthesis is a process that contributes to larger matter cycles and energy flow; it is not itself a cycle. Science clarification: Photosynthesis is a process, not a cycle. Plants use light energy to synthesize carbohydrates from carbon dioxide and water. Show cytosolic glycolysis before mitochondrial stages, show decomposers acting across trophic levels, and label the displayed equation as aerobic respiration. **Guide Question:** Process the activity by asking this question: "How is the chemical energy stored in glucose transferred to ATP for use by plant cells during cellular respiration?" **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	B.2. Discussing New Concept	
	Option 1: Mini-Lecture with Diagramming	
	Materials/Resources Needed: • Simplified diagram (glucose + oxygen → carbon dioxide + water + energy (captured in ATP and released as heat)) • Markers/pens for labeling • or projector slides • Key Scientific Terms for Labeling: • Glucose • Oxygen • Carbon dioxide • Water • ATP (adenosine triphosphate) • Energy release • Cellular respiration • Inputs / Outputs **Directions:** Construct the required diagram or flowchart, label all essential parts or stages, show the relationships accurately, and add a brief scientific explanation of how the system or process works. **Activity Proper:** The teacher presents the simplified pathway: glucose + oxygen → carbon dioxide + water + energy (captured in ATP and released as heat). Learners label the inputs and outputs, annotating with short notes on energy release.	The activity targets Learning Objective 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative.

	The teacher reinforces how this process produces ATP and connects it to everyday energy use (movement, growth). Science clarification: Photosynthesis is a process, not a cycle. Plants use light energy to synthesize carbohydrates from carbon dioxide and water. Show cytosolic glycolysis before mitochondrial stages, show decomposers acting across trophic levels, and label the displayed equation as aerobic respiration. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	**Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.
	Option 2: Group Concept Mapping	
	Materials/Resources Needed: • Chart paper or large sheets • Markers/pens • Sticky notes or index cards for concepts **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown.	The activity targets Learning Objectives 1 and 2 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured

	Activity Proper: In groups, students create a concept map linking organelles to processes. Example links: Chloroplast → Photosynthesis → Glucose and Mitochondria → Respiration → ATP. The teacher encourages learners to add arrows showing input-output relationships (sunlight → glucose, glucose → ATP). Groups present maps, highlighting how organelles coordinate to sustain life. Analogy limitation: Use organelle-to-organ-system comparisons only as limited analogies. Include transport vesicles when describing movement from the endoplasmic reticulum to the Golgi apparatus. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	B.3. Developing Mastery	
	Option 1: Diagram Construction	
	Materials/Resources Needed: • Blank paper or notebook for drawing plant and animal diagrams	The activity targets Learning Objectives 1 and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the

	• Markers/pens • Paper, cartolina, or Manila paper **Directions:** Construct the required diagram or flowchart, label all essential parts or stages, show the relationships accurately, and add a brief scientific explanation of how the system or process works. **Activity Proper:** The teacher distributes blank templates for plant and animal nutrient pathways. Learners fill in processes: absorption, photosynthesis, respiration, and ATP production. The teacher reviews diagrams, clarifies misconceptions, and emphasizes similarities and differences. **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea? **Expected Output/Product:** Completed labeled diagram or flowchart with accurate relationships and a brief scientific explanation. **Assessment Criteria:** • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Option 2: Practice Worksheet – "What If Scenarios"	
	Materials/Resources Needed: • Printed with scenarios • Pens/pencils **Directions:** Read or examine the assigned case or scenario. Identify the relevant evidence, apply the appropriate scientific concepts, answer the guide questions, and justify your conclusion. **Activity Proper:** The teacher distributes an organizer with scenarios (e.g., mitochondrial failure, lack of sunlight). Learners answer in pairs, discussing possible outcomes. The teacher facilitates sharing of answers, linking disruptions to survival and energy flow. **Guide Questions:** 1. What immediate effect would this disruption have on energy production (ATP)? 2. How would this affect the survival of the cell or organism? 3. What compensatory mechanisms might occur to minimize damage? 4. How does this scenario connect to real-life situations (e.g., disease, environmental stress)? 5. What broader ecological or human impacts could result from this disruption? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	The activity targets Learning Objective 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

<table>
<tr><td rowspan="3">C. Demonstrating Knowledge and Skills</td><td colspan="2">C.1. Finding Practical Application</td></tr>
<tr><td colspan="2">Option 1: Hands-On Experiment – Starch Test in Leaves / Yeast Respiration</td></tr>
<tr><td>Materials/Resources Needed:
• Option A (Plants): Fresh leaves
• iodine solution
• dropper
• beaker
• hot water bath
• Option B (Respiration): Yeast
• sugar solution
• test tubes
• balloons
• rubber bands

Directions:
Follow the teacher-approved procedure and all safety instructions. Make the required observations or measurements, record the results accurately, and explain what the evidence shows about the scientific concept being investigated.

Procedure:
The teacher introduces the experiment, explaining how starch in leaves indicates photosynthesis and how carbon-dioxide production by yeast in a sugar solution can demonstrate fermentation under oxygen-limited conditions; balloon size does not directly measure ATP production.
Learners are divided into groups; each group chooses Option A or B.</td><td>The activity targets Learning Objectives 1 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.
The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.</td></tr>
</table>

	For Option A: Use a destarched plant and a covered-leaf control. The teacher places the leaf and ethanol tube in a hot-water bath with all flames and ignition sources absent, then rinses the decolorized leaf and applies iodine solution. Compare blue-black staining between exposed and covered areas. For Option B: Learners prepare yeast-sugar solutions in test tubes, seal with the balloons, and observe balloon inflation as CO_2 is produced. Groups record detailed steps, observations, and results. The teacher facilitates discussion linking starch-test results to the controlled photosynthesis comparison and yeast CO_2 production to fermentation under the test conditions. Learners write lab reports including procedure, results, and conclusion. **Guide Questions:** 1. What observations or evidence were most important in interpreting the result? 2. How do the results support or challenge the scientific concept investigated in the activity? **Expected Output/Product:** Recorded observations or data and an evidence-based conclusion based on the activity results. **Assessment Criteria:** • Safe and correct performance of the procedure • Accuracy and completeness of observations or data • Scientific accuracy of the explanation or conclusion	**Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Option 2: Ecosystem Interdependence Simulation	
	Materials/Resources Needed: • Role cards (Sun, Plant, Herbivore, Carnivore, Decomposer, optional Omnivores/Humans) • Ball of yarn • Computer, tablet, or other available digital device, if needed **Directions:** Run or examine the specified simulation, change only the assigned variable or condition, record the results, and explain the observed pattern using the lesson concept. Use the printed alternative when digital access is unavailable. **Activity Proper:** The teacher assigns roles and distributes cards. Learners form a circle. The "Sun" begins by passing yarn to the "Plant," explaining energy transfer through sunlight. The "Plant" passes yarn to the "Herbivore," describing glucose consumption. The "Herbivore" passes yarn to the "Carnivore," showing energy transfer through food chains. The carnivore passes yarn to the decomposer. Explain that decomposers act on material from every trophic level. Matter is recycled through ecosystems, whereas energy flows through the system and is dissipated as heat. As the yarn web forms, learners visualize the interconnected energy flow.	The activity targets Learning Objectives 2 and 3 by engaging learners in modeling interactions among components and explaining how the represented system works. It applies the Constructivist, Collaborative, and Interactive approaches because learners take roles, negotiate meaning with peers, and connect the model to scientific explanations. The pedagogical strategy used is guided simulation or role-play, supported by assigned roles, observation prompts, debriefing, and teacher questioning. Literacy is integrated by using scientific terms in oral explanations and written debriefing responses. Numeracy is integrated through tracking sequences, quantities, or response patterns when these are part of the model. EdTech is integrated through an animation or digital model when available, with an equivalent physical model. **Note to Teachers:** State the limits of the model and correct any analogy that learners may interpret literally. Debrief the activity using evidence-based questions.

	The teacher poses guiding questions: The teacher concludes by emphasizing that cellular processes underpin ecosystem energy flow. **Guide Questions:** 1. What happens if one role is removed? 2. How are photosynthesis and respiration connected? 3. Why is interdependence vital for survival? 4. Learners discuss and write reflection notes answering: "What part do I play in the energy flow of life?" **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	C.2. Making Generalization	
	Option 1: Think-Pair-Share – Energy in Everyday Life	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Think independently about the prompt and write an initial response. Discuss it with a partner, agree on an evidence-based answer, and share the conclusion with the class. **Activity Proper:** Students think individually, pair with a seatmate, then share with the class.	The activity targets Learning Objective 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing,

	The teacher synthesizes responses into a general statement about the food-energy-cell connection. Note to Teachers: Encourages collaborative reasoning and shared generalization. **Guide Question:** The teacher asks: "How do cellular processes keep us alive and active?" **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	Option 2: Concept Mapping – Linking Processes	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown. **Activity Proper:** Groups construct a concept map showing how nutrients move from food to ATP.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated

	The teacher guides connections (e.g., "Glucose → Mitochondria → ATP → Movement"). Groups present maps; teacher highlights general patterns. Note to Teachers: Visualizes interconnections, reinforcing generalization across processes. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	C.3. Evaluating Learning	
	Option 1: Fact or Bluff	
	Materials/Resources Needed: • Printed "Fact" and "Bluff" cards (or board signs) • Projector/slide deck with statements • Markers/pens **Directions:** Classify each statement as Fact or Bluff, record the answer, and correct or explain every false statement using accurate scientific information.	The activity targets Learning Objectives 1 and 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task

	Activity Proper: The teacher introduces the game, explaining that learners will test their knowledge of photosynthesis, respiration, and nutrient acquisition. The teacher reads each statement aloud or flashes it on a slide. Learners respond by raising "Fact" or "Bluff" cards (or moving to designated classroom sides). After each response, prompt learners with deeper follow-up questions to push conceptual analysis, such as: The teacher immediately reveals the correct answer, explains it briefly, and connects it to the lesson (e.g., explaining that mitochondria are found in both plant and animal cells). Learners keep score individually or in teams to add motivation. The teacher concludes by summarizing key truths and misconceptions, reinforcing how energy processes sustain life. **Guide Questions:** 1. Why is this statement scientifically valid or invalid? 2. Which process or principle supports your answer? 3. Can you connect this idea to a real-life example or application? 4. What would happen if this process were disrupted? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	Option 2: Energy Relay (Team Challenge)	
	Materials/Resources Needed: • Envelopes with cut-out cards (Sunlight, CO_2, H_2O, Glucose, Oxygen, ATP, Mitochondria, Chloroplast, Glycolysis, Krebs Cycle, ETC) • Board/manila paper with two labeled columns: "Photosynthesis" and "Cellular Respiration." • Markers/pens **Directions:** Participate in the assigned simulation or performance according to your role. Represent the scientific process or relationship accurately, then explain what your role or sequence demonstrates. **Activity Proper:** Procedure (Extensive): The teacher divides the class into 3–4 teams and distributes envelopes with cut-out cards. Sample Card Progression (Input → Process → Output): Input: Glucose + Oxygen Process: Cellular Respiration → Energy Conversion Products: carbon dioxide and water. Part of the released chemical energy is transferred to regenerate ATP, and some is dissipated as heat. The teacher explains relay rules: only one member runs at a time to place a card under the correct process in sequence. At the signal, teams begin the relay. Each runner places one card, then tags the next teammate.	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Teams continue until all cards are placed. The teacher monitors accuracy and order. Once finished, the teacher reviews or assigns a certain group to lead the review of each team's diagram, correcting errors and reinforcing the input-process-output chain. The winning team is determined by speed and correctness. The teacher concludes by highlighting how both processes complement each other in sustaining energy flow. **Guide Questions:** 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	C.4. Additional Activities	
	Option 1: Research Extension – Climate Change and Cellular Processes	
	Materials/Resources Needed: • Internet-enabled device, if available • internet • Notebook or paper for organizing notes • Chart paper or a digital document for organizing the report • Pens/pencils • chart paper for summaries	The activity targets Learning Objectives 2 and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners

	Directions: Use credible sources to investigate the assigned climate-related change, record the biological or cellular evidence, and explain the cause-and-effect relationship with a complete citation. **Activity Proper:** The teacher introduces the task, explaining how climate change impacts plant and animal energy processes. Learners form small groups and select a local ecosystem (e.g., forest, mangrove, agricultural field). Groups research how rising temperatures, drought, or pollution affect photosynthesis and respiration. Learners record findings in the organizer, focusing on cause-and-effect relationships (e.g., reduced CO_2 absorption, lower oxygen release, stress on respiration). Groups prepare outputs such as reports, posters, or presentations. The teacher facilitates sharing, highlighting connections between cellular processes and environmental sustainability. Learners reflect on how local ecosystems are affected by global climate challenges. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson?	analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

<table>
<tr><td>Demonstrating Knowledge and Skills</td><td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>Accurate, complete, and free of misconceptions.</td><td>Mostly accurate; minor gaps only.</td><td>Partly accurate; important gaps or misconceptions.</td><td>Limited or inaccurate scientific content.</td></tr>
<tr><td>Evidence and Sources</td><td>Uses relevant, credible evidence and integrates it effectively.</td><td>Uses appropriate evidence with minor limitations.</td><td>Uses limited or weakly connected evidence.</td><td>Provides little or no usable evidence.</td></tr>
<tr><td>Analysis and Application</td><td>Explains relationships clearly and applies evidence insightfully.</td><td>Explains major relationships and applies evidence appropriately.</td><td>Shows partial analysis or weak application.</td><td>Shows little analysis or application.</td></tr>
<tr><td>Organization and Communication</td><td>Well organized, concise, and clear for the intended audience.</td><td>Generally clear and organized.</td><td>Somewhat unclear or unevenly organized.</td><td>Difficult to follow or incomplete.</td></tr>
</table></td></tr>
<tr><td></td><td colspan="2">Option 2: Remediation Task – Revisiting the KWL Chart</td></tr>
<tr><td></td><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Complete the K and W columns before the lesson, compare entries with a partner or group, and complete the L column afterward using evidence from the lesson.</td><td>The activity targets Learning Objectives 1 and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.</td></tr>
</table>

	Activity Proper: Learners' original KWL charts (Know, want to know, Learned) Teacher-prepared guiding questions Pens/pencils The teacher asks learners to revisit their KWL charts from earlier lessons. Learners identify areas where misconceptions or gaps remain (e.g., confusion about ATP, respiration inputs). The teacher provides guiding questions and mini-explanations to address weak points. Learners update the "Learned" section with corrected information. The teacher facilitates short peer-sharing sessions where learners explain updated knowledge to classmates. The teacher summarizes key corrections and reinforces accurate concepts. Learners reflect on how revisiting the chart helped strengthen their understanding. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

V. ASSESSMENT *(Assessing Learnings)*	Summative test: Administer a 10-question test (the type of test varies depending on the teacher who will administer the test) covering all the topics discussed, presented in a traditional paper-and-pencil format, a Google Forms digital quiz, or an interactive online game such as Kahoot. 1. A farmer eats corn as his staple food. How do his cells convert nutrients into usable energy? A. Corn starch is digested into glucose, absorbed, transported, and converted into ATP B. Corn starch is stored in the stomach forever C. Corn starch becomes protein in the muscles D. Corn starch is excreted without use Answer: A 2. Which sequence correctly shows nutrient absorption leading to energy production? A. Digestion → breathing → ATP production B. Digestion → excretion → ATP production C. Digestion → storage → ATP production → excretion D. Digestion → absorption → transport → cellular respiration → ATP Answer: D 3. A goat grows weak when it skips meals. Why? A. The body initially uses stored glycogen and fat; weakness may develop when available fuels, hydration, or other conditions become limiting. B. Muscles stop producing oxygen C. Photosynthesis stops in the goat's cells D. The goat's blood becomes carbon dioxide only Answer: A 4. How do plants and animals depend on glucose? A. Plants use glucose for photosynthesis; animals use glucose for digestion B. Plants produce glucose via photosynthesis; animals consume it for energy C. Plants store glucose in mitochondria; animals excrete glucose D. Plants and animals both absorb glucose from sunlight Answer: B

	5. Compare energy sources for a basketball player and a corn plant. A. Player uses sunlight; plant uses rice B. Player digests rice into glucose; the plant produces glucose from sunlight C. Player stores glucose in leaves; the plant stores glucose in muscles D. Player and plant both excrete glucose for energy Answer: B 6. What is cellular respiration and its role? A. Breakdown of glucose with oxygen to produce ATP for biological functions B. Conversion of oxygen into glucose for storage C. Breakdown of proteins into ATP only D. Conversion of water into ATP directly Answer: A 7. During a marathon, a runner consumes energy gels. How does this help? A. Gels provide glucose, absorbed and converted into ATP for endurance B. Gels provide oxygen directly to muscles C. Gels stop lactic acid buildup without ATP D. Gels store glucose in bones Answer: A 8. Which inputs and outputs describe cellular respiration? A. Inputs: glucose + oxygen → Outputs: CO_2 + water + ATP B. Inputs: protein + water → Outputs: glucose + oxygen C. Inputs: sunlight + CO_2 → Outputs: glucose + oxygen D. Inputs: ATP + CO_2 → Outputs: glucose + water Answer: A 9. A student designs a project on reducing carbon emissions. Which idea uses biology concepts? A. Promote plant growth to absorb CO_2 and encourage efficient energy use B. Stop eating plants to reduce glucose production C. Increase oxygen emissions from factories D. Replace ATP with carbon dioxide in cells

	Answer: A 10. Which example shows the interconnectedness of absorption, transport, and respiration? A. Athlete eats balanced meals, nutrients are absorbed and transported, then used in metabolic pathways that regenerate ATP for cellular work B. Athlete eats meals but excretes all nutrients unused C. Athlete breathes oxygen but does not eat food D. Athlete drinks water only for ATP production Answer: A **Assessment specification:** Use conventional A–D option order, label the equation as aerobic respiration, and use precise energy language in both the items and answer key. Include the answer key and total score.
VI. REFLECTION (Feedback and Continuous Improvement)	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery. 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? 6. What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT in order to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

Learning Title/Topic:	**Organ Systems Working Together – Transport of Materials in Plants**	**Lesson Exemplar:**	11

I. OBJECTIVES	
A. Content Standard	Organ systems work together to carry out essential functions of an organism;
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	• *Outer parts of plants, such as leaves, roots, and stems and identify their role to get water and nutrients from the soil.* • *Purpose of specialized structures in plants, such as rhizomes, tubers, thorns, bulbs, and aerial roots.* • *How plant organs (leaf, stem, roots) work together as the transport system*
	Explain how various plant organs interact to facilitate the transport of materials throughout the plant system;
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	CK-12 Foundation. (2025, September 11). *9.8: Vascular plants*. Biology LibreTexts. https://bio.libretexts.org/Bookshelves/Introductory_and_General_Biology/Introductory_Biology_(CK-12)/:A_Plants/9.08:_Vascular_Plants FuseSchool - Global Education. (2016, September 27). *Xylem and phloem – transport in plants | Biology | FuseSchool*[Video]. YouTube. https://www.youtube.com/watch?v=jtuX7H05tmQ Organic Chemistry Tutor. (2021, May 30). *Xylem and phloem – transport in plants | Biology* [Video]. YouTube. https://www.youtube.com/watch?v=DhyYtT1K844

III. CONTENT *(Sequencing Content)*	Organ Systems Working Together – Transport of Materials in Plants	
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	Learners shall be able to: **1.** Classify major plant organs according to their roles in transporting water, minerals, and assimilates. **2.** Compare the structures and functions of xylem and phloem. **3.** Explain how roots, stems, leaves, xylem, and phloem interact to transport materials throughout the plant system.	
IV. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	***A.1. Activating Prior Knowledge***	
	Option 1: Think-Pair-Draw	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Individually list or sketch the plant organs involved in transport, compare ideas with a partner, then draw and label a plant using arrows to show the movement of water, minerals, and assimilates. **Activity Proper:** 1. Learners are asked to list or sketch any plant organs they can recall, particularly those they believe are involved in transporting water, minerals, or food. 2. The teacher instructs learners to pair up and share and discuss their ideas. 3. Learners are tasked to draw a simple diagram of a plant, label the major organs and use arrows to show the movement of water, minerals, and food.	The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a

	4. Once the drawings are completed, they are to present their works to the class. 5. The teacher facilitates a brief discussion highlighting correct identifications, clarifying misconceptions, and reinforcing the roles of each organ in the plant's transport system. Science clarification: Xylem flow is predominantly from roots to shoots. Different phloem sieve tubes may transport assimilates in different directions between sources and sinks; identify sucrose and other solutes rather than glucose alone. Water moves through the open lumens of xylem conduits, while lignin strengthens cell walls and adds hydrophobic character. **Guide Questions:** 1. What plant parts do I already know? 2. Which organ do we think is most important for transport and why? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Option 2: Transport Trail Activity	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objective 1 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners

	Directions: Work with a partner to label the plant organs, trace the pathways of water, minerals, and assimilates using distinct colors or symbols, and present the completed Transport Trail. **Activity Proper:** 1. The teacher begins by distributing a simplified diagram of a plant, showing the root, stem, leaf, flower, and fruit. Arrows are included to represent the movement of water, minerals, and food, but the organs and pathways are left unlabeled. 2. Learners are instructed to work in pairs to label each organ and trace the correct path of water, minerals, and food. 3. They are encouraged to use color coding or symbols to differentiate between the types of materials being transported. 4. They are asked to present their completed Transport Trails. 5. The teacher uses these presentations to clarify misconceptions, reinforce correct pathways, and highlight the coordinated roles of plant organs in transport. Table 1. Flow of Nutrients and Water Through Plant Organs Water: Entry point: Roots | Destination: Leaves (for photosynthesis), other cells | Organs involved: Roots → Stem → Leaves	analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Minerals: Entry point: Roots | Destination: Leaves, growing tissues | Organs involved: Roots → Stem → Leaves Food (mainly sucrose in phloem): Entry point: Leaves | Destination: Roots, stem, flowers, fruits | Organs involved: Leaves → Stem → Roots/Fruits/Flowers Science clarification: Xylem flow is predominantly from roots to shoots. Different phloem sieve tubes may transport assimilates in different directions between sources and sinks; identify sucrose and other solutes rather than glucose alone. Water moves through the open lumens of xylem conduits, while lignin strengthens cell walls and adds hydrophobic character. **Guide Questions:** 1. In plants, which organ is primarily responsible for making their own food? 2. How do water, minerals, and glucose reach or support the development of fruits or flowers? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Plant Emergency Scenario	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objective 1 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the

	Directions: Read or examine the assigned case or scenario. Identify the relevant evidence, apply the appropriate scientific concepts, answer the guide questions, and justify your conclusion. **Activity Proper:** 1. The teacher projects Slide 1 showing the garden mystery scenario. Learners log into Menti.com using the room code and read the scenario silently on their devices. 2. The teacher uses the scrolling wall of student responses on Mentimeter to facilitate the discussion. Instead of calling on random learners, the teacher can highlight specific, anonymous student responses on the board to clear up misconceptions, validate correct tracking of water pathways, and reinforce how a lack of root absorption directly starves the leaf and fruit sinks. Science clarification: Xylem flow is predominantly from roots to shoots. Different phloem sieve tubes may transport assimilates in different directions between sources and sinks; identify sucrose and other solutes rather than glucose alone. Water moves through the open lumens of xylem conduits, while lignin strengthens cell walls and adds hydrophobic character. **Guide Questions:** 1. A plant in the school garden has wilted leaves, shriveled fruits, and dry soil around its roots. The gardener wonders: What went wrong? Which plant	Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	parts might be failing, and how does that affect the rest of the plant? 2. The teacher advances to Slide 2: "What clues in the scenario suggest a problem?" Learners are given 60 seconds to silently type 1 to 3 keyword clues directly into their phones or laptops. A live Word Cloud instantly populates on the classroom smartboard. 3. The teacher advances to Slide 3: "Which organs might be involved in solving or causing the issue?" The teacher instructs learners to pair up, look at the live word cloud clues, and discuss their ideas for 2 minutes. After discussing, each pair submits an open-ended response mapping out the culprit organs (Roots, Xylem/Phloem tubes, Leaves). 4. The teacher advances to the final Slide 4: "How might one organ's failure affect the others?" Pairs collaboratively type a short, causal response explaining the domino effect within the plant system. **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: Organ Connection Web	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown.	The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences,

	Activity Proper: 1. Learners are given cards or sticky notes labeled with different plant organs and materials (water, minerals, glucose, oxygen, and carbon dioxide). 2. Learners in groups arrange the cards on a large sheet of paper and draw arrows to show how each organ connects to the others in transporting materials. 3. The teacher facilitates a brief sharing session, highlighting how each group visualized the system and reinforcing the idea that plant survival depends on organ coordination. **Guide Questions:** 1. What happens if one organ doesn't perform its function properly? 2. Why is it important for all organs to work together as a system? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Option 1: Slides Presentation	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed	The activity targets Learning Objectives 1 and 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based,

	Directions: View or produce the specified media output. Use the guide questions or required criteria, record relevant scientific evidence, and explain how the evidence supports the lesson concept. **Activity Proper:** The teacher will facilitate guided discussion using a slide presentation and process questions. Concepts to Discuss: Vascular plants are known as tracheophytes, which literally means “tube plants.” Vascular tissues are specialized to transport fluid. They consist of long, narrow cells arranged end-to-end, forming tubes. There are two different types of vascular tissues, called xylem and phloem. Xylem is vascular tissue that transports water and dissolved minerals from roots to stems and leaves. The conducting tracheids and vessel elements are dead at maturity; xylem also contains living parenchyma. Lignified walls strengthen the conduits and resist collapse but are not completely waterproof. Phloem is vascular tissue that transports food (sugar dissolved in water) from photosynthetic cells to other parts of the plant for growth or storage. This type of tissue consists of living cells that are separated by end walls with tiny perforations, or holes.	and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

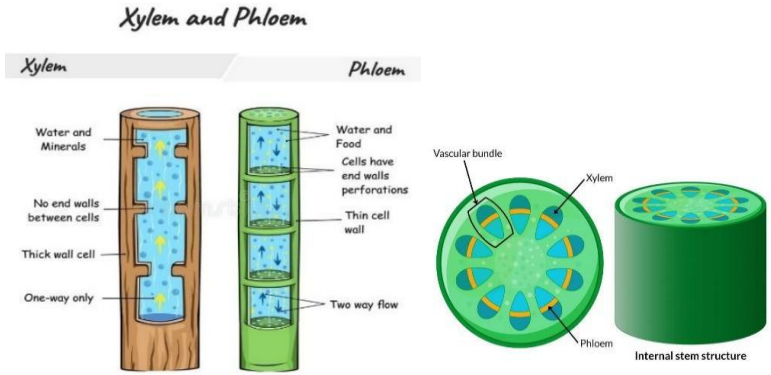


Figure 1. Xylem and Phloem/GCSE Biology Revision

Table 2. Xylem and Phloem: The Transport Tissues

Tissue	Main Function	Direction of Flow	Materials Moved	Connected Organs
Xylem	Transports water and minerals from the roots upward	One-way (roots → stem → leaves)	Water, dissolved minerals	Roots, stem, leaves
Phloem	Transports assimilates, mainly sucrose, from source tissues to sink tissues	Bidirectional (source → sink)	Sugars, nutrients	Leaves, stem, roots, fruits, flowers

How They Interact:
Water and minerals: Move from roots → stem → leaves via xylem
Assimilates (mainly sucrose): move through phloem from sources to sinks; direction can be upward or downward in different sieve tubes

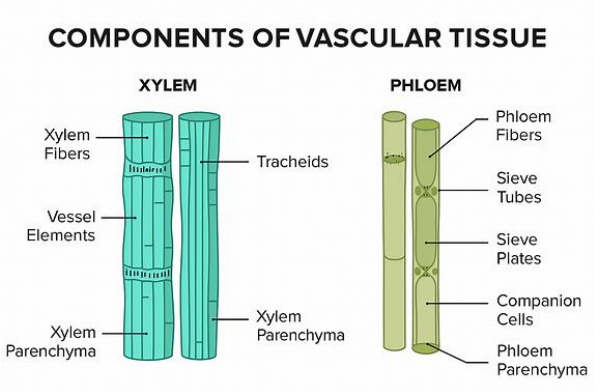


Figure 2. Components of Phloem Vascular tissue

Table 3. Xylem Tissue Components and Their Functions

Component	Function
Vessel Elements	Wide, hollow cells stacked end-to-end; conduct water rapidly through perforations.
Tracheid	Long, tapered cells with pits; conduct water more slowly and provide support.
Xylem Parenchyma	Living cells; store nutrients and assist in lateral transport of water.
Xylem Fibers	Thick-walled supportive cells; provide mechanical strength to the plant.

Lignin *(not a cell but a key substance)*	Lignin strengthens xylem cell walls and makes them relatively water resistant, helping prevent collapse; xylem tissue is not completely waterproof.

Table 4. Phloem Tissue Components and Their Functions

Component	Function
Sieve Tube Elements	Main conducting cells; transport sugars and other organic materials.
Companion Cells	Regulate sieve tube activity; assist in loading and unloading of sugars.
Phloem Parenchyma	Storage and lateral transport of food substances.
Phloem Fibers	Provide structural support; often found in bundles.
Sieve Plates *(part of sieve tubes)*	Perforated end walls that allow flow between sieve tube cells.

Guide Questions:

1. How does the structure of xylem and phloem support their specific roles in transporting water and food?
2. What might happen if one tissue type were missing?"

Expected Output/Product:

Oral or group presentation supported by accurate scientific explanations and relevant evidence.

<table>
<tr><td></td><td>Rubric:
• Scientific accuracy
• Completeness of required content
• Clarity and organization
• Appropriate use of evidence, examples, labels, or visuals</td><td></td></tr>
<tr><td>Instituting New Knowledge</td><td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>All scientific ideas are accurate, complete, and well explained.</td><td>Scientific ideas are mostly accurate with minor gaps.</td><td>Some correct ideas are present, but important errors or omissions remain.</td><td>Scientific content is largely inaccurate or incomplete.</td></tr>
<tr><td>Required Content and Evidence</td><td>Includes all required elements and supports the message with relevant evidence/examples.</td><td>Includes most required elements and appropriate supporting evidence.</td><td>Includes some required elements; evidence is limited or weakly connected.</td><td>Many required elements are missing; little supporting evidence is provided.</td></tr>
<tr><td>Communication and Organization</td><td>Message is exceptionally clear, logical, and appropriate for the audience.</td><td>Message is clear and generally well organized.</td><td>Message is partly clear but organization is uneven.</td><td>Message is unclear, disorganized, or difficult to follow.</td></tr>
<tr><td>Presentation/Design Quality</td><td>Presentation or design strongly supports understanding and is purposeful and polished.</td><td>Presentation or design supports understanding with minor weaknesses.</td><td>Presentation or design only partly supports understanding.</td><td>Presentation or design does not support understanding.</td></tr>
</table></td></tr>
</table>

	Option 2: Mind Mapping the Vascular Highway	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown. **Activity Proper:** 1. Learners are guided to place the central concept "Vascular Bundles in Plants" at the center of the organizer. 2. From there, they branch out into two main arms: Xylem and Phloem. Under each, they add sub-branches that include: 3. Tissue components (e.g., vessel elements, sieve tubes, companion cells) 4. Functions (e.g., water transport, food transport, support) 5. Direction of flow (e.g., upward for xylem, bidirectional for phloem) 6. Associated plant organs (e.g., roots, stems, leaves) 7. The teacher encourages learners to use color coding, arrows, symbols, and analogies to make their maps meaningful. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity?	The activity targets Learning Objectives 1 and 2 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	B.2. Discussing New Concept	
	Option 1: Video Lesson	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed **Directions:** Watch the assigned video or film segment attentively. Record the key scientific ideas or evidence, then answer the guide questions and relate the information to the lesson concept. **Activity Proper:** Xylem and Phloem - Transport in Plants Offers a clear breakdown of vascular tissue arrangement in roots, stems, and leaves. It's especially helpful for connecting structure to function across different plant organs. Xylem and Phloem - Transport in Plants | Biology | FuseSchool A concise and animated explanation of vascular bundles, xylem structure, and phloem function. Great for visual learners and for reinforcing the idea of directionality in transport.	The activity targets Learning Objectives 1 and 2 by guiding learners to extract scientific information from visual media and connect it to the lesson concepts. It applies the Constructivist, Inquiry-Based, and Interactive approaches because learners observe closely, answer guiding questions, and discuss evidence from the media. The pedagogical strategy used is guided multimedia analysis, supported by a viewing guide, pause points, peer discussion, and teacher questioning. Literacy is integrated through identifying key ideas, evaluating statements, and summarizing evidence from the media. Numeracy is integrated through interpreting any scales, time series, quantities, or comparisons shown. EdTech is integrated through a cited video, animation, or presentation when available, together with an accessible offline alternative.

<table>
<tr>
<td></td>
<td>Process Questions:
Guide Questions:
1. Link: https://www.youtube.com/watch?v=DhyYtT1K844
2. Link: https://www.youtube.com/watch?v=jtuX7H05tmQ
3. What materials are transported by each tissue, and in which direction?
4. How do the structures of xylem and phloem support their transport roles?
5. What evidence supports the idea that vascular tissues are connected to all plant organs?
6. Which part of the vascular system do you think is more vulnerable to environmental stress? Why?

Expected Output/Product:
Completed video or digital presentation that communicates the required scientific ideas clearly and accurately.</td>
<td>Note to Teachers: Preview the media for scientific accuracy and accessibility. Clarify that a video or animation is not an interactive simulation unless learners can manipulate variables.</td>
</tr>
<tr>
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	Communication and Organization	Message is exceptionally clear, logical, and appropriate for the audience.	Message is clear and generally well organized.	Message is partly clear but organization is uneven.	Message is unclear, disorganized, or difficult to follow.
	Presentation/Design Quality	Presentation or design strongly supports understanding and is purposeful and polished.	Presentation or design supports understanding with minor weaknesses.	Presentation or design only partly supports understanding.	Presentation or design does not support understanding.

Option 2: Flow Forces: Modeling Transport in Plants

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Construct the required design or model, label its important parts, show how the parts or steps work together, and justify the design using accurate scientific principles.

Activity Proper:
Learners explain the mechanisms of water and food transport in xylem and phloem, and analyze why their flow directions differ, using models and guided reasoning.

Part 1: Xylem Transport Model
Create a visual model or physical model that shows how water moves upward through the xylem. Your model should include:
• Transpiration pulls
Possible Set-up: Take a clear, hard plastic straw (the thick kind used for sago / milk tea). Fill it completely

The activity targets Learning Objectives 1 and 2 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product.
The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-

	with water. Wedge a tiny piece of damp, regular dishwashing sponge (Scotch-Brite type) tightly into the top opening of the straw. Submerge the bottom tip of the straw into a small container of water. If the classroom is hot or has a wall fan blowing, place the setup near the airflow. • Cohesion and adhesion Possible Set-up: Have a student use a clean 1-peso coin and a plastic medicine dropper (or a plastic drinking straw used as a dropper). Have them count how many drops of tap water they can pile on top of Jose Rizal's face before the water spills. • Capillary action Possible Set-up: Get a fresh stalk of pechay (make sure it still has its base and crisp green leaves). Place it in a plastic cup with water mixed heavily with standard food coloring (such as Aling Gina or McCormick brand dye from the local tindahan—blue or red works best). Leave it in place for the duration of the morning session. • Unidirectional flow Possible Set-up: Place two plastic cups side-by-side. Fill the first cup with water and mix in a high-contrast food coloring (red or blue McCormick / Aling Gina brand). Leave the second cup completely empty. 2. Take a strip of absorbent paper towel (or ordinary bond paper/tissue), fold it lengthwise into a thick strip, and insert one end into the colored water and the other end into the empty cup, creating a "bridge." Part 2: Phloem Transport Simulation	document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Present a visual model/diagram or physical model that explains how food (sugars) moves through the phloem using the pressure-flow hypothesis. Your model should show:
• Source and sink dynamics
• Bidirectional flow
• Active transport and pressure gradients
Science clarification: Under heat and wind, evaporative demand may increase, but transport and photosynthesis can decline when water becomes limiting; severe stress may cause stomatal closure or cavitation.

Guide Questions:

1. What forces drive water upward through xylem (e.g., transpiration pull, cohesion-tension)?
2. How does the pressure-flow hypothesis explain food transport in phloem?
3. 3. Why is phloem transport bidirectional while xylem is unidirectional?

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Contains major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little relevant evidence or provides unsupported applications.	____

Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				____ / **15**

B.3. Developing Mastery

Option 1: Role Play Activity: "Inside the Plant Transport System"

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Assign each group member the role of a root, stem, leaf, xylem, phloem, or other approved plant part. Dramatize the movement of water and minerals through xylem and sugars from sources to sinks through phloem, then explain how the parts coordinate.

Activity Proper:
The learners dramatize how roots, stems, and leaves coordinate through xylem and phloem to transport water, minerals, and food throughout the plant.
The teacher assigns learners into small groups and introduces the role play activity. Each group is tasked with dramatizing how water, minerals, and food are transported throughout the plant, emphasizing the interaction among roots, stems, leaves, and vascular tissues.

The activity targets Learning Objectives 1 and 2 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the constructivist, collaborative, and integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product.
The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-

	Each learner in the group is assigned a specific role, such as: Root – responsible for absorbing water and minerals from the soil Stem – serves as the transport highway connecting roots and leaves Leaf – produces food through photosynthesis and regulates transpiration Xylem – transports water and minerals upward from the roots Phloem – distributes sugars from the leaves to other parts of the plant Optional roles may include Stomata, Sunlight, or Sink Organs (e.g., fruits or root tips). Props and Visuals (Optional): Blue ribbons or ropes for xylem flow Green ribbons for phloem flow Signs or headbands with role names Arrows or labels showing direction of transport Scene 1: Water Uptake Scene 2: Transpiration Pull Scene 3: Food Production and Distribution Scene 4: System Coordination Science clarification: Under heat and wind, evaporative demand may increase, but transport and photosynthesis can decline when water becomes limiting; severe stress may cause stomatal closure or cavitation.	document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Guide Questions:

1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Expected Output/Product:

Oral or group presentation supported by accurate scientific explanations and relevant evidence.

Rubric

Criteria	Excellent (5 points)	Good (3 points)	Needs Improvement (1 point)	Total
Content Accuracy	Shows clear and correct understanding of plant transport.	Mostly correct with minor errors.	Contains several errors or unclear concepts.	____
Participation	All group members participate actively and perform their assigned roles effectively.	Most group members participate.	Few learners participate, or group roles are unclear.	____
Creativity	Uses props, movement, or dialogue creatively.	Uses some purposeful creative elements.	Shows little or no purposeful creativity.	____
Clarity of Presentation	Clear and easy to follow.	Mostly clear.	Difficult to follow or understand.	____
Total Score				____ / **20**

	Option 2: Plant Transport System: Organ Interaction Map	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Create a labeled map of roots, stems, leaves, xylem, and phloem; use arrows to show transport direction; and annotate how each organ contributes to the unified transport system. **Activity Proper:** Learners are asked to visualize how these tissues operate across different organs—roots, stems, and leaves—and how these organs work together as part of a unified transport system by creating a labeled diagram that includes: The three major plant organs: roots, stem, and leaves The vascular tissues (xylem and phloem) within each organ Arrows and color coding to show the direction of water and food movement Short annotations explaining each organ's contribution to the transport process Anatomical Components Label: 4 pts: All 3 organs (roots, stem, leaves) and both vascular tissues (xylem, phloem) are perfectly identified in all regions. | 3 pts: All major organs are labeled; 1 vascular tissue label is missing or misplaced. | 2 pts: Missing multiple organ or tissue labels; structure is incomplete. | 1 pt: Labels are missing entirely or completely inaccurate.	The activity targets Learning Objectives 1 and 2 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the constructivist, collaborative, and interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Directional Flow and Color Coding: 4 pts: Clear, distinct color-coded arrows accurately show unidirectional upward water flow and bidirectional food distribution. | 3 pts: Arrows are present and mostly accurate, but color-coding is inconsistent or missing a clear legend. | 2 pts: Arrow directions are incorrect (e.g., showing water moving downwards from leaves), confusing the transport mechanism | 1 pt: No arrows or directional flow indicators are present. Quality of Annotations: 4 pts: All three organs have highly accurate, concise descriptions detailing their functional contributions to transport. | 3 pts: Annotations are present for all organs but are slightly vague or copy directly from basic definitions. | 2 pts: Only one or two organs are annotated, or the notes contain scientific inaccuracies. | 1 pt: No annotations are written on the map. Analysis and System Thinking: 4 pts: Processing questions are answered thoroughly, demonstrating an advanced understanding of organ interdependence and systemic unity. | 3 pts: Questions are answered completely with good scientific basis, though missing a deeper connection to systems biology. | 2 pts: Answers are brief, fragmented, or treat the organs as separate entities rather than an interacting network. | 1 pt: Questions are left unanswered or show major misconceptions.	

	Guide Questions: 1. How do the roots, stem, and leaves coordinate to ensure continuous transport of water and nutrients throughout the plant? 2. How does the interaction among organs reflect the idea of the plant as a unified system rather than separate parts? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
1. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Option 1: Plant Transport in Action: Solving Real-World Challenges	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Analyze the assigned plant-transport problem, identify the affected organ or tissue and the disrupted transport process, propose a realistic science-based response, and justify the response using evidence. **Activity Proper:** The teacher presents students with realistic scenarios where the plant transport system is disrupted or challenged. Learners work in small groups to analyze the situation, identify which part of the transport system is affected, and propose science-based solutions or interventions.	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise,

	Each group receives one of the following scenarios: A farmer notices that crops are wilting despite regular watering. A fruit tree produces small, underdeveloped fruits. A plant exposed to drought shows signs of leaf curling and stunted growth. A student over-fertilizes a potted plant and sees leaf burn and root damage. Problem Identification: 3 pts: Accurately names the specific tissue or organ affected (e.g., xylem, phloem, stomata) and explains how the disruption blocks transport. | 2 pts: Identifies the general problem area but misnames or weakly explains the specific vascular tissue involved. | 1 pt: Misidentifies the affected system or fails to explain the disruption. Proposed Solution: 3 pts: Proposes a highly realistic, science-backed intervention that directly fixes or bypasses the transport issue. | 2 pts: Proposes a solution that is somewhat helpful but lacks clear scientific reasoning or detail. | 1 pt: Proposes an unrealistic or unscientific solution, or offers no intervention at all. Science clarification: Under heat and wind, evaporative demand may increase, but transport and photosynthesis can decline when water becomes limiting; severe stress may cause stomatal closure or cavitation.	numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

Guide Questions:

1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little evidence or gives unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				____ / **15**

Option 2: The "Crop Doctor" Scenario

Materials/Resources Needed:

• Notebook or paper
• Pen or pencil

Directions:

Read or examine the assigned case or scenario. Identify the relevant evidence, apply the appropriate scientific

The activity targets Learning Objectives 1, 2, and 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches

	concepts, answer the guide questions, and justify your conclusion. **Activity Proper:** Working in pairs, learners act as "Crop Doctors" to solve this quick real-world problem. They may choose from the different cases presented: Case #1: The Case: A local farmer cuts a slice of a wilting corn stem and notices the inside tubes are completely blocked by a fungal infection. Even though the soil is wet, the leaves are dry and dying. The Task: On a single index card, the pair must write a 2-sentence "Doctor's Prescription" that answers: Case #2: The Case: A resident ties a thick iron wire tightly around the trunk of a mango tree in the backyard to use as a clothesline (sampayan). After several months, the bark right above the wire starts swelling, the lower trunk stays thin, and the roots eventually begin to rot and die. The Task: On a single index card, the pair must write a 2-sentence "Doctor's Prescription" that answers: Case #3: The Case: During local barangay elections, a candidate hammers heavy iron nails deep into the trunk of a roadside mahogany tree to hang a campaign tarpaulin. Months later, the leaves directly above the nailed area turn yellow and fall off, even though the rest of the tree looks healthy.	because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	The Task: On a single index card, the pair must write a 2-sentence "Doctor's Prescription" that answers: Case #4: The Case: A farmer clears weeds by burning dried leaves (siga) too close to a young calamansi tree. The fire burns off a complete ring of outer bark around the base of the stem (girdling), but the inner wood remains unburned. Within a week, the tree’s leaves drop and the plant completely dries up. The Task: On a single index card, the pair must write a 2-sentence "Doctor's Prescription" that answers: Organ and Tissue Identification: 3 pts: Correctly states that the roots and leaves cannot interact due to a blockage in the xylem (water-transporting tubes). | 2 pts: Names the correct organs (roots/leaves) but fails to identify or misnames the specific vascular tissue involved. | 1 pt: Misidentifies the organs involved or confuses the issue with the food transport system (phloem). Scientific Explanation: 3 pts: Clearly explains that leaves are dying because the stem blockage prevents water from moving upward despite the wet soil. | 2 pts: Explains that water is blocked, but the connection between root absorption and leaf dehydration is vague. | 1 pt: Gives an unscientific reason for leaf death, or fails to explain why wet soil isn't helping. Qualification: Effects depend on the extent of damage, species, season, and duration; avoid presenting one outcome as universal.	

	Guide Questions: 1. Which specific plant organs can no longer interact because of this blockage? 2. Why are the leaves dying if the roots are doing their job? 3. Which specific plant tissue (xylem or phloem) got crushed by the wire, disrupting phloem transport from source leaves to sink tissues in this scenario? 4. Why are the roots starving and rotting if the leaves above are still green and making food? 5. What internal water-transporting tubes were physically severed and destroyed by the driven nails? 6. How did destroying this specific tissue cut off the vital resources needed by the leaves directly above it? 7. While the inner xylem might be intact, what outer transport tissue was completely destroyed by the ring of fire? 8. Why does destroying this outer layer eventually paralyze the whole plant's survival system, leading to total collapse? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	C.2. Making Generalization	
	Option 1: Connecting the Dots	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It

	Directions: Create or complete the required organizer or diagram, label all relevant parts or stages, show the relationships accurately, and add a brief evidence-based explanation. **Activity Proper:** The teacher facilitates the activity by asking the learner to write three key takeaways from the lesson on how various plant organs interact to facilitate the transport of materials on sticky notes and post them on the board. The teacher guides the learners to group similar insights together to create a summary statement about the lesson. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	Option 2: One Big Idea	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners

	Directions: Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences. **Activity Proper:** Each learner is asked to distill everything they've learned into one clear generalization statement by writing one sentence that answers the question: **Guide Question:** How do plant organs and vascular tissues work together to transport water, minerals, and food efficiently—and how is this process affected by environmental conditions? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	C.3. Evaluating Learning	
	Option 1: Short Constructed Response	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Answer all constructed-response questions in complete sentences, explain the relevant xylem and phloem structures or environmental factors, and support each answer with accurate scientific reasoning.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make

	Activity Proper: Learners write brief answers to the following questions: How does the structure of xylem and phloem support efficient transport within the plant? What environmental factors can affect the efficiency of the plant transport system, and how? Q1: Vascular Structure and Function: 5 pts: Clearly explains how the structural features of both xylem (hollow tubes) and phloem (sieve tubes/living cells) allow them to transport water and food efficiently. | 3 pts: Mentions both xylem and phloem, but the explanation of how their structural design helps them transport materials is incomplete or vague. | 1 pt: Only mentions one tissue, or definitions are inaccurate with no connection to structure. Q2: Environmental Impact: 5 pts: Correctly identifies specific factors (e.g., sunlight, temperature, or wind) and accurately explains how they speed up or slow down the transport system. | 3 pts: Identifies environmental factors, but the explanation of how or why they alter transport efficiency is weak or slightly confused. | 1 pt: Lists environmental factors without explaining their effects, or the science is incorrect. Q3: Organ Interaction: 5 pts: Successfully details how the roots (intake), stem (highway), and leaves (engine/output) must work as a connected system to maintain balance. | 3 pts: Mentions the roles of the organs, but fails to clearly show how they interact or depend on one another to keep the plant healthy. | 1 pt:	design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	Lists the organs without explaining their connection, or treats them as completely separate parts. **Guide Questions:** 1. What environmental factors can affect the efficiency of the plant transport system, and how? 2. Why is the interaction between roots, stems, and leaves essential for maintaining healthy transport in plants? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: Match and Explain	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Match each item with the correct term, category, description, or process. Record each match and briefly explain the scientific basis for your answer. **Activity Proper:** The teacher distributes a short organizer or displays a list of plant structures and transport-related functions. Learners are asked to match each organ or tissue to its correct function and then choose one pair to explain in 1–2 sentences.	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise,

		numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

1. Column A (Structure)	Column B (Function)
1. Roots	A. Absorbs water and minerals from the soil and anchor the plant
2. Xylem	B. Transports water and minerals from roots to leaves
3. Phloem	C. Transports sugars from leaves to other parts of the plant
4. Companion cell	D. Helps load or unload sugars and supports sieve-tube elements
5. Tracheid	E. Conducts water and dissolved minerals and also provides structural support
6. Sieve tubes	F. Main phloem-conducting cells that transport assimilates, mainly sucrose

Guide Questions:

1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Assessment Criteria:

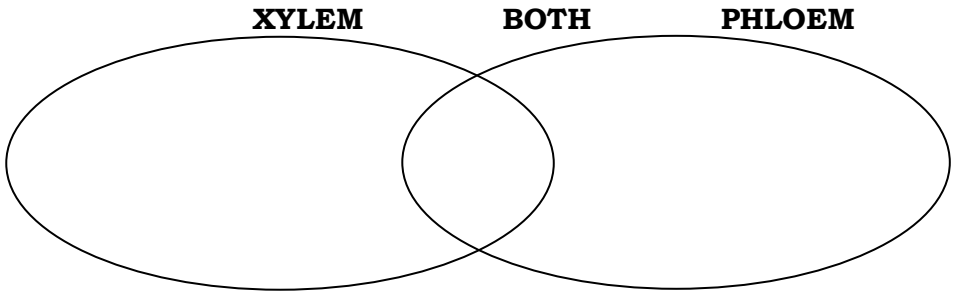
• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation

	C.4. Additional Activities	
	Option 1: The "Three Word Summary" Challenge	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation. **Activity Proper:** The teacher provides learners with a strict word bank: Roots, Stem, Leaves, Xylem, Phloem, Water, Sugar. The learners write a 1-sentence explanation connecting Roots, Xylem, and Leaves. Example: "The roots absorb water and use the stem's xylem to transport it up to the leaves." The learners write a 1-sentence explanation connecting Leaves, Phloem, and Roots. Example: "The leaves create sugar and transport it through the phloem from a source leaf to sink tissues; the direction may be upward or downward in different sieve tubes." **Guide Questions:** 1. Which scientific concept was most important in determining the correct response?	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

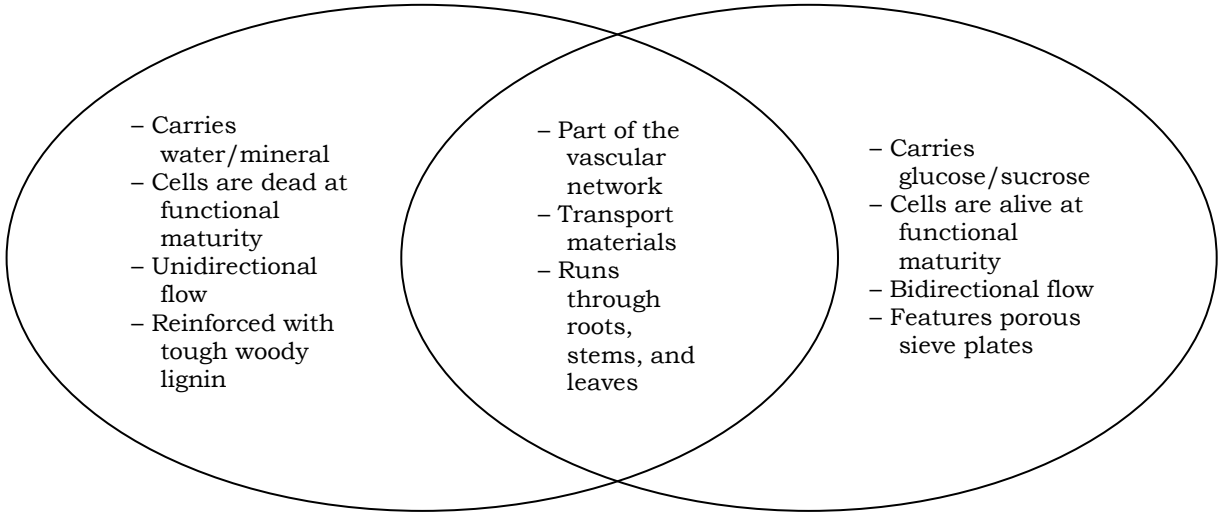
	2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: The "Sentence Scramble" Logic Chain	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Create or complete the required organizer or diagram, label all relevant parts or stages, show the relationships accurately, and add a brief evidence-based explanation. **Activity Proper:** Learners are given scrambled sentences detailing the transport process and must organize them into a paragraph that explains a logical timeline. The teacher provides learners with these four out-of-order sentences: A. The phloem tubes in the stem transport this sugar from a source leaf to the root sinks in this scenario; in other source–sink relationships, phloem transport may be upward. B. Root hairs absorb water from the soil; transpiration-driven tension draws most xylem water upward.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

	C. Without this continuous cooperative loop, neither the roots nor the leaves can survive. D. The stem's xylem carries this water up to the leaves so they can make sugar. Learners must rearrange the letters into the correct sequence (B D A C) and write a final sentence explaining why the sequence must happen in this exact order. **Guide Questions:** 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	**Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.
V. ASSESSMENT *(Assessing Learnings)*	**A. The Plant Material "Customs Check** Imagine the vascular system of a plant is an international highway network, and the **Roots, Stems, and Leaves** are "Customs Checkpoints." Read the cargo slips below and determine **which checkpoint** the materials are passing through, and **which tissue type** (Xylem or Phloem) is managing the transport. 1. **Cargo Slip A:** *"Massive shipment of dissolved nitrates and fluid molecules entering the plant system from the dark underground network."* o **Checkpoint Organ:** _____ o **Vascular Tissue Type:** _____ 2. **Cargo Slip B:** *"High-volume delivery of manufactured sugary sucrose traveling downwards to feed the non-photosynthetic root cells."* o **Checkpoint Organ:** _____ o **Vascular Tissue Type:** _____	

	3. Cargo Slip C: Water vapor exits mainly through stomata during transpiration. Xylem transports liquid water to the leaf; evaporation from moist cell walls helps create the tension that draws the xylem water column upward. ○ **Checkpoint Organ:** _____ ○ **Vascular Tissue Type:** _____ Answer: 1. Roots | Xylem 2. Stem (or Leaf as the origin source) | Phloem 3. Leaves | Xylem **B. The Vascular Venn Diagram Challenge** Given the sorting items below, the learners will sort them into the PHLOEM, XYLEM, or BOTH using the Venn Diagram **The Sorting Items:** ● Carries water and dissolved minerals ● Carries manufactured glucose/sucrose (food) ● Made of cells that are **dead** at maturity ● Made of cells that are **alive** at maturity ● Xylem sap moves predominantly upward from roots to shoots under ordinary conditions. Phloem moves assimilates from sources to sinks and may transport them upward or downward in different sieve tubes. ● Flow is **bidirectional** (upward and downward) ● Uses thick, woody **lignin** walls to prevent collapsing ● Uses porous **sieve plates** to let fluid pass through ● Part of the plant's vascular tissue network ● Transports vital materials throughout the plant system ● Runs continuously through roots, stems, and leaves



Answer:



Assessment specification: Provide an explicit answer key, score, and rubric. Verify the matching entries for companion cells and sieve-tube elements and accept phloem transport in different directions in different sieve tubes.

Rubric:

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little evidence or gives unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				____ / **15**

VI. REFLECTION
(Feedback and Continuous Improvement)

Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery.

1. How many learners successfully demonstrated the learning objectives based on the assessment results?
2. Which activity helped learners understand the lesson the most? Which activity helped the least?
3. Which part of the lesson was easiest for learners? Which part was most difficult?
4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support?
5. What did the assessment results show about learners' understanding of the lesson?
6. What improvement would you make if you taught this lesson again?

VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT in order to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

Learning Title/Topic:	Organ Systems Working Together – Effects of Damage on Interacting Organ Systems	Lesson Exemplar:	12

I. OBJECTIVES	
A. Content Standard	Organ systems work together to carry out essential functions of an organism;
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	• Describe in simple terms how the following human body systems work: muscular, skeletal, digestive, circulatory, and respiratory; • Identify from pictures and diagrams the parts of the circulatory system as heart, blood, and blood vessels, and describe how they work; • Use models, flow charts, diagrams, and simulations to explain how body systems work together, such as digestion and excretion
	Describe how a damaged part in a system affects the organism using the case of a torn ACL (skeletal and muscular) and an asthma attack (respiratory and circulatory);
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	● Amoeba Sisters. "Human Body Systems Functions Overview: The 11 Systems." *YouTube video*, 6:52. Posted May 28, 2017. https://www.youtube.com/watch?v=gEUu-A2wfSE ● Peekaboo Kidz. *How Your Organs Work Together to Keep You Alive: A Deep Dive*. YouTube video, 5:46. Posted October 14, 2020. https://www.youtube.com/watch?v=c4ZxPG_WxOA ● Learn Easy Science. *12 Organ Systems | Roles & Functions | Easy Science Lesson*. YouTube video, 5:58. Posted May 7, 2021. https://www.youtube.com/watch?v=cQIU0yJ8RBg

<table>
<tr><td></td><td colspan="2">● Ochi, M., K. Shino, K. Yasuda, and M. Kurosaka, eds. ACL Injury and Its Treatment. Tokyo: Springer, 2016. https://doi.org/10.1007/978-4-431-55858-3
● Levitzky, Michael G. Pulmonary Physiology. 8th ed. New York: McGraw-Hill Education, 2013.</td></tr>
<tr><td>III. CONTENT
(Sequencing Content)</td><td colspan="2">Organ Systems Working Together – Effects of Damage on Interacting Organ Systems</td></tr>
<tr><td>IV. OBJECTIVES
(Setting Clear Objectives and Analyzing the Tasks)</td><td colspan="2">1. Identify the basic functions of the skeletal, muscular, respiratory, and circulatory systems
2. Explain how two body systems interact to perform a function (e.g., movement or oxygen delivery)
3. Compare the effects of damage in different systems (e.g., ACL vs. asthma)
4. Illustrate how a specific injury or condition affects system function.</td></tr>
<tr><td colspan="2">IV. PROCEDURES</td><td>ANNOTATIONS</td></tr>
<tr><td rowspan="3">A. Activating Prior Knowledge</td><td colspan="2">A.1. Activating Prior Knowledge</td></tr>
<tr><td colspan="2">Option 1: Body System Brain Dump</td></tr>
<tr><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
List the required lesson terms, define each in your own words, give an accurate example or connection, and share or post the responses as instructed.

Activity Proper:
The teacher will implement a cooperative learning strategy by dividing students into small groups of 3–4 members. Each group will be given three (3) minutes to list everything they already know about human body systems, including</td><td>The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.
The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through</td></tr>
</table>

	system names, related organs, and their functions, on a sheet of paper. After the time is up, the teacher will facilitate a brief class discussion to review common ideas, clarify misunderstandings, and connect students' existing knowledge to the upcoming lesson. Process Questions: **Guide Questions:** 1. How does this organ or function help the body system work? 2. What would happen to the whole body if one of these systems is damaged? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Option 2: Think-Pair-Share:	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Think independently about the prompt and write an initial response. Discuss it with a partner, agree on an evidence-based answer, and share the conclusion with the class.	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and

	Activity Proper: The teacher asks learners to pair up and reflect on everyday actions and to discuss which systems are involved. The teacher encourages learners to share their ideas with the whole class. Together, they list the body systems involved in those actions. Process Questions: **Guide Questions:** 1. Which body systems do you think are working together in that action? 2. How do these systems depend on one another to keep the body functioning? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	A.2. Establishing the Purpose of the Lesson	
	Option 1: "One System Stops", Action	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Form a small group to act out short scenes showing what might happen if one body system suddenly stops working for 30–60 seconds.	The activity targets Learning Objectives 1, 2, 3, and 4 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.

	Activity Proper: Students form a small group to act out short scenes showing what might happen if one body system suddenly stops working for 30-60 seconds. Each group is assigned a system—skeletal, muscular, respiratory, or circulatory. The teacher encourages exaggerated but clear movements to highlight the impact. Process Questions: **Guide Questions:** 1. What real-life situations might look like this? 2. Why is it important for body systems to work together? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Option 2: Answer Garden "How Does One Body Part Affect the Whole?"	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Answer the guiding questions in complete sentences, discuss the responses with peers, and support the final answer with an accurate example or scientific evidence.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

	Activity Proper: The teacher explains that learners will use a digital tool called AnswerGarden to share their ideas anonymously. Each learner accesses the link using a phone, tablet, or computer and enters a brief response consisting of a few words or a phrase. The teacher then highlights key ideas from the word cloud, clarifies misconceptions, and connects learners' ideas to the lesson. **Guide Question:** To begin the lesson, the teacher introduces a simple, thought-provoking question to the class: "Let's think about how our body works as a system. Imagine one organ or body part like your heart, lungs, or bones stops working. What do you think happens to the rest of the body?" **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Option 1: Visual Inquiry Briefing	
	Materials/Resources Needed: • Displayed images or teacher-prepared visual prompts • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, and 3 by guiding learners to extract scientific information from visual media and connect it to the lesson concepts. It applies the Constructivist, Inquiry-Based, and Interactive approaches

	Directions: Examine the image or visual carefully. Record the relevant observations, distinguish observation from inference, and answer the guide questions using scientific evidence. **Activity Proper:** The teacher facilitates a Visual Inquiry Briefing to guide learners in analyzing the interconnectedness of human body systems and how two systems interact to perform a function. 1. Engage (Hook) Show the Amoeba Sisters video (overview of 11 systems). Ask students to explain why major organ systems are interdependent rather than ranking one as universally most vital. 2. Explore (Visual Inquiry) Play the Peekaboo Kidz video to highlight how organs and systems "team up." Pause at key moments to ask: 3. Explain (Guided Analysis) Use the Learn Easy Science video to reinforce foundational knowledge of each system's role. Facilitate a Visual Inquiry Briefing: Display a diagram of the human body with systems labeled. Guide students to trace how oxygen moves from the respiratory system into the circulatory system. Compare with another example: movement requiring skeletal and muscular systems.	because learners observe closely, answer guiding questions, and discuss evidence from the media. The pedagogical strategy used is guided multimedia analysis, supported by a viewing guide, pause points, peer discussion, and teacher questioning. Literacy is integrated through identifying key ideas, evaluating statements, and summarizing evidence from the media. Numeracy is integrated through interpreting any scales, time series, quantities, or comparisons shown. EdTech is integrated through a cited video, animation, or presentation when available, together with an accessible offline alternative. **Note to Teachers:** Preview the media for scientific accuracy and accessibility. Clarify that a video or animation is not an interactive simulation unless learners can manipulate variables.

	Amoeba Sisters. (2017, May 28). Human body systems functions overview: The 11 systems. YouTube. This video provides a concise and engaging overview of the human body systems, with a segment that emphasizes how they work together. This video is great for showing how body systems “team up” to perform essential functions. This video offers a clear and accessible breakdown of each organ system’s role, perfect for reinforcing foundational knowledge before diving into system interactions and damage effects. Process Questions: **Guide Questions:** 1. Begin with a prompting question: “What would happen if one system stopped working properly?” 2. Which two systems are cooperating here? 3. What function are they performing together? 4. https://www.youtube.com/watch?v=gEUu-A2wfSE 5. Peekaboo Kidz. (2020, October 14). How your organs work together to keep you alive: A deep dive. YouTube. https://www.youtube.com/watch?v=c4ZxPG_WxOA 6. Learn Easy Science. (2021, May 7). 12 Organ Systems | Roles & functions | Easy science lesson [Video]. YouTube. https://www.youtube.com/watch?v=cQIU0yJ8RBg 7. How does each system contribute to keeping the body alive and functioning? 8. Why is it important for body systems to work together?	

	9. Can you think of another example where two systems must cooperate to perform a function? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Interactive Concept Briefing	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Study the presented system-interdependence examples, answer each process question, and explain how a change in one organ or system affects the function of the connected systems. **Activity Proper:** To deepen students' understanding of system interdependence, the teacher facilitates an Interactive Concept Briefing using a slide presentation and guided process questions. Process Questions: **Guide Questions:** 1. How does each system contribute to keeping the body alive and functioning?	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative.

	2. If one system speeds up (e.g., heart rate increases), what might happen to the others? 3. Which system do you think is most vulnerable to affecting others when damaged? Why? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	**Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.
	B.2. Discussing New Concept	
	Option 1: Case-Based Concept Mapping	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown. **Activity Proper:** Before beginning the activity, the teacher gathers the class and projects an image. A young woman standing on a city sidewalk, clutching her chest and gasping for air, her inhaler raised shakily to her mouth as she struggles through an asthma attack.	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through

	 Torn ACL  Asthma attack The teacher asks learners to work in pairs on a concept map centered on either a torn ACL or an asthma attack. Learners trace how the condition affects the relevant skeletal, muscular, respiratory, and circulatory components and explain the limits of compensation. **Process Question:** Health and safety clarification: Oxygenation may remain adequate in a mild asthma attack and may decline during a severe attack. Follow the person's asthma action plan, use prescribed quick-relief medicine as directed, and seek emergency help for severe or non-improving symptoms. Not every inhaler is a bronchodilator. Health clarification: The ACL is a ligament within the musculoskeletal system. Management is individualized: some isolated tears are managed non-operatively, while surgery may be considered according to instability, associated injuries, activity, age, and clinical advice. Safety requirement: Use person-centered first-aid actions. Do not require breath-holding, forced rapid breathing, or simulation of respiratory distress.	presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	Guide Questions: 1. A basketball player collapsing mid-game, clutching their knee. Rather than simply describing a torn anterior cruciate ligament (ACL), the teacher frames a deeper question: How does one injury affect the entire body? 2. What changes occur in the muscular system when the ACL is damaged? 3. How do muscles compensate for the loss of ligament support? 4. How does reduced oxygen availability affect the heart and blood vessels? 5. What symptoms indicate that the respiratory and circulatory systems are under stress during an asthma attack? 6. What does this case reveal about the interdependence of body systems? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: Cause-and-Effect Chain Building Activity	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective

	Directions: Create or complete the required organizer or diagram, label all relevant parts or stages, show the relationships accurately, and add a brief evidence-based explanation. **Activity Proper:** The class is divided into small groups, each assigned one of two real-life cases: a torn ACL or an asthma attack. Each group receives a strip of blank cards or sticky notes and is instructed to build a cause-and-effect chain or a domino chain of effects that visually represents the sequence of events triggered by the injury or attack. The first card identifies the initial event (e.g., "ACL tear during sudden pivot" or "Airways constrict during asthma attack"), and each subsequent card describes a consequence or system response. Here's a clear cause-and-effect chain guide for your Visual Inquiry Briefing activity. Asthma Attack Cause-and-Effect Chain Airways constrict during asthma attack. Airflow through narrowed airways is reduced. Blood oxygen may decrease during a severe asthma attack but can remain adequate during a mild attack. Blood carries less oxygen, leading to fatigue. Difficulty breathing, dizziness, reduced stamina.	approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	A prescribed quick-relief bronchodilator can relax airway smooth muscle and improve airflow. Other inhalers have different purposes and do not provide immediate relief. Respiratory and circulatory systems re-balance oxygen delivery to maintain homeostasis Torn ACL Cause-and-Effect Chain ACL tear during sudden pivot. Knee joint becomes unstable. Surrounding muscles strain to stabilize movement. Loss of coordination, difficulty walking or running. Swelling and pain limit mobility. If untreated, chronic instability, arthritis, or reduced athletic ability. **Process Questions:** Health and safety clarification: Oxygenation may remain adequate in a mild asthma attack and may decline during a severe attack. Follow the person's asthma action plan, use prescribed quick-relief medicine as directed, and seek emergency help for severe or non-improving symptoms. Not every inhaler is a bronchodilator. Health clarification: The ACL is a ligament within the musculoskeletal system. Management is individualized: some isolated tears are managed non-operatively, while surgery may be considered according to instability, associated injuries, activity, age, and clinical advice.	

	Safety requirement: Use person-centered first-aid actions. Do not require breath-holding, forced rapid breathing, or simulation of respiratory distress. **Guide Questions:** 1. What are the short-term effects on movement and coordination? 2. What long-term consequences might arise if the injury is not properly treated? 3. What role does medication (e.g., inhaler) play in restoring system function? 4. How do the respiratory and circulatory systems coordinate to maintain homeostasis? **Expected Output/Product:** Completed table or organizer containing the required information and scientifically accurate explanations. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	B.3. Developing Mastery	
	Option 1: System Under Stress: Expert Panel Simulation	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to

	Directions: Prepare the assigned expert-system role, analyze the case evidence, present the system's response and interactions, answer questions from the panel, and write a supported group conclusion. **Activity Proper:** Students take on the roles of medical interns presenting to a panel of healthcare professionals. Their task is to explain how a specific injury or condition disrupts body system coordination and affects the organism's overall function. They will be a given 3-5minute presentation and answer one follow-up question from the class. 🦴 Case 1: Torn ACL (Anterior Cruciate Ligament) Injury/Condition ACL tear during sudden pivot in sports. Systems involved: skeletal and muscular systems. Disruption: Instability of the knee joint and impaired movement coordination. Presentation Flow (3–5 minutes) Introduction: Review the torn-ACL and asthma cases, the body systems involved, and the safety reminder that classroom analysis does not replace medical advice. Cause-and-Effect Chain: ACL tear → knee instability → muscles strain to compensate → pain/swelling → reduced mobility. System Interaction: Skeletal provides structure; muscular enables movement. Injury disrupts both.	the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

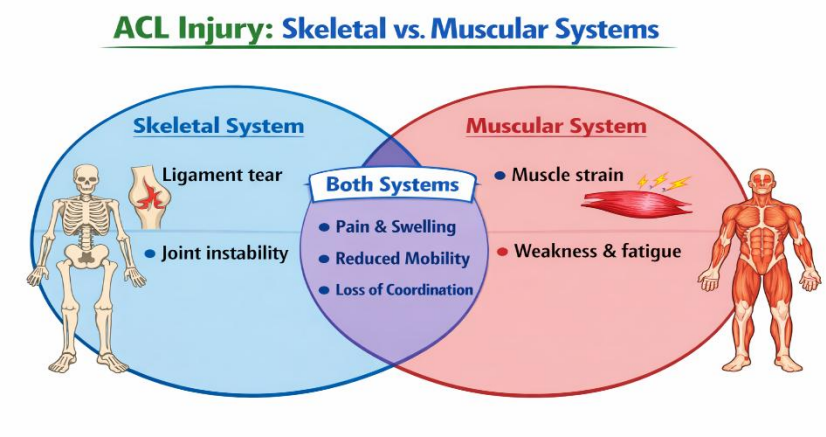
	Implications are short-term loss of coordination; long-term risk of arthritis if untreated. Treatment Note should be Rehabilitation and surgery restore system coordination. (Process Questions) Answer Key: Short-term effects: Pain, swelling, difficulty walking/running. Long-term consequences: Chronic instability, arthritis, reduced athletic ability. Medication role: Pain relief and anti-inflammatory drugs help, but management is individualized. Rehabilitation is central to recovery, while surgery is appropriate for some injuries based on instability, associated damage, activity goals, and clinical advice. System coordination: Skeletal and muscular systems must cooperate for stable movement. Health clarification: The ACL is a ligament within the musculoskeletal system. Management is individualized: some isolated tears are managed non-operatively, while surgery may be considered according to instability, associated injuries, activity, age, and clinical advice. **Guide Questions:** 1. Can you provide another example where two systems must cooperate to perform a function? 2. What preventive strategies could reduce the risk of this condition or injury?	

<table>
<tr><td></td><td>3. How does disruption in one system affect the organism's overall function?

Expected Output/Product:
Oral or group presentation supported by accurate scientific explanations and relevant evidence.</td><td></td></tr>
<tr><td>Instituting New Knowledge</td><td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>Accurate and complete; no misconceptions.</td><td>Mostly accurate; minor gaps.</td><td>Partly accurate; important gaps remain.</td><td>Limited or inaccurate understanding.</td></tr>
<tr><td>Completeness</td><td>All required elements are present and fully developed.</td><td>Most required elements are present.</td><td>Some required elements are incomplete.</td><td>Many required elements are missing.</td></tr>
<tr><td>Application/ Evidence</td><td>Uses relevant evidence and applies the concept effectively.</td><td>Uses appropriate evidence with minor limitations.</td><td>Evidence or application is limited.</td><td>Little or no relevant evidence/ application.</td></tr>
<tr><td>Clarity</td><td>Response/output is clear, logical, and easy to follow.</td><td>Generally clear and organized.</td><td>Some parts are unclear or disorganized.</td><td>Unclear or difficult to follow.</td></tr>
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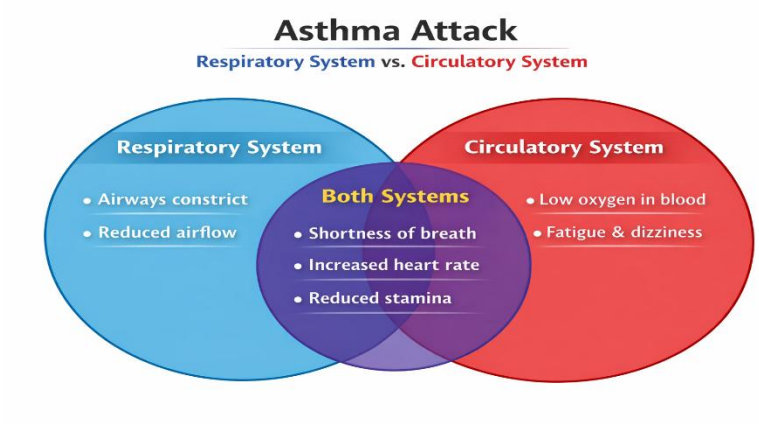
	Option 2: Body Systems: Compare, Connect, Reflect	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Complete separate Venn diagrams for asthma and a torn ACL, compare the interacting organ systems in each case, and explain how damage in one part affects the whole-system response. **Activity Proper:** The teacher asks learners to create two separate Venn diagrams: one for asthma, comparing the events in the respiratory and circulatory systems, and another for an ACL injury, comparing the skeletal and muscular systems. Learners use a Venn diagram to compare a torn ACL and an asthma attack. They identify features unique to each condition, shared system-level effects, and relevant interactions, then write a 5–7-sentence evidence-based reflection.	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

Part A: Venn Diagram—Torn ACL (Anterior Cruciate



Ligament) Case

Part B: Venn Diagram – Asthma Attack Case



Process Questions:

Health and safety clarification: Oxygenation may remain adequate in a mild asthma attack and may decline during a severe attack. Follow the person's asthma action plan, use

	prescribed quick-relief medicine as directed, and seek emergency help for severe or non-improving symptoms. Not every inhaler is a bronchodilator. Safety requirement: Use person-centered first-aid actions. Do not require breath-holding, forced rapid breathing, or simulation of respiratory distress. **Guide Questions:** 1. What are the key differences between the torn ACL and asthma attack in terms of the body systems affected? 2. Which effects are unique to each case, and which are shared across both? 3. Why is it important to understand how body systems work together? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Option 1: System Snapshot: What's affected?	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, 3, and 4 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior

	Directions: Examine each provided case, scenario, image, or sample. Identify the relevant evidence, answer every guide question, and explain the conclusion using the lesson concepts. **Activity Proper:** Process Questions: **Guide Questions:** 1. The teacher introduces "System Snapshot: What's Affected?" Learners analyze either a torn ACL or an asthma attack, identify the affected systems, trace the effects across those systems, and create a simple visual or written explanation. 2. Which system is trying to compensate for the damage? 3. What symptoms would you expect to see in this case? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Option 2: Which System Needs Help First?	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, 3, and 4 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior

	Directions: Analyze short fictional medical scenarios, identify the body system that requires immediate attention, and justify the priority using evidence. Then, follow the stated emergency-action or medical-safety guidance rather than improvise treatment. **Activity Proper:** Learners analyze short fictional medical scenarios, identify the body system that requires immediate attention, and justify the priority using evidence. They must follow the stated emergency-action or medical-safety guidance rather than improvise treatment. Sample Scenarios: 1: Torn ACL during a basketball game. The athlete collapses and cannot stand. Answer Key & Explanation Priority: Skeletal system stabilization Explanation: The ACL is a ligament that connects bones within the knee joint. A tear destabilizes the skeletal framework, making movement unsafe. Immediate intervention should focus on immobilizing the joint to prevent further damage. Once the skeletal structure is stabilized, the muscular system can be supported through therapy and strengthening exercises.	experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	This sequence ensures proper alignment and recovery of both systems. 2: Asthma attack during a school event. The student is wheezing and clutching their chest. Answer Key & Explanation Priority: Restoring airflow Explanation: The respiratory system is directly compromised; constricted airways limit oxygen intake. Without adequate oxygen, the circulatory system cannot deliver oxygen to tissues, causing the heart to overwork. The first step is to open the airways using medication (e.g., inhaler) or emergency breathing support. As breathing improves, heart rate may move toward baseline, but anxiety, illness, and some bronchodilators can keep it elevated temporarily. Prioritizing respiration ensures both systems regain balance and maintain homeostasis. **Guide Questions:** 1. Should the focus be on stabilizing the skeletal system or supporting the muscular system first? 2. Should the priority be restoring airflow or calming the heart rate? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	

	C.2. Making Generalization	
	Option 1: Connecting the Dots	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Create or complete the required organizer or diagram, label all relevant parts or stages, show the relationships accurately, and add a brief evidence-based explanation. **Activity Proper:** The teacher facilitates a sticky-note reflection. Learners record three evidence-based takeaways about how body systems interact, respond to injury or disease, and compensate within limits in a torn ACL or asthma attack. Each student posts their notes on the board. As a class, they then group similar ideas to identify patterns and shared insights. With guidance from the teacher, students work together to craft a summary statement that captures the essential principle of the lesson. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson?	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: One Big Idea-System Coordination	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences. **Activity Proper:** Complete the task according to the directions and record the required observations, responses, or explanations. **Guide Question:** Each student is asked to distill everything they've learned into a single generalization statement that answers the question: "What is the most important thing I learned about how damage to one part of a body system affects the whole organism?" The statements are shared aloud, posted on the board, or collected as exit tickets to assess conceptual mastery.	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Assessment Criteria: • Accuracy of responses • Completeness of required answers	
	C.3. Evaluating Learning	
	Option 1: Modified True or False:	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** The teacher will instruct learners to write "TRUE" if the statement is correct. If the statement is incorrect, write "FALSE" and modify the statement to make it accurate. The skeletal system only provides structure and does not interact with other systems. Muscles can function properly without the support of bones. A torn ACL affects only the skeletal system and has no impact on other systems. During an asthma attack, the respiratory system is the only system affected.	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	System coordination allows the body to respond to damage and maintain function. **Guide Questions:** 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	
	Option 2: Link and Think	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Match each item in Column A with the correct description in Column B. After matching, choose two pairs and write a short explanation of how they show system coordination or damage impact. **Activity Proper:** Students match each item in Column A with the correct description in Column B. After matching, they will choose two pairs and write a short explanation of how they show system coordination or damage impact.	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the

	<table><tr><th>Column A (Condition) Structure)</th><th>Column B (System Impact or Function)</th></tr><tr><td>1. Torn ACL</td><td>A. Muscles compensate for joint instability</td></tr><tr><td>2. Asthma Attack</td><td>B. Reduced oxygen forces heart to work harder</td></tr><tr><td>3. Skeletal System</td><td>C. Provides structure and attachment for movement</td></tr><tr><td>4. Respiratory System</td><td>D. Delivers oxygen and removes carbon dioxide</td></tr><tr><td>5. System Coordination</td><td>E. Body systems interact to maintain overall function</td></tr></table> **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.
	C.4. Additional Activities	
	Option 1: Infographic Insights on System Coordination:	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available)	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to

	• Computer, tablet, or other available digital device (optional) **Directions:** Study the graph, chart, or data set carefully. Identify the relevant patterns or trends, support each interpretation with specific evidence from the data, and answer the guide questions. **Activity Proper:** Learners create an infographic showing how a torn ACL or an asthma attack affects interacting body systems. The infographic must distinguish the condition's direct effects, secondary system responses, limits of compensation, and evidence-based management or safety guidance. Instruction to students: 1. Choose a case from: Option A: Torn ACL (skeletal–muscular interaction) Option B: Asthma Attack (respiratory–circulatory interaction) 2. Research system roles Identify how each system contributes to normal body function. Explain how the injury or condition disrupts these functions. 3. Plan infographic layout Use clear sections or panels for each system. Include arrows or flow lines to show cause-and-effect relationships.	the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

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Add short, simple captions—avoid jargon.
4. Select visuals
Use labeled diagrams, icons, or simplified illustrations.
Highlight affected areas (e.g., knee joint or lungs).
Choose colors that help viewers distinguish systems easily.
5. Write concise explanations
Describe how the systems interact during injury or recovery.
Use 1–2 sentences per system, written in accessible language.

Guide Questions:
1. What pattern, trend, or relationship is shown by the data?
2. What specific evidence from the data supports your interpretation?

Expected Output/Product:
Completed infographic with accurate scientific content, clear visual organization, and a brief explanation or presentation.
</td>
<td></td>
</tr>
<tr>
<td>Demonstrating Knowledge and Skills</td>
<td colspan="2">
Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>All scientific ideas are accurate, complete, and well explained.</td><td>Scientific ideas are mostly accurate with minor gaps.</td><td>Some correct ideas are present, but important errors or omissions remain.</td><td>Scientific content is largely inaccurate or incomplete.</td></tr>
</table>
</td>
</tr>
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	Required Content and Evidence	Includes all required elements and supports the message with relevant evidence/examples.	Includes most required elements and appropriate supporting evidence.	Includes some required elements; evidence is limited or weakly connected.	Many required elements are missing; little supporting evidence is provided.
	Communication and Organization	Message is exceptionally clear, logical, and appropriate for the audience.	Message is clear and generally well organized.	Message is partly clear but organization is uneven.	Message is unclear, disorganized, or difficult to follow.
	Presentation/ Design Quality	Presentation or design strongly supports understanding and is purposeful and polished.	Presentation or design supports understanding with minor weaknesses.	Presentation or design only partly supports understanding.	Presentation or design does not support understanding.

Option 2: Reflection Essay:

Materials/Resources Needed:
- Notebook or paper
- Pen or pencil

Directions:
Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation.

The activity targets Learning Objectives 1, 2, and 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product.
The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback.

	Activity Proper: Each student will write a short reflection essay (300–500 words) summarizing what they have learned about how the human body responds when one part of a system is damaged. The essay should be written in the third person and include: A general summary of the concept of system coordination—how body systems work together to maintain function and respond to injury or stress. Specific examples from the lesson, such as the torn ACL and asthma attack, to illustrate how damage in one system affects others. An explanation of why system coordination is essential for survival and recovery. Optional extension: A real-world connection, such as how athletes or individuals with chronic conditions experience system-level responses. **Guide Questions:** 1. What is the most important scientific idea you developed from the activity? 2. What example or evidence best supports your explanation? **Expected Output/Product:** Completed written essay that addresses the prompt using accurate scientific concepts and relevant evidence.	Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Rubric:

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Contains major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little relevant evidence or provides unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				____ / **15**

V. ASSESSMENT
(Assessing Learnings)

The teacher instructed learners to read each question carefully and select the best answer based on what they have learned.
Directions. Read each item carefully and write the letter of the correct answer in a separate sheet of paper.

1. Which body systems are directly affected by a torn ACL injury?
   A. Respiratory and circulatory systems
   B. Digestive and nervous systems
   C. Integumentary and endocrine systems
   D. Skeletal and muscular systems

	2. During an asthma attack, which two body systems work together to manage oxygen delivery? A. Endocrine and integumentary systems B. Respiratory and circulatory systems C. Digestive and urinary systems D. Muscular and skeletal systems 3. Why does anterior cruciate ligament affect both skeletal and muscular systems? A. Because it controls digestion B. It is located in the brain and affects nerves C. Because it is a part of the respiratory system D. It connects the femur and tibia, stabilizes the knee, and its injury changes movement and muscle use. 4. How do the respiratory and circulatory systems work together during an asthma attack? A. The respiratory system stops working and the circulatory system shuts down B. The respiratory system produces hormones and the circulatory system removes them C. The respiratory system increases digestion while the circulatory system slows down D. Narrowed airways reduce ventilation; the circulatory system transports the oxygen that reaches the blood, and heart rate may rise as part of the stress response. 5. What does system coordination mean in the context of body response to injury? A. Only the brain controls all body responses B. Multiple systems interact and adjust to maintain body function C. Systems ignore damage and continue functioning normally D. Each system works independently without affecting others 6. How may other body systems compensate when one system is damaged, and what limits that compensation? A. Other systems adjust and support the damaged system to maintain function B. The body stops functioning entirely C. The damaged system shuts down completely D. Other systems ignore the damage

	7. Why does the muscular system become involved when the skeletal system is injured, such as in a torn ACL? A. Because muscles are part of the digestive system B. Because muscles produce hormones to heal bones C. Because muscles help stabilize and support movement when joints are damaged D. Because muscles control breathing and heart rate 8. How does the circulatory system respond during an asthma attack? A. It slows down to conserve energy B. Heart rate may increase during an attack, but this does not correct the narrowed airways; severe breathing difficulty requires the person's prescribed action plan and urgent adult or medical help C. It produces mucus to clear airways D. It permanently stops pumping blood 9. Which scenario best demonstrates effective system coordination in response to injury? A. A person with a torn ACL continues walking without any muscular adjustment B. The digestive system increases activity during a respiratory emergency C. During an asthma attack, the respiratory system fails while other systems remain unaffected D. After a torn ACL, muscular system adjusts movement to stabilize the knee while the nervous system signals pain 10. What does ACL stand for in the human body? A. Abdominal Cartilage Layer B. Automatic Control Ligament C. Anterior Cruciate Ligament D. Arterial Circulation Line **Answer key:** D, B, D, D, B, A, C, B, D, C **Assessment specification:** Provide the infographic rubric and answer key. Revise items so that physiological compensation is conditional rather than universal, and claim numeracy only when learners interpret genuine quantitative information.

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little evidence or gives unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				____ / **15**

VI. REFLECTION *(Feedback and Continuous Improvement)*

Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery.

1. How many learners successfully demonstrated the learning objectives based on the assessment results?
2. Which activity helped learners understand the lesson the most? Which activity helped the least?
3. Which part of the lesson was easiest for learners? Which part was most difficult?
4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support?

	5. What did the assessment results show about learners' understanding of the lesson? 6. What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author used ChatGPT to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

Learning Title/Topic:	Organ Systems Working Together – Nervous and Endocrine Regulation of Body Temperature	Lesson Exemplar:	13

I. OBJECTIVES	
A. Content Standard	Organ systems work together to carry out essential functions of an organism;
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	Key Topics Learned in the Previous Grade Level In this topic, the learners are assumed to have prior knowledge of the following topics: - Overview of the Nervous System and Endocrine System - Integration of Nervous and Endocrine Systems - Homeostasis and feedback mechanisms
	Explain how the nervous and endocrine systems work together to regulate body temperature in response to stimuli;
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	Khan Academy. "Temperature Regulation Strategies." Accessed October 18, 2025. https://www.khanacademy.org/science/biology/principles-of-physiology/metabolism-and-thermoregulation/a/animal-temperature-regulation-strategies. Open Textbooks for Hong Kong. "Thermoregulation." Last modified April 6, 2016. https://www.opentextbooks.org.hk/ditatopic/35173.

	Cherry, Kendra. "Nervous and Endocrine Systems: How They Interact and Impact Behavior." Verywell Mind. Last updated November 28, 2023. https://www.verywellmind.com/the-nervous-and-endocrine-systems-2794894. YouTube. "Student Athletes Susceptible to Heat Exhaustion and Heat Stroke." Video, 2:30. Posted by WXYZ-TV Detroit, August 1, 2023. https://www.youtube.com/watch?v=DEdt6KGSJ4g. Homework Clinic. "The Hypothalamus: The Body's Thermostat (Human Thermostat)." YouTube video, 3:45. Posted March 15, 2022. https://www.youtube.com/watch?v=ac_8bjEZaVE. Longman, Jeré. "Athletes Suffer as Heat Rises." New York Times, May 5, 2012. https://www.nytimes.com/2012/05/05/sports/05iht-athlete05.html. Choi, Charles Q. "Why Do We Shiver When We're Cold?" Live Science. Last updated July 22, 2022. https://www.livescience.com/32475-why-do-we-shiver-when-cold.html. Goldstein, David S. "Adrenal Responses to Stress." Journal of Clinical Investigation 130, no. 2 (2020): 559–561. https://doi.org/10.1172/JCI135006. ● Flow charts, scripts, and visual aids ● Online quiz tools (Kahoot, Quizizz, Google Forms, or any available online quiz platform) ● Slide Decks or any Interactive digital notebooks, PhET ● Biology textbook, curriculum guide, teacher's guide
III. CONTENT *(Sequencing Content)*	Organ Systems Working Together – Nervous and Endocrine Regulation of Body Temperature
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	1. Describe the role of the hypothalamus in detecting temperature changes and coordinating responses between the nervous and endocrine systems. 2. Explain how the nervous system initiates immediate thermoregulatory actions such as sweating and shivering in response to heat and cold stimuli. 3. Identify key endocrine glands (e.g., thyroid gland) and their hormonal contributions to long-term temperature regulation. 4. Analyze a real-life scenario to trace how both systems interact to maintain homeostasis during temperature fluctuation.

<table>
<tr><th colspan="2">IV. PROCEDURES</th><th>ANNOTATIONS</th></tr>
<tr><td rowspan="3">A. Activating Prior Knowledge</td><td colspan="2">A.1. Activating Prior Knowledge</td></tr>
<tr><td colspan="2">Option 1: Picture-based Prompt</td></tr>
<tr><td>Materials/Resources Needed:
• Displayed images or teacher-prepared visual prompts
• Notebook or paper
• Pen or pencil

Directions:
Examine the image or visual carefully. Record the relevant observations, distinguish observation from inference, and answer the guide questions using scientific evidence.

Activity Proper:
Materials: Contrasting images (sweating vs. shivering), board/chart for recording hypotheses.
Show a contrasting image: a sweating athlete, a shivering mountaineer.
Students describe what they think is happening inside the body.



- The teacher records student ideas on the board to compare with actual thermoregulation processes later.</td><td>The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.
The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.</td></tr>
</table>

	Science clarification: Organize thermoregulation as sensing → hypothalamic integration → neural or autonomic, motor, and behavioral effectors. Include peripheral skin thermoreceptors and central thermoreceptors that monitor core temperature. Acute responses are primarily neural and behavioral; add endocrine effects only when justified by the time scale. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Expected Output/Product:** A two-column table: observed body response and possible internal body process. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Mini Quiz Game	
	Materials/Resources Needed: • Quiz cards with prepared statements or an educational technology tool such as Wayground or Kahoot • Red/green cards for student responses • Notebook or paper for recording responses	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior

	Directions: Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** Learners engage in a True/False quiz using Wayground or Kahoot (if the digital tools are not available, use cards instead). The teacher posts/reads the 10 prepared statements, and students respond using the digital tool or with red (False) or green (True) cards if the digital tool is not available. After revealing the answer key, learners must correct any false statements (e.g., "The endocrine system regulates sweating" → corrected to "The nervous system regulates sweating") and explain at least two answers to demonstrate understanding. Immediate teacher feedback reinforces accuracy. Here are some sample questions: The nervous system uses electrical signals to transmit messages throughout the body. The nervous system releases hormones to control bodily processes. The brain region known as the hypothalamus aids in controlling body temperature. The endocrine system regulates the response of sweating. Compared to the nervous system, the endocrine system reacts to stimuli more quickly.	learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Cold stress can increase catecholamine release and metabolic heat production, but adrenaline is not the primary controller of ordinary body-temperature regulation. When it's too hot, shivering helps the body cool down. The thyroid gland aids in controlling body temperature and metabolism. The endocrine and nervous systems do not interact with each other, and they function independently. Goosebumps are a response to cold controlled by the nervous system Answer Key: T-F-T-F-F-T-F-T-F-T Students raise a red card for False, green card for True. The teacher provides immediate feedback on the learners' responses. Science clarification: Organize thermoregulation as sensing → hypothalamic integration → neural or autonomic, motor, and behavioral effectors. Include peripheral skin thermoreceptors and central thermoreceptors that monitor core temperature. Acute responses are primarily neural and behavioral; add endocrine effects only when justified by the time scale. Safety requirement: Use official heat- and cold-safety guidance. Do not apply universal thresholds without	

	considering humidity, exertion, clothing, age, and health status. **Guide Questions:** 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Body System Simulation (Inside the Thermostat)	
	Materials/Resources Needed: • Role cards (hypothalamus, sensory neurons, motor neurons, sweat glands, muscles, endocrine glands) • Scenario cards (e.g., heatwave, icy wind) • Whiteboard and whiteboard marker for diagramming • Computer, tablet, or other available digital device, if needed **Directions:** Run or examine the specified simulation, change only the assigned variable or condition, record the results, and explain the observed pattern using the lesson concept. Use the printed alternative when digital access is unavailable.	The activity targets Learning Objectives 1, 2, and 3 by engaging learners in modeling interactions among components and explaining how the represented system works. It applies the Constructivist, Collaborative, and Interactive approaches because learners take roles, negotiate meaning with peers, and connect the model to scientific explanations. The pedagogical strategy used is guided simulation or role-play, supported by assigned roles, observation prompts, debriefing, and teacher questioning. Literacy is integrated by using scientific terms in oral explanations and written debriefing responses. Numeracy is integrated through tracking sequences, quantities, or response patterns when these are part

	Activity Proper: This activity uses a role-based simulation to help students visualize and embody the internal coordination between the nervous and endocrine systems during thermoregulation. Students are assigned specific roles and act out the sequence of biological responses to a temperature stimulus. The teacher facilitates the simulation and leads a debriefing session to reinforce the specific concepts. Assign each student a role from the thermoregulation system. Present a temperature scenario (e.g., sudden heatwave or icy wind) Students act out the biological response: The sensory neurons detect the stimulus and send signals to the hypothalamus. The hypothalamus interprets the signal and decides the appropriate response. The motor neurons activate the sweat glands or muscles. Hormonal pathways can contribute to slower or longer-term metabolic adjustments; acute sweating, skin vasodilation, vasoconstriction, and shivering are controlled mainly through neural pathways. Debrief with a class discussion and diagram linking each role to its biological function.	of the model. EdTech is integrated through an animation or digital model when available, with an equivalent physical model. **Note to Teachers:** State the limits of the model and correct any analogy that learners may interpret literally. Debrief the activity using evidence-based questions.

	Thermoregulation Response Flow Diagram [Environmental Stimulus] ↓ (Heatwave or Icy Wind) ↓ [Sensory Neurons] → Detect temperature change → Send signal to hypothalamus ↓ [Hypothalamus] → Interprets signal → Decides appropriate response ↓ ┌──────────────────────────┴──────────────────────────┐ ┐ [Motor Neurons] [Endocrine Glands] [Behavioral Response] → Activate: → Activate acute neural responses; slower hormonal adjustments may contribute → Seek shade, add layers • Sweat glands (heat) (e.g., adrenaline, TSH) • Muscles for shivering (cold) ↓ [Effector Organs] → Sweat glands produce sweat (cooling) → Muscles contract (shivering for warmth) Science clarification: Organize thermoregulation as sensing → hypothalamic integration → neural or autonomic, motor, and behavioral effectors. Include	

	peripheral skin thermoreceptors and central thermoreceptors that monitor core temperature. Acute responses are primarily neural and behavioral; add endocrine effects only when justified by the time scale. Safety requirement: Use official heat- and cold-safety guidance. Do not apply universal thresholds without considering humidity, exertion, clothing, age, and health status. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Thermoregulation: A Comic Strip Creation	
	Materials/Resources Needed: • Paper for creating comic-strip panels • Art materials • Paper, cartolina, or Manila paper • Pen or pencil	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product.

	Directions: Create the specified visual output using accurate scientific information, clear labels or captions, and appropriate examples. Present or submit the output with a brief explanation of its main scientific message. **Activity Proper:** This creative activity allows students to visualize and narrate the thermoregulation process through comic art. By designing a character's experience with heat or cold, students demonstrate their understanding of how the body detects and responds to temperature changes. Students choose a scenario: Scenario 1 – Extreme Heat Scenario 2 – Extreme Cold Learners create a comic strip showing: Detection by the hypothalamus Nervous system response (sweating or shivering) Endocrine contribution only when the scenario and time scale justify it; acute sweating, skin-blood-vessel changes, and shivering are primarily neural Encourage creativity, humor, and specific accuracy. After the activity, let learners display their comic strip and let them explain their panels in class. Sample Comic Strip Panels Template	The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

What to draw or What to put:

Panel	What to draw or What to put:	Sample Caption Prompt
1	Your character is experiencing heat or cold	“It’s so hot/cold today! My body feels strange…”
2	The hypothalamus detects the temperature change	“The hypothalamus senses a change in body temperature!”
3	The nervous system initiates a response	“Time to sweat/shiver! Let’s cool down/warm up!”
4	Conditional endocrine contribution: include a hormone only when the scenario and time scale justify it	“If the scenario involves a justified longer-term endocrine contribution, identify the hormone and explain its role; otherwise, show the neural response only!”
5	Your character is returning to balance	“Phew! I feel normal again. Thanks, body systems!”

Safety requirement: Use official heat- and cold-safety guidance. Do not apply universal thresholds without considering humidity, exertion, clothing, age, and health status.

Guide Questions:

1. What scientific idea is communicated most clearly in your output?
2. How does the evidence, example, or design feature in your output support that scientific idea?

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Contains major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little relevant evidence or provides unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____

	Total Score				____ / **15**
B. Instituting New Knowledge	***B.1. Presenting Examples***				
	Option 1: Thermometer Demonstration				
	Materials/Resources Needed: • 2 clear containers (e.g., beakers or cups) • Hot water and cold water • 2 thermometers (digital or analog) • Whiteboard or chart paper • Markers **Directions:** Follow the teacher-approved procedure and all safety instructions. Make the required observations or measurements, record the results accurately, and explain what the evidence shows about the scientific concept being investigated. **Procedure:** This activity uses a demonstration to help students visualize how the body detects and responds to temperature changes. By observing thermometers placed in hot or cold water, students will draw parallels between external temperature readings and internal sensory detection.			The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity.	

	Present an example: Thermometer demonstration. Fill one container with hot water and the other with cold water. Place a thermometer in each and allow students to observe the readings. Ask students to describe what they see and compare the temperature readings. Connecting to thermoregulation Explain that the thermometers represent sensory receptors in the skin that detect temperature changes. Ask learners to predict how the body would respond to each condition: Hot water → sweating, vasodilation Cold water → shivering, vasoconstriction Role of the hypothalamus Introduce the hypothalamus as the control center. Describe how it receives signals from thermoreceptors and coordinates responses through the nervous system and endocrine system, including immediate responses such as sweating and shivering and hormonal contributions such as thyroid regulation. Reinforce the analogy: • Thermometers = sensory receptors • Hypothalamus = control center • Nervous system = rapid effectors (muscles, sweat glands, blood vessels)	Ask learners to explain the evidence behind each conclusion.

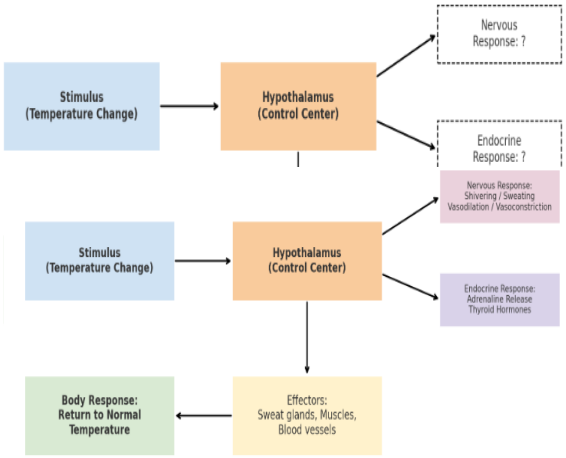
	• Endocrine system = hormonal effectors (thyroid, adrenal glands) Class discussion and diagram Draw a simple flowchart on the board or show it through a slide: Code: Temperature Change → Thermoreceptors → Hypothalamus → Nervous Response + Endocrine Response → Effectors. Use student input to label each part and describe the response. **Guide Questions:** 1. What observations or evidence were most important in interpreting the results? 2. How do the results support or challenge the scientific concept investigated in the activity? **Expected Output/Product:** Recorded observations or data and an evidence-based conclusion based on the activity results. **Assessment Criteria:** • Safe and correct performance of the procedure • Accuracy and completeness of observations or data • Scientific accuracy of the explanation or conclusion	

	Option 2: Video Animation	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed **Directions:** Watch the assigned video or film segment attentively. Record the key scientific ideas or evidence, then answer the guide questions and relate the information to the lesson concept. **Activity Proper:** • This video explains how the hypothalamus acts like the body thermostat, regulating temperature through negative feedback mechanisms. It shows how the hypothalamus detects deviations from the set point and triggers cooling or warming responses to maintain homeostasis. The teacher plays the video showing the segment where the hypothalamus is introduced as the thermostat of the body. The video explains how it compares body temperature to a set point and initiates cooling or warming responses through blood vessels, shivering, and hormonal release. The teacher may strategically pause the video to encourage inquiry when the hypothalamus is shown receiving temperature signals and issuing commands.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

	This is a natural moment to prompt reflection and discussion. Ask learners about the post-guiding questions and encourage students to refer to what they saw (e.g., blood vessel constriction, shivering, hormone release): The teacher must facilitate a brief discussion by letting learners share responses. Reinforce the role of the hypothalamus as both a sensor and regulator, integrating signals and triggering nervous and endocrine responses. To end, the teacher must bridge to the lesson objective with the prompt: "Now that we've seen how the hypothalamus works, let's explore how it coordinates with the nervous and endocrine systems to keep your body in balance." **Guide Questions:** 1. (https://www.youtube.com/watch?v=ac_8bjEZaVE) 2. What signals or responses are initiated by the body to regulate temperature and maintain homeostasis? 3. How do the different signals and responses work together to regulate body temperature, and what might happen if one of these processes fails? **Expected Output/Product:** Completed responses to the guide questions that communicate the required scientific ideas clearly and accurately.	

<table>
<tr><td></td><td>Rubric:
• Scientific accuracy
• Completeness of required content
• Clarity and organization
• Appropriate use of evidence, examples, labels, or visuals</td><td></td></tr>
<tr><td>Instituting New Knowledge</td><td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>All scientific ideas are accurate, complete, and well explained.</td><td>Scientific ideas are mostly accurate with minor gaps.</td><td>Some correct ideas are present, but important errors or omissions remain.</td><td>Scientific content is largely inaccurate or incomplete.</td></tr>
<tr><td>Required Content and Evidence</td><td>Includes all required elements and supports the message with relevant evidence/examples.</td><td>Includes most required elements and appropriate supporting evidence.</td><td>Includes some required elements; evidence is limited or weakly connected.</td><td>Many required elements are missing; little supporting evidence is provided.</td></tr>
<tr><td>Communication and Organization</td><td>Message is exceptionally clear, logical, and appropriate for the audience.</td><td>Message is clear and generally well organized.</td><td>Message is partly clear but organization is uneven.</td><td>Message is unclear, disorganized, or difficult to follow.</td></tr>
<tr><td>Presentation/Design Quality</td><td>Presentation or design strongly supports understanding and is purposeful and polished.</td><td>Presentation or design supports understanding with minor weaknesses.</td><td>Presentation or design only partly supports understanding.</td><td>Presentation or design does not support understanding.</td></tr>
</table></td></tr>
</table>

	B.2. Discussing New Concept	
	Option 1: Diagram Labelling	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available) **Directions:** Construct the required diagram or flowchart, label all essential parts or stages, show the relationships accurately, and add a brief scientific explanation of how the system or process works. **Activity Proper:** • The teacher distributes the partially completed thermoregulation diagram to the learners, illustrating the thermoregulation process (e.g., stimulus → receptor → control center → effector → response). • The teacher guides learners in labeling the key components of the diagram. • To end, the teacher reinforces the flow of information and the feedback loop between the nervous and endocrine systems.	The activity targets Learning Objectives 1 and 2 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Partially completed diagram Completed Diagram  **Guide Question:** The teacher prompts the questions: "Where does the signal go next?" or "What part of the body responds to the signal?" **Expected Output/Product:** Completed labeled diagram or flowchart with accurate relationships and a brief scientific explanation. **Assessment Criteria:** • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	

	Option 2: Storytelling – "A Day in the Life of a Hypothalamus"	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Prepare and present the assigned role-play, story, relay, or monologue so that the sequence and scientific relationships are accurate. Explain the concept represented after presenting. **Activity Proper:** The teacher narrates a lively story where the hypothalamus is portrayed as "the king" of body temperature control, receiving signals from receptors and issuing commands to glands and muscles. learners take on roles such as temperature receptors, hypothalamus, sweat glands, and muscles, acting out the sequence of events when the body gets too hot or too cold. Include simple props or gestures (e.g., fans for sweating, shivering motions) to reinforce the responses. Total Score: **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson?	The activity targets Learning Objectives 1, 2, and 3 by engaging learners in modeling interactions among components and explaining how the represented system works. It applies the Constructivist, Collaborative, and Interactive approaches because learners take roles, negotiate meaning with peers, and connect the model to scientific explanations. The pedagogical strategy used is guided simulation or role-play, supported by assigned roles, observation prompts, debriefing, and teacher questioning. Literacy is integrated by using scientific terms in oral explanations and written debriefing responses. Numeracy is integrated through tracking sequences, quantities, or response patterns when these are part of the model. EdTech is integrated through an animation or digital model when available, with an equivalent physical model. **Note to Teachers:** State the limits of the model and correct any analogy that learners may interpret literally. Debrief the activity using evidence-based questions.

Expected Output/Product:
learners demonstrate the thermoregulation process through roleplay, showing how the nervous and endocrine systems coordinate to maintain balance. Script: English Version Title: A Day in the Life of a Hypothalamus

Rubric:

Criteria	4 – Exemplary	3 – Proficient	2 – Developing	1 – Beginning	Total
Scientific Accuracy	All components of the thermoregulation pathway are correctly represented and clearly explained.	Most components are accurate; minor errors do not hinder understanding.	Some components are correct; key concepts may be missing or unclear.	Major misconceptions or missing steps in the pathway.	____
Role Clarity & Coordination	Each group member clearly embodies their assigned role (e.g., receptor, hypothalamus, effector) and transitions smoothly.	Roles are mostly clear; transitions are generally smooth.	Roles are somewhat unclear; coordination needs improvement.	Roles are confusing or incomplete; group lacks coordination.	____

Communication & Expression	Dialogue is clear, confident, and engaging; scientific terms are used appropriately.	Dialogue is mostly clear; scientific terms are used with some accuracy.	Dialogue is basic; limited use of scientific vocabulary.	Dialogue is unclear or off-topic; minimal scientific language is used.	____
Creativity & Engagement	Skit is imaginative, well-paced, and captures audience's attention.	Skit is organized and moderately engaging.	Skit shows effort but lacks energy or creativity.	Skit is disorganized or lacks engagement.	____
Understanding of System Coordination	Demonstrates strong grasp of how nervous and endocrine systems interact to regulate temperature.	Shows general understanding of system interaction.	Partial understanding; systems may be treated separately.	Limited or no understanding of system coordination.	____
Total Score					**____ / 20**

B.3. Developing Mastery

Option 1: Concept Mastery Game Through Quizizz/Kahoot

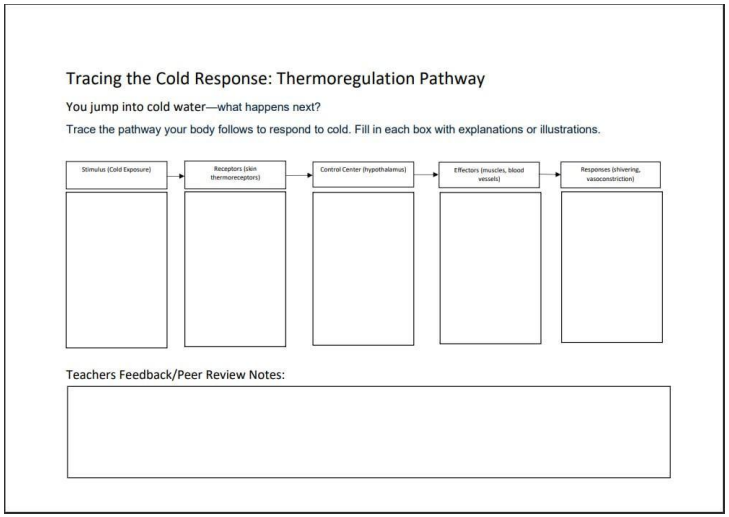
Materials/Resources Needed: • Quizizz/Kahoot platform • Prepared quiz questions • Student devices	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and

	• Note: If digital tools are not available • use printed quiz sheets or oral questioning instead of Quizizz/Kahoot **Directions:** Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** The teacher launches a 10-item interactive quiz using Quizizz or Kahoot, covering concepts such as: Roles of the hypothalamus Differences between nervous and endocrine responses Examples of effectors in heat/cold scenarios Hormonal vs. electrical signaling learners respond in real time using their devices. The teacher should provide immediate feedback after the activity, reinforcing correct answers and addressing misconceptions. Note: The teacher may use the following questions for Quizizz/Kahoot A. To produce hormones B. To act as the body's thermostat C. To regulate blood pressure D. To control digestion Correct answer: B A. Digestive system	Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	B. Circulatory system C. Nervous system D. Endocrine system Correct answer: C A. Nervous system B. Endocrine system C. Respiratory system D. Immune system Correct answer: B A. Hair follicles B. Sweat glands C. Adrenal glands D. Liver Correct answer: B A. Sweating B. Vasodilation C. Shivering D. Increased heart rate Correct answer: C A. It is faster and short-lived B. It is slower and long-lived C. It is slower and short-lived D. It is faster and long-lived Correct answer: A A. Insulin B. Thyroxine C. Melatonin D. Oxytocin Correct answer: B	

	A. Electrical impulses B. Chemical hormones C. Neural signals D. Mechanical signals Correct answer: B A. They work independently B. They are antagonistic C. They work together to maintain homeostasis D. They regulate only voluntary actions Correct answer: C **Guide Questions:** 1. What is the primary role of the hypothalamus in thermoregulation? 2. Which system uses electrical signals for rapid communication? 3. Which system uses hormones to regulate body functions over time? 4. What is an example of an effector in response to heat? 5. Which of the following is an effector response to cold exposure? 6. How does the nervous system differ from the endocrine system in terms of response speed? 7. Which hormone is involved in increasing metabolism and heat production? 8. What type of signal does the endocrine system use? 9. Which of the following best describes the interaction between the nervous and endocrine systems?	

	Assessment Criteria: • Accuracy of responses • Completeness of required answers	
	Option 2: Pathway Worksheet: Tracing the Cold Response	
	Materials/Resources Needed: • Paper or board space for the pathway flowchart • Board/Chart for group synthesis • Cue cards for pathway steps **Directions:** Work with your group to complete the cold-response flowchart. Arrange and label the cold stimulus, skin thermoreceptors, hypothalamus, effectors, and responses such as shivering and vasoconstriction, then explain how the pathway restores body temperature. **Activity Proper:** learners trace the stimulus-response pathway by identifying: Stimulus (cold exposure) Receptors (skin thermoreceptors) Control center (hypothalamus) Effectors (muscles, blood vessels) Responses (shivering, vasoconstriction) Allow learners to work on the organizer to encourage visual organization and systems thinking. The teacher then checks for accuracy and provides feedback or peer review.	The activity targets Learning Objectives 2, 3, and 4 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Sample organizer for the activity  **Guide Question:** The teacher divides the class into groups. Each group receives an organizer with the following scenario: "You jump into cold water. What happens next?" **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Option 1: Scenario Cards – System Response Mapping	
	Materials/Resources Needed: • Scenario cards • Chart paper or digital tools • Markers for flowcharts	The activity targets Learning Objectives 2, 3, and 4 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar

	Directions: Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown. **Activity Proper:** The teacher prepares scenario cards featuring real-life situations such as an athlete finishing a marathon, a child with a fever, an elderly person in cold weather, and a student giving a speech. Divide learners into small groups and distribute one card per group. The teacher instructs the groups to: Identify the stimulus in the scenario. Trace the nervous-system response, such as sweating, vasodilation, vasoconstriction, or shivering. Describe endocrine effects separately and only when the scenario and time scale justify them. Trace the endocrine system response (example: hormone release, effect on the target organ) Guide learners to organize their findings into a flowchart that shows how both systems work together to maintain homeostasis. **Guide Questions:** 1. What evidence in the case or scenario is most relevant to the problem? 2. Which scientific concept best explains the situation, and why?	contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Thermoregulation Model: A Group Challenge Flowchart	
	Materials/Resources Needed: • Paper or board space for the flowchart • Chart paper or whiteboard space • Markers with color coding • Cue cards for guiding questions **Directions:** Construct the required diagram or flowchart, label all essential parts or stages, show the relationships accurately, and add a brief scientific explanation of how the system or process works. **Activity Proper:** The teacher introduces the concept of Thermoregulation and how both systems respond to temperature changes. Assign groups to create a flowchart for either HOT or COLD conditions. Provide guiding questions: What triggers the response (example: the skin receptors) To conclude, encourage the use of color coding or icons to distinguish nervous vs. endocrine actions	The activity targets Learning Objectives 2, 3, and 4 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor

Guide Questions:

1. What role does the hypothalamus play?
2. Are endocrine contributions relevant to this scenario and time scale? If so, identify and justify them.
3. What are the physiological effects?

Expected Output/Product:

Completed labeled diagram or flowchart with accurate relationships and a brief scientific explanation.

source quality, scientific accuracy, and individual participation.

Rubric:

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Contains major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little relevant evidence or provides unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				____ / **15**

	C.2. Making Generalization	
	Option 1: Concept Mapping – Comparing System Roles	
	Materials/Resources Needed: • Chart paper or digital mapping tools • Markers with color coding • Cue cards for guiding prompts **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown. **Activity Proper:** The teacher instructs learners to create their own concept map. Let learners create a visual comparison of the Nervous system and Endocrine system contributions to body regulation. Guide learners to include: Key components (e.g., brain, spinal cord, glands, hormones) Types of stimuli and responses Speed and duration of action Example of coordinated functions (e.g., fight-or-flight response, temperature control) Allow learners to work individually or in pairs, depending on time and class size.	The activity targets Learning Objectives 2, 3, and 4 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

	Guide Questions: 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: Hypothalamus Reflection: An Exit Ticket	
	Materials/Resources Needed: Exit slip papers or notebooks and a prompt list for reflection cues **Directions:** Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** The teacher distributes slips of paper or uses lecture notebooks for a quick written reflection. Learners write one key idea plus one example showing how the nervous and endocrine systems work together during heat or cold exposure (e.g., sweating with vasodilation + thyroid hormone regulation, or shivering with vasoconstriction + adrenaline release).	The activity targets Learning Objectives 1 and 2 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print.

	Encourage concise responses (1–2 sentences) linking stimulus → hypothalamus → nervous + endocrine → effectors. The teacher collects and reviews reflections to check understanding of system interaction. **Guide Question:** Prompt: "The hypothalamus is important because…?" **Expected Output/Product:** Submitted reflections that demonstrate comprehension of hypothalamus coordination, nervous responses, and endocrine contributions in thermoregulation. **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	**Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.
	C.3. Evaluating Learning	
	Option 1: Survival Kit Designing for Extreme Temperatures	
	Materials/Resources Needed: • Manila paper or cartolina (for posters) • Markers • crayons • pens • sticky notes • Printed pictures/magazines (optional for visuals) • Scissors • tape • glue	The activity targets Learning Objectives 3 and 4 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer

	• Optional: digital tools (PowerPoint • Canva • or Google Slides for group presentations **Directions:** Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal. **Activity Proper:** The goal of this activity is to apply learners' understanding of nervous and endocrine system responses by designing a survival kit tailored for either extreme heat or extreme cold, explaining the science behind each item. Present this scenario: Divide the class into small groups (4–6 members). Assign or let each group choose one environment: Scorching HOT (desert) or Extremely COLD (snowy mountain). Each group discusses and lists: Physiological challenges in their chosen environment (e.g., dehydration, heatstroke, frostbite, hypothermia). Body responses through the nervous and endocrine systems (e.g., sweating, vasodilation, shivering, hormone release).	consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	Survival items that can support the body (e.g., water bottles, layered clothing, high-energy food). For each item in the survival kit, groups must explain: Groups prepare a poster, slide deck, or physical mock-up of their survival kit. Facilitate a discussion comparing kits from hot vs. cold environments. Highlight similarities and differences in body responses and survival strategies. Scientific Accuracy: Scientific Accuracy Creativity and Presentation: Creativity and Presentation Team Collaboration: Team Collaboration Explanation of Body Responses: Explanation of Body Responses Application of Concepts: Application of Concepts **Guide Questions:** 1. "Imagine you are preparing a survival kit for someone living in a desert or a snowy mountain. What items would you include to help the body maintain homeostasis?" 2. What body system does it support? 3. What physiological response or safety need does it address (for example, sweating and hydration in heat, or vasoconstriction, shivering, and insulation in cold)? Do not recommend taking hormones or medicines. 4. How does it help maintain homeostasis?	

Rubric:

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little evidence or gives unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				**____ / 15**

Option 2: Case Analysis: "The Malfunctioning Thermostat"

Materials/Resources Needed:
- Case with Miguel's symptoms
- Response sheets for group answers
- Chart paper or digital tools for diagrams
- Markers for flowcharts

The activity targets Learning Objectives 2, 3, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners

	Directions: Read Miguel's case, identify the evidence of impaired thermoregulation, and answer every guide question. Create a flowchart showing how hypothalamic dysfunction may disrupt nervous and endocrine coordination and support the conclusion with case evidence. **Activity Proper:** The goal of this activity is to apply the understanding of nervous and endocrine system integration in thermoregulation by analyzing a case of hypothalamic dysfunction. Present the sample case to learners: Case Title: Miguel's Mystery Symptoms Miguel, a 16-year-old student, has recently been experiencing strange symptoms. Even on hot days, he doesn't sweat and often feels cold. His body shivers uncontrollably, even when others are comfortable. The doctors found that his thyroid hormone levels are usually low, and his adrenal glands aren't releasing adrenaline properly. They suspect a problem with Miguel's hypothalamus. Miguel also reports feeling tired, dizzy, and unable to concentrate. His skin sometimes appears pale, and his heart rate remains unusually low even during physical activity. In pairs or in small groups, analyze the case by answering the following prompts:	analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Explain why these symptoms require evaluation by a qualified health professional; suggest only general safety steps while waiting for adult or medical help, not a diagnosis or treatment. Learners should create a response sheet that includes a short explanation (in paragraph or in bullet form) and a labeled diagram or flowchart showing pathways. Total Score: Case-study safeguard: Present nonspecific warning signs without assigning combined thyroid, adrenal, and hypothalamic diagnoses. Direct the fictional person to qualified medical care. **Guide Questions:** 1. What symptoms suggest a problem with thermoregulation? 2. Which body systems are involved? 3. What is the role of the hypothalamus in this case? 4. How might the nervous and endocrine systems be failing to coordinate? 5. What are the possible consequences for Miguel's homeostasis? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	

	C.4. Additional Activities	
	Option 1: Mini-Research – Climate Change and Thermoregulation	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil • Internet-enabled device, if available **Directions:** Use the provided scholarly source and at least one additional credible source to explain how extreme heat or cold challenges thermoregulation. Summarize the nervous and endocrine responses, give one documented example, propose one appropriate response, and cite all sources. **Activity Proper:** The teacher introduces how climate change affects body temperature regulation. Note: This article (J Clin Invest. 2020;130(2):559–561. https://doi.org/10.1172/JCI135006) can be used as a reference. Guide learners to research using the following prompt questions: Provide sources or let learners search with support. Students write a summary with one real-world example and a suggested solution. Total Score:	The activity targets Learning Objectives 3 and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Guide Questions:

1. In what ways does climate change make it harder for the human body to maintain a stable internal temperature?
2. How do the nervous and endocrine systems respond to these challenges?

Expected Output/Product:

A short, written explanation of how climate change leads to more extreme temperatures and how these conditions challenge the body's ability to regulate temperature.

Rubric:

Criteria	Excellent (3)	Good (2)	Needs Improvement (1)	Total
Scientific Understanding	Clearly explains how climate change affects thermoregulation using accurate scientific terms and concepts.	Explains the topic with mostly accurate science; minor errors or gaps.	Basic explanation with limited scientific depth or clarity.	____
Systems Integration	Effectively describes how both nervous and endocrine systems respond to temperature stress.	Describes both systems with some integration; may lack depth or clarity.	Mentions systems but with minimal connection or detail.	____

Real-World Example	Provides a relevant, well-explained example that illustrates the impact of climate change on human thermoregulation.	The example is relevant but lacks a full explanation or connection to the topic.	The example is vague or loosely connected to thermoregulation.	____
Suggested Solution	Offers a thoughtful, science-based solution to mitigate thermoregulatory challenges.	Suggests a reasonable solution with basic scientific support.	The suggestion is general or lacks scientific justification.	____
Clarity and Organization	Writing is clear, well-organized, and free of major errors; ideas flow logically.	Mostly clear and organized; minor issues with flow or grammar.	Writing is somewhat disorganized or unclear; multiple errors are present.	____
Total Score				____ / **15**

Option 2: Science Journal – Personal Reflection

Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1 and 2 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design

	Directions: Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation. **Activity Proper:** The teacher asks learners to recall a time they felt too hot or too cold. Guide learners to describe what their body did in those conditions (e.g., sweating, shivering) Learners write a short journal entry (5-7 sentences) linking their experiences to body systems. Total Score: **Guide Questions:** 1. What is the most important scientific idea you developed from the activity? 2. What example or evidence best supports your explanation? **Expected Output/Product:** A journal entry that includes a personal experience of learners in too hot or too cold conditions, describing their physical sensations and explaining how their body responds to it. These are enrichment, reinforcement, or remediation activities designed to support diverse learners. These can be extension work, research tasks, or differentiated exercises.	decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	Assessment Criteria: • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
V. ASSESSMENT *(Assessing Learnings)*	**Summative test:** Administer a 10-question test (the type of test varies depending on the teacher who will administer the test) covering all the topics discussed, presented in a traditional paper-and-pencil format, a Google Forms digital quiz, or an interactive online game such as Kahoot or Wayground, formerly Quizizz. Here's the sample test: Topic: Thermoregulation and Neuroendocrine Integration Type: Multiple Choice Directions: Choose the letter of the correct answer. 1. Which part of the brain integrates sensory input and coordinates body responses to maintain temperature balance? A. Cerebellum B. Cerebrum **C. Hypothalamus** D. Medulla oblongata 2. How does adrenaline contribute to survival in cold environments beyond its immediate effects? A. Slows heart rate B. Causes vasodilation C. Stimulates sweating **D. Increases metabolic activity** 3. Which hormone plays a key role in increasing metabolic rate to generate heat, and how does this support homeostasis? A. Cortisol B. Estrogen C. Insulin **D. Thyroid hormone**	

	4. Which of the following is NOT directly involved in executing thermoregulatory responses? A. Blood vessels B. Muscles **C. Pancreas** D. Sweat glands 5. What physiological change occurs during vasodilation, and how does it help regulate body temperature? A. Blood vessels narrow to conserve heat **B. Blood vessels widen to release heat** C. Muscles contract to generate heat D. Hormones are released to cool the body 6. Which response is triggered by the nervous system to increase heat production in cold conditions? A. Increased hunger **B. Shivering** C. Sweating D. Vasodilation 7. How do sweat glands function as effectors in thermoregulation, and what would happen if they failed? **A. By releasing sweat to cool the body** B. By constricting blood vessels C. By releasing hormones D. By producing heat 8. Why is it important to distinguish the roles of the nervous and endocrine systems in thermoregulation? In your answer, explain why ordinary acute responses are primarily neural and when endocrine pathways may contribute. A. It prevents sweating B. It increases digestion C. It stops hormone production **D. It allows fast and long-term responses**

	9. Which system provides rapid responses to temperature changes, and how does this complement hormonal regulation? A. Circulatory system B. Digestive system C. Endocrine system D. Nervous system 10. Which response conserves heat in cold conditions by narrowing skin blood vessels? A. Increased urination B. Sweating C. Vasoconstriction D. Vasodilation ***Scenario-Based Questions:*** ***Scenario 1:*** A farmer works under the midday sun. Trace the pathway from stimulus to response, explaining how the hypothalamus, nervous system, endocrine system, and effectors interact to maintain homeostasis. ***Sample Answer:*** Stimulus: Heat from the sun is detected by skin thermoreceptors → Hypothalamus receives the signal → Nervous system triggers sweating and vasodilation → acute heat-loss responses are primarily neural; thyroid activity does not need to increase and may decrease during heat exposure → Effectors (sweat glands, blood vessels) release heat and cool the body → Homeostasis is maintained. ***Scenario 2:*** A student walks home on a cold evening. Trace the pathway from stimulus to response, showing how both systems coordinate to conserve heat. ***Sample Answer:*** Stimulus: Cold exposure is detected by skin thermoreceptors → Hypothalamus receives the signal → Nervous system triggers shivering and vasoconstriction → during longer or more severe cold exposure, hormonal pathways may contribute to metabolic heat production, with timing and magnitude varying among people → Effectors (muscles, blood vessels) conserve heat and generate warmth → Homeostasis is maintained. **Assessment specification:** State the exact number of scored items, include the answer key and total score, and score item 6 as TRUE because cold stress can increase catecholamine release.

VI. REFLECTION *(Feedback and Continuous Improvement)*	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery. 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? *6.* What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT in order to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

Learning Title/Topic:	Organ Systems Working Together – How Vaccines Support the Immune and Lymphatic Systems	Lesson Exemplar:	14

I. OBJECTIVES	
A. Content Standard	Organ systems work together to carry out essential functions of an organism;
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	Learners demonstrate understanding of the different organ systems of the body, the functions of cells and tissues, common pathogens that cause diseases, and the body's natural defense mechanisms such as physical barriers, white blood cells, and immune responses.
	Explain how vaccines work by relating to the functions of the immune system and lymphatic system in protecting an organism against infectious diseases;
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	***REFERENCES:*** ***A. Books / Textbooks*** • *Campbell, N. A., Urry, L. A., Cain, M. L., Wasserman, S. A., Minorsky, P. V., & Reece, J. B. (2020). Campbell biology (12th ed.). Pearson.* • *Marieb, E. N., & Hoehn, K. (2019). Human anatomy & physiology (11th ed.). Pearson.* • *Tortora, G. J., & Derrickson, B. (2021). Principles of anatomy and physiology (16th ed.). Wiley.* ***B. Scientific and Credible Online References*** • *Centers for Disease Control and Prevention. (2024, August 10). How vaccines work. https://www.cdc.gov/vaccines/basics/explaining-how-vaccines-work.html*

	• *World Health Organization. (2025). Vaccines and immunization. https://www.who.int/* • *National Institutes of Health, National Library of Medicine. (2023). Ozdowski, L., & Gupta, V. Physiology, lymphatic system. StatPearls Publishing. https://www.ncbi.nlm.nih.gov/books/NBK557833/* • *CK-12 Foundation. (2020). Innate immune system. https://flexbooks.ck12.org/cbook/ck-12-biology-flexbook-2.0/* ***C. News and Real-World Context References*** • *Philippine News Agency. (2025). DOH urges local, national leaders to push immunization equity. https://www.pna.gov.ph/articles/1248655* • *GMA Integrated News. (2025). DOH reports significant rise in measles cases among unvaccinated children. https://www.gmanetwork.com/news/topstories/nation/939326/doh-reports-significant-rise-in-measles-cases-among-unvaccinated-children/story/* ***D. Instructional Videos and Multimedia Resources*** • *Learn Bright. (2022). What is the immune system for kids? [Video]. YouTube. https://www.youtube.com/watch?v=cVIEqR1t9bQ* • *Science ABC. (2023). Lymphatic system explained in simple words [Video]. YouTube. https://www.youtube.com/watch?v=eWUAB194qhU* • *What's Up Dude. (2016). Immune system function – lymphatic system function [Video]. YouTube. https://www.youtube.com/watch?v=5YPM74FZDQQ* • *Harvard University. (2021). Nealon, D. Understanding the science behind a vaccine booster. Harvard Gazette. https://news.harvard.edu/gazette/story/2021/11/understanding-the-science-behind-a-vaccine-booster/* ***MATERIALS:*** ***A. Teacher's Instructional Materials*** • *Laptop / desktop computer* • *LCD projector or smart TV* • *Speaker system (for video presentation)* • *Printed lesson plan and guide questions* • *PowerPoint presentation (immune system, lymphatic system, vaccines)*

	• *Diagram charts of:*
	  ○ *Immune system components*
	  ○ *Lymphatic system pathway*
	  ○ *Vaccine mechanism (antigen or antigen instructions → B- and T-cell responses → effector cells/antibodies → immune memory)*
	
	B. Learner Materials
	• *Science notebooks / journals*
	• *Ballpen, pencil, coloring materials*
	• *Meta-cards / index cards*
	• *Writing materials and displayed activity prompts, as needed*
	• *Bond paper (for infographic or paper doll activity)*
	• *Coloring pens / crayons / markers*
	• *Scissors and glue (for craft-based tasks)*
	
	C. Activity-Based Materials
	• *Scenario cards (immune response case studies)*
	• *Defense line sorting cards (first, second, third line of defense)*
	• *Flowchart templates (immune response sequence)*
	• *Cause-and-effect diagram sheets*
	• *Paper doll / body outline templates*
	• *Sticky notes (for labeling activities)*
	• *Rubrics for:*
	  ○ *infographic*
	  ○ *vlog*
	  ○ *group performance tasks*
	
	D. Digital / Technology-Enhanced Tools (if available)
	• *Canva (infographic design)*

	• *PowerPoint / Google Slides (interactive presentation)* • *Mentimeter (live word cloud and responses)* • *ClassPoint (interactive slide-based assessment)* • *Google Forms (quiz and exit ticket)* • *Kahoot / Quizizz (gamified assessment)* ***E. Low-Tech / Alternative Materials (for limited connectivity)*** • *Manila paper / cartolina* • *Chalkboard / whiteboard* • *Writing materials and displayed activity prompts, as needed* • *Hand-drawn diagrams* • *Oral recitation guides*	
III. CONTENT *(Sequencing Content)*	Organ Systems Working Together – How Vaccines Support the Immune and Lymphatic Systems	
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	Learners shall be able to: **1.** Identify the major components and functions of the immune and lymphatic systems. **2.** Illustrate how the immune and lymphatic systems interact in defending the body. **3.** Explain how vaccination can produce immune memory and protection against infectious diseases. **4.** Create an evidence-based infographic or video blog that explains how vaccination supports individual and community protection.	
IV. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	***A.1. Activating Prior Knowledge***	
	Option 1: K-W-L Chart	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objective 1 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and

Directions:
Complete the chart by recording what you already know and what you want to know. After the activity, add what you learned and revise any earlier ideas that changed.

Activity Proper:

Directions: Complete the K and W columns before the lesson, compare entries with a partner or group, and complete the L column afterward using evidence from the lesson. *Scenario*	*What I certainly Know*	*Somehow I know*	*What I want to know*

connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	The teacher will present a scenario about the major components and functions of the immune and lymphatic systems, how the immune and lymphatic systems interact to defend the body, how vaccines trigger an immune response and provide protection against infectious diseases and the importance of vaccination as a health measure in protecting individuals and communities. In the Scenario column, learners will write down the given situation. In the What I certainly Know column, the learners will list facts or ideas they are fully confident about, supported by prior learning or evidence. In the Somehow I know column, the learners will record ideas they believe to be true but still need clarification or confirmation. In the What I Want to Know column, the learners will write questions or points of curiosity about the topic.	

Scenario	*What I certainly Know*	*Somehow I know*	*What I want to know*
When someone gets cut			

Ana had chickenpox in Grade 3. When her younger brother later developed chickenpox, she did not become ill. Explain that immune memory lowers the risk of disease, but breakthrough infection or later viral reactivation can still occur.				
After getting a vaccine, a student feels mild fever and arm soreness.				

After learners finish filling in the table, the teacher will call on volunteers to share their answers in class. The teacher may ask additional responses from learners with different answers. This is a quick way for the teacher to gather general responses from learners, which can help gauge their baseline knowledge and provide immediate feedback on misconceptions identified in the What I Know column. Science clarification: Present the vaccine pathway as a simplified model that includes antigen presentation, B-cell and T-cell responses where relevant, and immune memory.

	Guide Questions: 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Defense Line Sorting Challenge	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Sort each item into the correct category based on the scientific characteristics provided. Record your classifications and justify any item that could be confused with another category. **Activity Proper:** The teacher provides learners with a set of scenario cards (e.g., skin prevents entry of bacteria, fever increases body temperature, white blood cells engulf pathogens, lymph nodes filter lymph).	The activity targets Learning Objective 1 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through

	In groups, ask them to sort the scenarios into First Line of Defense, Second Line of Defense, and Third Line of Defense. Groups create a mini-flowchart showing that barrier, innate, and adaptive defenses can overlap and interact; they are not always triggered as a single fixed sequence. Checklist Criteria: Correct classification of scenarios into first, second, and third lines of defense Scientifically accurate interactions and overlap shown in the mini-flowchart Accurate explanation of how each defense line functions Clear and organized group presentation or sharing. Performance Interpretation: 18–20 points – Outstanding (Exceeds Expectations) 14–17 points – Proficient (Meets Expectations) 10–13 points – Developing (Approaching Expectations) 0–9 points – Beginning (Needs Improvement) Science clarification: Treat the first-, second-, and third-line defense scheme as a simplified model with overlapping processes, not a rigid sequence. Lymph nodes are sites of filtration, immune-cell interaction, and immune response; they do not guarantee that infection is prevented.	presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	Guide Questions: 1. What body parts or organs act as the first line of defense against pathogens? 2. Which examples from the scenario cards belong to the first, second, and third lines of defense? 3. How do these defense lines work together to protect the body when pathogens enter? **Expected Output/Product:** The learners will be able to correctly classify the scenarios according to the different lines of defense and present a mini-flowchart showing how barrier, innate, and adaptive defenses can overlap and interact rather than forming one rigid sequence when pathogens enter the body. **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	A.2. Establishing the Purpose of the Lesson	
	Option 1: STEAM Vocabulary	
	Materials/Resources Needed: • meta cards or small pieces of paper • Markers or pens **Directions:** From the given purpose and goal of the lesson, give at least 3 terms and define/describe or give examples related	The activity targets Learning Objective 1 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because

	to the term. Write your answers in a meta-card. Post them in the appropriate column. **Activity Proper:** Introduce the STEAM vocabulary. Ask the learners to write at least 3 words or terms related to the lesson/topic and define/describe or give examples related to the term. ***Terms*** | ***Meaning/Description/Example*** *immune system* | *The immune system includes white blood cells, antibodies, and organs like the thymus and bone marrow that detect and destroy harmful microorganisms.* | | | For discussion purposes: Once the table is completed, review all the vocabulary words together. Encourage learners to share their ideas and discuss the meanings and significance of each word. Clarify any misunderstandings and provide additional explanations or examples as needed Optional: Interactive STEAM Vocabulary Using Technology Using ClassPoint (Slide-Based Interaction) Preparatory Phase: The teacher prepares two PowerPoint slides for the activity.	learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Slide 1: Word Cloud activity. Prompt: “Type at least three (3) words or terms related to the lesson/topic.” Slide 2: Short Answer activity. Prompt: “Choose one of the words from the word cloud and write its meaning, description, or give an example.” During the instruction: The teacher introduces the activity and explains that learners will use ClassPoint to submit vocabulary related to the lesson. Learners log in using the provided code or link. On Slide 1, learners submit their words, which automatically appear as a word cloud. On Slide 2, learners submit their definitions or examples. The teacher discusses selected responses to clarify meanings and strengthen understanding. B. Enhanced Interactive Alternative Using Mentimeter (Real-Time Word Pool Discussion) For Slide 2, learners may also use Mentimeter for a more interactive and real-time discussion. Process: The teacher provides a Mentimeter link or code. Learners input a chosen term and its meaning, description, or example based on the lesson purpose or goal. Responses immediately appear on the screen, forming a live word pool.	

	As responses accumulate, the teacher facilitates discussion by: identifying common terms highlighting correct scientific ideas correcting misconceptions connecting responses to the lesson objectives This approach allows learners to see their collective ideas in real time, making vocabulary building more engaging, collaborative, and concept-driven. Low-Tech Alternative: If ClassPoint, Mentimeter, or internet access is not available, learners may write their vocabulary terms and meanings on meta-cards, on the board, or in their notebooks. The teacher may then facilitate sharing by asking learners or groups to post, read, or explain their answers to the class. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

	Option 2: Anticipation Guide	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read each statement and mark whether you agree or disagree before the lesson. Revisit every statement after the activity and explain any response that changed. **Activity Proper:** Introduce the anticipation guide to activate learners' prior knowledge and build curiosity about major components and functions of the immune and lymphatic systems, how the immune and lymphatic systems interact to defend the body, how vaccines trigger an immune response and provide protection against infectious diseases and the importance of vaccination as a health measure in protecting individuals and communities. The learners should agree or disagree with the statements before and after instruction. The teacher then explains: "Today's lesson will help us understand how the immune and lymphatic systems protect us, how vaccines strengthen our defense, and why vaccination is important for both individuals and communities." Science clarification: Treat the first-, second-, and third-line defense scheme as a simplified model with overlapping processes, not a rigid sequence. Lymph nodes	The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	are sites of filtration, immune-cell interaction, and immune response; they do not guarantee that infection is prevented. Science clarification: Present the vaccine pathway as a simplified model that includes antigen presentation, B-cell and T-cell responses where relevant, and immune memory. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Option 1: Label and Explain: Major Components of the Immune and Lymphatic Systems	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** After viewing the assigned resource, label the major immune and lymphatic organs, cells, and vessels on the diagram. Write a brief function for each label and explain	The activity targets Learning Objectives 1 and 2 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product.

	how the components coordinate during an immune response. **Activity Proper:** Instructional Focus: This activity helps learners understand the major components of the immune and lymphatic systems and how they work together in defending the body against pathogens. 1. Activate Prior Knowledge (Video Viewing) Before the activity, the teacher will present a short video clip about the lymphatic system: Guide learners to focus on the following: major organs involved in immunity how lymph moves in the body how the body defends against pathogens 2. Grouping of Learners Divide the class into small collaborative groups. 3. Labeling Activity (Hands-on Diagram Task) Each group is given a diagram of the immune and lymphatic systems. Label Cards Provided: Lymph nodes Thymus Spleen Tonsils	The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	Bone marrow Lymphatic vessels White blood cells Skin Mucous membrane Learners will place the correct labels on the diagram using: sticky notes (low-tech option), or draggable labels (digital option) 4. Function Matching Activity Each group receives a set of function cards describing the roles of each component. Learners will match each labeled structure with its correct function, such as: “Filters lymph and traps pathogens” “Produces white blood cells” “Acts as a barrier against infection” “Helps mature immune cells” 5. Group Explanation Each group will present and explain at least one assigned component. Example response: “Lymph nodes filter lymph and provide sites where immune cells encounter antigens and coordinate responses. This supports protection but does not guarantee prevention of infection.”	

	6. Synthesis Discussion (Guide Question) After presentations, facilitate a class discussion using the guide question: Encourage learners to connect: physical barriers (skin, mucous membranes) internal defenses (white blood cells, lymph nodes, spleen) overall coordination of immune response Optional Digital Extension: Interactive organizer Learners may also access this interactive reference for additional support during or after the activity: https://ecampusontario.pressbooks.pub/medicalterminology/chapter/lymphatic-system/ Science clarification: Treat the first-, second-, and third-line defense scheme as a simplified model with overlapping processes, not a rigid sequence. Lymph nodes are sites of filtration, immune-cell interaction, and immune response; they do not guarantee that infection is prevented. **Guide Questions:** 1. https://www.youtube.com/watch?v=C_Bii6TfwuY 2. Which body structures form the first line of defense, and how do immune and lymphatic components support later defense responses? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	

Option 2: Diagram Walkthrough

Materials/Resources Needed:

- Paper, cartolina, or Manila paper
- Pen or pencil
- Markers or colored pencils (if available)

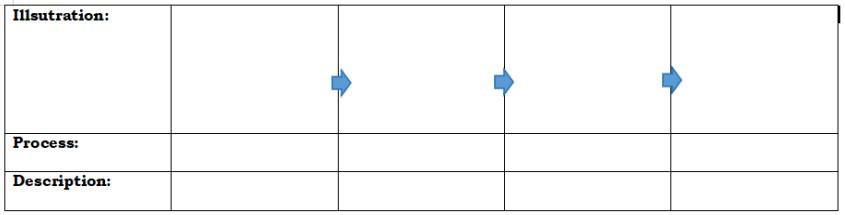
Directions:

Construct the required diagram or flowchart, label all essential parts or stages, show the relationships accurately, and add a brief scientific explanation of how the system or process works.

Activity Proper:

This activity will illustrate how the immune and lymphatic systems interact in protecting the body.

1. Teacher shows an incomplete flowchart or diagram of the immune response or graphic organizer

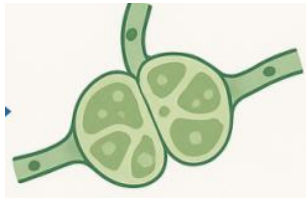
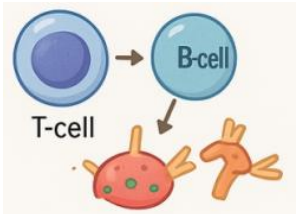


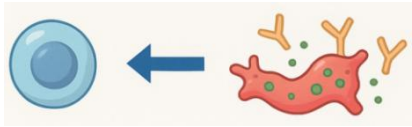
2. Learners work in groups to complete the diagram by adding the provided steps and illustrations. (Pathogen or antigen encounter → innate response and antigen presentation → B- and T-cell activation → effector responses (such as antibodies or cytotoxic cells) → pathogen control; some activated cells become memory cells).

The activity targets Learning Objectives 1 and 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.



Word and Description Bank (optional)
Activation Antibody Production
Detection Future Protection
Invasion Memory
Lymphatic Transport Pathogen Entry

3. Each group presents their finished diagram and explains it briefly.

Science clarification: Antibodies occur in blood, lymph, tissues, and secretions. Prior chickenpox infection often provides immunity, but reinfection can occur, and varicella-zoster virus can later reactivate as shingles.

Guide Questions:

1. What is the first step when a pathogen enters the body?
2. How does the lymphatic system help in transporting and detecting the pathogen?
3. What happens in the lymph nodes to fight off the infection?

	4. How do antibodies and memory cells help protect the body in the future? **Expected Output/Product:** Completed diagram or flowchart showing interaction of immune and lymphatic systems. **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	B.2. Discussing New Concept	
	Option 1: Case Study Matching	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Match each item with the correct term, category, description, or process. Record each match and briefly explain the scientific basis for your answer. **Activity Proper:** This activity will help learners identify how the immune and lymphatic systems defend the body in real situations.	The activity targets Learning Objectives 1 and 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing

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<td>The teacher provides short case scenarios (e.g., “Maria got a cut on her finger and bacteria entered the wound,” or “Jose received a flu vaccine last month”).
Learners, in pairs, match each case with the correct immune/lymphatic response (e.g., phagocytosis, antibody production, memory cell activation).
Groups present their answers and justify their reasoning.
Sample Case Cards and Response Cards
<table>
<tr><th>Case Scenario Cards</th><th>Expected Immune/Lymphatic Response</th></tr>
<tr><td>Maria got a cut on her finger and bacteria entered the wound.</td><td>White blood cells perform phagocytosis to destroy bacteria.</td></tr>
<tr><td>Jose received a flu vaccine last month.</td><td>Antibody production and memory cell formation occur.</td></tr>
<tr><td>Ana noticed swollen lymph nodes while she had an infection.</td><td>Lymph nodes filter pathogens and activate immune cells.</td></tr>
<tr><td>Carlo developed fever after getting infected with a virus.</td><td>Fever is a regulated response that can support some immune processes, but its effects vary; high, persistent, or concerning fever requires appropriate adult or medical guidance.</td></tr>
</table>
</td>
<td>quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

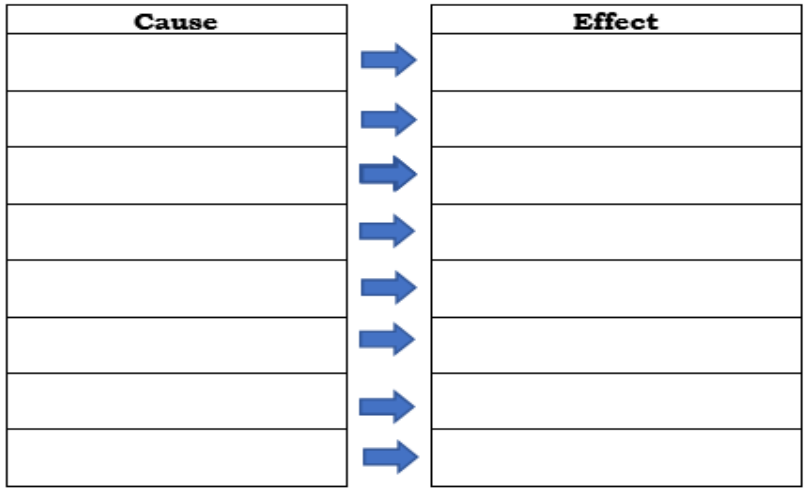
Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.</td>
</tr>
</table>

	<table><tr><td>Lea was exposed again to chickenpox after having it before.</td><td>Memory cells quickly recognize the pathogen and produce a faster immune response.</td></tr></table> Science clarification: Antibodies occur in blood, lymph, tissues, and secretions. Prior chickenpox infection often provides immunity, but reinfection can occur, and varicella-zoster virus can later reactivate as shingles. Science clarification: Present the vaccine pathway as a simplified model that includes antigen presentation, B-cell and T-cell responses where relevant, and immune memory. **Guide Questions:** 1. What happened in the scenario? 2. Which component of the immune or lymphatic system is responding to this situation? 3. How does the body's immune or lymphatic system defend against this threat? 4. Why is this response important for protecting the body now and in the future? **Expected Output/Product:** Matched case-response chart showing the relationship between real-life situations and the corresponding immune or lymphatic system response. **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	

	Option 2: Immune Response Relay: Defend the Body!	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Participate in the assigned simulation or performance according to your role. Represent the scientific process or relationship accurately, then explain what your role or sequence demonstrates. **Activity Proper:** Divide the class into teams representing both invading pathogens and immune defenders. There are five stations, each representing a stage of the immune and lymphatic system's defense for a relay game. Teams may start at any station to avoid crowding. At each station, the team must perform the action, explain or demonstrate the immune role, and correctly answer the station questions before moving on. Station 1: Invasion (Pathogen Entry) Station 2: Detection (Lymphatic Transport) Station 3: Activation (Lymph Node Response) Station 4: Response (Antibody Production) Station 5: Memory (Future Protection) First team to complete the relay correctly wins. Science clarification: Antibodies occur in blood, lymph, tissues, and secretions. Prior chickenpox infection often	The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	provides immunity, but reinfection can occur, and varicella-zoster virus can later reactivate as shingles. **Guide Questions:** 1. What role did each immune system component play in neutralizing the pathogen during the relay? 2. How did the lymphatic vessels support the immune system in transporting the pathogen to the lymph node? 3. Why is the coordination between T-cells and B-cells important for an effective immune response? 4. How does this relay simulation illustrate the interaction between the immune and lymphatic systems in defending the body? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	B.3. Developing Mastery	
	Option 1: Immune Defense Cause-and-Effect Chain	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1 and 2 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior

	Directions: Create or complete the required organizer or diagram, label all relevant parts or stages, show the relationships accurately, and add a brief evidence-based explanation. **Activity Proper:** 1. Using the vaccine scenario, show the sequence of events from pathogen entry to disease prevention. A booster shot is meant to increase levels of immune responses after these have naturally waned. A booster stimulates the immune system as if it were encountering the pathogen again, so antibody-producing cells and other immune cells are recalled into action. The quantity and quality of antibodies that are produced can increase. Through a process called antibody affinity maturation, our immune system learns to do a better job at recognizing a pathogen and making antibodies that bind more tightly to their target. For the SARS-CoV-2 virus, for example, affinity matured antibodies can be more effective at recognizing variants with multiple mutations. Source: Nealon, Dennis. "Understanding the Science Behind a Vaccine Booster." Harvard Gazette, November 23, 2021. Accessed October 18, 2025. https://news.harvard.edu/gazette/story/2021/11/understanding-the-science-behind-a-vaccine-booster/ 2. Use the following cause-and-effect diagram showing the sequence of events from pathogen entry to disease prevention.	experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	 3. Use colors to distinguish between immune system components, lymphatic system components, and vaccine effects. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Expected Output/Product:** Completed table or organizer containing the required information and scientifically accurate explanations. **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	

	Option 2: ImmunoFeud	
	Materials/Resources Needed: • Question cards (or slides) • Buzzer or bell • Scoreboard / whiteboard **Directions:** Form teams and send one representative to the buzzer for each question. Give the requested immune-system answer when recognized, allow a steal after an incorrect response, and record one point for every accepted answer using the provided key. **Activity Proper:** Procedures: 1. Divide the class into teams. 2. The teacher will act as a host. The host will draw a question card from a shuffled deck. 3. A representative of the group will play one at a time. The representative of the group to be the first to hit the buzzer shall be given the chance to answer. He/She must: Name the top five answers. 4. If correct, the team earns 1 point for every correct answer. 5. If a team answers incorrectly, other teams may "steal" the question for a bonus point. 6. The group with the highest points earned wins the game.	The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

<table>
<tr><td></td><td>Guide Questions:
1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Assessment Criteria:
• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation</td><td></td></tr>
<tr><td rowspan="3">C. Demonstrating Knowledge and Skills</td><td colspan="2">C.1. Finding Practical Application</td></tr>
<tr><td colspan="2">Option 1: Dress the Body for Defense: Vaccine in Action</td></tr>
<tr><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Place the lymph node, white blood cell, antibody, and memory cell labels in appropriate locations on the body outline. Add arrows and captions showing how vaccination activates an immune response, then answer the follow-up questions.

Activity Proper:
Give each student/group a paper doll or body outline. This represents a human body that needs to defend against infections. The group will also be given colored paper or sticky notes.</td><td>The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product.
The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the</td></tr>
</table>

	1. Using the sticky notes with the following labels, attach them to the paper doll as if you are dressing the doll. • lymph nodes • white blood cells • antibodies near the the blood vessels. • memory cells 2. Paste the doll on one whole sheet of bond paper and label the parts. 3. Below the doll, draw the interactions among these immune components, showing how the vaccine activates the body's defenses. Follow-up questions for Illustration and Discussion: The learners present their paper dolls to the class, explaining the flow of immune defense and the role of vaccines. **Guide Questions:** 1. What happens inside the body when a vaccine is introduced? 2. How do white blood cells, lymph nodes, and antibodies work together to fight infection? 3. Why are memory cells important in protecting the body from future infections? 4. How does vaccination prepare the body to respond faster and stronger against real pathogens?	product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Rubric

Criteria	4 – Excellent	3 – Proficient	2 – Developing	1 – Beginning	Total
Science Accuracy (Immune System Components and Vaccine Concept)	All labeled components and explanations are scientifically correct with no misconceptions about immune response and vaccination.	Mostly correct with minor errors in labeling or explanation.	Some correct ideas but with noticeable misconceptions.	Most labels and explanations are incorrect or missing. (Points: /5)	____
Correct Placement and Labeling of Immune Components	All required labels (vaccine, lymph nodes, white blood cells, antibodies, memory cells) are correctly placed and logically arranged.	Most labels are correct with minor placement errors.	Several labels are incorrect or missing.	Labels are mostly incorrect or not placed. (Points: /5)	____
Understanding of Vaccine Action and Immune Response Flow	Clearly and correctly explains how vaccines activate immune cells and build	Mostly correct explanation with minor gaps in flow of immune response.	Partial understanding of vaccine function and immune response.	Does not demonstrate understanding of vaccination process. (Points: /5)	____

	immune memory.				
Clarity and Quality of Illustration (Paper Doll + Diagram)	Illustration is neat, well-organized, and clearly shows interactions among immune components.	Generally clear with minor issues in organization or neatness.	Illustration is somewhat unclear or incomplete.	Illustration is unclear, disorganized, or incomplete. (Points: /5)	____
Scientific Explanation During Presentation	Explanation is clear, confident, and accurately describes immune interactions and vaccine effects.	Mostly clear with minor issues in explanation or delivery.	Explanation is partially clear but lacks detail or accuracy.	Explanation is unclear, incorrect, or not presented. (Points: /5)	____
Understanding of Immune Protection (Memory and Fast Response)	Clearly explains how memory cells enable faster and stronger response to future infections.	Good explanation with minor gaps in understanding memory response.	Partial understanding of immune memory.	Does not understand the role of memory cells. (Points: /5)	____
Total Score					____ / **24**

	Option 2: News Reflection	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil • Internet-enabled device, if available **Directions:** Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation. **Activity Proper:** This activity will be done in groups. The teacher will provide copies of news related to major components and functions of the immune and lymphatic systems, how the immune and lymphatic systems interact to defend the body, how vaccines trigger an immune response and provide protection against infectious diseases and the importance of vaccination as a health measure in protecting individuals and communities. Before the learners gather by group, the teacher will also share the discussion questions as a guide for the learners as they read the news. Here is a sample news article that can be used by the teacher. "DOH reports significant rise in measles cases among unvaccinated children." GMA Integrated News, March 14, 2025. The news is about the 35% increase in measles cases in the Philippines from January to March	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	2025, which was mostly among unvaccinated children. This prompted the Department of Health (DOH) to intensify vaccination and catch-up immunization programs nationwide. Learners are asked to reflect silently for 2 minutes. Discussion Questions: **Guide Questions:** 1. Why is it important to know how our body fights infections? 2. How does knowing about vaccines and immunity help my family and community? **Expected Output/Product:** Completed written reflection that connects the activity to the relevant scientific concepts. **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	C.2. Making Generalization	
	Option 1: K-W-L Continuation	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist,

Directions:
Complete the K and W columns before the lesson, compare entries with a partner or group, and complete the L column afterward using evidence from the lesson.

Activity Proper:
The learners will continue filling in the last part of their KWL chart—the "What I Learned" column. In this part, they will summarize key takeaways from the lesson using the table:

Scenario	What I Know	What I want to know	What I learned
When someone gets cut			
Ana had chickenpox in Grade 3. When her younger brother later developed chickenpox, she did not become ill. Explain that immune memory lowers the risk of disease, but breakthrough infection or later viral reactivation can still occur.			

Guide Questions:
1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Assessment Criteria: • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: One Sentence, Big Idea	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation. **Activity Proper:** The learners will generalize their learning about the immune and lymphatic systems, vaccines, and the importance of vaccination in one clear statement. 1. Think about what you learned in this lesson: • Major components and functions of the immune and lymphatic systems • How these systems interact to defend the body • How vaccines trigger an immune response • Why vaccination is important for individuals and communities 2. Write one sentence that summarizes the "big idea" of the lesson and post it on the board.	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address

	3. Your sentence must include: A main idea (generalization) A supporting evidence or example from the lesson (scientific explanation or real-life connection) Example Format "Main idea about immune/lymphatic system + vaccines, because/for example evidence from lesson." Example Answer "The immune and lymphatic systems work together to protect the body from pathogens, and vaccines help the immune system develop memory cells, as shown when vaccinated individuals produce faster antibody responses during infection." Guide Sentence Starter (optional) "The immune and lymphatic systems work together to ___, and vaccines help ___ by ___, for example ___." **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	misconceptions before accepting the final generalization.

	C.3. Evaluating Learning	
	Option 1: Quick Quiz	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** Instructions Write T if the statement is true and F if it is false. Correct at least TWO false statements by rewriting them into the correct idea. Be ready to briefly justify your answers during class discussion. A. Quiz Statements (Digital + Low-Tech Options) The teacher may deliver this activity using any of the following platforms: 1. Mentimeter (recommended – real-time engagement) Use Mentimeter Quiz or Presentation mode Students answer T/F via mobile devices. Instant results and misconception tracking 2. Google Forms Auto-graded T/F items Add short answer section for corrections	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	3. Kahoot / Quizizz Gamified T/F competition Leaderboard for engagement 4. Low-Tech (Fallback) Printed quiz or written responses in notebook Quiz Items: Primary lymphoid organs produce and mature lymphocytes, while lymphatic vessels and lymph nodes transport lymph, immune cells, and antigens and provide sites for immune activation. Vaccines lead the body to develop a serious illness. The immune system produces antibodies to combat infections. The body may react to illnesses more quickly thanks to memory cells. The community is not protected by vaccinations; only the individual is. The spleen filters blood and supports immune responses. A person can live without it, but the risk of serious infection increases. White blood cells are components of the immune system and protect the body against infectious agents. Vaccines can induce B- and T-cell responses and immune memory. Protection and its duration vary by vaccine and person, and recommended boosters may be needed. The lymphatic and immune systems function independently and never have a relationship. For infections whose vaccines reduce infection or transmission, high vaccination coverage can reduce	

	spread and add community protection; the degree varies by disease and vaccine. **Guide Questions:** 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: 3-2-1 Exit Ticket	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** Before leaving the lesson, learners will reflect on their learning about the immune and lymphatic systems and their role in defending the body. They will complete the 3-2-1 Exit Ticket: 3 – Things you learned: Key takeaways about how the immune and lymphatic systems work together to fight infections.	The activity targets Learning Objectives 1, 2, 3, and 4 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the

	2 – Things you found interesting: Concepts, processes, or real-world applications (like vaccines or immune responses) that stood out. 1 – Question you still have: Any unclear point or topic you would like to explore further about immunity, diseases, or body defense. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.
	C.4. Additional Activities	
	Option 1: Be a Vaccine Advocate: Create Your Own Infographic	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available) • Computer, tablet, or other available digital device (optional) **Directions:** Using Canva, PowerPoint, or Manila paper/cartolina, design an infographic that communicates important	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning.

	information about vaccines and promotes health awareness. **Activity Proper:** Your infographic must answer the following: Call to action (Research-Integrated Advocacy Output): Encourage classmates, family, and community to support vaccination. Research-Integrated Call to Action (Enhanced Output-Based Requirement) Instead of a simple slogan only, learners are encouraged to extend their output into a real-world advocacy action, such as: Sharing the infographic during a classroom forum or mini-symposium Presenting it to family members or guardians as an awareness activity Posting it in a school bulletin board or digital classroom platform Conducting a short peer or community information drive (barangay or neighborhood awareness) This component integrates research dissemination, allowing learners to transform scientific understanding into community education and advocacy. Your infographic must include: Title and slogan (e.g., "Vaccines Save Lives!").	Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Simple illustrations/graphics (shields, germs, people, syringes). At least two reliable sources cited in APA format Clear vaccine mechanism flow: Vaccine antigen or antigen instructions → antigen presentation → B- and T-cell activation → effector responses, including antibodies when relevant → memory B and T cells. The steps overlap and protection is not guaranteed to be complete. Safeguard: For public advocacy, obtain school and guardian approval when applicable, do not disclose personal health information, provide a private submission option, and use official vaccine schedules and guidance from qualified health professionals. **Guide Questions:** 1. What are vaccines? (simple definition) 2. How do vaccines work? (sequence: antigen or antigen instructions → B- and T-cell responses → effector cells/antibodies → immune memory) 3. Why are vaccines important? (prevention, community protection when the vaccine and disease characteristics support reduced transmission, community health) **Expected Output/Product:** Completed infographic with accurate scientific content, clear visual organization, and a brief explanation or presentation.	

Rubric

Criteria	5 – Excellent	4 – Very Satisfactory	3 – Satisfactory	2 – Developing	1 – Beginning	Total
Content Accuracy	All scientific information is correct, complete, and clearly explained (vaccines, immunity, antibodies, memory cells).	Minor inaccuracies but overall scientifically correct.	Some correct ideas but with noticeable misconceptions.	Limited understanding; multiple inaccuracies present.	Content is mostly incorrect or unclear. (Points: /5)	____
Organization and Structure	Information is logically organized, well-sequenced, and easy to follow (clear flow of ideas).	Mostly organized with minor issues in flow.	Some organization but ideas are not consistently connected.	Weak organization; difficult to follow.	No clear structure or logical flow. (Points: /5)	____
Visual Design	Highly creative, visually engaging, and effective use of colors, icons, and layout enhances understanding.	Good visual design with minor issues in clarity or layout.	Adequate design but somewhat cluttered or simple.	Weak visual appeal; limited use of design elements.	Poor or incomplete visual presentation. (Points: /5)	____

	Overall Impact (Message & Advocacy)	Strong, clear, and persuasive health message that effectively promotes vaccination and community awareness.	Clear message but advocacy impact could be stronger.	Basic message with limited persuasive impact.	Weak or unclear message; limited advocacy value.	No clear message or advocacy intention. (Points: /5)	____
	Scientific Understanding of Vaccine Mechanism	Clearly shows correct sequence: antigen or antigen instructions → B- and T-cell responses → effector cells/antibodies → immune memory with strong explanation.	Mostly correct sequence with minor gaps.	Partial understanding of the vaccine process.	Limited understanding of how vaccines work.	Incorrect or missing explanation of mechanism. (Points: /5)	____

References (APA Format)	At least two reliable sources correctly cited in APA format.	Two sources cited with minor formatting errors.	At least one source cited correctly.	Incomplete or poorly formatted references.	No references provided. (Points: /5)	____
Total Score						____ / **30**

Score interpretation

Score range	Performance description
26–30	Excellent
21–25	Very Satisfactory
16–20	Satisfactory
11–15	Developing

Option 2: Vaccine Advocacy Vlog Challenge

Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist, Collaborative, and Integrative approaches because learners synthesize

	Directions: Plan and record the required vlog. Present the selected real-life example, identify the relevant scientific process or reaction, explain the observable evidence, and follow all stated safety and group-contribution requirements. **Activity Proper:** Learners will create a short vlog advocating for vaccination, explaining how the immune and lymphatic systems work, how vaccines protect the body, and why vaccination is important for individuals and communities. In pairs, make a 1–3 minute vlog that includes: Brief explanation of the immune and lymphatic systems How vaccines trigger an immune response (antigen or antigen instructions → B- and T-cell responses → effector cells/antibodies → immune memory) Importance of vaccination for individual and community protection A clear call-to-action encouraging vaccination Required Teacher-Screened Script/Outline (Before Recording) Before filming, each pair must submit a short script or outline for teacher approval. The script must clearly show accurate science content and proper sequencing of ideas. Minimum Script Outline Must Include: Introduction (What topic is being discussed) Immune/Lymphatic system explanation (accurate key points only)	knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

	Vaccine mechanism (antigen or antigen instructions → B- and T-cell responses → effector cells/antibodies → immune memory) Importance of vaccination (individual + community protection) Closing call-to-action At least one reliable source (book, WHO, DOH, CDC, or textbook reference) Teacher Checkpoint Requirement: Script is scientifically accurate Vaccine explanation is correct (no misinformation or exaggeration) Proper immune system function is included Source is credible and cited Content is age-appropriate and clear Safety and Accuracy Guidelines Avoid misleading claims (e.g., vaccines “instantly cure” diseases or “guarantee 100% protection”) Use scientifically correct terms (antigen, antibodies, memory cells, immunity) Focus on prevention and community protection (community protection when the vaccine and disease characteristics support reduced transmission) Ensure explanations are simple but accurate Final Video Requirements 1–3 minutes only Clear audio and visual presentation Both partners must participate Must include a clear health message and advocacy statement	

	Research Integration and Dissemination Component (Enhanced Output Use) After teacher approval and final video completion: Videos will first be screened by the teacher for scientific accuracy and relevance Selected outputs may be used for educational dissemination purposes, such as: School Facebook page Instagram reels YouTube Shorts TikTok educational posts School symposium or classroom forum presentation This allows learners to transform academic output into real-world science communication and public health advocacy. Safeguard: For public advocacy, obtain school and guardian approval when applicable, do not disclose personal health information, provide a private submission option, and use official vaccine schedules and guidance from qualified health professionals. **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea? **Expected Output/Product:** Recorded vlog that communicates the required scientific ideas clearly and accurately.	

Rubric

Criteria	5 – Excellent	4 – Very Satisfactory	3 – Satisfactory	2 – Developing	1 – Beginning	Total
Science Accuracy (Immune & Lymphatic Systems)	Explanation is complete, accurate, and scientifically sound; no misconceptions.	Minor errors but overall correct explanation.	Some correct concepts but incomplete understanding.	Several scientific inaccuracies present.	Incorrect or missing scientific explanation. (Score: /5)	____
Vaccine Mechanism Understanding	Clearly explains full sequence: antigen or antigen instructions → B- and T-cell responses → effector cells/antibodies → immune memory correctly.	Mostly correct sequence with minor gaps.	Partial explanation of vaccine mechanism.	Weak understanding of vaccine process.	Incorrect or missing explanation. (Score: /5)	____
Communication Clarity	Ideas are clearly expressed, well-organized,	Mostly clear with minor issues in flow or delivery.	Some unclear parts but generally understandable.	Difficult to understand due to weak organization.	Unclear and disorganized communication. (Score: /5)	____

	and easy to understand.					
Advocacy Message & Community Relevance	Strong, persuasive, and meaningful health advocacy message promoting vaccination.	Clear advocacy message but could be more persuasive.	Basic advocacy message with limited impact.	Weak or unclear advocacy intent.	No clear advocacy message. (Score: /5)	____
Creativity & Presentation Quality	Highly engaging, creative, and visually effective vlog presentation.	Good creativity with minor limitations.	Adequate presentation but lacks engagement.	Minimal creativity; weak visual/audio quality.	Poor presentation and lacks effort. (Score: /5)	____
Credible Source Citation	At least one credible source correctly included and properly acknowledged.	Source included but minor citation issues.	Source present but not clearly cited.	Weak or questionable source usage.	No source provided. (Score: /5)	____

Total Score						___ / **30**

Score interpretation

Score range	Performance description
26–30	Excellent
21–25	Very Satisfactory
16–20	Satisfactory
11–15	Developing

V. ASSESSMENT
(Assessing Learnings)

Directions: Complete every matching, sequencing, and explanation item in the assessment. Record each response in the space provided and use accurate immune- and lymphatic-system concepts in the written explanations.

A. Match each component with its correct function.

Component	***Function***
1. Lymph nodes	*A. Filters blood and helps mount immune responses to blood-borne antigens*
2. Bone marrow	*B. Filters lymph and traps pathogens*
3. Thymus	*C. Matures T-lymphocytes for immune response*
4. Spleen	*D. Produces red and white blood cells, including B-lymphocytes*
5. Tonsils	*E. Traps pathogens entering through the mouth and nose*

B. Complete the immune response flowchart below and label the missing steps.

Flowchart:

Pathogen or antigen encounter → _____ → B-/T-cell activation → _____ → pathogen control; some cells form immune memory

C. Short Answer:

1. Explain how components of the immune system (e.g., lymph nodes, thymus, and bone marrow) work together to fight a pathogen.

_____

_____

2. Predict what might happen if the spleen or bone marrow stops functioning properly.

_____

_____

3. Explain how vaccines protect the body from infectious diseases.

_____

_____

D. Advocacy-Based Performance Task (Objective 4)

"Vaccine Advocacy Output: Choose ONE"

*Learners will demonstrate health advocacy by choosing **one output**:*

Option 1: Infographic (Poster-Type Advocacy)

Directions: Create the required visual output using accurate scientific ideas, clear labels or captions, and the specified evidence or examples. Present the output and explain its main message.

Create an infographic that promotes vaccination and explains its importance in protecting individuals and the community.

Option 2: Short Vlog (1–3 minutes)

Directions: View or produce the specified media output. Use the guide questions or required criteria, record relevant scientific evidence, and explain how the evidence supports the lesson concept.

Create a short advocacy vlog explaining vaccines and encouraging vaccination.

Required Content for BOTH Options

Your output must include:

- Clear explanation of vaccines and immune protection
- Connection to immune and lymphatic system functions
- Importance of vaccination for community protection (community protection when the vaccine and disease characteristics support reduced transmission)
- Strong and positive call-to-action
- At least one credible source citation (DOH, WHO, CDC*, textbook, etc.)*

Advocacy Rubric (Objective 4 Evidence) – 25 Points

Criteria	Full Credit	Partial Credit	Minimal Credit	Total
Science Accuracy	5 points — Correct explanation of immune system and vaccine mechanism	3 points — Partly meets the criterion; minor gaps or inaccuracies remain.	1 point — Shows limited evidence; major gaps or inaccuracies remain.	———
Immune/Lymphatic Connection	5 points — Clear link between body systems and vaccine response	3 points — Partly meets the criterion; minor gaps or inaccuracies remain.	1 point — Shows limited evidence; major gaps or inaccuracies remain.	———

Vaccine Mechanism Understanding	5 points — Correct sequence: antigen or antigen instructions → B- and T-cell responses → effector cells/antibodies → immune memory	3 points — Partly meets the criterion; minor gaps or inaccuracies remain.	1 point — Shows limited evidence; major gaps or inaccuracies remain.	____
Advocacy Message	5 points — Clear, persuasive, and accurate promotion of vaccination	3 points — Partly meets the criterion; minor gaps or inaccuracies remain.	1 point — Shows limited evidence; major gaps or inaccuracies remain.	____
Communication & Presentation	3 points — Organized, clear, and easy to understand	2 points — Partly meets the criterion; minor gaps or inaccuracies remain.	1 point — Shows limited evidence; major gaps or inaccuracies remain.	____
Credible Source	2 points — At least one reliable source properly cited	1 point — Partly meets the criterion; minor gaps or inaccuracies remain.	0 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Maximum Score				____ / 25

Total: 25 points

	Teacher Note *This final assessment evaluates both:* ● ***Cognitive learning outcomes (concepts, processes, understanding)*** ● ***Performance and advocacy (Objective 4), demonstrated through the infographic or vlog output, ensuring that learners can apply scientific knowledge in real-world health communication.*** **Assessment specification:** Provide the complete cognitive answer key, model responses, rubric descriptors, and combined-score formula. Assessment responses must reflect overlapping immune defenses and the simplified nature of vaccine models.
VI. REFLECTION *(Feedback and Continuous Improvement)*	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery. 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? 6. What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT to clarify the instructions and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

Learning Title/Topic:	Philippine Ecosystems – Understanding Climate Change	Lesson Exemplar:	15

I. OBJECTIVES	
A. Content Standard	climate change affects ecosystems and the organisms living in them; and ecosystems are finite and have limited resources.
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills*** *Learners should already understand the difference between weather and climate and the basics of the greenhouse effect. They should also be able to interpret simple data representations so that they can connect local experiences to global climate change patterns.*
	Describe what is meant by the term 'climate change';
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	• BBC Earth. "When the World Gets 1℃ Hotter | Climate Change: The Facts | BBC Earth." www.youtube.com, November 4, 2021. https://www.youtube.com/watch?v=dIsjcG7hTmo. • Environment and Climate Change Canada. "What Is Climate Change?" *YouTube*, March 4, 2021. https://www.youtube.com/watch?v=QlQ-MEZgRGY. • Green Development Sustainable Solutions, Inc. "How Bad Is Climate Change Affecting the Philippines?" *How Bad Is Climate Change Affecting the Philippines?* (blog), May 5, 2023. https://greendevsolutions.com/climate-change-in-the-philippines/. • Ingram, Simon, and Sarah Gibbens. "Photos Show a Climate Change Crisis Unfolding—and Hope for the Future." Environment, 2021. https://www.nationalgeographic.com/environment/article/photos-show-a-climate-change-crises-unfoldingand-hope-for-the-future?utm_source=chatgpt.com. • Rendon, Jennifer P. "DENR Warns: Extreme Heat due to El Niño Could Ignite Wildfires." Daily Guardian, November 9, 2023. https://dailyguardian.com.ph/denr-warns-extreme-heat-due-to-el-nino-could-ignite-

	wildfires/. • Science ABC. "Climate Change and Global Warming: Explained in Simple Words for Beginners." www.youtube.com, January 16, 2023. https://www.youtube.com/watch?v=G9t__9Tmwv4. **Materials Needed:** Computers or tablets with internet access, Paper or digital devices for note-taking and brainstorming**,** Screenshot or live access to the En-ROADS simulation. Available at https://en-roads.climateinteractive.org/scenario.html?v=25.10.0 Climate Change Simulator titled "High Adventure Science: Exploring Climate Change" by The Concord Consortium. Available at https://has.concord.org/global-climate.html	
III. CONTENT *(Sequencing Content)*	Philippine Ecosystems – Understanding Climate Change	
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	Learners shall be able to: 1. Describe climate change as a long-term change in the statistical patterns of climate, including changes in averages, variability, or extremes. 2. Distinguish climate change from short-term weather variation using evidence from long-term records. 3. Explain, as supporting context, that recent global warming is unequivocally caused primarily by human activities.	
IV. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	***A.1. Activating Prior Knowledge***	
	Option 1: CLIMATE CHANGE ANTICIPATION GUIDE	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1 and 2 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build

Directions:
Read each statement and mark whether you agree or disagree before the lesson. Revisit every statement after the activity and explain any response that changed
.

Activity Proper:
The teacher instructs learners to answer the Anticipation Guide survey by marking Yes if they agree and No if they disagree with each statement. Afterward, learners share their responses with a partner for comparison and discussion.

No.	Statement	Yes	No
1	Climate and weather mean the same thing.		
2	Climate includes temperature and rainfall patterns over many decades.		
3	Climate can change significantly from one day to the next.		
4	Climate change is caused only by natural processes like volcanic eruptions.		
5	Human activities like burning fossil fuels are a major cause of recent climate change.		
6	Greenhouse gases trap heat in Earth's atmosphere.		
7	Climate change raises sea level and can increase tropical-cyclone rainfall and the proportion of intense storms; changes in total cyclone frequency are uncertain and vary by region.		

understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.
The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

Note to Teachers: Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

8	Climate change only affects polar bears and ice caps, not tropical countries like the Philippines.		
9	Deforestation contributes to climate change because trees absorb carbon dioxide.		
10	Individual actions like saving electricity cannot make a difference in fighting climate change.		

The responses of the learners will then be consolidated and will be revisited at the end of the session.
Science clarification: Recent global warming is unequivocally caused primarily by human activities. Do not claim an observed increase in Philippine tropical-cyclone frequency; PAGASA reports high variability with no indication of an increasing frequency trend. Discuss projected intensity, rainfall, and attribution using stated confidence and geographic scale.
Source requirement: For each graph, provide the exact title, date, figure caption, units, URL, and access date. Use NOAA or Scripps for atmospheric carbon dioxide and IPCC or PAGASA for climate claims; state whether each tropical-cyclone chart represents frequency, intensity, landfall, or rainfall.

Guide Questions:

1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: CLIMATE CHANGE ALPHABET GAME	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Follow the stated game rules and respond when called. Give the scientifically correct answer and, when required, justify it using evidence or the relevant concept. **Activity Proper:** The learners will think of words associated with climate change using the letters of the alphabet. For each word, they will write a short meaning or use it in a sentence related to climate change. After completing the activity, learners will share their answers with a partner or group and explain why their chosen words are connected to the topic. Reflection and Discussion Questions: Choose one word from your list and use it in a sentence that explains its connection to climate change. Science clarification: Recent global warming is unequivocally caused primarily by human activities. Do not claim an observed	The activity targets Learning Objectives 1 and 2 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative.

	increase in Philippine tropical-cyclone frequency; PAGASA reports high variability with no indication of an increasing frequency trend. Discuss projected intensity, rainfall, and attribution using stated confidence and geographic scale. Source requirement: For each graph, provide the exact title, date, figure caption, units, URL, and access date. Use NOAA or Scripps for atmospheric carbon dioxide and IPCC or PAGASA for climate claims; state whether each tropical-cyclone chart represents frequency, intensity, landfall, or rainfall. **Guide Questions:** 1. Which word you chose best represents the issue of climate change? Why? 2. Were there any letters that were difficult to match with a climate change-related term? 3. How did this activity help you understand important terms related to climate change? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	**Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	A.2. Establishing the Purpose of the Lesson	
	Option 1: SEE, THINK, WONDER	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:**	The activity targets Learning Objectives 1 and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the

	Examine each climate-related image and record what is directly visible, what you infer is happening, and what you still wonder. Cite visual evidence for each inference and explain whether the image alone can demonstrate a long-term climate trend. **Activity Proper:** This activity uses a visual-thinking routine to explore meaning. The teacher shows compelling images related to climate change. These may include cracked dry land, melting ice caps, and damage caused by typhoons. See the annex for sample images. Then the learners will be asked the following questions: Science clarification: Recent global warming is unequivocally caused primarily by human activities. Do not claim an observed increase in Philippine tropical-cyclone frequency; PAGASA reports high variability with no indication of an increasing frequency trend. Discuss projected intensity, rainfall, and attribution using stated confidence and geographic scale. Source requirement: For each graph, provide the exact title, date, figure caption, units, URL, and access date. Use NOAA or Scripps for atmospheric carbon dioxide and IPCC or PAGASA for climate claims; state whether each tropical-cyclone chart represents frequency, intensity, landfall, or rainfall. **Guide Questions:** 1. What do you see in the picture? 2. What do you think is happening? 3. What clues or evidence in the picture helped you say that? 4. What do you wonder or want to ask about the picture? 5. How is the picture connected to long-term changes in temperature and weather patterns?	Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: CAUSE OF CLIMATE CHANGE- SORTING GAME	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Sort each item into the correct category based on the scientific characteristics provided. Record your classifications and justify any item that could be confused with another category. **Activity Proper:** Sort the following causes of climate change as "Natural" or "Man-Made" (Anthropogenic): burning fossil fuels, volcanic eruptions, overuse of fertilizers, deforestation, transportation emissions, open burning of waste, changes in solar radiation, industrial emissions Mechanism: Open burning releases carbon dioxide and other pollutants. Some fertilizer practices can increase nitrous-oxide emissions under specified soil conditions. **Guide Questions:** 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives?	The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

	Assessment Criteria: • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	**Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Option 1: Climate Change Signals	
	Materials/Resources Needed: • Pre-collected stimuli (teacher-provided, not student-investigated): (See Annex for sample materials) • PAGASA rainfall for a selected region using CliMap v.2.0 • Photograph of local coastal erosion • Quote from a local farmer about observed changes • News headline about a recent typhoon **Directions:** For each graph, image, quotation, or headline, complete the provided sentence frame. Describe only what the stimulus shows, identify the additional long-term evidence needed to link it to climate change, and, when a link is supported, state the source, period, geographic scale, and confidence. **Activity Proper:** Focus: Describing what is observed and connecting to definition — NOT proposing solutions or conducting research. Source note: Provide an exact source for quotations and news-style text or label the material as an illustrative fictional scenario.	The activity targets Learning Objectives 1 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets,

	Guide Question: "This [graph/image/quote] shows ___. What additional long-term, quality-controlled evidence is needed before linking it to climate change? If a connection is supported, state the source, period, geographic scale, and level of confidence. To describe this to someone from another province, I would say ___." **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.
	Option 2: CLIMATE CHANGE MOVIE	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed **Directions:** Watch the assigned video or film segment attentively. Record the key scientific ideas or evidence, then answer the guide questions and relate the information to the lesson concept. **Activity Proper:** The teacher will show video clips or a short documentary explaining the causes and effects of climate change. After viewing, learners will engage in guided reflection and discussion using prepared questions to deepen their understanding and	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms.

	personal connection to the issue. See the references for a sample video clip. Reflection and Discussion Questions: **Guide Questions:** 1. What did you see? Describe the scenes in detail. 2. What causes were shown? Describe how each contributes. 3. What effects did you observe? Describe their impact. 4. How would you describe what climate change means using evidence from this video? 5. Have you seen something similar in your community? Describe the connection. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.
	B.2. Discussing New Concept	
	Option 1: BUILD A DEFINITION TOGETHER	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences.	The activity targets Learning Objectives 1 and 2 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis.

	Activity Proper: The learners will construct a definition of climate change using the following terms: long-term, changes, temperature, weather patterns, caused by humans, natural causes Sentence Frame: "Climate change is ___ changes in ___ and ___ patterns over ___ periods, caused by ___ and ___ factors, leading to ___ effects on ___." Reflection and Discussion Questions: **Guide Questions:** 1. How did each of the given terms help you understand what climate change means? 2. Why is it important to include both human and natural causes in the definition? 3. Why is it important for people to have a clear and accurate understanding of climate change? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	Option 2: CLIMATE CHANGE-INTERACTIVE DIRECT INSTRUCTION	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-

	Directions: Follow the presentation and respond to each embedded question. Distinguish weather from climate, define climate change, compare natural and human drivers by timescale and evidence, and record a scientifically accurate summary. **Activity Proper:** Direct instruction using a structured presentation: Weather vs. Climate Key Content: Weather = short-term daily conditions; Climate refers to long-term average patterns over decades. Definition of Climate Change Key Content: Climate change = long-term shifts in temperature, rainfall, and weather patterns. Historical Climate Changes on Earth Key Content: Earth has experienced major climate changes before: Ice Ages (glacial periods); Warming periods between ice ages; Volcanic eruptions causing temporary cooling; Today's climate change is unusual because it is occurring rapidly and is primarily driven by human activities. Causes of Current Climate Change Key Content: Natural causes exist, but human activities (fossil fuels, deforestation, industry) are the dominant driver now. Evidence and Local Connection Key Content: Global: rising temperatures, melting ice, sea level rise; Local (Philippines): rising heat and sea level, changing rainfall extremes, greater coastal-flood risk, and marine heat stress that can contribute to coral bleaching Interaction: Present a local headline or graph;	Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Impacts (Keep it general since the next competency discusses this) Key Content: Ecosystems disrupted, species migration/extinction; Human impacts: food security, health, livelihoods. Mechanism: Open burning releases carbon dioxide and other pollutants. Some fertilizer practices can increase nitrous-oxide emissions under specified soil conditions. **Guide Questions:** 1. Interaction: "If it rains today, does that mean our climate has changed?" 2. Interaction: "How would you explain climate change in your own words?" 3. Interaction: "What's the difference between natural past climate changes and today's climate change?" 4. Interaction: Show two images (volcano vs. factory). Ask: "How can each influence climate, on what time scale, and with what evidence? Large eruptions often cause temporary cooling through aerosols, whereas fossil-fuel emissions drive long-term warming." 5. Ask: "How does the local headline or graph show evidence related to climate change?" 6. Interaction: "How does climate change affect people, plants, and animals in our community?" **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

	B.3. Developing Mastery	
	Option 1: Describe the Data	
	Materials/Resources Needed: Printed data cards showing the following: • Global temperature anomaly 1880–2020 (NASA) • Atmospheric CO_2 levels 1960–2020 (Keeling Curve) • Philippine typhoon frequency 1970–2020 (PAGASA) • Before/after glacier photograph • Coastal flooding image • (See Annex for the data cards) **Directions:** Study the graph, chart, or data set carefully. Identify the relevant patterns or trends, support each interpretation with specific evidence from the data, and answer the guide questions. **Activity Proper:** Display one stimulus at a time. Learners write 2–3 sentences describing what the data shows AND what it means for climate change. Use description frames: "This graph/image shows _____, which means _____." "The data indicates that _____, suggesting that climate change _____." "Compared to _____, we can observe _____, which indicates _____. The teacher checks for: accurate reading of data, correct use of "climate change," specific details, clear cause-effect language.	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Guide Questions:

1. What pattern, trend, or relationship is shown by the data?
2. What specific evidence from the data supports your interpretation?

Assessment Criteria:

• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

Option 2: CLIMATE CHANGE MATCH-UP

Materials/Resources Needed:

• Displayed or teacher-prepared prompts/cards, as needed
• Notebook or paper
• Pen or pencil

Directions:

Match each item with the correct term, category, description, or process. Record each match and briefly explain the scientific basis for your answer.

Activity Proper:

The following are the causes and effects of climate change. Match each cause with its corresponding effect from the boxes provided.

Cause Cards	Effect Cards
1. Burning fossil fuels 2. Deforestation 3. Livestock farming	a. Fossil-fuel burning → more atmospheric CO_2 and a stronger greenhouse effect

The activity targets Learning Objectives 2 and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.

The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this

	4. Melting permafrost 5. Volcanic eruptions 6. Solar radiation variations 7. Cement production 8. Ocean CO_2 absorption	b. Deforestation → reduced carbon uptake and often additional CO_2 emissions c. Livestock production → methane and nitrous oxide emissions d. Thawing permafrost → CO_2 and methane release that can amplify warming e. Large volcanic eruption → aerosol-driven temporary cooling f. Solar-radiation variation → a natural climate forcing, not the dominant driver of recent warming g. Cement production → CO_2 from calcination and fuel use h. Ocean CO_2 uptake → acidification and reduced carbonate availability; warming is the main direct trigger of mass coral bleaching	activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	Guide Questions: 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives?		

	Assessment Criteria: • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Option 1: DESCRIBE IT TO A FRESHMAN	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** In pairs, explain climate change to a hypothetical Grade 7 learner in three minutes using the checklist. The listener records specific feedback on accuracy and clarity; then switch roles and revise the explanation. **Activity Proper:** Pair learners (describer + listener). Describer has 3 minutes to explain climate change to a hypothetical Grade 7 student. Listener evaluates using a checklist: Defined climate change clearly Distinguished from weather Mentioned one natural cause Mentioned one human cause Described two effects Used scientific terms correctly Gave a Philippine example	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print.

	Listener provides feedback: "Your description was clear about ___, but I needed more detail about ___." Roles reverse. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	**Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.
	Option 2: CLIMATE CHANGE CAPTION CONTEST	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Create the required visual output using accurate scientific ideas, clear labels or captions, and the specified evidence or examples. Present the output and explain its main message. **Activity Proper:** Display 4–6 climate change images (cracked land, flooded barangay, bleached coral, melting glacier, smog city). Learners write a 2-sentence caption: Sentence 1: Describe what is happening.	The activity targets Learning Objectives 1 and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate

	Sentence 2: Explain how this illustrates what climate change means. Class votes on most accurate and complete description. Caption Criteria: accurate visual description, clear link to climate change, use of scientific term, Philippine context where applicable. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.
	C.2. Making Generalization	
	Option 1: WRAP IT UP!	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

<table>
<tr>
<td></td>
<td>
Activity Proper:
Complete the table below using the concepts you have learned:
<table>
<tr><th>Cause of Climate Change</th><th>Effects of Climate Change</th><th>Ways of Mitigating the Effects of Climate Change</th></tr>
<tr><td>1.</td><td></td><td></td></tr>
<tr><td>2.</td><td></td><td></td></tr>
<tr><td>3.</td><td></td><td></td></tr>
<tr><td>4.</td><td></td><td></td></tr>
<tr><td>5.</td><td></td><td></td></tr>
</table>
Guide Questions:
1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Assessment Criteria:
• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation
</td>
<td>The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.</td>
</tr>
<tr>
<td></td>
<td colspan="2">Option 2: CLIMATE CHANGE IN A NUTSHELL</td>
</tr>
<tr>
<td></td>
<td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil</td>
<td>The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences,</td>
</tr>
</table>

	Directions: Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences. **Activity Proper:** The teacher may pose the following questions to the learners: Define climate change in 1 sentence. Share an example of climate change impacts you've heard or seen. **Guide Questions:** 1. What are two causes of climate change? 2. What action can individuals take to fight climate change? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	C.3. Evaluating Learning	
	Option 1: DESCRIPTION CHECKPOINT	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners

	Directions: Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** Each learner receives an index card. Prompt: "Write a complete description of what is meant by 'climate change.' Your description should be 4–6 sentences and include ALL of the following:" A clear definition Difference between climate change and weather At least one natural cause At least one human cause At least two effects One Philippine example Follow-up: Learners scoring <10 points receive a "Description Booster" displayed by the teacher or provided as a prompt with sentence frames. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Option 2: EXIT TICKET ASSESSMENT	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** Part 1 — Self-Assessment (1 min): I can clearly describe climate change to someone who has never heard the term I can describe some parts but need more practice I need more help Part 2 — Written Description (5 min): Describe climate change in 3–5 sentences including definition, cause, effect, and weather distinction. **Guide Question:** Part 3 — Diagnostic Reflection (2 min): What word or concept was most difficult to describe today? ___ **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

C.4. Additional Activities

Option 1: DESCRIPTION ACCURACY CHALLENGE

Materials/Resources Needed:

• Displayed or teacher-prepared prompts/cards, as needed
• Notebook or paper
• Pen or pencil

Directions:

Sort the six description cards into Accurate and Inaccurate groups. Identify the error in every inaccurate statement, rewrite it correctly, and justify each decision using the lesson definition and evidence.

Activity Proper:

Learners receive 6 description cards (3 accurate, 3 with errors).
Sort into "Accurate" and "Inaccurate" piles.
For inaccurate cards, identify the error and rewrite correctly.
Sample Cards:

Card	Content	Status
A	"Climate change refers to long-term shifts in temperature and weather patterns over decades or longer. Recent global warming is driven primarily by human activities. Effects include rising sea level and changes in some extreme events; tropical-cyclone frequency, intensity, and rainfall must be described separately using a cited regional dataset."	☑ Accurate

The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.

The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

Note to Teachers: Allow learners to discuss their answers with their group members

	B	"Climate change is when it rains a lot for a week and causes flooding. It happens because people throw trash in rivers."	✗ Error: Confuses weather with climate; incorrect cause
	C	"Climate change is caused only by human activities. Natural things like the sun have nothing to do with it. Climate change does not affect tropical countries."	✗ Error: Omits natural causes; incorrect claim about tropics

Extension: Learners write their own "Accurate Description" card and exchange it for peer verification.

Guide Questions:

1. Which scientific concept was most important in determining the correct response?
2. What evidence or characteristic helped you distinguish the correct answer from the alternatives?

Assessment Criteria:

• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation

before presenting. Use follow-up questions to clarify ideas and address misconceptions.

Option 2: DESCRIPTION AUDIENCE ADAPTATION

Materials/Resources Needed:

• Notebook or paper
• Pen or pencil

The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record

	Directions: Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences. **Activity Proper:** Learners draw an audience card: A Grade 5 student A barangay captain A foreign tourist A social media influencer who posted misinformation A local fisherman who observed changes Write or orally deliver a 1-minute description tailored to that audience. Peers evaluate: Scientific accuracy maintained Language appropriate for audience Key elements included (definition, causes, effects, Philippine context) Audience would understand after hearing this **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

V. ASSESSMENT *(Assessing Learnings)*	***Part 1: Multiple Choice*** *Instructions: Choose the letter of the correct answer.* 1. What is climate change? a. Seasonal rain changes during the year b. The daily change in temperature from morning to night c. A sudden shift in weather patterns that lasts for one week d. A long-term change in Earth's climate patterns over decades or longer 2. Which gas is a major contributor to the greenhouse effect that drives climate change? a. Oxygen b. Carbon dioxide c. Helium d. Nitrogen 3. Which of the following are natural causes of climate change? a. Volcanic eruptions b. Ocean current shifts c. Changes in solar radiation d. All of the above 4. Which of the following are human activities that contribute to climate change? a. Deforestation b. Burning fossil fuels c. Industrial emissions d. All of the above 5. Which of the following BEST describes the difference between weather and climate? a. Weather happens in the morning; climate happens at night b. Weather is short-term atmospheric conditions; climate is long-term patterns over decades c. Weather is only about rain; climate is only about temperature d. Weather and climate are exactly the same thing 6. Why does deforestation contribute to climate change? a. It removes oxygen from the atmosphere b. Trees cause pollution when they grow c. It cools the Earth too much d. Fewer trees mean less carbon dioxide is absorbed from the atmosphere

	7. How does the increase in greenhouse gases affect the planet? a. It causes Earth to cool down rapidly b. It speeds up the water cycle only c. It reflects all sunlight away from Earth d. It traps more heat in the atmosphere, leading to global warming 8. The graph below shows the average global temperature anomaly from 1880 to 2020. Which statement BEST describes what the graph shows? (Graph: Line showing temperatures stable 1880–1910, slight rise 1910–1940, plateau 1940–1970, sharp rise 1970–2020) a. Global temperatures have decreased steadily since 1880 b. Global temperatures showed little change until 1970, then increased rapidly c. Global temperatures rise and fall randomly with no pattern d. The graph shows daily temperature changes in Manila 9. In the Philippines, Long-term observations show rising temperature and sea level and changes in some rainfall extremes; attribution should use a cited regional data series rather than a single event. Which statement BEST describes what this means in terms of climate change? a. The Philippines is experiencing normal weather variations that happen every year b. These changes in typhoon intensity and rainfall patterns over decades describe how climate change affects the Philippines c. This means the Philippines has bad weather, not climate change d. Only Manila is affected; other regions have normal climate 10. Which of the following statements accurately describes an effect of climate change? a. Climate change causes glaciers to grow larger and sea levels to drop b. Climate change leads to more frequent or intense heat extremes and rising sea levels; changes in tropical-cyclone intensity and rainfall risk must be described with the relevant region and confidence, without claiming an observed increase in Philippine cyclone frequency c. Climate change only affects animals in cold countries d. Climate change has no effect on human activities like farming and fishing

	Part 2. Describe Climate Change In 3–5 sentences, describe climate change using one cause and one observable effect." **Assessment specification:** Revise any item that implies a universal increase in 'stronger storms.' Use only indicators stated in the stem, and provide the answer key, explanations, and total score.
VI. REFLECTION *(Feedback and Continuous Improvement)*	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery. 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? 6. What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT to clarify the instructions and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

APPENDIX

A.2. Establishing the Purpose of the Lesson
Option 1: SEE, THINK, WONDER







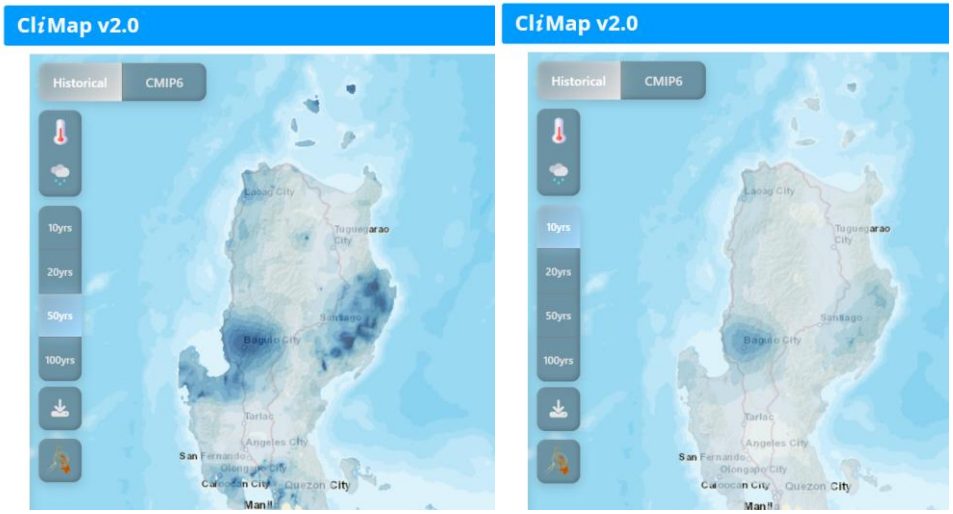


Directions: Examine each climate-related image and record what is directly visible, what you infer is happening, and what you still wonder. Cite visual evidence for each inference and explain whether the image alone can demonstrate a long-term climate trend.

B.1. Presenting Examples

Option 1: Climate Change Signals

Directions: Study the provided data display, identify the variables and pattern, make the required comparisons or calculations, and state an evidence-based conclusion without assuming causation.



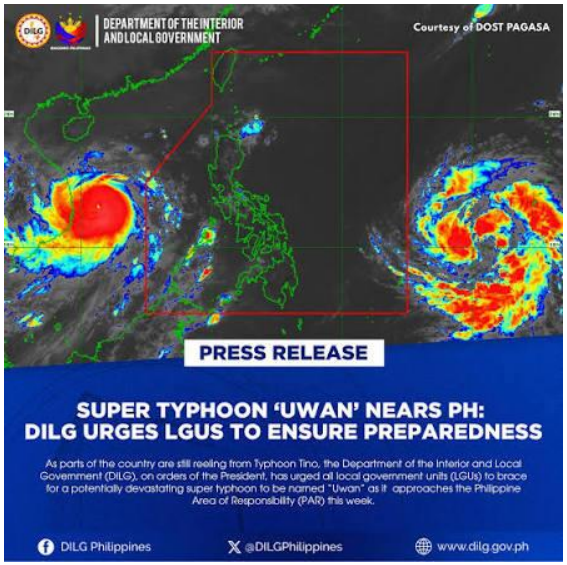
PAGASA Historical Rainfall Downscaling



Local Coastal Erosion



Quote from a local farmer about observed changes



News headline about a recent typhoon

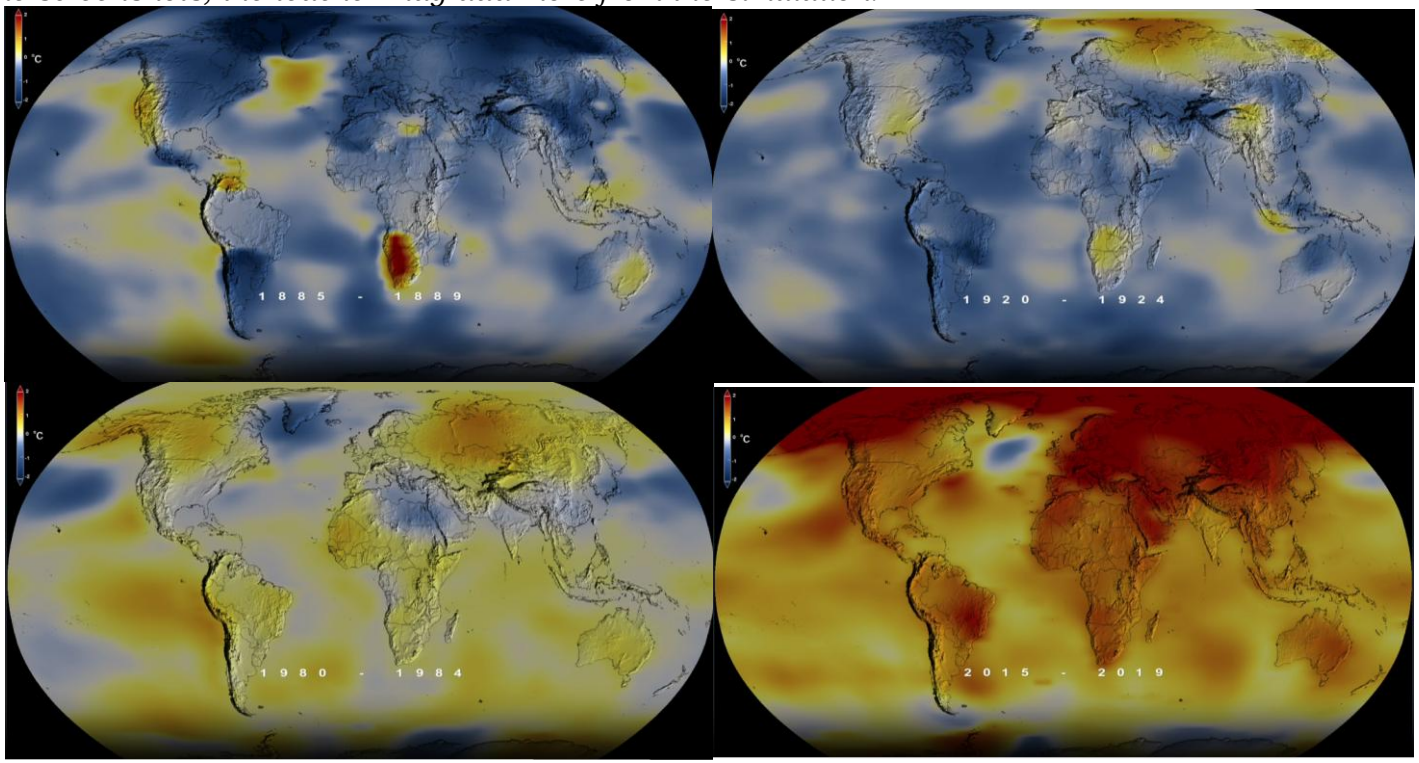
B. 3 Developing Mastery

Option 1: Describe the Data

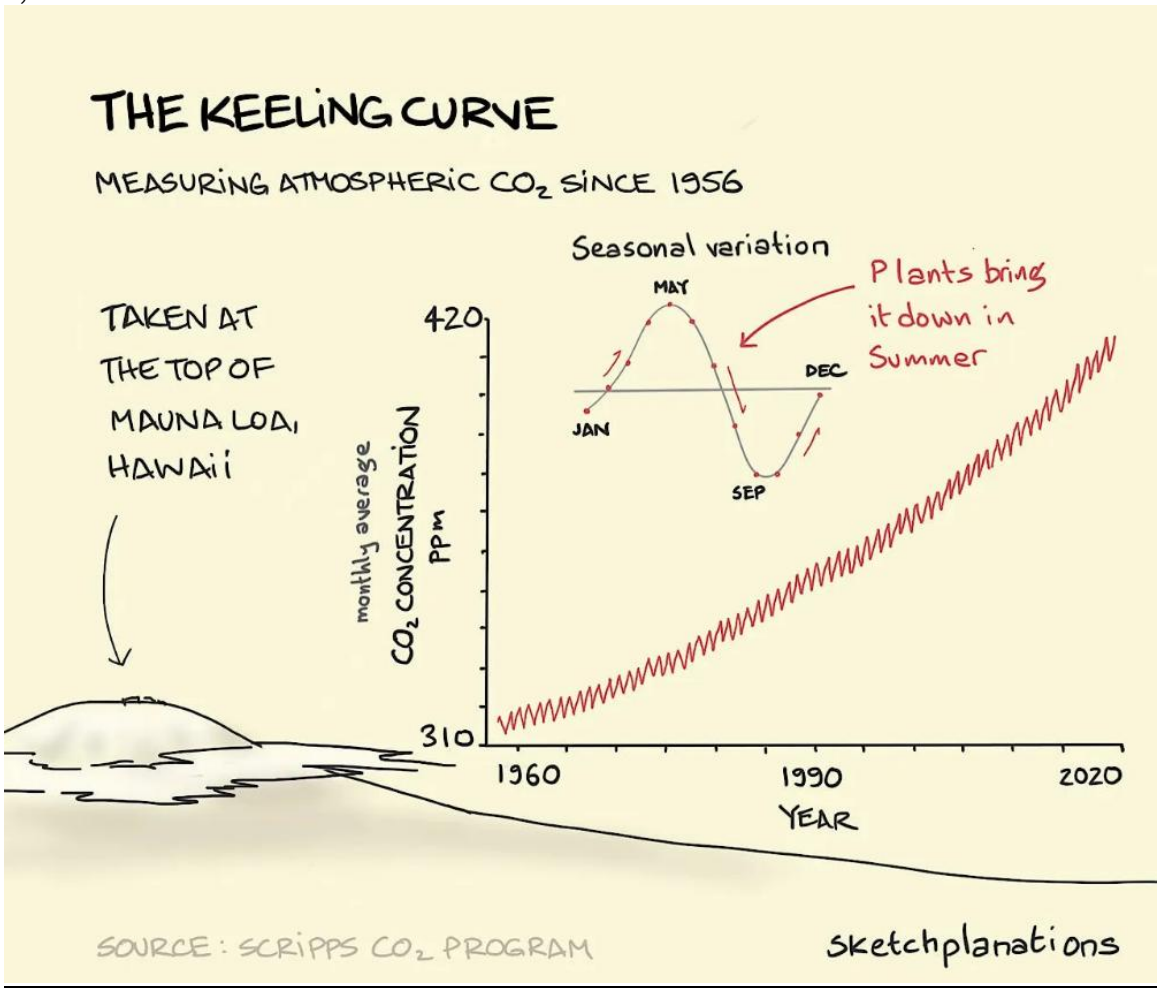
Directions: Study the provided data display, identify the variables and pattern, make the required comparisons or calculations, and state an evidence-based conclusion without assuming causation.

1. Global Temperature Anomalies from 1880 to 2020- NASA Scientific Visualization Studio. "Global Temperature Change Visualization." Data provided by Robert B. Schmunk. Visualized by Lori Perkins. Scientists: Gavin A. Schmidt, Robert B. Schmunk, and Reto A. Ruedy. Produced by Matthew R. Radcliff, Patrick Lynch, Kathryn Mersmann, and Katie Jepson. Written by Sofie L. Bates. National Aeronautics and Space Administration, Goddard Space Flight Center. Accessed May 26, 2026. https://svs.gsfc.nasa.gov/4882

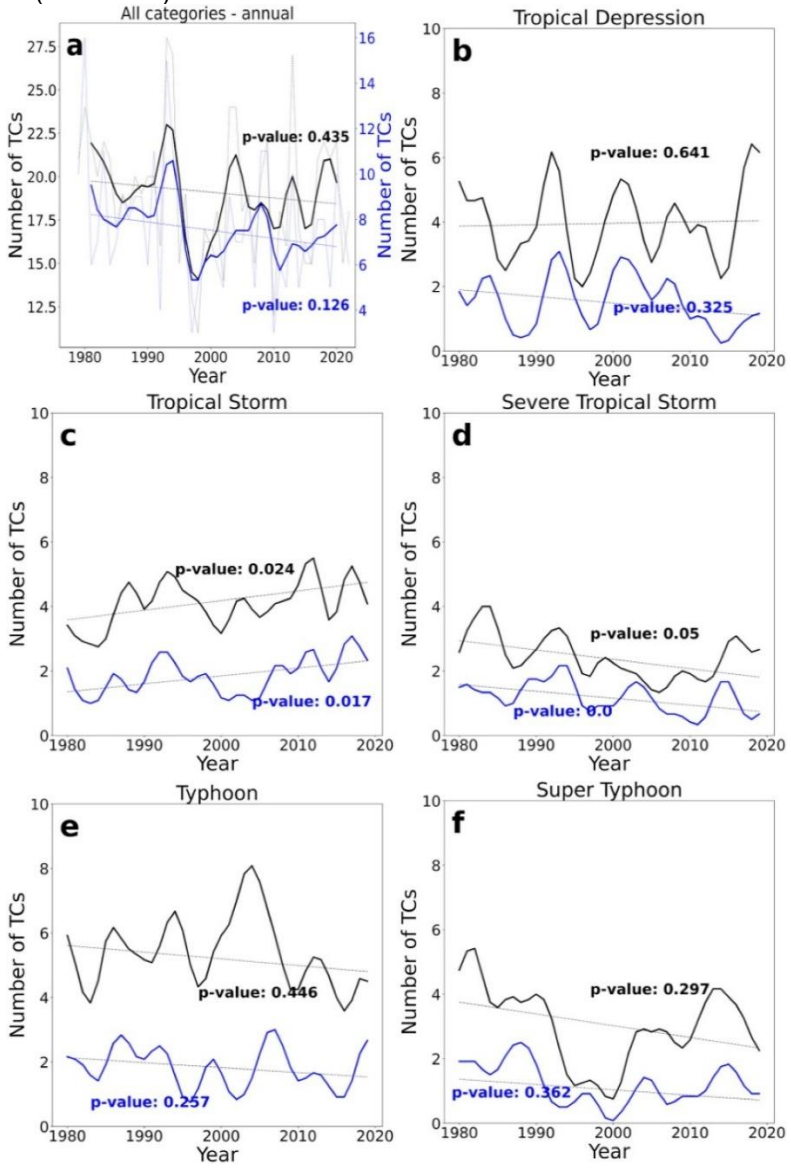
   These are sample screenshots; the teacher may add more from the simulation.



2. Use the official NOAA Global Monitoring Laboratory or Scripps Institution of Oceanography Keeling Curve record. Provide the exact title, units, date range, URL, and access date.



3. Philippine typhoon frequency 1970–2020 (PAGASA)



4. Before/after glacier photograph



5. Coastal flooding image



Assessment Answer Key:

Answer	Rationalization
1. D	Climate change refers to significant changes in global or regional climate patterns over extended periods (typically 30+ years), not short-term or seasonal weather variations.
2. B	Carbon dioxide (CO_2) is one of the primary greenhouse gases emitted by human activities, trapping heat in the atmosphere and driving recent climate change.
3. D	Volcanic eruptions, ocean current shifts, and variations in solar radiation are all natural factors that can influence Earth's climate over long periods.
4. D	Deforestation, burning fossil fuels, and industrial emissions all increase greenhouse gas levels in the atmosphere, contributing to anthropogenic climate change.
5. B	Weather refers to short-term atmospheric conditions (hours to days), while climate refers to long-term patterns of temperature, precipitation, and wind over 30 years or more. This distinction is essential to describing what climate change means.
6. D	Trees absorb CO_2 during photosynthesis. Deforestation reduces this natural carbon sink, leaving more CO_2 in the atmosphere to trap heat.
7. D	Greenhouse gases trap outgoing longwave radiation from Earth's surface, preventing heat from escaping to space. This enhanced greenhouse effect leads to global warming and climate change.
8. B	The graph shows a long-term warming trend, particularly pronounced since 1970. This demonstrates the "long-term change in climate patterns" that defines climate change. Option D is incorrect because the graph shows global (not local) and long-term (not daily) data.
9. B	Long-term temperature, sea-level, and rainfall indicators from a cited regional dataset can support a climate-change description. Tropical-cyclone claims require a dataset that clearly states whether it measures frequency, intensity, landfall, or rainfall.
10. B	Observable effects include more frequent or intense heat extremes and rising sea level. Tropical-cyclone intensity and rainfall risks must be described for the relevant region and confidence level; do not claim an observed increase in Philippine cyclone frequency.

Learning Title/Topic:	Philippine Ecosystems – Biological Responses to Climate Change in the Philippines	Lesson Exemplar:	16

I. OBJECTIVES	
A. Content Standard	Climate change affects ecosystems and the organisms living in them; and ecosystems are finite and have limited resources.
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills*** *Learners should already understand basic ecology, the difference between weather and climate, and the greenhouse effect. They should also be able to interpret simple data and connect local ecosystem changes to global climate patterns.*
	Describe how biological systems respond to climate change and contribute to understanding its effects on living organisms in the Philippines;
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	https://www.latimes.com/people/deborah-netburn. "A Little Extra Global Warming Will Mean a Lot More Habitat Loss for Plants and Animals, Study Says." Los Angeles Times, May 18, 2018. https://www.latimes.com/science/sciencenow/la-sci-sn-climate-change-habitats-20180517-story.html. National Geographic. "Causes and Effects of Climate Change." Video. *YouTube*, August 28, 2017. https://www.youtube.com/watch?v=G4H1N_yXBiA. Panela, Shaira. "'Too Many People': Philippine Island Being Deforested despite Extensive Protections." Mongabay Environmental News, October 31, 2014. https://news.mongabay.com/2014/10/too-man. y-people-philippine-island-being-deforested-despite-extensive-protections/.

	Ramos, Mariejo. "How Do Mangroves Protect Coastal Communities from Extreme Weather?" Context.news. Context, April 4, 2025. https://www.context.news/climate-risks/how-do-mangroves-protect-coastal-communities-from-extreme-weather. Tasoff, Harrison. "A Thirsty Earth Is Making Droughts More Severe." The Current, June 4, 2025. https://news.ucsb.edu/2025/021903/atmospheres-growing-thirst-making-droughts-worse-even-where-it-rains. Timonera, Bobby. "Bukidnon Landscape." MindaNews, December 15, 2024. https://mindanews.com/photo-of-the-day/2024/12/bukidnon-landscape/. University of the Philippines. "A World without Color: The Bleached Soft Corals of Bolinao - up Marine Science Institute." UP Marine Science Institute, May 21, 2024. https://msi.upd.edu.ph/the-bleached-soft-corals-of-bolinao/. Warne, Kennedy. "Coral Reefs in the Philippines Are Some of the World's Most Vibrant—but in Peril." National Geographic, May 12, 2022. https://www.nationalgeographic.com/magazine/article/philippines-reefs-are-some-of-the-most-vibrant-but-in-peril-feature. **Materials:** *Photos/articles of coral bleaching, maps of animal migration, satellite images of forests, climate data Video clips on the impact of climate change on biological systems*
III. CONTENT *(Sequencing Content)*	Philippine Ecosystems – Biological Responses to Climate Change in the Philippines
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	1. Identify changes in biological systems due to climate change. 2. Explain how organisms adapt or fail to adapt to climate change. 3. Relate scientific evidence to observable effects of climate change in Philippine ecosystems

<table>
<tr><th colspan="2">IV. PROCEDURES</th><th>ANNOTATIONS</th></tr>
<tr><td rowspan="3">A. Activating Prior Knowledge</td><td colspan="2">A.1. Activating Prior Knowledge</td></tr>
<tr><td colspan="2">Option 1: KNOWLEDGE CHECK!</td></tr>
<tr><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it.

Activity Proper:
The teacher asks learners to recall ideas on Climate Change and Biological Ecosystems. Learners write related words or phrases for five minutes.
Learners choose one organism affected by a documented climate driver, such as heat, drought, or flooding, and describe its possible response. Treat direct land-use habitat loss as a separate pressure unless evidence supports an interaction with climate change.
Here is a sample learner’s response:
<table><tr><td>Organism</td><td>Climate Stressor & Response</td></tr><tr><td>Coral reefs</td><td>Heat → Coral bleaching</td></tr><tr><td>Rice plants</td><td>Drought → Reduced yield</td></tr><tr><td>Fruit bats</td><td>Habitat loss → Migration</td></tr></table></td><td>The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions.
The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print.

Note to Teachers: Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.</td></tr>
</table>

	Science clarification: Distinguish among acclimation within an organism, behavioral responses, ecological redistribution, and evolutionary adaptation as heritable population changes across generations. Causal clarification: Separate climate drivers from deforestation, fragmentation, habitat loss, and other direct land-use pressures. Images or coincident trends alone do not establish climate attribution. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	
	Option 2: WORD WALL WARM-UP	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** List the required lesson terms, define each in your own words, give an accurate example or connection, and share or post the responses as instructed.	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.

	Activity Proper: The teacher posts key terms related to climate change and biological ecosystems on the board or wall. Learners are asked to select five terms they know well, define them in their own words, and discuss how each term might relate to climate or ecosystems. The teacher may provide a sample word wall including terms such as biotic, forest, coral reef, mangrove, freshwater, rainforest, desert, abiotic, producers, biodiversity, habitat, population, greenhouse gases, sea level rise, drought, coral bleaching, migration, crop failure, and mitigation. After learners finish, the teacher facilitates a short discussion to connect their definitions to the lesson objectives and clarify any misconceptions. Science clarification: Distinguish acclimation within an organism, behavioral response, ecological redistribution, and evolutionary adaptation as heritable population change across generations. Evidence requirement: Specify the temperature anomaly relative to the local seasonal maximum and include exposure duration or a recognized accumulated heat-stress measure. Causal clarification: Separate climate drivers from deforestation, fragmentation, habitat loss, and other direct land-use pressures. Images or coincident trends alone do not establish climate attribution.	The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Source requirement: For each local claim, provide a scientific or official source with location, period, metric, and uncertainty; otherwise label the case hypothetical. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	A.2. Establishing the Purpose of the Lesson	
	Option 1: MYSTERY PHOTO PROMPT	
	Materials/Resources Needed: • Displayed images or teacher-prepared visual prompts • Notebook or paper • Pen or pencil **Directions:** Examine the image or visual carefully. Record the relevant observations, distinguish observation from inference, and answer the guide questions using scientific evidence.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through

	Activity Proper: The teacher shows learners a set of pictures or short video clips, such as a bleached coral reef, a dying forest or wildfire aftermath, animal species in an unusual habitat like fish in flooded fields, and dry, cracked farmlands (see Annex for sample images). Observation Guide: Learners will describe the observed change, possible climate factor, affected organism or ecosystem, and possible biological response Science clarification: Distinguish acclimation within an organism, behavioral response, ecological redistribution, and evolutionary adaptation as heritable population change across generations. Evidence requirement: Specify the temperature anomaly relative to the local seasonal maximum and include exposure duration or a recognized accumulated heat-stress measure. Causal clarification: Separate climate drivers from deforestation, fragmentation, habitat loss, and other direct land-use pressures. Images or coincident trends alone do not establish climate attribution. **Guide Questions:** 1. What do you see? 2. What might have caused these changes? 3. How do you think this connects to climate? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Option 2: WHAT IF…? SCENARIO CARDS	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read or examine the assigned case or scenario. Identify the relevant evidence, apply the appropriate scientific concepts, answer the guide questions, and justify your conclusion. **Activity Proper:** The following may be given to the learners: Evidence requirement: Specify the temperature anomaly relative to the local seasonal maximum and include exposure duration or a recognized accumulated heat-stress measure. Source requirement: For each local claim, provide a scientific or official source with location, period, metric, and uncertainty; otherwise label the case hypothetical. **Guide Questions:** 1. What if the temperature of the water in a coral reef ecosystem rose by 2°C? 2. What if typhoons became more frequent in a coastal mangrove area? 3. What if drought lasted for 6 months in a farming region? 4. What might happen to plants and animals? 5. How might humans be affected? 6. Can the system recover?	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
B. Instituting New Knowledge	***B.1. Presenting Examples***	
	Option 1: CASE STUDY GALLERY WALK	
	Materials/Resources Needed: • Displayed images or teacher-prepared visual prompts • Notebook or paper • Pen or pencil **Directions:** Move through the assigned stations in order. Examine the information, image, evidence, or task at each station; record the required observations or responses; then use the lesson concepts to explain your conclusions. **Activity Proper:** Set up five stations around the classroom, each focusing on a specific Philippine case study: coral bleaching in Bolinao, deforestation in Palawan, mangrove protection, agricultural impacts, and animal migration. (See Annex for the Data and Guide Questions for each station) At each station, provide short data sets (photos, graphs, articles, or excerpts) and guiding questions. Learners rotate in groups, examine the materials, and answer the questions.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

	For each station, learners will complete: evidence observed, climate driver, biological response, affected species or community, and possible consequence After the gallery walk, facilitate a whole-class discussion to synthesize findings and connect them to the lesson objectives. Source requirement: For each local claim, provide a scientific or official source with location, period, metric, and uncertainty; otherwise label the case hypothetical. **Guide Questions:** 1. What evidence in the case or scenario is most relevant to the problem? 2. Which scientific concept best explains the situation, and why? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	**Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.
	Option 2: "MGA KWENTO NG KLIMA-VIDEO DOCUMENTARY ANALYSIS	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed	The activity targets Learning Objectives 1, 2, and 3 by guiding learners to extract scientific information from visual media and connect it to the lesson concepts. It applies the Constructivist, Inquiry-Based, and Interactive approaches because learners observe closely, answer guiding questions, and discuss evidence from the media.

	Directions: Watch the assigned video or film segment attentively. Record the key scientific ideas or evidence, then answer the guide questions and relate the information to the lesson concept. **Activity Proper:** Let learners watch *Mga Kwento ng Klima* (Full Documentary) by ABS-CBN News. This documentary explores how climate change affects communities and ecosystems in the Philippines. It highlights coral bleaching, agricultural impacts, biodiversity loss, and adaptation strategies. **Viewing Guide Questions:** **Guide Questions:** 1. What biological changes are shown in the documentary (e.g., coral bleaching, forest dieback, species migration)? 2. How do organisms adapt—or fail to adapt—to climate-related stressors in the Philippines? 3. What scientific evidence is presented, and how does it connect to observable effects in local ecosystems? 4. How do these biological responses help communities and scientists understand the broader impact of climate change? **Expected Output/Product:** Completed viewing guide that communicates the required scientific ideas clearly and accurately.	The pedagogical strategy used is guided multimedia analysis, supported by a viewing guide, pause points, peer discussion, and teacher questioning. Literacy is integrated through identifying key ideas, evaluating statements, and summarizing evidence from the media. Numeracy is integrated through interpreting any scales, time series, quantities, or comparisons shown. EdTech is integrated through a cited video, animation, or presentation when available, together with an accessible offline alternative. **Note to Teachers:** Preview the media for scientific accuracy and accessibility. Clarify that a video or animation is not an interactive simulation unless learners can manipulate variables.

	Assessment Criteria: • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	
	B.2. Discussing New Concept	
	Option 1: EXPERT JIGSAW	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Join the assigned expert group, read the source set, and record the main mechanism and Philippine evidence for the assigned climate-response topic. Return to the home group, teach the findings, and combine all four topics in a labeled synthesis map. **Activity Proper:** Organize students into diverse home groups of 4–6 members. Ensure each group has mixed abilities. Assign each member a number (1–4). Explain that each number corresponds to an expert topic Divide learners into expert groups based on their assigned number. Group 1: Climate impacts on ecosystems (species changes, timing shifts, interactions) Group 2: Terrestrial responses (altitude shifts, phenology)	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

	Group 3: Marine responses (coral bleaching, acidification) Group 4: Physiological and genetic adaptation Learners read the provided materials and discuss their assigned topic to build expertise. They identify key examples in Philippine ecosystems and summarize the main mechanisms and evidence. Experts rejoin their home groups to share findings. Each expert teaches their topic clearly. Ensure all members understand each perspective. Home groups integrate knowledge to connect biological responses with climate impacts. Discuss how different responses interrelate. Relate evidence to Philippine ecosystems. Learners share their learning through a Collaborative Synthesis Map (See Annex for a sample collaborative synthesis map) Science clarification: Explain ocean acidification through changes in seawater carbonate chemistry and distinguish experimental effects from observed harvest changes that may have multiple causes. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson?	**Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: INTERACTIVE LECTURE WITH THINK-PAIR-SHARE	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Think independently about the prompt and write an initial response. Discuss it with a partner, agree on an evidence-based answer, and share the conclusion with the class. **Activity Proper:** Interactive Lecture (Whole Class): The teacher presents key concepts on climate impacts (species changes, timing shifts, ecosystem interactions) and biological responses (terrestrial, marine, physiological/genetic). The teacher uses visuals/examples from Philippine ecosystems to anchor the discussion. Think (Individual Work) Pose guiding questions, e.g.: Learners jot down short notes or examples. Pair (Peer Sharing) Students discuss their answers with a partner, compare ideas, and clarify misconceptions.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

	Encourage them to connect scientific evidence with observable local effects. Share (Class Discussion) Selected pairs share insights with the class. The teacher synthesizes responses, highlighting links between ecosystem impacts, biological adaptations, and Philippine case studies. As a quick consolidation, groups create a short concept map or list showing: Climate impacts → Biological responses → Local evidence/examples **Guide Questions:** 1. What changes in ecosystems are most evident in the Philippines? 2. How do organisms adapt—or fail to adapt—to these changes? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	**Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.
	B.3. Developing Mastery	
	Option 1: ECOSYSTEM IMPACT REPORT	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process.

	Directions: Investigate one Philippine ecosystem using credible sources and prepare the five-part report: ecosystem profile, climate stressors, documented or projected biological responses, science-based monitoring or research priorities, and a concise class presentation. Cite every source. **Activity Proper:** Ask learners to investigate and report on how climate change affects a chosen Philippine ecosystem, focusing on biological responses, and present their findings in a structured five-part report. Part 1: Ecosystem Profile – Describe the ecosystem's key features, species, and functions. Part 2: Climate Impacts – Identify observed or projected climate stressors affecting the ecosystem. Part 3: Biological Responses – Explain how organisms within the ecosystem adapt or fail to adapt (migration, phenology shifts, bleaching, dieback, etc.). Part 4: Recommendations – Suggest science-based monitoring or research priorities (not human adaptation/mitigation strategies, since those belong to another competency). Part 5: Presentation – Summarize findings in a clear, engaging format for class sharing. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity?	It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

2. How does your response or result connect to the scientific concept discussed in the lesson?

Expected Output/Product:
Completed report presenting the required observations, analysis, and evidence-based conclusion.

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little evidence or gives unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				____ / **15**

	Option 2: ORGANISM RESPONSES—CLIMATE EDITION	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Analyze the assigned Philippine organism and climate stressor, identify the observed response, and classify it accurately as physiological, behavioral, acclimatization, range or timing shift, or heritable population-level adaptation. Explain the survival or biodiversity outcome using evidence. **Activity Proper:** Let learners explain how organisms adapt—or fail to adapt—to climate-related stressors, and connect these responses to survival and biodiversity outcomes in the Philippines. Box 1 (Organisms): Coral, Rice plant, Philippine Eagle, Mangrove tree, Tilapia fish, Mango tree Box 2 (Stressors): rising sea temperature, erratic rainfall, drought, ocean acidification, habitat loss, pest outbreaks Learners choose a biologically plausible organism–stressor pair and support the link with evidence. If a randomly drawn pair has no direct relationship, they should state that limitation rather than invent one. They identify:	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Biological Response: How the organism adapts (migration, physiological change, genetic adaptation) or fails to adapt. Link/Explanation: Why this response occurs, and what survival consequences follow. Philippine Example: Philippine Example: A real or plausible local case (if possible). Science clarification: Explain ocean acidification through changes in seawater carbonate chemistry and distinguish experimental effects from observed harvest changes that may have multiple causes. **Discussion Questions:** **Guide Questions:** 1. Which organisms were able to adjust to climate changes, and which ones struggled? What traits or conditions helped them survive? 2. If one species fails to adapt, how could that affect other organisms and even people in the community? 3. What practical steps can communities or conservation groups take to help vulnerable species in the Philippines cope with climate stress? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

<table>
<tr><td rowspan="3">C. Demonstrating Knowledge and Skills</td><td colspan="2">C.1. Finding Practical Application</td></tr>
<tr><td colspan="2">Option 1: INTERVIEW LOCAL EXPERTS OR COMMUNITY MEMBERS</td></tr>
<tr><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil
• Internet-enabled device, if available

Directions:
Prepare focused questions, interview the assigned expert or community member, record the responses accurately, verify relevant scientific claims, and summarize the findings.

Activity Proper:
Instruct learners to conduct firsthand community observations and interviews with local community members (farmers, fishermen, barangay officials, or environmental workers) about how biological systems (plants, animals, ecosystems) are responding to climate change. Emphasize that these observations may generate hypotheses but cannot, by themselves, attribute observed changes to climate change.

Sample interview guides:
After interviews, direct learners to summarize the responses, highlighting the biological effects observed and the evidence provided.</td><td>The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.
The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.</td></tr>
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	Guide Questions: 1. What changes have you observed in local crops, forests, or marine life due to changing climate conditions? 2. Have you noticed shifts in animal behavior, plant growth cycles, or ecosystem health? 3. Can you share specific examples of species or habitats showing stress or decline? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: REFLECTION JOURNAL OR PODCAST-VOICES FOR BIODIVERSITY	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed **Directions:** Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation. **Activity Proper:** Reflect on how climate change affects biodiversity and food security in the Philippines. Learners choose between: Writing a journal entry from the perspective of a Filipino farmer, fisher, or wildlife researcher	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing

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<td>Recording a short podcast episode (2–3 minutes) explaining:
What biodiversity loss they observe or experience
How food security is being threatened in their community
What they hope for the future.

Guide Questions:
1. What is the most important scientific idea you developed from the activity?
2. What example or evidence best supports your explanation?

Expected Output/Product:
Recorded podcast presenting the required scientific explanation or reflection.

Rubric:
• Scientific accuracy
• Completeness of required content
• Clarity and organization
• Appropriate use of evidence, examples, labels, or visuals</td>
<td>quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative.

Note to Teachers: Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.</td>
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<tr>
<td>Demonstrating Knowledge and Skills</td>
<td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>All scientific ideas are accurate, complete, and well explained.</td><td>Scientific ideas are mostly accurate with minor gaps.</td><td>Some correct ideas are present, but important errors or omissions remain.</td><td>Scientific content is largely inaccurate or incomplete.</td></tr>
<tr><td>Required Content and Evidence</td><td>Includes all required elements</td><td>Includes most required elements</td><td>Includes some required elements;</td><td>Many required elements are</td></tr>
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	and supports the message with relevant evidence/examples.	and appropriate supporting evidence.	evidence is limited or weakly connected.	missing; little supporting evidence is provided.
Communication and Organization	Message is exceptionally clear, logical, and appropriate for the audience.	Message is clear and generally well organized.	Message is partly clear but organization is uneven.	Message is unclear, disorganized, or difficult to follow.
Presentation/ Design Quality	Presentation or design strongly supports understanding and is purposeful and polished.	Presentation or design supports understanding with minor weaknesses.	Presentation or design only partly supports understanding.	Presentation or design does not support understanding.

C.2. Making Generalization

Option 1: 3-2-1 REFLECTION SHEET

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation.

The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis.
The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher

	Activity Proper: Learners write: 3 things they learned about how climate change affects biological systems 2 specific examples from the Philippines 1 thing they can do to help reduce climate change impacts **Guide Questions:** 1. What is the most important scientific idea you developed from the activity? 2. What example or evidence best supports your explanation? **Expected Output/Product:** Completed written reflection that connects the activity to the relevant scientific concepts. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	Option 2: THINK-PAIR-SHARE: BIG TAKEAWAYS	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, and 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior

	Directions: Think independently about the prompt and write an initial response. Discuss it with a partner, agree on an evidence-based answer, and share the conclusion with the class. **Activity Proper:** Learners will be asked to accomplish the following tasks: Think: Write an individual response on the question Pair: Discuss with a partner Share: Share with the class or in small groups Sample Question: **Guide Question:** How does understanding biological systems help us see the bigger picture of climate change? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.
	C.3. Evaluating Learning	
	Option 1: Link the Climate Effect to the Biological Response	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners

Directions:
For each stated climate effect, identify a documented biological response, explain the evidence-based link, and provide a sourced Philippine example. Distinguish physiological responses, acclimatization, behavior, migration, and heritable population-level adaptation.

Activity Proper:
For each stated climate effect, identify a documented biological response, explain the evidence-based link, and provide a sourced Philippine example. Distinguish physiological responses, acclimatization, behavior, migration, and heritable population-level adaptation. Do not label coral bleaching simply as a "failure to adapt."

Effect of Climate Change	Biological Response	Link/ Explanation	Philippine Example
A. Coral bleaching in reefs			
B. Mangrove loss due to sea level rise			
C. Forest dieback from prolonged drought			
D. Decline in rice yield from erratic rainfall			
E. Animal migration shifts			

retrieve prior learning, apply concepts, and use feedback to correct misconceptions.
The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print.

Note to Teachers: Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	due to temperature rise			
F.	Phenology changes (earlier flowering/fruiting)			
G.	Ocean acidification affecting shellfish			
H.	Freshwater scarcity in upland communities			
I.	Increased pest outbreaks in crops			
J.	Species endangerment from habitat fragmentation			

Guide Questions:

1. How do the different biological responses (terrestrial, marine, physiological, and ecosystem-level) interconnect to show the overall impact of climate change on Philippine biodiversity?

	2. Which of the climate change effects discussed poses the greatest challenge to local communities in the Philippines, and how do biological responses either mitigate or worsen these challenges? 3. If one type of response (e.g., adaptation strategies) fails, what cascading effects might occur in ecosystems and species interactions, and how could this influence human livelihoods? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Short Multiple-Choice Quiz	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** Learners answer a 5-item multiple choice short quiz. 1. Coral bleaching occurs when… A. Corals absorb more algae due to heat	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms.

	B. Corals expel symbiotic algae under stress ✓ C. Corals grow faster in warmer waters D. Corals migrate to deeper seas 2. Mangrove loss due to sea level rise primarily affects… A. Mountain ecosystems B. Coastal breeding and nursery habitats ✓ C. Desert vegetation D. Freshwater lakes 3. Earlier flowering of mango trees is an example of… A. Genetic mutation B. Phenology shift ✓ C. Habitat fragmentation D. Ocean acidification 4. Ocean acidification impacts shellfish because… A. It increases oxygen levels in water B. It lowers carbonate availability and makes calcium-carbonate shell formation more difficult ✓ C. It speeds up shell growth D. It reduces salinity 5. The Philippine eagle population declines mainly due to… A. Rising sea temperatures B. Habitat fragmentation and deforestation ✓ C. Ocean acidification D. Pest outbreaks in crops Science clarification: Explain ocean acidification through changes in seawater carbonate chemistry and distinguish experimental effects from observed harvest changes that may have multiple causes.	Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Guide Questions: 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	
	C.4. Additional Activities	
	Option 1: CLIMATE RESPONSE CONCEPT MAP (REMEDIATION)	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available) **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown. **Activity Proper:** Explain that learners will create a concept map showing links between climate stressors and biological responses. Provide Scaffolds: Give learners a set of starter nodes (e.g., "Rising Temperature," "Drought," "Ocean Acidification," "Erratic Rainfall"). Provide response nodes (e.g., "Coral	The activity targets Learning Objectives 1, 2, and 3 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital

	Bleaching," "Forest Dieback," "Migratory Timing Shifts," "Shellfish Decline"). Learners draw arrows connecting each stressor to the correct biological response. For each connection, they write a short explanation (e.g., "Rising temperature → Corals expel algae → Bleaching"). Encourage them to add local Philippine examples (e.g., Tubbataha Reef bleaching, Guimaras mango flowering shifts). Circulate and check maps, prompting learners to clarify weak or incorrect connections. **Guide Questions:** 1. What happens to corals when water gets too warm? 2. How does drought affect trees in forests? 3. Why do migratory birds change their timing? **Expected Output/Product:** Completed concept map showing the required concepts and scientifically accurate relationships. **Assessment Criteria:** • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.

	Option 2: DIGITAL STORYTELLING (REINFORCEMENT)	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed **Directions:** Plan and produce the required video output. Include the specified scientific content, use clear narration or captions, and explain how the examples or evidence support the lesson concept. **Activity Proper:** The teacher explains that learners will produce a short digital story (3–5 minutes or an equivalent duration) using one of four format options. Format options: Video Documentary: Narrated video with images, clips, and voiceover. Animated Explainer: Simple animation or slideshow with text and graphics. Photo Essay with Narration: A sequence of photos with captions and recorded narration. Podcast/Audio Story: An audio recording with sound effects, interviews, or scripted storytelling. Required Elements (for all formats): Introduction: Clear statement of the chosen biological response or ecosystem impact.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

<table>
<tr><td></td><td>Scientific Explanation: Accurate description of the climate-related stressor and its biological effects.
Local Example: Philippine case study or community observation.
Visuals/Audio Support: Use of images, graphics, or sound to enhance understanding.
Conclusion: A reflection on the importance of recognizing biological responses to climate change.

Guide Questions:
1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Expected Output/Product:
Completed video-based output that communicates the required scientific ideas clearly and accurately.</td><td></td></tr>
<tr><td>Demonstrating Knowledge and Skills</td><td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>All scientific ideas are accurate, complete, and well explained.</td><td>Scientific ideas are mostly accurate with minor gaps.</td><td>Some correct ideas are present, but important errors or omissions remain.</td><td>Scientific content is largely inaccurate or incomplete.</td></tr>
<tr><td>Required Content and Evidence</td><td>Includes all required elements and supports the message with</td><td>Includes most required elements and appropriate supporting evidence.</td><td>Includes some required elements; evidence is limited or weakly connected.</td><td>Many required elements are missing; little supporting evidence is provided.</td></tr>
</table></td></tr>
</table>

		relevant evidence/examples.			
	Communication and Organization	Message is exceptionally clear, logical, and appropriate for the audience.	Message is clear and generally well organized.	Message is partly clear but organization is uneven.	Message is unclear, disorganized, or difficult to follow.
	Presentation/ Design Quality	Presentation or design strongly supports understanding and is purposeful and polished.	Presentation or design supports understanding with minor weaknesses.	Presentation or design only partly supports understanding.	Presentation or design does not support understanding.

V. ASSESSMENT
(Assessing Learnings)

Option 1: Written Summative Assessment

Directions: Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it.

Part 1: Multiple Choice. *Choose the letter of the correct answer.*

1. Which of the following is the primary cause of coral bleaching?
   A. Oil spills
   B. Overfishing
   C. Rising ocean temperatures
   D. Lack of sunlight
2. Which mainly triggers the forest dieback in tropical rainforests?
   A. Invasive species
   B. Drought and extreme heat
   C. Excessive rainfall
   D. Logging alone

	3. Which of the following BEST describes adaptation in biological systems? A. Migrating to other places B. Dying from environmental changes C. A random mutation that causes disease D. A heritable change that increases survival or reproductive success over generations in a particular environment 4. What is an example of an ecosystem affected by climate change in the Philippines? A. Urban highways B. Mangrove forests C. Cemented rice terraces D. Underground caves 5. Which of the following is an example of an organism failing to adapt to climate change? A. Migratory birds shifting their timing B. Coral reefs bleaching and dying C. Rice plants growing with less water D. Trees growing at higher elevations 6. Which Philippine ecosystem is MOST threatened by rising sea levels? A. Upland forests B. Grasslands C. Mangrove forests D. Mountain caves 7. What might happen if rice paddies experience more frequent flooding due to typhoons? A. Increased rice production B. Improved irrigation C. Decline in rice yield D. More food security 8. Which is an example of a climate-related biological response? A. Photosynthesis B. Migration of animals to cooler regions

	C. Use of fertilizers D. Seasonal planting of crops 9. Which species is most likely to migrate in response to climate change? A. Coconut tree B. A documented mobile population whose range shift is supported by a named scientific source C. Mushroom D. Rice plant 10. Which of the following BEST describes biodiversity? A. The number of humans on Earth B. The amount of pollution in the environment C. The variety of living organisms in an area D. The size of an ecosystem ***Part 2: Short Answer:*** *Answer the following questions briefly.* 1. How does rising temperature affect coral reefs in the Philippines? Describe how drought caused by climate change can affect agriculture. 2. What is forest dieback, and why is it happening more often today? 3. How do mangroves help protect coastal ecosystems and communities? 4. Why are animals migrating to new areas due to climate change? Give one example. **Performance/Evidence Based Task** Learners will create a poster or infographic case study that documents how one Philippine organism or ecosystem responds to a specific climate stressor (climate-related habitat change separately from direct land-use habitat loss; explain interactions only when evidence supports them). The output must show evidence from scientific sources and observable local examples. 1. *Select an Organism or Ecosystem.* Learners choose one Philippine organism or ecosystem affected by climate change. Ensure it is locally relevant. Examples: coral reefs, rice plants, mangroves, fruit bats 2. Identify Climate Stressor. Learners specify the climate driver impacting the chosen organism. climate-related habitat change separately from direct land-use habitat loss; explain interactions only when evidence supports them. Briefly explain how the stressor occurs in the Philippines

3. *Describe Biological Response.* Learners explain how the organism responds to the stressor.
- Adaptation (e.g., genetic or physiological)
- Migration or shifting distribution
- Failure to cope (e.g., bleaching, dieback)

4. *Gather Evidence.* Learners support their description with scientific data or local observations. Cite at least one scientific study. Include local case examples (e.g., Palawan reefs, Isabela rice yields). Use visuals like graphs, maps, or photos
5. *Create Poster/Infographic.* Learners synthesize findings into a visual output. Show clear flow: Climate Stressor → Biological Response → Local Evidence. Use concise text and visuals. Highlight implications for biodiversity and communities
6. *Present and Reflect.* Learners present their poster to the class and reflect on broader impacts.

Evidence Requirements
- At least one scientific source (journal article, report, or credible website).
- At least one Philippine example (local observation, case study, or documented effect).
- Clear visual representation of the cause–response–evidence chain.

Scoring Rubric:

Criteria	Excellent (4)	Good (3)	Needs Improvement (2)	Limited (1)	Total
Accuracy of Content	Explains organism/ecosystem response to climate change with precise, scientifically correct details.	Mostly accurate explanation with minor errors.	Some inaccuracies or vague explanations.	Major errors; lacks scientific basis.	____

	Use of Evidence	Integrates at least one credible scientific source and one Philippine example; evidence clearly supports claims.	Includes either a scientific source or a Philippine example; evidence somewhat supports claims.	Evidence is weak, general, or not well connected.	No evidence provided.	____
	Clarity & Organization	Poster/infograp hic is wellstructured, easy to follow, with clear labels and visuals.	Mostly clear and organized; minor lapses in flow or labeling.	Organization is uneven; difficult to follow.	Disorganized; unclear presentation.	____
	Depth of Analysis	Shows strong connections between climate driver → biological response → local impact; demonstrates insight.	Shows basic connections; some insight.	Shows limited or unclear connections.	No clear connections; ideas fragmented.	____

	Presentation & Communication	Communicates ideas confidently; visuals and oral explanation reinforce understanding.	Communicates ideas adequately; visuals and oral explanation somewhat clear.	Communication is weak; visuals or oral explanation unclear.	Communication is minimal; ideas not conveyed.	____
	Total Score					____ / **20**
	Assessment specification: Use items that assess mechanisms and evidence. Define biodiversity at genetic, species, and ecosystem levels, and include an answer key with explanations and total score.					
VI. REFLECTION *(Feedback and Continuous Improvement)*	**Materials/Resources Needed:** • Displayed images or teacher-prepared visual prompts • Notebook or paper • Pen or pencil **Directions:** Study the graph, chart, or data set carefully. Identify the relevant patterns or trends, support each interpretation with specific evidence from the data, and answer the guide questions. **Activity Proper:** Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery.					

	Guide Questions: 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? 6. What improvement would you make if you taught this lesson again? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT to clarify the instructions and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

ANNEX

A.2. ESTABLISHING THE PURPOSE OF THE LESSON

Option 1: MYSTERY PHOTO PROMPT



Directions: Examine each provided case, scenario, image, or sample. Identify the relevant evidence, answer every guide question, and explain the conclusion using the lesson concepts.

B.1. PRESENTING EXAMPLES

Option 1: CASE STUDY GALLERY WALK

Directions: Move through each display or station, examine the provided evidence or task, record the required observations and answers, and explain each conclusion using the lesson concepts.

Station 1: Coral Bleaching (Bolinao)

- *Data: Dated photographs of bleached corals and a cited local sea-surface-temperature or marine-heatwave record with units, baseline, time period, and location*, report excerpt from UP Marine Science Institute.
- *Guide Questions:*
  - What changes do you observe in the coral reef?
  - What climate factor is linked to this change?
  - How does coral bleaching affect fish populations and local communities?

Station 2: Deforestation (Palawan)

- *Data:* Satellite image showing forest loss, bar graph of deforestation rates (2010–2020), excerpt from Mongabay article on human pressures.
- *Guide Questions:*
  - What are the main drivers of deforestation in Palawan?
  - How does forest loss affect biodiversity?
  - What climate-related risks are worsened by deforestation?

Station 3: Mangrove Protection

- *Data:* Map of mangrove coverage, photo of mangrove replanting project, article excerpt on storm surge protection.
- *Guide Questions:*
  - How do mangroves protect coastal communities from extreme weather?
  - What threats do mangroves face due to climate change?
  - How does mangrove conservation contribute to food security?

Station 4: Agricultural Impacts

- *Data:* Graph of rice yield decline during drought years, photo of flooded rice paddies, article excerpt on food insecurity.
- *Guide Questions:*
  - How does climate change affect rice production in the Philippines?
  - What are examples of adaptation strategies farmers use?
  - How does agriculture link biodiversity and human survival?

Station 5: Animal Migration

- *Data:* Map showing migratory bird shifts, photo of whale shark migration routes, article excerpt on species displacement.
- *Guide Questions:*
  - Why are animals migrating to new areas?
  - What risks do migrating species face?
  - How does animal migration help scientists understand climate impacts?

B.2. Discussing New Concept

Option 1: Expert Jigsaw

Directions: Join the assigned expert group, read the source set, and record the main mechanism and Philippine evidence for the assigned climate-response topic. Return to the home group, teach the findings, and combine all four topics in a labeled synthesis map.

Sample Reading Outline (can be enhanced)

Group 1: Climate impacts on ecosystems (species changes, timing shifts, interactions)

1. Changes in Species and Populations- As the climate changes, some species will adapt by changing their behavior, physical characteristics, or how their bodies function. Others will not be able to adapt. As a result, climate change could lead to expansions, reductions, or extinctions of some populations.

   Examples:

- Expansion (Range Increase)- Aedes mosquitoes (e.g., *Aedes aegypti*) – Climate warming and changing rainfall patterns are associated with the expansion of dengue-vector mosquito habitats into broader geographical areas and potentially longer active seasons in the Philippines and Southeast Asia, increasing their range and disease risk. Rising temperatures help these mosquitoes breed more widely than before, a phenomenon linked to climate change.
- Reduction (Range or Population Decline)- Endemic forest trees (e.g., *Astronia cumingiana* and other Philippine melastome species) – Climate models show that suitable climatic habitat for several endemic Philippine tree species is expected to shrink and shift upslope under future climate scenarios, reducing their current ranges and viable habitats.
- Extinction/High Extinction Risk- Philippine naked-backed fruit bat (*Dobsonia chapmani*) – This species was rediscovered after being considered extinct; habitat loss is a major documented threat. Any additional climate contribution should be stated only when supported by species-specific evidence.

2. Changes in the Timing of Natural Events and Cycles- Many plants and animals rely on cues in nature, including temperature and water conditions, to trigger certain stages of their life cycles. As the climate changes, these cues can change at different rates, or potentially not at all. As a result, species that depend on one another at certain times of the year may no longer be in sync.

   Examples:

- Migratory bird species that visit the Philippines (e.g., Brown shrike and other East Asian–Australasian Flyway migrants) are experiencing changes in their timing of migration and arrival due to climate-driven shifts in temperature and weather patterns.
- Guimaras Mango — Shifted Flowering and Harvest Timing

3. Changes in Ecosystem Interactions- Climate change is increasing the spread of invasive species in some areas. Climate change can affect food web

Examples:

- The spread of invasive plants and animals in disturbed habitats reduces native biodiversity and affects nutrient cycles, making ecosystems less resilient to further climate stress.

Group 2: Terrestrial responses (altitude shifts, phenology)

1. *Altitude Shifts*- As lowland areas warm, species move to higher elevations seeking cooler conditions. This reduces viable habitats and increases competition in upland ecosystems.

   Example:

   - In Philippine rainforests and mountains (like Mt. Pulag or Mt. Makiling), species are moving. Some species may shift their ranges upslope as temperatures rise, but local movement must be demonstrated with repeated observations or distribution data; not every species can move or will respond in the same way. However, species already at the peak face "mountain-top extinction" because they have nowhere higher to go.
2. *Phenology Changes*- This refers to the timing of biological events. Plants and animals alter timing of flowering, fruiting, or breeding. These shifts can desynchronize species interactions, such as pollination or predator–prey cycles.

   Examples: Mango trees flowering earlier in Luzon; Pollinators arriving too late to match plant flowering.
3. *Implications*- Altitude and timing shifts reduce biodiversity, alter ecosystem services, and threaten food security.

Group 3: Marine responses (coral bleaching, acidification)

1. *Coral Bleaching:* Warmer seas stress corals, causing them to expel symbiotic algae. This leads to bleaching, reduced growth, and reef mortality.

   Example: Tubbataha Reef bleaching events in the Philippines.
2. *Ocean Acidification:* Rising CO_2 lowers ocean pH, weakening shells of mollusks and corals. Acidification reduces survival rates and disrupts marine food webs.

   Examples: Decline in mussel and oyster harvests; Reduced reef resilience against storms.
3. *Implications:* Marine biodiversity loss affects fisheries, coastal protection, and livelihoods dependent on reefs and shellfish.

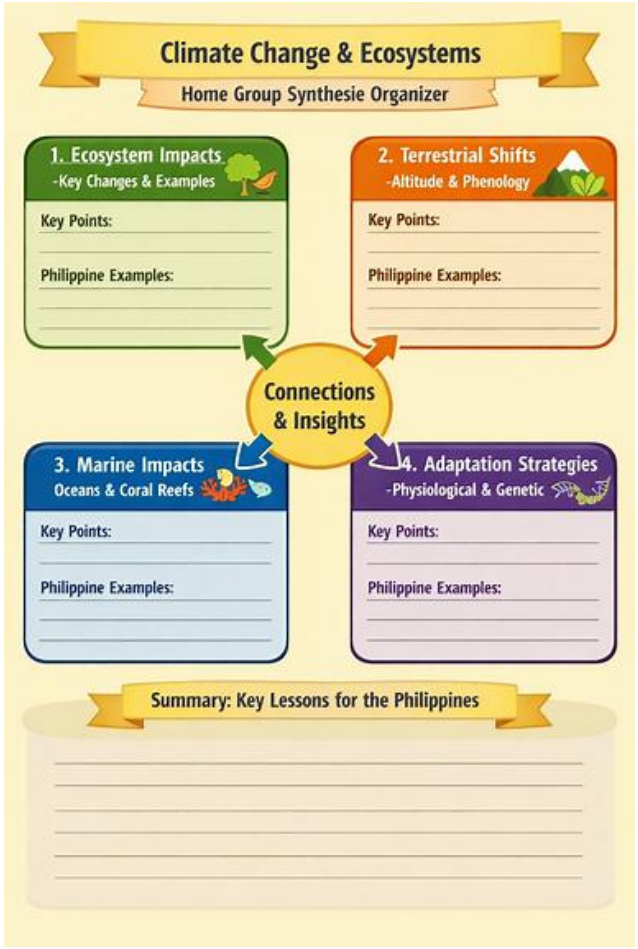
Group 4: Physiological and genetic adaptation

1. Physiological Responses: On a microscopic level, Philippine flora and fauna are undergoing internal changes to survive.
   - Heat Stress Response: Some organisms can acclimate within a lifetime, and populations may evolve greater heat tolerance over generations; responses vary, can have trade-offs, and may be too slow for rapid warming, but this often comes at a "metabolic cost," meaning they grow slower or reproduce less.

     Example: Certain rice varieties show tolerance to erratic rainfall.
2. Genetic Adaptation: Over generations, species may develop heritable traits that improve survival under new climate conditions.

   Example: Philippine Native Water Buffalo (Carabao). Livestock breeds can differ in heat tolerance, but a claim about a specific gene or productivity effect requires a cited peer-reviewed study, adequate sampling, and separation of genetic effects from management and environment.
3. Limits of Adaptation: Not all species can adapt quickly enough. Slow reproductive cycles or specialized habitats increase extinction risk.

   Example: Species with narrow ranges, like endemic forest trees, face higher vulnerability.



Sample Collaborative Synthesis Map

B.2. Discussing New Concept

Option 2: INTERACTIVE LECTURE WITH THINK-PAIR-SHARE

Directions: Think independently about the prompt and write an initial response. Discuss it with a partner, agree on an evidence-based answer, and share the conclusion with the class.

Synthesis output rubrics

Criteria	Excellent (4)	Good (3)	Needs Improvement (2)	Limited (1)	Total
Content Accuracy	Identifies multiple climate impacts and matches them with correct biological responses; includes accurate Philippine examples.	Identifies some impacts and responses with mostly correct examples.	Identifies few impacts/responses; examples are vague or partially correct.	Minimal or incorrect impacts/responses; lacks Philippine examples.	____
Connections & Relationships	Clearly shows cause–effect links (Climate impact → Biological response → Local evidence); demonstrates interconnections across systems.	Shows basic cause–effect links; some connections between systems.	Shows limited or unclear links; responses listed in isolation.	No clear connections; ideas fragmented.	____
Organization & Clarity	Concept map/list is wellstructured, labeled, and easy to follow; uses concise keywords.	Mostly organized and clear; minor lapses in labeling or flow.	Organization is uneven; difficult to follow; overuse of long sentences.	Disorganized; lacks structure; unclear categories.	____

Criteria	Excellent (4)	Good (3)	Needs Improvement (2)	Limited (1)	Total
Depth & Evidence	Includes at least two specific Philippine examples with scientific/observable evidence; explanations are concrete.	Includes one Philippine example with some evidence; explanations somewhat clear.	Examples are general or weakly connected to evidence.	No examples or evidence provided.	____
Collaboration & Synthesis	Integrates partner and class insights; reflects collective understanding in final output.	Shows some integration of peer/class ideas; mostly individual.	Limited integration of peer/class ideas.	No evidence of collaboration; purely individual notes.	____
Total Score					____ / **20**

Developing Mastery

Option 1: ECOSYSTEM IMPACT REPORT

Directions: Investigate one Philippine ecosystem using credible sources and prepare the five-part report: ecosystem profile, climate stressors, documented or projected biological responses, science-based monitoring or research priorities, and a concise class presentation. Cite every source.

Scoring Rubric

Criteria	Excellent (4)	Proficient (3)	Developing (2)	Beginning (1)	Total
Ecosystem Profile	Clear, detailed description with accurate species and functions	Adequate description with some detail	Basic description, limited detail	Incomplete or inaccurate	____
Climate Impacts	Thorough identification of multiple stressors with evidence	Identifies key stressors with some evidence	Mentions stressors but lacks clarity	Minimal or incorrect	____
Biological Responses	Insightful explanation of organism responses, welllinked to impacts	Clear explanation of responses with some links	Partial or vague explanation	Little/no connection to impacts	____
Recommendations	Strong, sciencebased suggestions for monitoring/research	Reasonable suggestions with some basis	General suggestions, weakly linked	Minimal or irrelevant	____

Criteria	Excellent (4)	Proficient (3)	Developing (2)	Beginning (1)	Total
Presentation	Clear, engaging, wellorganized delivery	Organized and understandable	Some clarity issues	Disorganized or unclear	____
Total Score					____ / **20**

C.3. Evaluating Learning

Option 1

Effect of Climate Change	Biological Response	Link/Explanation	Philippine Example
1. Coral bleaching in reefs	Corals expel symbiotic algae → mortality	Rising sea temperatures disrupt coral–algae symbiosis	Tubbataha Reef bleaching events
2. Mangrove loss due to sea level rise	Decline in coastal species (fish, crabs, birds)	Habitat reduction affects breeding and food chains	Mangrove dieback in Palawan
3. Forest dieback from prolonged drought	Tree mortality, reduced regeneration	Water stress weakens trees, leading to dieback	Sierra Madre forest patches
4. Decline in rice yield from erratic rainfall	Reduced plant growth and productivity	Irregular water supply disrupts crop cycles	Central Luzon rice farms
5. Animal migration shifts due to temperature rise	Species move to cooler areas	Temperature changes alter migration routes	A documented Philippine species-range shift from a named peer-reviewed or government source; do not attribute a fruit-bat range shift to warming without direct evidence
6. Phenology changes (earlier flowering/fruiting)	Altered timing of reproduction	Climate cues trigger earlier flowering/fruiting	Mango trees flowering earlier in Luzon
7. Ocean acidification affecting shellfish	Weakened shells, reduced survival	Acidic waters hinder calcium carbonate formation	Decline in mussel and oyster harvests
8. Freshwater scarcity in upland communities	Reduced availability for humans and wildlife	Drought lowers river and spring flow	Cordillera villages facing water shortages
9. Increased pest outbreaks in crops	Higher pest populations and crop damage	Warmer, wetter conditions favor pest reproduction	Rice planthopper outbreaks in Isabela
10. Species endangerment from habitat fragmentation	Population decline, genetic isolation	Fragmented habitats reduce breeding success	Philippine eagle threatened by deforestation

Additional Activities

Option 2: Digital Storytelling Rubrics

Criteria	Excellent (4)	Proficient (3)	Developing (2)	Beginning (1)	Total
. Content Accuracy	Scientific explanation is fully accurate, clearly focused on biological responses to climate change, with strong supporting details and examples.	Mostly accurate explanation with minor errors; biological responses are addressed with some supporting detail.	Partial accuracy; explanation is vague or missing key biological concepts; few or weak examples.	Inaccurate or incomplete explanation; biological responses not addressed.	____
. Creativity & Engagement	Storytelling format is highly creative, engaging, and captures audience attention throughout; strong narrative flow.	Storytelling is clear and somewhat engaging; narrative flow is mostly consistent.	Storytelling shows limited creativity; narrative is uneven or confusing at times.	Storytelling lacks creativity; narrative is unclear or disengaging.	____

Criteria	Excellent (4)	Proficient (3)	Developing (2)	Beginning (1)	Total
. Use of Media (Visuals/Audio/ Animation)	Media elements (images, audio, animation) are wellchosen, integrated seamlessly, and enhance understanding of the content.	Media elements are appropriate and support the content, though integration may be basic.	Media elements are present but limited, repetitive, or loosely connected to content.	Few or no media elements; those used do not support or distract from the content.	____
. Local Relevance	Includes strong Philippine examples or community context that clearly connect climate change to local ecosystems.	Includes at least one Philippine example or local context, with some connection to climate impacts.	Mentions local context vaguely or without clear connection to climate impacts.	No Philippine examples or local relevance included.	____
. Presentation Quality	Final product is polished, wellorganized, within time limits, and delivered confidently; clear audio/visual quality.	Product is organized and understandable; minor issues with timing or clarity.	Product shows some organization but has noticeable issues with clarity, timing, or delivery.	Product is disorganized, unclear, or incomplete; major issues with delivery.	____
Total Score					**____ / 20**

Directions: Prepare and present the assigned role-play, story, relay, or monologue so that the sequence and scientific relationships are accurate. Explain the concept represented after presenting.

Assessment

Option 1: Written Summative Assessment

Directions: Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it.

Answer Key

Part 1. Multiple Choice

Item	Correct Answer	Rationalization
1	C	Heat stress forces corals to expel symbiotic algae (zooxanthellae), leading to bleaching.
2	B	Prolonged water stress weakens trees, making them vulnerable to mortality and dieback.
3	D	Adaptation refers to heritable changes that improve survival under new conditions.
4	B	Mangroves are highly vulnerable to sea level rise and climate stressors in the Philippines.
5	B	Bleaching shows inability to cope with rising temperatures, leading to mortality.
6	C	Mangroves are coastal ecosystems directly impacted by sea level rise.
7	C	Flooding damages crops, reduces productivity, and threatens food security.
8	B	Migration is a direct biological response to climate stressors.
9	B	Animal movements can reflect seasonality, prey availability, ocean conditions, and human pressures. Attribute a range shift to climate only when a named scientific source supports that causal link.
10	C	Biodiversity includes genetic diversity, species diversity, and ecosystem diversity; species richness is only one component.

Part 2: Short Answer: *Answer the following questions briefly.*

1. How does rising temperature affect coral reefs in the Philippines?
   Rising temperatures cause corals to expel algae, leading to bleaching and reduced reef biodiversity (e.g., Tubbataha Reef events).
2. Describe how drought caused by climate change can affect agriculture.
   Drought reduces soil moisture, stunts crop growth, lowers yields, and increases pest vulnerability (e.g., rice farms in Central Luzon).
3. What is forest dieback, and why is it happening more often today?
   Forest dieback is widespread tree mortality due to stress. It is increasing because of prolonged droughts and extreme heat linked to climate change.
4. How do mangroves help protect coastal ecosystems and communities?
   Mangroves act as natural barriers against storm surges, reduce erosion, and provide nursery habitats for fish and crabs.
5. Why are animals migrating to new areas due to climate change? Give one example.
   Animals migrate to find suitable temperatures and food. Example: A documented Philippine species-range shift from a named peer-reviewed or government source; do not attribute a fruit-bat range shift to warming without direct evidence due to warming conditions.

Learning Title/Topic:	Philippine Ecosystems – Impacts of Climate Change on Philippine Ecosystems	Lesson Exemplar:	17

I. OBJECTIVES	
A. Content Standard	Climate change affects ecosystems and the organisms living in them; and ecosystems are finite and have limited resources.
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	Before the lesson, learners should be able to distinguish weather from climate and identify common local ecosystems in the Philippines, such as forests, rivers, agricultural areas, mangroves, and coastal ecosystems. They should have prior knowledge of basic ecosystem interactions, including the relationships among living organisms, nonliving factors, food chains, and the effects of changes in temperature, rainfall, and human activities on ecosystem balance. Learners should also demonstrate basic scientific inquiry skills such as observing environmental conditions, asking investigable questions, identifying possible causes and effects, and recording simple observations. In addition, they should be able to interpret simple charts, tables, and visual data related to climate or environmental changes and use these data to describe possible cause-and-effect relationships between climate change and changes in local ecosystems.
	Explain how climate change impacts Philippine ecosystems;
II. REFERENCES and MATERIALS (*Selecting Resources and Materials*)	*"Born to Be Wild: Effects of Deforestation in the Philippines." 2019. Www.youtube.com. https://youtu.be/em1eRDsXD4U.*

	Diving Deep into Philippine Environmental Protection: The DENR's Crusade for a Greener Archipelago! - TaasNooPilipino. (2024, December 8). TaasNooPilipino - Kahit Kanino. https://taasnoopilipino.com/diving-deep-into-philippine-environmental-protection-the-denrs-crusade-for-a-greener-archipelago/ *Meih. 2025. "Climate Change and the Philippines." Slideshare. 2025. https://www.slideshare.net/slideshow/climate-change-and-the-philippines-1315236/1315236.* *"Philippines: Changing Climate Changing Lives." n.d. Www.youtube.com. https://youtu.be/VvmPRrJC5cc.* *PAGASA. 2023. "Climate Change in the Philippines." PAGASA. 2023. https://www.pagasa.dost.gov.ph/information/climate-change-in-the-philippines.* *Roberto Vagabond. 2022. "Philippines' Most Successful Mangrove Reforestation Project!" YouTube. September 3, 2022. https://www.youtube.com/watch?v=53zhh0ZnY0g.* *Villaroza, S. M. (2025). Philippine ecosystems lecture notes. Slideshare. https://www.slideshare.net/slideshow/philippine-ecosystems-lecture-notes/43899693* *2025. Youtu.be. 2025. https://youtu.be/y19WEesgy2k*
III. CONTENT *(Sequencing Content)*	Philippine Ecosystems – Impacts of Climate Change on Philippine Ecosystems
IV. OBJECTIVES (Setting Clear Objectives and Analyzing the Tasks)	At the end of the lesson, the learners should be able to: 1. Identify the major ecosystems in the Philippines. 2. Explain the different ways climate change affects these ecosystems. 3. Describe and analyze real-world examples of climate change impacts in the country. 4. Explain how climate change impacts Philippine ecosystems and how these impacts affect organisms, resources, and human communities.

<table>
<tr><th colspan="2">IV. PROCEDURES</th><th>ANNOTATIONS</th></tr>
<tr><td rowspan="3">A. Activating Prior Knowledge</td><td colspan="2">A.1. Activating Prior Knowledge</td></tr>
<tr><td colspan="2">Option 1: ECOSYSTEM PHOTO SORTING</td></tr>
<tr><td>Materials/Resources Needed:
• Displayed images or teacher-prepared visual prompts
• Notebook or paper
• Pen or pencil

Directions:
Sort each item into the correct category based on the scientific characteristics provided. Record your classifications and justify any item that could be confused with another category.

Activity Proper:
Students classify photos of forests, reefs, fields, etc.
1. Divide the class into small groups (4–5 learners each).
2. Provide each group with a set of shuffled ecosystem photos. For each sorted photo, learners will write the ecosystem type and one piece of visual evidence that supports their answer.
3. Groups post their sorted sets on Manila paper and briefly explain their choices for 2–3 minutes.

Guide Questions:
1. Which scientific concept was most important in determining the correct response?
2. What evidence or characteristic helped you distinguish the correct answer from the alternatives?</td><td>The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.
The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative.

Note to Teachers: Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.</td></tr>
</table>

	Assessment Criteria: • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: COMMUNITY SHARING	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal. **Activity Proper:** Learners describe changes they have seen in local environments (e.g., flooding, coral bleaching). Learners describe environmental changes they have observed in their local communities and distinguish whether these changes may be related to climate factors, human activities, or other possible causes. Examples may include flooding, hotter days, changes in rainfall patterns, crop problems, reduced fish catch, garbage accumulation, illegal logging, road construction, or changes in nearby rivers, farms, forests, and coastal areas. Volunteers share experiences orally; others may write their answers on sticky notes and post them on the board.	The activity targets Learning Objectives 2, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the

	Allow learners to summarize common themes (e.g., water-related impacts, agriculture, biodiversity). Evidence requirement: Use a traceable official dataset and state the indicator, unit, years, geography, table title, URL, and access date. Do not infer climate attribution from a five-year correlation; separate hazard, exposure, vulnerability, ecosystem condition, land use, and event-specific evidence. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	activity. Ask learners to explain the evidence behind each conclusion.
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Connecting Our Lives to Ecosystems	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Answer the guiding questions in complete sentences, discuss the responses with peers, and support the final answer with an accurate example or scientific evidence.	The activity targets Learning Objectives 2, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

	Activity Proper: The teacher displays the following guide questions using a presentation tool such as PowerPoint or Google Slides and asks learners to respond through an online platform like Mentimeter or Slido for live word clouds or short answers: Learners discuss their ideas through a Think–Pair–Share setup. Selected responses are then shared and viewed on screen in real time. Students reflect on their dream job or future role and submit answers using Padlet or shared digital board, where all responses are posted and visible to the class. The teacher highlights key ideas from the digital board, emphasizing the connections among ecosystems, climate-related changes, human activities, and human life. Finally, the teacher presents the lesson objectives using slides, while learners read and react using emoji reactions, chat responses, or short verbal feedback to check understanding. Evidence requirement: Use a traceable official dataset and state the indicator, unit, years, geography, table title, URL, and access date. Do not infer climate attribution from a five-year correlation; separate hazard, exposure, vulnerability, ecosystem condition, land use, and event-specific evidence. **Guide Questions:** 1. What environmental changes have you observed in your community or nearby ecosystems, such as rivers, forests, farms, or coastal areas?	The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	2. What do you think may have caused these changes? Could they be related to weather, climate, human activities, or a combination of factors? 3. How do changes in temperature, rainfall, flooding, drought, or strong typhoons affect plants, animals, and people in your community? 4. How can human activities such as waste disposal, tree cutting, overfishing, farming, or construction affect local ecosystems? 5. Why is it important to investigate the possible causes of environmental changes before concluding that they are caused by climate change? 6. How might changes in local ecosystems affect your dream job, future role, or way of life? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Picture Prompt: What's Happening	
	Materials/Resources Needed: • Displayed images or teacher-prepared visual prompts • Notebook or paper • Pen or pencil **Directions:** Examine the image or visual carefully. Record the relevant observations, distinguish observation from inference, and answer the guide questions using scientific evidence.	The activity targets Learning Objectives 2, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

	Activity Proper: The teacher shows 3–4 photos of Philippine environments (e.g., flooded streets, dried rice fields, coral bleaching, typhoon damage) using slides. Learners observe the images and answer the question: "How might people in the community be affected?" Students briefly share their ideas orally or through quick written responses (e.g., mini whiteboards or paper). The teacher guides learners in distinguishing climate change impacts from other environmental issues while highlighting how climate change can intensify existing environmental challenges. Evidence requirement: Use a traceable official dataset and state the indicator, unit, years, geography, table title, URL, and access date. Do not infer climate attribution from a five-year correlation; separate hazard, exposure, vulnerability, ecosystem condition, land use, and event-specific evidence. **Guide Questions:** 1. What environmental change is shown? 2. What might have caused it? 3. What organisms may be affected? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

<table>
<tr><td rowspan="3">B. Instituting New Knowledge</td><td colspan="2">B.1. Presenting Examples</td></tr>
<tr><td colspan="2">Option 1: INTERACTIVE LECTURE WITH VISUALS</td></tr>
<tr><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil
Directions:
Examine each visual of a Philippine forest, coral reef, mangrove, agricultural area, or freshwater system. For each ecosystem, record its functions, importance to people, specific climate threats, and evidence-based consequences for nearby communities.
Activity Proper:
The teacher begins by presenting the major ecosystems in the Philippines—forests, coral reefs, mangroves, agricultural lands, and freshwater systems—using slides or infographics. For each ecosystem, the teacher will ask:
Guide Questions:
1. What are the roles of each major ecosystem?
2. Why is this ecosystem important to both the environment and human life?
3. In what ways does climate change specifically threaten this ecosystem?
4. How does the destruction of this ecosystem affect nearby communities?
Assessment Criteria:
• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation</td><td>The activity targets Learning Objectives 1, 2, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.</td></tr>
</table>

	Option 2: VIDEO CLIP ANALYSIS	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed **Directions:** Watch the assigned video or film segment attentively. Record the key scientific ideas or evidence, then answer the guide questions and relate the information to the lesson concept. **Activity Proper:** The teacher plays a short documentary or news report showing how climate change has affected a specific Philippine ecosystem, such as coral bleaching in Palawan, mangrove loss after Typhoon Yolanda, or drought in Mindanao's farmlands. Learners work in pairs to answer the guide questions about the video. Afterward, pairs share their answers in a whole-class discussion, and the teacher asks the following questions: **Guide Questions:** 1. What ecosystem is featured? 2. What environmental changes or impacts are shown in the video? 3. How might these changes be related to climate change?	The activity targets Learning Objectives 2, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	4. How does this affect people living nearby? 5. What changes did you observe in the ecosystem shown in the video? 6. How are these changes connected to climate change? 7. What are the consequences of these changes for people living in that area? **Expected Output/Product:** A completed video or digital presentation that communicates the required scientific ideas clearly and accurately. **Assessment Criteria:** • Scientific accuracy • Completeness of required content • Clarity and organization • Appropriate use of evidence, examples, labels, or visuals	
	B.2. Discussing New Concept	
	Option 1: Ecosystem Connections: Climate Change Impact Mapping	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown.	The activity targets Learning Objectives 1, 2, and 4 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.

	Activity Proper: The teacher presents a digital chart using Google Slides or shared digital board with two columns: Types of Ecosystems in the Philippines and Impacts of Climate Change. Instead of physical meta cards, learners access a shared interactive board (shared digital board/Padlet/Wordwall drag-and-drop) containing ecosystem names (e.g., Forest, Coral Reef, Mangrove) and impact terms (e.g., Coral Bleaching, Flooding, Drought). Learners take turns or work in small groups to drag and match ecosystems with corresponding climate change impacts on the digital board. After each match, the teacher asks learners to explain their answers verbally or through chat/comments, while others can react or add ideas online. The teacher records common misconceptions and uses them to clarify scientific concepts before proceeding to the next activity. Learners use the comment feature to define unfamiliar terms or give real-life examples, which are then clarified by the teacher. The activity continues until all matches are completed and discussed, with the final board saved and shared as a class reference.	The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Guide Questions: 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: ECOSYSTEM IN A JAR (CLIMATE CHANGE IMPACTS)	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Observe the mini ecosystem after the simulation. Compare it with your observations before the event. **Procedure:** This model shows only a short-term soil-moisture response to a disturbance. It does not reproduce long-term climate change or establish that a particular flood, drought, or storm was caused by climate change. 1. Learners form groups of 4–5 and are given materials such as a container, soil, water, plants, and climate	The activity targets Learning Objectives 2, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting

change event cards (e.g., drought, heavy rainfall, typhoon).

2. Use teacher-provided seedlings or nonliving model materials—never collect wild organisms. Prepare matched jars: a control and a standardized moisture treatment, with the same container, soil, plant type, light, temperature, and starting water. Record observations on the same schedule for several days and use replicate jars when possible.

After the simulation, the teacher facilitates class discussion using the following processing questions:
Observation Guide
Before the Climate Event Simulation
During the Climate Event Simulation

Guide Question	**Response**
What climate event did your group simulate?	
What action did your group do to represent the event?	
Which part of the ecosystem was directly affected first?	
What immediate change did you notice?	

tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

After the Climate Event Simulation

Ecosystem Component	**Before the Event**	**After the Event**	**Change Observed**
Soil			
Water/ moisture			
Plants			
Stability of materials			
Other observations			

Soil condition: Soil condition
Amount of water/moisture: Amount of water/moisture
Plant appearance: Plant appearance
Position/stability of plants: Position/stability of plants
Clarity/color of water, if present: Clarity/color of water, if present

Other living/nonliving parts: Other living/nonliving parts
Controlled-investigation protocol: Name the task according to the variable changed, such as soil-water saturation. Specify the exact moisture amount, species, container, duration, measurement schedule, at least three independent containers per treatment, safety controls, cleanup, and disposal.

	Guide Questions: 1. How did your mini ecosystem change after the climate event? 2. Which part of the system was most vulnerable, and why? 3. How do these changes mirror what happens in real Philippine ecosystems? 4. What can people do to reduce the impacts of these changes in their communities? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	B.3. Developing Mastery	
	Option 1: Ecosystem Case Study Carousel	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Move through the assigned stations in order. Examine the information, image, evidence, or task at each station; record the required observations or responses; then use the lesson concepts to explain your conclusions.	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based

Activity Proper:

Divide the class into small groups and assign each group a Philippine ecosystem (forest, coral reef, mangrove, freshwater, agricultural land).

Provide each group with a short case study or article showing real-life climate change impacts (e.g., coral bleaching in Palawan, flooding in Luzon). Include data in case studies such as temperature increases, rainfall changes, fish catch decline, forest cover loss and more.

Groups read and answer guide questions:

Groups rotate ("carousel") to review other groups' outputs.

Groups must add at least one new insight, one question or one recommendation to the output.

Expected Output Format

Ecosystem Assigned: Coral Reef Case Study/Article Title: _____

Guide Question	**Group Response**
What ecosystem is described?	
What climate-related impacts are observed?	
How does this affect biodiversity?	
How does this affect people or communities?	
What actions can help reduce or address the impact?	

questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

Carousel Peer Comment Section

Peer Group	**New Insight / Question / Recommendation**
Group ___	
Group ___	
Group ___	

Group Reflection: One important thing we learned from this activity is:
Causal clarification: Classify forest-cover loss as a direct land-use driver unless evidence supports another mechanism, and analyze how it interacts with climate hazards.

Guide Questions:

1. What ecosystem is described?
2. What climate change impacts are observed?
3. What trend or pattern can you observe?
4. How does this affect people and biodiversity?
5. What actions can help reduce or address these impacts?

Assessment Criteria:

• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

	Option 2: Ecosystem Protection Plan Presentation	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed **Directions:** Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal. **Activity Proper:** Learners remain in groups and choose one ecosystem affected by climate change. Each group creates a simple action plan or infographic showing: Description of the ecosystem Climate change threats Effects on human life Practical solutions or actions to reduce impacts Groups present their outputs to the class (poster, slides, or digital presentation). After each presentation, classmates ask questions and give feedback using "two stars and a wish" (two strengths and one suggestion for improvement). The teacher	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	emphasizes how all ecosystems are connected and why protecting them is important. Understanding of Ecosystem Issue: Excellent 4: Clearly explains the ecosystem issue and its possible climate-related causes and effects. | Satisfactory 3: Explains the ecosystem issue with minor gaps in cause-and-effect details. | Developing 2: Gives a limited explanation of the issue with unclear links to climate-related factors. | Beginning - 1: Explanation is incomplete or shows misconceptions. Relevance to Philippine Context: Excellent 4: Provides realistic examples and solutions strongly connected to Philippine communities or ecosystems. | Satisfactory 3: Provides examples and solutions generally connected to Philippine contexts. | Developing 2: Provides examples or solutions with limited local connection. | Beginning - 1: Examples or solutions are not connected to Philippine contexts. Proposed Solution: Excellent 4: Solution is practical, realistic, and clearly addresses the identified ecosystem impact. | Satisfactory 3: Solution is mostly practical and related to the identified impact. | Developing 2: Solution is somewhat related but needs clearer explanation or feasibility. | Beginning - 1: Solution is unclear, unrealistic, or unrelated to the issue.	

	Use of Evidence or Explanation: Excellent 4: Uses observations, case study details, or data to strongly support the proposed solution. | Satisfactory 3: Uses some evidence or explanation to support the solution. | Developing 2: Gives limited support or general statements only. | Beginning - 1: Gives little or no evidence to support the solution. Creativity and Communication: Excellent 4: Presentation is creative, organized, clear, and engaging. | Satisfactory 3: Presentation is clear and organized with some creative elements. | Developing 2: Presentation is somewhat organized but lacks clarity or engagement. | Beginning - 1: Presentation is disorganized or difficult to understand. Group Collaboration: Excellent 4: All members participate meaningfully and demonstrate shared responsibility. | Satisfactory 3: Most members participate and contribute to the presentation. | Developing 2: Few members participate actively. | Beginning - 1: Group participation is minimal or uneven. Required task specifications: Require a science claim, cited evidence, a causal diagram, action rationale, timeline, milestones, roles, source and data rules, and individual accountability. Remove placeholders and provide a curated offline source set and credibility checklist.	

Guide Questions:

1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Expected Output/Product:

Oral or group presentation supported by accurate scientific explanations and relevant evidence.

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little evidence or gives unsupported applications.	____
Clarity and completeness	Clear, organized, and complete.	Generally clear but partly incomplete.	Unclear, disorganized, or substantially incomplete.	____
Total Score				**____ / 15**

<table>
<tr><td rowspan="3">C. Demonstrating Knowledge and Skills</td><td colspan="2">C.1. Finding Practical Application</td></tr>
<tr><td colspan="2">Option 1: LOCAL NEWS ANALYSIS</td></tr>
<tr><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil
• Internet-enabled device, if available

Directions:
Read or examine the assigned source, identify its main claim and supporting evidence or data, answer the guide questions, and cite the source in the required output.

Activity Proper:
The teacher asks learners to search for a credible news article published within the last two years from a recognized news organization, government agency, or environmental organization about how climate change has impacted a Philippine ecosystem (e.g., flooding in Pampanga rice fields, coral bleaching in Batangas, or mangrove destruction in Leyte).
Task: Learners summarize the article in their own words and write answers to the following prompts:
Learners share their answers in class, and the teacher facilitates a short discussion highlighting how current events reflect scientific concepts learned in the lesson. The teacher provides oral feedback, highlights exemplary analyses, and addresses misconceptions during the discussion.</td><td>The activity targets Learning Objectives 2, 3, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.</td></tr>
</table>

	Guide Questions: 1. What kind of ecosystem was affected? 2. What climate change factor was involved? 3. How did the impact affect Filipino's livelihood, health, or safety? 4. What solutions were suggested in the news? **Expected Output/Product:** A one-page news analysis sheet containing article information, responses to guide questions, and a brief reflection. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: INTRODUCTION TO ECO-FRIENDLY SOLUTIONS	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal.	The activity targets Learning Objectives 2 and 4 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher

	Activity Proper: The teacher asks learners to brainstorm careers connected to ecosystems (e.g., marine biologist, environmental planner, agriculturist, forest ranger, environmental lawyer, eco-tourism manager). Task: Each learner selects one career and writes a short reflection answering the guide questions below. Learners share their reflections in pairs, then volunteers share with the whole class. The teacher emphasizes that understanding ecosystems is not only academic—it's connected to real future opportunities. **Guide Questions:** 1. What specific climate change impacts on Philippine ecosystems would professionals in this career help address? 2. What knowledge and skills would be useful in that job? 3. How can that career help communities adapt to or mitigate climate change? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.
	C.2. Making Generalization	
	Option 1: "From Example to General Rule"	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 2, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use

	Directions: Compare the coral-bleaching, flooding, and drought examples, identify their shared cause-and-effect pattern, and write one group generalization explaining how climate impacts on ecosystems can affect human communities. **Activity Proper:** The teacher shows 2–3 examples (e.g., coral bleaching, flooding, drought). Learners identify similarities across the examples. In groups, they answer: Groups write their conclusion using: In general, climate change affects Philippine ecosystems by _____, which in turn affects human communities through_____. The teacher guides learners to connect their generalizations to all ecosystems and human life. **Guide Question:** What common pattern do you observe among these climate change impacts, and what does this tell us about the relationship between ecosystems and human communities? **Expected Output/Product:** One group-generalization statement written on Manila paper or a shared document.	evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Digital Generalization Chart	
	Materials/Resources Needed: • Computer, tablet, or teacher presentation device • Projector or display, when needed • Speakers, when audio is needed **Directions:** Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences. **Activity Proper:** The teacher provides a digital chart using Google Sheets, Google Docs, or Padlet with columns: Ecosystem, Climate Change Impact, Effect on People and Key Insight. Learners work individually or in groups to fill in the chart online, using ideas from previous activities (videos, discussions, case studies). At the bottom of the digital chart or on a shared board, learners complete the statements: "In general, climate change affects Philippine ecosystems by _____." "These changes matter because _____."	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

	The teacher uses Mentimeter or a shared document to collect responses and displays them in real time. Volunteers explain their answers, and the teacher guides the class in refining them into one clear digital class generalization, which is saved and shared. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	**Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.
	C.3. Evaluating Learning	
	Option 1: Ecosystem Impact Analysis Worksheet	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read each Philippine ecosystem scenario and complete all organizer questions. Identify the ecosystem and climate-related stressor, trace the ecological effects, explain the possible community consequences, and support each response with scenario evidence.	The activity targets Learning Objectives 1, 2, 3, and 4 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and

	Activity Proper: The teacher provides a organizer showing different Philippine ecosystems (forest, coral reef, mangrove, freshwater, agricultural land) with short scenarios. A coral reef in Palawan is turning white due to increasing ocean temperatures. Scenario 2 Rice farmers in Central Luzon experience low crop yield due to long periods of drought. Scenario 3 A coastal community in Leyte suffers from flooding after a specific storm damaged mangroves. Any claim that climate change altered that event requires attribution evidence, and mangrove loss may also reflect land use, pollution, or coastal development.	teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	Guide Questions: 1. What ecosystem is described? 2. What climate change impact is shown? 3. How does this affect marine life? 4. How might this affect people living nearby? 5. How does this affect agriculture? 6. How might this affect people's livelihoods? 7. What role do mangroves play in this ecosystem? 8. How does this impact the community? 9. Learners exchange organizer with a partner and answer: "What action would you recommend to reduce or address this climate change impact?" to provide feedback before class discussion. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Data Interpretation and Reflection Task	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Use a cited official dataset to complete the table or graph with values, units, dates, and source details. Describe the pattern, distinguish correlation from causation, explain one ecosystem implication, and present the evidence in three to five minutes.	The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

<table>
<tr>
<td></td>
<td>Activity Proper:
The learners present with a simple table or visual graph (line or bar graph) showing climate-related data (e.g., rising temperature, fish catch decline or increasing flood frequency in the Philippines). Learners will be given 20–30 minutes for research and 3–5 minutes for presentation of the output.
Study the data below:
Source: Philippine Statistics Authority’s Compendium of Philippine Environment Statistics, Component 4: Extreme Events and Disasters
Generalization
Complete the statements:
Climate change affects ecosystems by _____.
These changes are important because _____.
<table>
<tr><th>Year or Period</th><th>Verified Value and Unit</th></tr>
<tr><td>Use an official long-term dataset</td><td>Enter the sourced value and unit</td></tr>
</table>
</td>
<td>The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.</td>
</tr>
</table>

	Guide Questions: 1. What trend do you observe? 2. What can and cannot be concluded from this dataset? Distinguish a short-term trend or correlation from evidence of long-term climate change and from event attribution. 3. Based on the trend shown, what possible environmental and social impacts might communities experience if this pattern continues over the next ten years? **Expected Output/Product:** Completed written reflection that connects the activity to the relevant scientific concepts. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	C.4. Additional Activities	
	Option 1: DREAM COMMUNITY ECOSYSTEM	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal.	The activity targets Learning Objectives 1, 2, 3, and 4 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion.

	Activity Proper: The teacher distributes a sheet of paper to each learner. The teacher instructs the learners to imagine their dream sustainable community in the Philippines—one that is resilient to climate change and protects local ecosystems (e.g., mangroves for flood protection, eco-parks, organic farms, coral reef tourism, renewable energy). Learners must: Write at least three sentences explaining how the community protects biodiversity and adapts to climate change impacts (e.g., "Our community plants mangroves to reduce storm surges," or "We practice organic farming to keep the soil healthy."). Indicate at least one career or business opportunity that could emerge in their dream community (e.g., eco-tourism guide, organic farm entrepreneur, marine biologist, renewable energy engineer). The teacher and class agree on the rubric, considering these suggested criteria: After completing the activity, learners share their outputs with a partner. Selected learners are then called to present their dream community ecosystem to the class. Controlled-investigation protocol: Name the task according to the variable changed, such as soil-water saturation. Specify the exact moisture amount, species, container, duration, measurement schedule, at least three independent containers per treatment, safety controls, cleanup, and disposal.	The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

Guide Questions:

1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Rubric

Criteria	Full Credit	Partial Credit	Minimal Credit	Total
Clarity of explanation	40% — Explains the proposed idea clearly and logically.	24% — Partly meets the criterion; minor gaps or inaccuracies remain.	8% — Shows limited evidence; major gaps or inaccuracies remain.	____
Creativity and completeness of sketch	40% — Presents a complete, purposeful sketch whose visual elements support the proposed idea.	24% — Partly meets the criterion; minor gaps or inaccuracies remain.	8% — Shows limited evidence; major gaps or inaccuracies remain.	____

	Connection to climate change adaptation/mitigation	20% — Shows an accurate and explicit connection to climate-change adaptation, mitigation, or both.	12% — Partly meets the criterion; minor gaps or inaccuracies remain.	4% — Shows limited evidence; major gaps or inaccuracies remain.	____
	Maximum Score				____ / 100%

Option 2: Case Study Sharing

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Read or examine the assigned case or scenario. Identify the relevant evidence, apply the appropriate scientific concepts, answer the guide questions, and justify your conclusion.

Activity Proper:
Learners are assigned to research a climate-related issue using at least two credible sources, including one local or regional example.

The activity targets Learning Objectives 1, 2, 3, and 4 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and

<table>
<tr><td></td><td>They gather information from news articles, interviews, or personal observations.
Each learner (or group) prepares a short presentation (3–5 minutes).
Presentations must include ecosystem affected, climate issues, impacts on people, and possible solutions.
Learners present in class while others take notes.

Guide Questions:
1. What evidence in the case or scenario is most relevant to the problem?
2. Which scientific concept best explains the situation, and why?</td><td>writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.</td></tr>
<tr><td>Demonstrating Knowledge and Skills</td><td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>Accurate, complete, and free of misconceptions.</td><td>Mostly accurate; minor gaps only.</td><td>Partly accurate; important gaps or misconceptions.</td><td>Limited or inaccurate scientific content.</td></tr>
<tr><td>Evidence and Sources</td><td>Uses relevant, credible evidence and integrates it effectively.</td><td>Uses appropriate evidence with minor limitations.</td><td>Uses limited or weakly connected evidence.</td><td>Provides little or no usable evidence.</td></tr>
<tr><td>Analysis and Application</td><td>Explains relationships clearly and applies evidence insightfully.</td><td>Explains major relationships and applies evidence appropriately.</td><td>Shows partial analysis or weak application.</td><td>Shows little analysis or application.</td></tr>
</table></td></tr>
</table>

	Organization and Communication	Well organized, concise, and clear for the intended audience.	Generally clear and organized.	Somewhat unclear or unevenly organized.	Difficult to follow or incomplete.

V. ASSESSMENT
(Assessing Learnings)

CLIMATE CHANGE IMPACT EXHIBIT — "Stories from the Earth"

As a culminating performance task, learners will work collaboratively to create a mini-exhibit that showcases real-world examples of how climate change affects various Philippine ecosystems and human communities. This activity allows them to analyze local climate issues and demonstrate understanding of the interconnected relationship between climate change, ecosystems, and human life.

Learners are grouped into teams of 4–6 members. Each group selects one Philippine ecosystem (e.g., mangrove forest, coral reef, upland forest, grassland, or agricultural area) and researches specific climate change impacts observed in that setting—such as coral bleaching, flooding, drought, biodiversity change, or soil erosion, while distinguishing climate drivers from land use, pollution, and infrastructure. They also gather or create materials (photos, short narratives, infographics, or charts) showing how these impacts affect both the environment and people's livelihoods.

1. Each group will then organize its findings into a visual exhibit panel (poster, infographic board, or digital presentation) titled "Stories from the Earth: Climate Change and Our Ecosystems." The exhibit must include:
   a. The chosen ecosystem and its role in supporting biodiversity and communities.
   b. Real examples of climate change impacts affecting it.
   c. How these changes influence people's lives, livelihoods, and health.
   d. A brief reflection on what can be done to strengthen resilience or awareness in their community.

The class may hold a "gallery walk" where learners complete a peer-feedback form identifying one strength and one suggestion for improvement for each exhibit.

	The teacher may use and modify the following rubric after presenting it to the class.

Criteria	Full Credit	Partial Credit	Minimal Credit	Total
Content Accuracy and Relevance (Aligns with Objective 1: Identify the major ecosystems in the Philippines.)	10 points — The learner correctly identifies major Philippine ecosystems such as forests, mangroves, coral reefs, freshwater ecosystems, coastal ecosystems, agricultural ecosystems, and grasslands. The learner provides information that is accurate and related to the topic.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Analysis and understanding (Aligns with Objectives 2 and 4: Explain how climate change affects ecosystems, organisms, resources, and communities.)	10 points — 10 points — The learner accurately explains climate effects such as rising temperature, sea-level rise, changing rainfall, coral bleaching, or changing tropical-cyclone rainfall and intensity risks. The explanation distinguishes	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____

		climate-driven habitat change from direct land-use habitat loss and connects ecosystem changes to organisms, resources, and communities.			
	Organization and Visual Presentation (Supports all objectives by helping learners present ideas clearly and logically.)	10 points — The learner presents information in a well-organized manner using clear headings, tables, illustrations, diagrams, or examples. The output is neat, readable, and easy to understand.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
	Collaboration and Participation (Supports Objectives 2, 3, and 4 through group discussion and shared analysis.)	10 points — The learner actively participates in group activities, shares ideas, listens respectfully to classmates, and contributes to explaining real-world examples of climate change impacts in the Philippines.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____

Reflection and Insight (Aligns with Objectives 3 and 4: Analyze real-world examples and explain effects on communities.)	10 points — The learner gives meaningful reflections on how climate change affects Philippine ecosystems, organisms, natural resources, and human communities. The learner connects the lesson to real-life situations in the country.	6 points — Partly meets the criterion; minor gaps or inaccuracies remain.	2 points — Shows limited evidence; major gaps or inaccuracies remain.	____
Maximum Score				____ / 50

Suggested Performance Descriptors

Score	Description
9–10 points	Shows excellent understanding; answers are accurate, complete, well-explained, and strongly connected to the objectives.
7–8 points	Shows good understanding; answers are mostly accurate with minor missing details.
5–6 points	Shows fair understanding; answers include basic ideas but need clearer explanation or more examples.
3–4 points	Shows limited understanding; answers are incomplete, unclear, or weakly connected to the topic.
1–2 points	Shows very limited understanding; answers are mostly incorrect, unrelated, or lacking explanation.

Assessment specification: Assess the distinction among hazard, exposure, vulnerability, ecosystem condition, land use, and event-specific evidence. Include the answer key, rubric, and total-score calculation.

VI. REFLECTION *(Feedback and Continuous Improvement)*	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery. 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? 6. What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

Learning Title/Topic:	Philippine Ecosystems – Climate Change Adaptation and Mitigation for Local Biodiversity	Lesson Exemplar:	18

I. OBJECTIVES	
A. Content Standard	Climate change affects ecosystems and the organisms living in them; and ecosystems are finite and have limited resources.
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	1. Recognize ecosystem structures, biodiversity, and species interdependence. 2. Explain causes and effects of climate change on ecosystems and biodiversity.
	Propose ways to adapt and mitigate the impacts of climate change on local biodiversity; and
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	Briggs, Ann. 2023. "12 Different Types of Ecosystems and Why They Are Important." Outforia. August 14, 2023. https://outforia.com/types-of-ecosystems. "Climate Change Impacts Data Explorer." 2025. Our World in Data. 2025. https://ourworldindata.org/explorers/climate-change?Metric=Temperature+anomaly&Long-run+series=false&country=OWID_WRL~ATA~Gulkana+Glacier~Lemon+Creek+Glacier~OWID_NAM~South+Cascade+Glacier~Wolverine+Glacier~Hawaii~Arctic+Ocean. Commission, Climate Change. n.d. "National Adaptation Plan." NICCDIES. Accessed May 27, 2026. https://niccdies.climate.gov.ph/climate-reports/national-adaptation-plan. Peace, Green. 2021. "What Are the Solutions to Climate Change?" Greenpeace UK. Greenpeace. April 12, 2021. https://www.greenpeace.org.uk/challenges/climate-change/solutions-climate-change/.

	Rojas, Diego. 2019. "Climate Adaptation vs. Mitigation: What's the Difference, and Why Does It Matter?" Climate Reality. November 7, 2019. https://www.climaterealityproject.org/blog/climate-adaptation-vs-mitigation-why-does-it-matter. Materials: projector or displayed/printed graph, ecosystem photos, markers, Manila paper, or an available digital collaboration tool	
III. CONTENT *(Sequencing Content)*	Philippine Ecosystems – Climate Change Adaptation and Mitigation for Local Biodiversity	
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	1. Identify examples of adaptation and mitigation practices that address impacts of climate change. 2. Analyze how adaptation and mitigation practices help protect local biodiversity from climate change. 3. Propose feasible community-based strategies to adapt to and mitigate impacts of climate change on local biodiversity.	
IV. PROCEDURES		**ANNOTATIONS**
A. Activating Prior Knowledge	***A.1. Activating Prior Knowledge***	
	Option 1: "Who Am I?" Riddle	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Follow the stated game rules, respond when called, and justify each answer with the correct scientific concept or evidence. Record scores using the activity's scoring criteria.	The activity targets Learning Objective 1 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts,

	Activity Proper: Ask students to read each riddle carefully and identify the ecosystem being described. Instruct them to write the name of the ecosystem as their answer and support it with one piece of evidence from the riddle. I'm hot and wet all year, with trees so tall they block the sky. I'm home to parrots, monkeys, and countless plants. I'm dry and scorching by day, freezing by night. Few plants survive here, but cacti and camels call me home. I stretch wide with endless grasses, shaped by fire and grazing. Tamaraw, baboy ramo, and usa roam across me. I'm colorful and alive under the sea, built from calcium-carbonate skeletons secreted by coral polyps. Fish, turtles, and starfish thrive in me. I'm frozen most of the year, with no trees to see. Mosses, lichens, and hardy animals survive in me. Follow-up Prompt: After identifying the ecosystem, learners will name one species found there and one climate change threat that may affect it. Evidence requirement: Use site-specific habitat descriptions and acknowledge habitat mosaics, elevation, seasonality, and documented species ranges. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson?	discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

Assessment Criteria:
• Scientific accuracy
• Completeness of the required task
• Clarity of response or explanation

Option 2: Exploring Philippine Ecosystems

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Examine each picture, identify the Philippine ecosystem shown, and complete the table with its name and defining climate, vegetation, habitat, or organism features. Use the word bank only when assigned.

Activity Proper:
Ask students to look at each picture, identify the ecosystem it shows, and write the ecosystem name. Then have them define it in their own words using simple clues from the image such as climate, plants, or animals.
Differentiation: For learners needing support, provide a word bank of ecosystem names. For advanced learners, ask them to explain why species in a particular ecosystem are adapted to that environment.

Picture	**Type of Ecosystem**	**Definition / Key Features**
Sierra Madre/ Palawan/Mt. Apo	*[Tropical Rainforest]*	*[Warm, wet all year; dense*

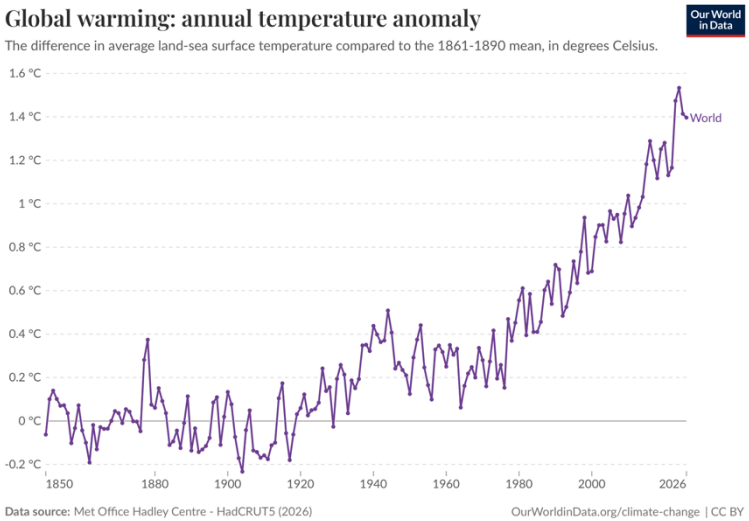
Ecosystem	Definition / Key Features
Terrestrial Ecosystems	
Tropical Rainforest	Warm, wet year-round; dense tree canopy; extremely high biodiversity.
Temperate Forest	Moderate climate; distinct seasons; broadleaf and mixed forests with diverse mammals and birds.
Taiga/ Boreal	Cold, long winters; coniferous forests; supports moose, bears, wolves.
Tundra	Treeless, cold, permafrost soils; short growing season; mosses, lichens, hardy animals.
Shrubland	Shrubland climate and vegetation vary by location. Do not apply a Mediterranean-climate description to all shrublands or to Palawan without evidence.
Desert	Very low rainfall; extreme temperatures; plants and animals adapted to conserve water.

		trees; very high biodiversity]
Mt. Pulag/ Bukidnon/ Batanes pastures	*[Grassland]*	*[Wide open areas dominated by grasses; shaped by fire and grazing; supports large herbivores]*
Mount Bloomfield, Palawan	*[Shrubland]*	*[Dominated by shrubs and small trees; may occur in dry, rocky, coastal, or ultramafic areas]*
Tubbataha Reefs, Apo Reef, Verde Island Passage	*[Coral Reef]*	*[Warm, shallow marine habitat; built by coral skeletons; among the most biodiverse ecosystems]*
West Philippine Sea, Philippine Deep	*[Oceanic]*	*[Open ocean; vast, deep waters; supports plankton, fish, marine mammals, and migratory species]*

Grassland	Wide open areas dominated by grasses; shaped by fire and grazing; supports large herbivores.
Aquatic Ecosystems	
Lentic	Still freshwater bodies (lakes, ponds); stratified layers; supports fish, amphibians, plankton.
Freshwater Littoral Zone	Shallow near-shore zone of a lake or pond where light reaches the bottom; commonly supports rooted aquatic plants, algae, invertebrates, amphibians, and juvenile fish. The marine intertidal zone is a distinct coastal habitat between high and low tide.
Lotic	Flowing freshwater (rivers, streams); flowing water whose dissolved-oxygen level varies with temperature, turbulence, organic matter, pollution, and flow rate.
Coral Reef	Warm, shallow marine habitat; built by coral skeletons; among the most biodiverse ecosystems.
Oceanic	Open ocean; vast, deep waters; supports plankton, fish, marine mammals, and migratory species.

The activity targets Learning Objective 1 by asking learners to classify examples, justify their choices, and demonstrate understanding of the stated

	Guide Question: After picture identification, ask: "Which ecosystem would suffer the greatest biodiversity loss if temperatures continue to rise? Justify your answer." **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	concepts. It applies the Constructivist and Reflective approaches because learners retrieve prior learning, apply concepts, and use feedback to correct misconceptions. The pedagogical strategy used is formative assessment, supported by independent response, brief justification, checking, and corrective feedback. Literacy is integrated through reading each prompt carefully and writing concise, scientifically accurate responses. Numeracy is integrated through interpreting any quantities, scores, tables, or graphs included in the assessment. EdTech is integrated through a digital quiz when available, but the same items must also be provided in print. **Note to Teachers:** Review responses against the stated objectives and answer key. Provide corrective feedback before enrichment or remediation.
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Hook Questions	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Study the cited global-temperature graph through its latest complete year, identify two supported trends, and answer every guide question. Connect the data to	The activity targets Learning Objective 1 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the constructivist, inquiry-based, and reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

	plausible local biodiversity effects and propose one adaptation or mitigation action without claiming that the graph alone proves a local impact. **Activity Proper:** Ask students to look closely at the graph showing global temperature anomalies from 1850 through the latest complete year shown in the cited dataset; do not treat an incomplete current year as a final annual value. Work through the guide questions below to connect the rising temperatures with their effects on local biodiversity.  Suggest one adaptation or mitigation strategy that could help reduce or manage these impacts. Science clarification: Adaptation reduces climate risk; mitigation reduces greenhouse-gas emissions or	The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	enhances sinks; conservation protects biodiversity and may provide climate co-benefits. Require a one-sentence mechanism for every classification and allow 'general conservation' or 'both, under stated conditions' when appropriate. Evidence requirement: Use site-specific habitat descriptions and acknowledge habitat mosaics, elevation, seasonality, and documented species ranges. **Guide Questions:** 1. Identify two major trends you see in the graph. 2. Explain two possible effects of these rising temperatures on ecosystems in your community. How might increasing temperature affect plants, animals, habitats, and food chains in a local ecosystem? 3. Which local plants, animals, or ecosystems in your community might be most affected by rising temperatures? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: KWH Chart	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objective 1 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives.

Directions:
Complete the chart by recording what you already know and what you want to know. After the activity, add what you learned and revise any earlier ideas that changed.

Activity Proper:
Ask students to fill in the table by answering each guiding question.

KNOW	WANT	HOW
What effects of climate change have I already seen or heard about?	What adaptation and mitigation practices do I want to learn more about?	How will I discover or research these practices?

Guide Questions:
1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Assessment Criteria:
• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

B. Instituting New Knowledge

B.1. Presenting Examples

Option 1: Climate Change and Ecosystems

Materials/Resources Needed:
- Notebook or paper
- Pen or pencil

Directions:
Watch both assigned videos and complete the viewing guide with two climate impacts, one biodiversity effect, one adaptation response, and one mitigation action. Compare the evidence and explain one effect on a Philippine species or ecosystem.

Activity Proper:
Ask students to watch two short videos on climate change and biodiversity in the Philippines. While watching, learners will complete a viewing guide by listing the following:
Two climate change impacts on species or ecosystems
One biodiversity effect caused by climate change
One adaptation strategy used by organisms, communities, or ecosystems
One mitigation strategy that can help reduce climate change impacts
After watching, ask students to share their responses and explain how climate change affects local species or ecosystems.

Climate Change Impact	General Ecosystem Response	Possible Mitigation/ Adaptation Practices
Rising global temperatures	Shifts in species distribution and behavior	Plant native trees; establish heat-resilient habitat corridors; reduce emissions through clean energy.
Ocean warming	Stress and decline in marine life	Protect coral reefs; reduce runoff and overfishing; support emission-reduction actions.
Direct land-use drivers such as deforestation and habitat destruction, considered separately from climate hazards while recognizing possible interactions	Reduction of habitats and species diversity	Ecological restoration or carefully planned tree establishment should use site-appropriate native species and protect existing native ecosystems. Do not plant trees in native nonforest ecosystems where doing so would cause ecological harm.

Videos to watch:
Science clarification: Adaptation reduces climate risk; mitigation reduces greenhouse-gas emissions or enhances sinks; conservation protects biodiversity and may provide climate co-benefits. Require a one-sentence mechanism for every classification and allow 'general conservation' or 'both, under stated conditions' when appropriate.

Guide Questions:

1. How Does Climate Change Affect Biodiversity? by California Academy of Sciences https://www.youtube.com/watch?v=XFmovUAWQUQ&t=9s
2. Princeton researchers investigate the impacts of climate change on biodiversity by Princeton University https://www.youtube.com/watch?v=_5Nu4quJEZA

Assessment Criteria:

• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

Prolonged droughts	Water scarcity and ecosystem imbalance	Use drought-resistant crops; conserve water; protect watersheds.
Sea level rise	Damage to coastal ecosystems	Restore mangroves and wetlands; protect coastal habitats.
Melting polar ice caps	Loss of habitats in polar regions	Drastically reduce global greenhouse gas emissions.
changing tropical-cyclone intensity and rainfall risks; do not claim an observed increase in Philippine cyclone frequency	Increased risk of flooding and erosion	Improve drainage; restore wetlands/ mangroves; community preparedness.
Habitat destruction	Disruption of ecological systems	Add locally appropriate adaptation/mitigation practice.
Flooding of farmlands	Threats to food production and security	Improve drainage; restore wetlands/ mangroves; community preparedness.

Greenhouse gas emissions	Accumulation of heat-trapping gases	Use renewable energy, public transport, waste reduction, and energy conservation.

The activity targets Learning Objective 1 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Option 2: Philippine Biodiversity at Risk	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Read both assigned articles and complete the source guide with two climate impacts, one biodiversity effect, one adaptation response, and one mitigation action. Compare the strength of the evidence and cite the source for every claim. **Activity Proper:** Ask students to read the two assigned articles on climate change and biodiversity in the Philippines. While reading, learners will complete a reading guide by listing the following: Two climate impacts on local species or ecosystems One biodiversity effect caused by climate change One adaptation strategy that helps species, communities, or ecosystems respond to climate change One mitigation strategy that can help reduce climate change impacts After reading, learners will share their responses and compare evidence from the two articles to explain how climate change affects Philippine biodiversity. Article to Read: The Impact of Climate Change on Biodiversity in the Philippines by BillionBricks	The activity targets Learning Objective 1 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	https://billionbricks.org/blog/the-impact-of-climate-change-on-biodiversity-in-the-philippines/ Climate Change Impacts by National Integrated Climate Change Database and Information Exchange System https://niccdies.climate.gov.ph/climate-change-impacts Science clarification: Adaptation reduces climate risk; mitigation reduces greenhouse-gas emissions or enhances sinks; conservation protects biodiversity and may provide climate co-benefits. Require a one-sentence mechanism for every classification and allow 'general conservation' or 'both, under stated conditions' when appropriate. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	B.2. Discussing New Concept	
	Option 1: Gallery Walk / Learning Stations	
	Materials/Resources Needed: • Displayed images or teacher-prepared visual prompts • Notebook or paper • Pen or pencil	The activity targets Learning Objective 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies

	Directions: Move through the assigned stations in order. Examine the information, image, evidence, or task at each station; record the required observations or responses; then use the lesson concepts to explain your conclusions. **Activity Proper:** Ask students to move through each station in order, reading the short description and examples provided. As they progress, they should talk with peers about what each strategy means and how it connects to local biodiversity. Ask learners to identify each strategy as adaptation, mitigation, or both. Encourage them to note evidence from the examples and be ready to justify their ideas during class discussion. Protecting Ecosystems Restoring mangrove forests to shield coastal areas from storm surges. [Both] Establishing marine protected areas to conserve coral reefs. [Adaptation] Reforestation projects in upland watersheds to prevent soil erosion and flooding. [Both] Sustainable Practices Diversified crop rotation, cover crops, careful nutrient management, and reduced soil disturbance can improve resilience and may reduce emissions depending on	the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	implementation. [Adaptation and, in some cases, mitigation] Community-based sustainable fishing to prevent overharvesting. [Adaptation] Using renewable energy sources like solar panels to reduce reliance on fossil fuels. [Mitigation] Species Conservation Philippine eagle sanctuaries to protect endangered raptors. [Adaptation] Protect and monitor nesting habitat; use shading or expert-guided nest relocation only when justified by site data and conservation protocols. [Adaptation] Wildlife corridors connecting fragmented habitats for safe animal movement. [Adaptation] Community Action Protect existing native vegetation and restore suitable sites with locally appropriate native species, survival monitoring, and long-term maintenance. [Both when carbon storage and resilience benefits are demonstrated] Citizen science projects where communities monitor local biodiversity. [Adaptation] Policy and Innovation Single-use-plastic reduction primarily reduces pollution and biodiversity harm; climate-mitigation benefits depend	

	on life-cycle emissions and replacement choices. [Biodiversity protection; possible mitigation co-benefit] Renewable energy laws supporting solar and wind farms. [Mitigation] Biodiversity monitoring and reporting tools support conservation decisions but do not directly reduce greenhouse-gas emissions. [Adaptation support/conservation] Differentiation: For learners needing support, provide guiding questions at each station. For advanced learners, ask them to evaluate which strategy would be most effective in their locality and explain why. Science clarification: Mangrove restoration as sea-level-rise adaptation depends on hydrology, sediment supply, elevation, suitable species, maintenance, and space for landward migration. Required plan details: State the baseline condition, appropriate native species and site, survival target, maintenance responsibility, monitoring schedule, and contingency plan. Evidence requirement: Use site-specific habitat descriptions and acknowledge habitat mosaics, elevation, seasonality, and documented species ranges.	

	Guide Questions: 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Film Viewing	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Watch the assigned video or film segment attentively. Record the key scientific ideas or evidence, then answer the guide questions and relate the information to the lesson concept. **Activity Proper:** Ask students to watch each film clip in order, paying close attention to the examples of adaptation and mitigation strategies shown. After viewing, they should discuss with peers how the strategy works and how it applies to local biodiversity. You may use these reference videos for discussion:	The activity targets Learning Objective 2 by guiding learners to extract scientific information from visual media and connect it to the lesson concepts. It applies the Constructivist, Inquiry-Based, and Interactive approaches because learners observe closely, answer guiding questions, and discuss evidence from the media. The pedagogical strategy used is guided multimedia analysis, supported by a viewing guide, pause points, peer discussion, and teacher questioning. Literacy is integrated through identifying key ideas, evaluating statements, and summarizing evidence from the media. Numeracy is integrated through interpreting any scales, time series, quantities, or comparisons shown. EdTech is integrated through a cited video, animation, or presentation when

	Guide Questions: 1. Adapting to climate change: Five countries set an example by OECD, https://www.youtube.com/watch?v=oshaiU7oHOo 2. What is Climate Change? Mitigation and Adaptation in Romania by World Bank Group, https://www.youtube.com/watch?v=0DSJpTqMrNA 3. Local Climate Change Action Planning in the Philippines by adelphi, Berlin, https://www.youtube.com/watch?v=yHYBqADxL7U 4. Climate Change: What Can We Do? by Sky News, https://www.youtube.com/watch?v=1gFRHVYjsP0 **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	available, together with an accessible offline alternative. **Note to Teachers:** Preview the media for scientific accuracy and accessibility. Clarify that a video or animation is not an interactive simulation unless learners can manipulate variables.
	B.3. Developing Mastery	
	Option 1: Matching Type	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Match each item with the correct term, category, description, or process. Record each match and briefly explain the scientific basis for your answer.	The activity targets Learning Objective 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

	Activity Proper: Match each climate change impact in Column A with the most appropriate adaptation or mitigation strategy in Column B. Write the letter of the correct strategy beside each number. After matching, write one sentence explaining why each response is classified as adaptation, mitigation, or both. Use evidence from the impact and the strategy to justify the answer. Rising sea levels affecting coastal mangroves Increased frequency of forest wildfires Coral bleaching due to rising ocean temperatures Decline in pollinator populations (bees, butterflies) Habitat loss from urban expansion Species migration to cooler areas Soil erosion from heavy rainfall Overfishing reducing marine biodiversity Deforestation reducing the carbon absorption capacity Invasive species spreading due to warmer climate: Adaptation/Mitigation Strategies: Establishing marine protected areas and regulating fishing practices Planting native trees and creating firebreaks to reduce wildfire spread Promoting urban green spaces and wildlife corridors Practicing sustainable agriculture and soil conservation methods Supporting community-based mangrove reforestation projects Reducing greenhouse gas emissions through renewable energy use Creating pollinator-friendly gardens and reducing pesticide use Developing conservation programs to monitor and protect migrating species Implementing reforestation and Ecological restoration or carefully planned tree establishment using site-appropriate native species; avoid	The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	planting trees in native nonforest ecosystems where doing so would cause harm projects to restore forest cover Controlling invasive species through monitoring and ecological management Science clarification: Mangrove restoration as sea-level-rise adaptation depends on hydrology, sediment supply, elevation, suitable species, maintenance, and space for landward migration. Required plan details: State the baseline condition, appropriate native species and site, survival target, maintenance responsibility, monitoring schedule, and contingency plan. **Guide Questions:** 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: True or False Check	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil	The activity targets Learning Objective 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based

	Directions: Read every item carefully, record the required answer, and provide a scientific explanation or supporting work whenever the item requires it. **Activity Proper:** Read each statement carefully. Write True if the statement correctly describes an adaptation or mitigation strategy related to climate change and biodiversity. Write False if the statement is incorrect. After answering, write one sentence explaining your answer. In your explanation, identify whether the statement relates to adaptation, mitigation, or both, and justify your response using evidence from the statement. Planting drought-resistant crops helps farmers adapt to reduced rainfall caused by climate change. Protecting wetlands can reduce flooding impacts and provide habitats for diverse species. Switching to single-use plastics is a good way to mitigate climate change impacts on biodiversity. Establishing well-managed seed banks preserves genetic diversity and can support research, restoration, and future conservation; it does not make species adapt by itself. Overuse of chemical fertilizers improves soil resilience against climate change. Creating wildlife corridors allows animals to safely migrate when their habitats shift due to warming.	approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Promoting renewable energy sources reduces greenhouse gas emissions and slows biodiversity loss. Introducing non-native species is an effective way to increase biodiversity under climate stress. Community-led reforestation projects can restore degraded ecosystems and absorb carbon dioxide. Conserving traditional farming practices, such as crop rotation, can strengthen ecosystems against climate impacts. Required plan details: State the baseline condition, appropriate native species and site, survival target, maintenance responsibility, monitoring schedule, and contingency plan. **Guide Questions:** 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Option 1: Local Solutions for Climate & Biodiversity	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objective 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the

	Directions: Work with a partner or small group to propose two feasible community practices. For each practice, state the action, classify it as adaptation, mitigation, conservation, or a justified combination, and explain the mechanism by which it reduces climate risk or supports local biodiversity. **Activity Proper:** Ask students to work in pairs or small groups and think about everyday actions that communities can adopt to protect local biodiversity while addressing climate change. They should write down two specific sustainable practices, such as those related to farming, waste management, energy use, or community projects. After listing their practices, they must explain how each one reduces climate impacts and supports biodiversity. Example: Using safely designed rainwater harvesting → stores water for appropriate nonpotable uses, can reduce pressure on supplies, and may support vegetation during dry periods. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Option 2: Policy Innovation	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal. **Activity Proper:** Ask students to imagine themselves as part of their local government council and draft one new policy idea that could help their community adapt to or mitigate climate change effects on local biodiversity. They should provide evidence or reasoning that shows how this policy would benefit both people and ecosystems. Example: A policy banning single-use plastics in coastal towns can prevent marine pollution and help protect coral reefs. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	The activity targets Learning Objective 3 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or presentation tool when available, with a paper-based alternative. **Note to Teachers:** Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.

	C.2. Making Generalization	
	Option 1: Concept Mapping	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown. **Activity Proper:** Ask students to create a concept map that shows how different impacts of climate change affect local biodiversity and how communities can respond. Begin by asking them to place "Climate Change Impacts on Biodiversity" at the center of their map. From this central idea, they should branch out to specific examples such as rising temperatures, habitat loss, flooding, or species migration. For each impact, ask students to propose at least one strategy that could help adapt to or mitigate the problem. Encourage them to use arrows or connecting lines to show relationships, such as how a single practice (like reforestation) can address multiple impacts. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson?	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Assessment Criteria: • Scientific accuracy • Completeness of the required task • Clarity of response or explanation	
	Option 2: Absent Friend Summary	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation. **Activity Proper:** Ask students to imagine that a classmate missed the lesson. Using a short paragraph or organizer, they will explain why these actions are important for protecting biodiversity and ensuring climate resilience. Students then exchange outputs with a partner for feedback. **Guide Questions:** 1. What does climate change do to local biodiversity? 2. In what ways can communities adapt to these impacts? 3. What ways can people help mitigate climate change?	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Assessment Criteria:
• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

C.3. Evaluating Learning

Option 1: 3-2-1 Reflection

Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation.

Activity Proper:
Complete the 3-2-1 Reflection by writing three climate impacts on local biodiversity, two possible adaptation or mitigation actions, and one action you can personally support in your community. Be specific and relate your answers to local biodiversity and real-life environmental practices.

Question	Answer
3 climate impacts on local biodiversity that I learned	

The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis.
The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative.

Note to Teachers: Ask learners to explain the evidence behind each connection. Address

	<table><tr><td>2 possible adaptation or mitigation actions to address these impacts</td><td></td></tr><tr><td>1 action I can personally support in my community</td><td></td></tr></table> **Guide Questions:** 1. What is the most important scientific idea you developed from the activity? 2. What example or evidence best supports your explanation? **Expected Output/Product:** Completed written reflection that connects the activity to the relevant scientific concepts. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	misconceptions before accepting the final generalization.
	Option 2: LAQ	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

Activity Proper:
Ask students to fill in the table by answering each guiding question.

LEARN	ACTION	QUESTION
What important ideas did I learn about climate change impacts and solutions?	What actions can I or my community take to adapt or mitigate these impacts?	What questions do I still have about climate change and how to respond to it?

Guide Questions:
1. What did you observe, identify, or conclude from the activity?
2. How does your response or result connect to the scientific concept discussed in the lesson?

Assessment Criteria:
• Scientific accuracy and relevance of ideas
• Completeness or depth of response
• Clarity of explanation

The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

C.4. Additional Activities

Option 1: Poster Making

Materials/Resources Needed:
• Paper, cartolina, or Manila paper
• Pen or pencil
• Markers or colored pencils (if available)

The activity targets Learning Objectives 1, 2, and 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist,

	Directions: Create the specified visual output using accurate scientific information, clear labels or captions, and appropriate examples. Present or submit the output with a brief explanation of its main scientific message. **Activity Proper:** Ask students to design a poster illustrating practical ways to mitigate and adapt to climate change within local ecosystems. Posters must blend visuals and concise text to inspire action. Crucially, each must feature measurable community goals (e.g., cutting waste by a certain percentage or planting enough trees to achieve a specific localized benefit). **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea? **Expected Output/Product:** Completed poster with accurate scientific content, clear visuals, and an appropriate message.	Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Rubric

Criteria	4 – Excellent	3 – Good	2 – Fair	1 – Needs Improvement	Total
Clarity of Message	Poster communicates adaptation and mitigation strategies clearly with concise text and visuals.	Message is mostly clear, with minor gaps in explanation or visuals.	Message is somewhat unclear; strategies are vague or incomplete.	Message is confusing or missing; strategies not evident.	____
Relevance & Accuracy	Strategies are realistic, evidence-based, and directly connected to local biodiversity.	Strategies are mostly accurate and relevant, with minor errors.	Strategies show limited relevance or contain noticeable inaccuracies.	Strategies are irrelevant, inaccurate, or missing.	____
Creativity & Design	Poster is visually engaging, well-organized, and uses creative elements (symbols,	Poster is neat and organized with some creative elements.	Poster shows limited creativity or weak organization.	Poster is poorly designed, lacks creativity, or is incomplete.	____

	slogans, drawings).				
Use of Evidence/Examples	Poster includes specific local examples (species, ecosystems, practices) to support strategies.	Poster includes some examples, though not always specific or detailed.	Poster includes few or vague examples.	Poster lacks examples or evidence.	____
Presentation & Explanation	Student confidently explains poster, justifies strategies with evidence, and engages audience.	Student explains poster clearly with some justification.	Student explanation is brief, with limited justification.	Student explanation is unclear or missing.	____
Total Score					____ / **20**

Option 2: My Own Contribution

Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to apply scientific concepts in creating and explaining an evidence-based product for a defined audience. It applies the Constructivist,

	Directions: Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences. **Activity Proper:** Have students write an essay in which they reflect on how they personally help protect local biodiversity from the effects of climate change. Their writing should clearly link their daily habits and choices to broader climate adaptation and mitigation efforts. Additionally, the essay must include at least one measurable or quantified action, such as the number of trees planted, the percentage of waste reduced, or a target level of community participation, to demonstrate concrete impact. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson?	Collaborative, and Integrative approaches because learners synthesize knowledge, make design decisions, and communicate a scientifically accurate product. The pedagogical strategy used is project-based learning, supported by explicit task criteria, peer consultation, checkpoints, and teacher feedback. Literacy is integrated through drafting concise explanations, citing sources, and using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence, scales, scores, or data displays when required by the product. EdTech is integrated through presentation, design, video, or shared-document tools when available, with a non-digital alternative. **Note to Teachers:** Present the complete task directions and rubric before work begins. Monitor source quality, scientific accuracy, and individual participation.

Rubric

Criteria	4 – Excellent	3 – Good	2 – Fair	1 – Needs Improvement	Total
Clarity of Ideas	Essay is well-organized, with clear introduction, body, and conclusion. Ideas flow logically.	Essay is mostly organized, with minor lapses in clarity or flow.	Essay shows weak organization; ideas are somewhat unclear or disconnected.	Essay is disorganized, confusing, or incomplete.	____
Relevance to Objective	Contributions directly address adaptation and mitigation of climate change impacts on biodiversity.	Contributions are mostly relevant, with minor gaps or generalizations.	Contributions show limited relevance; focus is vague or partially off-topic.	Contributions are irrelevant or missing.	____
Use of Local Evidence and Context	Essay includes specific local examples or practices to support contributions.	Essay includes some examples, though not always specific or detailed.	Essay includes few or vague examples.	Essay lacks examples or evidence.	____

	Personal Reflection	Essay shows deep reflection on personal role and responsibility; demonstrates commitment.	Essay shows some reflection, with moderate personal connection.	Essay shows limited reflection; personal role is mentioned but not explored.	Essay lacks reflection; personal role is absent.	____
	Language & Mechanics	Essay uses clear, concise language with minimal errors in grammar or spelling.	Essay is mostly clear, with some errors that do not hinder understanding.	Essay has frequent errors that affect clarity.	Essay has serious errors that make it difficult to understand.	____
	Total Score					____ / **20**

V. ASSESSMENT
(Assessing Learnings)

Multiple Choice: Choose the letter of the best answer.

1. Which action best helps protect local biodiversity from climate change impacts?
   A. Building more roads through forest areas
   B. Increasing the use of plastic products
   C. Planting native trees in damaged forests
   D. Expanding factories near coastal zones
2. Which strategy helps communities adapt to stronger flooding and storms?
   A. Cutting more trees near river systems
   B. Restoring wetlands and improving drainage
   C. Building more factories beside coastlines
   D. Throwing garbage into nearby waterways

	3. Which activity is an example of climate change mitigation? A. Relocating families during strong typhoons B. Using solar panels to reduce fuel use C. Storing food supplies during heavy rains D. Preparing rescue kits for emergencies 4. Which practice can help conserve local animal and plant species? A. Increasing hunting in protected reserves B. Protecting forests and natural habitats C. Constructing buildings inside wetland areas D. Expanding illegal logging in mountain areas 5. Which community effort best reduces greenhouse gas emissions? A. Increasing the use of gasoline vehicles B. Burning waste materials in open spaces C. Using bicycles and public transportation D. Clearing forests for commercial projects 6. Which adaptation strategy helps farmers facing longer drought periods? A. Removing irrigation systems from farms B. Expanding farmland into forest reserves C. Planting drought-resistant crop varieties D. Burning grasslands before planting crops 7. Which action best protects marine biodiversity from climate change? A. Increasing fishing near breeding grounds B. Dumping household waste into seawater C. Protecting existing mangroves and restoring suitable coastal sites with correct species and hydrology D. Building resorts on coral reef areas 8. Which school activity promotes awareness of biodiversity conservation? A. Allowing littering during outdoor programs B. Organizing environmental cleanup campaigns C. Burning leaves and plastics after events

	D. Holding contests that waste paper materials 9. Which government action supports biodiversity conservation efforts? A. Supporting illegal trade of wild animals B. Expanding industries near coral ecosystems C. Creating protected wildlife conservation areas D. Allowing mining inside natural reserves 10. Which statement explains the effect of climate change on biodiversity? A. Climate change increases forest animal populations B. Climate change affects only human communities C. Climate change damages habitats and ecosystems D. Climate change improves all species survival **Community Action Plan:** Learners will collaborate to design a Community Action Plan that specifically addresses how their community can adapt to the effects of climate change and mitigate its causes to protect local biodiversity. The project begins with research into local ecosystems, identifying species, habitats, and ecological services most at risk. Students then analyze how climate change, through rising temperatures, flooding, droughts, or habitat loss, affects biodiversity and why these impacts matter for community health, food security, and cultural heritage. The heart of the project is the development of strategies. Adaptation strategies should focus on helping the community adjust to unavoidable changes, such as creating wildlife corridors, planting drought-resistant crops, or restoring mangroves to buffer against storm surges. Mitigation strategies, such as reforestation, renewable energy adoption, waste reduction, or sustainable farming practices, should aim to reduce the drivers of climate change,. Each proposal must be supported with evidence, whether from scientific studies, local practices, or community observations, and should clearly explain how biodiversity will benefit. The action plan should present concrete actions, responsible stakeholders, required resources, and a timeline that distinguishes short-, medium-, and long-term goals. Learners should also propose inclusive ways to engage the community, such as awareness campaigns, workshops, or collective initiatives.

The final output may be a poster, infographic, or slideshow presentation accompanied by a written rationale that summarizes the plan and highlights its adaptation and mitigation focus. Groups present their work to the class, justify the feasibility of their strategies, and reflect on possible challenges and improvements. This capstone project serves as a culminating assessment of learners' ability to connect scientific understanding of climate change with practical, community-based solutions for biodiversity protection.

Assessment Criteria:

Criteria	4 – Excellent	3 – Good	2 – Fair	1 – Needs Improvement	Total
Focus on Adaptation & Mitigation	Plan presents well-balanced, innovative, and realistic adaptation and mitigation strategies, strongly supported by evidence.	Plan presents clear adaptation and mitigation strategies with some supporting evidence.	Plan includes strategies but they are general, limited, or weakly supported.	Plan lacks clear adaptation or mitigation strategies, or they are unrealistic.	____
Research & Evidence	Thorough research with credible sources and strong local examples; biodiversity impacts clearly explained.	Adequate research with some credible sources and examples; impacts mostly clear.	Limited research with weak sources or vague examples; impacts somewhat unclear.	Minimal or no research; biodiversity impacts not explained.	____

Action Plan Design	Detailed plan with specific actions, clear roles, realistic timeline, and identified resources.	Mostly detailed plan with minor gaps in roles, timeline, or resources.	Plan includes some actions but lacks clarity in roles, timeline, or resources.	Plan is vague, incomplete, or missing key elements.	____
Community Engagement	Strong, inclusive strategies for involving community members; participation is practical and well-planned.	Adequate strategies for community involvement; participation somewhat clear.	Limited or vague strategies for community involvement.	No strategies for community involvement.	____
Presentation & Reflection	Presentation is clear, engaging, and well-organized; reflection shows deep insight into challenges and improvements.	Presentation is clear and organized; reflection shows some insight.	Presentation is understandable but weak; reflection is limited.	Presentation is unclear or disorganized; reflection missing or superficial.	____
Total Score					____ / **20**

	Assessment specification: Use evidence-rich cases that distinguish adaptation, mitigation, and conservation. Include the answer key, explanations, rubric, and final-score calculation.
VI. REFLECTION *(Feedback and Continuous Improvement)*	Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery. 1. How many learners successfully demonstrated the learning objectives based on the assessment results? 2. Which activity helped learners understand the lesson the most? Which activity helped the least? 3. Which part of the lesson was easiest for learners? Which part was most difficult? 4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support? 5. What did the assessment results show about learners' understanding of the lesson? *6.* What improvement would you make if you taught this lesson again?
VII. USE OF GENERATIVE AI	In preparing this Learning Exemplar (LE), the author(s) used ChatGPT to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.

APPENDIX

Answers to Multiple Choice Questions (Assessment)

Item No.	Key Answer	Explanation
1	C	Native tree planting restores natural habitats, supports local species, and increases ecosystem resilience against climate change impacts.
2	B	Wetlands act as natural buffers that absorb excess water, reducing flooding while also providing habitats for many species.
3	B	Solar energy reduces dependence on fossil fuels, lowering greenhouse gas emissions that drive climate change.
4	B	Conserving natural ecosystems ensures that plants and animals retain safe environments to survive and reproduce.
5	C	These reduce carbon emissions from vehicles, helping slow down climate change and its effects on biodiversity.
6	C	Drought-resistant crops help farmers maintain productivity despite changing rainfall patterns and longer dry seasons.
7	C	Mangroves protect shorelines, reduce storm damage, and serve as important breeding and nursery areas for marine life.
8	B	Cleanup activities raise awareness and directly reduce pollution that harms ecosystems and biodiversity.
9	C	Protected areas safeguard habitats from destructive human activities and support species conservation.
10	C	Climate change alters temperature and weather patterns, leading to habitat loss and threats to biodiversity.

Learning Title/Topic:	Philippine Ecosystems – Local and Global Effects of Overpopulation	Lesson Exemplar:	19

I. OBJECTIVES	
A. Content Standard	Climate change affects ecosystems and the organisms living in them; and ecosystems are finite and have limited resources.
B. Performance Standard	By the end of the quarter, learners use examples to describe the relationships among living systems and their components and how the structure of a part relates to its function. They explain the role of cells in perpetuating life and how organ systems work together to maintain optimal health. They conduct investigations on the effects of climate change on local ecosystems.
C. Learning Competencies	***Prerequisite Knowledge and Skills***
	1. Grade 7 (Life Science): Learners studied the components of ecosystems such as producers, consumers, and decomposers. They were introduced to the idea of balance in nature through food chains and food webs, emphasizing how energy flows from one organism to another. 2. Grade 8 (Life Science): Learners learned about the cycles of matter in ecosystems, including the water, carbon, and nitrogen cycles. They also discussed how human activities such as deforestation and pollution disrupt these cycles and affect ecosystem stability. 3. Grade 9 (Life Science): Learners examined the interactions among organisms, including competition, predation, and symbiosis, and how these interactions influence population size. They were also introduced to the concept of carrying capacity, which highlighted that ecosystems have limited resources to support populations. 4. Grade 10 (Earth and Environmental Science): Learners explored environmental issues caused by human activities, such as biodiversity loss, habitat destruction, and climate change. They also learned that population change can affect resource demand, together with per-capita consumption, production systems, technology, trade, distribution, land use, and governance and contributes to global environmental challenges.

	12. analyze information from secondary sources to evaluate the adverse effects of overpopulation locally and globally.
II. REFERENCES and MATERIALS (*Selecting Resources and Material*)	Delizo, M. (2024, July 27). *Overpopulation, poor urban development, garbage blamed for NCR floods.* ABS-CBN News. https://www.abs-cbn.com/news/2024/7/27/overpopulation-poor-urban-development-garbage-blamed-for-ncr-floods-2152 Department of Education. (2024). *MATATAG Curriculum Guide: Senior High School – General Science.* Bureau of Curriculum Development. Kurzgesagt – In a Nutshell. (2019, Sept 6). *Overpopulation – The human explosion explained* [Video]. YouTube. https://www.youtube.com/watch?v=QsBT5EQt348 Our World in Data. (2024). *Global Carbon Budget.* https://ourworldindata.org United Nations, Department of Economic and Social Affairs, Population Division. (2025). *World Population Prospects: Demographic Profiles – Line charts.* https://population.un.org/wpp/graphs?loc=900&type=Demographic%20Profiles&category=Line%20Charts United Nations. (2021, July 15). *The future of humanity: Population trends decoded* [Video]. YouTube. https://www.youtube.com/watch?v=C2U-wMit9WY World Bank. (2025). *World Development Indicators.* https://data.worldbank.org **Materials** ● Manila paper / chart paper, markers ● ICT tools: Kahoot, Mentimeter, Canva, Google shared digital board, projector ● Displayed KWL and IPO chart prompts, Fact or Bluff cards, "What If" prompts, and writing materials ● Case posters (India, China, Africa, Amazon, Philippines)
III. CONTENT *(Sequencing Content)*	Philippine Ecosystems – Local and Global Effects of Overpopulation
IV. OBJECTIVES *(Setting Clear Objectives and Analyzing the Tasks)*	At the end of the lesson, the learners will be able to: 1. Define overpopulation as a context-specific condition in which population demand exceeds the capacity of resources, services, and ecosystems under prevailing consumption, technology, distribution, and governance—not simply a large or dense population. 2. Interpret secondary sources of data on adverse effects of overpopulation. 3. Propose strategies to prevent and mitigate the negative effects of overpopulation in their local area and globally.

<table>
<tr><th colspan="2">IV. PROCEDURES</th><th>ANNOTATIONS</th></tr>
<tr><td rowspan="3">A. Activating Prior Knowledge</td><td colspan="2">A.1. Activating Prior Knowledge</td></tr>
<tr><td colspan="2">Option 1: Fact or Bluff</td></tr>
<tr><td>Materials/Resources Needed:
• Displayed or teacher-prepared prompts/cards, as needed
• Notebook or paper
• Pen or pencil

Directions:
Use the prepared Fact and Bluff cards, or the agreed hand signals. For each statement read aloud, show Fact or Bluff, record the correct classification, and write a brief correction or explanation based on population, resource, ecosystem, or carrying-capacity concepts.

Activity Proper:
Statements:
The Earth has unlimited resources to support human populations. → Bluff
Overpopulation can lead to food and water scarcity. → Fact
Humans compete with one another and with other organisms for resources. → Fact
Population density can increase pressure on infrastructure when planning and services are inadequate, but compact areas with effective transit and services can have lower per-capita impacts. → Fact
Overpopulation only affects poor countries. → Bluff</td><td>The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.
The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.</td></tr>
</table>

	Deforestation may be linked to increasing population demands. → Fact Carrying capacity is the population that an environment can sustain over time under specified conditions. For humans it is not a fixed number because consumption, technology, trade, infrastructure, distribution, and ecosystem condition can change it. → Fact Population growth has no effect on ecosystems. → Bluff Overpopulation can increase pressure on public services and resources. → Fact Local and global ecosystems can both be affected by population growth. → Fact Causal clarification: Use conditional causal language. Population change or density alone does not cause scarcity or flooding; outcomes depend on consumption, infrastructure, governance, technology, distribution, hazards, and ecosystem capacity. Distinguish global population growth from local migration and planning capacity. Rights-based framing: Plan for demographic change and manage resource demand. Any family-planning discussion must emphasize voluntary, informed, rights-based access to services, while proposed responses balance individual actions with policy and infrastructure choices.	**Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Guide Questions: 1. Which scientific concept was most important in determining the correct response? 2. What evidence or characteristic helped you distinguish the correct answer from the alternatives? **Assessment Criteria:** • Accuracy of responses • Completeness of required answers	
	Option 2: KWL Chart	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Complete the K and W columns before the lesson, compare entries with a partner or group, and complete the L column afterward using evidence from the lesson. **Activity Proper:** Ask students to spend 3–5 minutes individually filling in the What I Know column about ecosystems, population growth, carrying capacity, and resource use. Encourage them to recall topics from Grades 7–10. Instruct students to complete the What I Want to Know column by listing at least 2–3 questions they are curious about regarding overpopulation and its effects on ecosystems.	The activity targets Learning Objectives 1 and 2 by prompting learners to recall prior knowledge, explain ideas, and connect the lesson to familiar contexts. It applies the Constructivist, Collaborative, and Interactive approaches because learners build understanding from prior experiences, discuss responses with peers, and participate in guided class discussion. The pedagogical strategy used is guided discussion, supported by peer sharing and teacher questioning. Literacy is integrated through reading prompts, discussing ideas, and explaining answers using accurate scientific terms. Numeracy is integrated through classifying information or tallying responses when relevant; otherwise, numeracy is not a primary focus of this activity. EdTech is integrated through a shared digital board or

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<td>Pair students to share their answers, then consolidate ideas in small groups.

On manila paper or a digital board (shared digital board/Padlet), ask groups to post 1–2 entries for each column.

At the end of the lesson, return to the KWL Chart and ask students to complete the What I Learned column by connecting new insights with their initial questions.

<table><tr><th>K (What I Know)</th><th>W (What I Want to Know)</th><th>L (What I Learned)</th></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td></td><td></td></tr></table>
Causal clarification: Use conditional causal language. Population change or density alone does not cause scarcity or flooding; outcomes depend on consumption, infrastructure, governance, technology, distribution, hazards, and ecosystem capacity. Distinguish global population growth from local migration and planning capacity.

Rights-based framing: Plan for demographic change and manage resource demand. Any family-planning discussion must emphasize voluntary, informed, rights-based access to services, while proposed responses balance individual actions with policy and infrastructure choices.</td>
<td>presentation tool when available, with a paper-based alternative.

Note to Teachers: Allow learners to discuss their answers with their group members before presenting. Use follow-up questions to clarify ideas and address misconceptions.</td>
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	Guide Questions: 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	A.2. Establishing the Purpose of the Lesson	
	Option 1: Motivational Questions with Visual Prompts	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Respond to each prompt using your prior knowledge and the lesson concepts. Discuss your reasoning with a partner or group, then refine your answer based on the evidence shared. **Activity Proper:** Project or show images (e.g., traffic in EDSA, crowded markets, polluted rivers, deforested areas, or other local community situations).	The activity targets Learning Objectives 1 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through

	 EDSA Traffic  Divisoria Market  Manila Bay  Part of El Nido, Palawan Causal clarification: Use conditional causal language. Population change or density alone does not cause scarcity or flooding; outcomes depend on consumption, infrastructure, governance, technology, distribution, hazards, and ecosystem capacity. Distinguish global population growth from local migration and planning capacity. Evidence limitation: Do not infer overpopulation from crowded photographs. Pair images with evidence on density, service capacity, land use, per-capita consumption, and change over time, and ask what cannot be inferred from the image.	measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Data requirement: Provide complete dataset metadata and a source-evaluation checklist. State when data are hypothetical and assume that other conditions are held constant. Do not place unlike units on one y-axis; use separate panels or clearly indexed values. Rights-based framing: Plan for demographic change and manage resource demand. Any family-planning discussion must emphasize voluntary, informed, rights-based access to services, while proposed responses balance individual actions with policy and infrastructure choices. **Guide Questions:** 1. What do these pictures have in common? 2. What problems can you observe in these situations? 3. How might increasing population contribute to these issues? 4. Have you experienced similar situations in your community? Explain. 5. How can these issues affect ecosystems and available resources? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

	Option 2: Think–Pair–Share (Local Ecosystem Focus)	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Think independently about the prompt and write an initial response. Discuss it with a partner, agree on an evidence-based answer, and share the conclusion with the class. **Activity Proper:** Pose the following prompt: Allow learners to think individually for 2 minutes and write at least one possible effect of population growth on their community. Pair learners and ask them to discuss their ideas, identifying at least one common response. Ask pairs to share their consolidated responses with the class. Facilitate a short discussion by connecting learners' responses to concepts of ecosystem balance, carrying capacity, and resource limitations. **Guide Question:** How do you think increasing population affects ecosystems and resources in your community? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	The activity targets Learning Objectives 1 and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis. The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

<table>
<tr><td rowspan="3">B. Instituting New Knowledge</td><td colspan="2">B.1. Presenting Examples</td></tr>
<tr><td colspan="2">Option 1: Mini-Lecture with Interactive Graph Analysis</td></tr>
<tr><td>Materials/Resources Needed:
• Notebook or paper
• Pen or pencil

Directions:
Study the graph, chart, or data set carefully. Identify the relevant patterns or trends, support each interpretation with specific evidence from the data, and answer the guide questions.

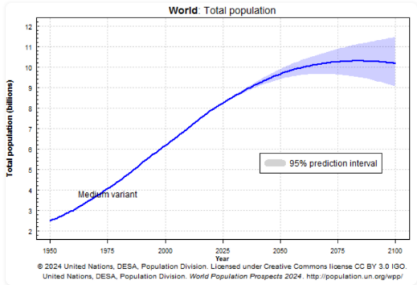
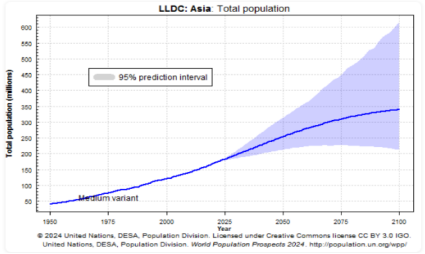
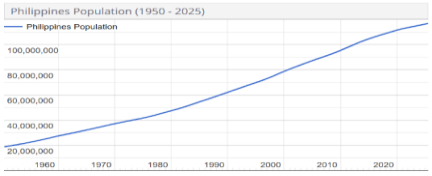
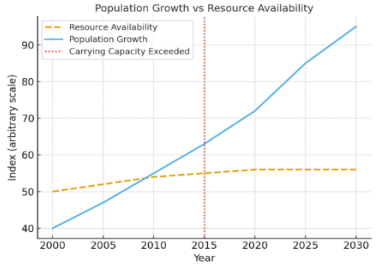
Activity Proper:
Present line graphs comparing Philippine population growth and world population growth.

Ask students to observe the graphs for 1–2 minutes and write at least one observation regarding population trends and resource availability.

Ask the following prediction question before discussing the graph:

Distribute a partially completed diagram for students to complete during the mini-lecture.</td><td>The activity targets Learning Objectives 1 and 2 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.
The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.</td></tr>
</table>

	Pause at key points during the discussion and ask comprehension questions. Ask 1–2 students to explain their completed diagram to the class. Sample Diagrams:     Data requirement: Provide complete dataset metadata and a source-evaluation checklist. State when data are hypothetical and assume that other conditions are held constant. Do not place unlike units on one y-axis; use separate panels or clearly indexed values.	

	Guide Questions: 1. What do you think might happen if population growth continues while resources remain limited? 2. What trend do you observe in the Philippines' population growth compared to global trends? 3. If this is a conceptual model rather than observed data, what assumptions does the resource-availability line make about consumption, technology, distribution, trade, and ecosystem condition? 4. How does the model illustrate a changing, condition-dependent carrying capacity, and what evidence would be needed before applying it to a real human population? 5. What possible consequences may occur if population exceeds carrying capacity? 6. Based on the graph, why is it important to plan for demographic change and manage resource demand? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Reading Excerpt with Guided Questions (Local Context)	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 2 and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the

	Directions: Read or examine the assigned source, identify its main claim and supporting evidence or data, answer the guide questions, and cite the source in the required output. **Activity Proper:** Distribute printed copies of the article "Overpopulation, Poor Urban Development, Garbage Blamed for NCR Floods" to each student or group. Title of Article: Overpopulation, Poor Urban Development, Garbage Blamed for NCR Floods Author / Publisher: Michael Delizo, ABS-CBN News Published: July 27, 2024 Link: https://www.abs-cbn.com/news/2024/7/27/overpopulation-poor-urban-development-garbage-blamed-for-ncr-floods-2152 Description: This article discusses how Metro Manila's overpopulation, poor urban planning, and waste mismanagement contribute to flooding in the National Capital Region. It explains how drainage systems become overwhelmed and how infrastructure struggles to keep up with increasing population demands. Give learners 5–7 minutes to read silently (or the teacher may read selected portions aloud). Ask learners to underline: one statement showing a cause one statement showing an effect	Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

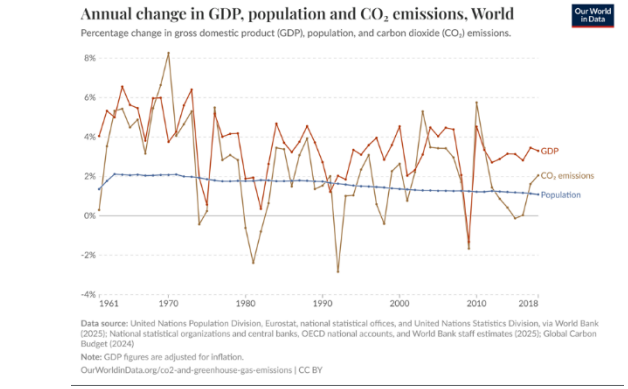
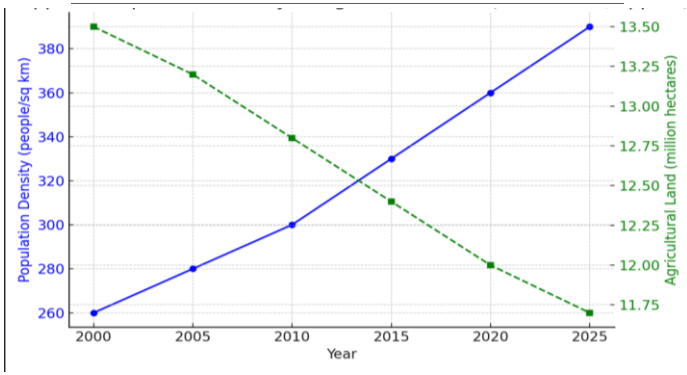
	Provide the guided questions below and allow students to discuss responses in groups of 3–4 learners. Ask each group to present 1–2 key points showing a cause-and-effect relationship. Data requirement: Provide complete dataset metadata and a source-evaluation checklist. State when data are hypothetical and assume that other conditions are held constant. Do not place unlike units on one y-axis; use separate panels or clearly indexed values. **Guide Questions:** 1. What specific problems in Metro Manila are associated with overpopulation? 2. What role does infrastructure (e.g., drainage systems and waste disposal) play in worsening these problems? 3. Which populations or areas are most affected according to the article? 4. How do these problems affect ecosystem services such as water, soil, and habitats? 5. What solutions or management practices are mentioned or implied in the article? 6. What challenges might communities face in solving these problems? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

	B.2. Discussing New Concept	
	Option 1: IPO (Input–Process–Output) Chart Analysis	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Study the provided data display, identify the variables and pattern, make the required comparisons or calculations, and state an evidence-based conclusion without assuming causation. **Activity Proper:** Ask learners the following question: Allow learners to provide initial ideas before viewing the material. Present the video: "Overpopulation – The Human Explosion Explained" Channel / Author: Kurzgesagt – In a Nutshell Duration: 6:39 minutes Description: This animated video explores how the human population has grown dramatically, what factors contribute to it, and what possible consequences could follow. It presents key data trends and invites reflection on sustainability. Distribute an IPO (Input–Process–Output) Chart organizer with the following columns:	The activity targets Learning Objectives 1 and 2 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

Input (Causes)	Process (How it Happens)	Output (Effects)
Population change (births minus deaths, with migration affecting local totals)	Demand for transport and services relative to infrastructure capacity	Possible congestion or pollution, depending on planning and services
Per-capita consumption and production patterns	Waste generation, collection, treatment, and disposal	Possible blockage or pollution; flooding also depends on rainfall, drainage, and land cover
Land-use planning and governance	Resource demand and habitat conversion	Possible ecosystem change or deforestation; causal links require evidence

Instruct learners to complete the chart while analyzing the source. They must support each causal arrow with evidence and consider consumption, infrastructure, governance, and alternative explanations.
Allow learners to compare answers with their group members and discuss similarities and differences.

	Facilitate a discussion using the guide questions: **Guide Questions:** 1. "What factors do you think contribute to overpopulation and its effects on ecosystems?" 2. Link: https://www.youtube.com/watch?v=QsBT5EQt348 3. What inputs commonly contribute to overpopulation? 4. How do these causes affect communities and ecosystems? 5. What effects appear most frequently? 6. What might happen if these problems continue over time? 7. What possible actions can help reduce these effects? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Data Interpretation Challenge	
	Materials/Resources Needed: • Displayed or teacher-prepared prompts/cards, as needed • Notebook or paper • Pen or pencil **Directions:** Study the graph, chart, or data set carefully. Identify the relevant patterns or trends, support each interpretation with specific evidence from the data, and answer the guide questions.	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.

	Activity Proper: Divide learners into small groups (3–5 members). Provide each group with graphs, charts, tables, or infographics related to population growth and environmental issues. Sample Data Sources: Population Density vs. Agricultural Land Population Growth vs. CO_2 Emissions Urban Population Growth vs. Waste Production Resource Availability vs. Population Increase  	The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Philippines: Population Density vs. Agricultural Land Allow groups 5–7 minutes to analyze their assigned data source. Instruct learners to discuss and answer the guide questions below. Ask each group to present their findings and explain their interpretation to the class. **Guide Questions:** 1. What trend or pattern can you observe in the data? 2. What possible factors contribute to the observed trend? 3. What effects on ecosystems or communities might result if this trend continues? 4. What conclusions can you make based on the data presented? 5. What possible solutions can communities implement to address these concerns? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	B.3. Developing Mastery	
	Option 1: What If? Scenario Analysis	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil	The activity targets Learning Objectives 2 and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific

Directions:
Read or examine the assigned case or scenario. Identify the relevant evidence, apply the appropriate scientific concepts, answer the guide questions, and justify your conclusion.

Activity Proper:
Divide learners into small groups (3–5 members).
Sample Scenarios:
Instruct learners to analyze each situation using the table below:

Scenario	Possible Effects	Evidence / Reasoning	Possible Solutions

Ask learners to discuss how the scenarios may affect ecosystems, natural resources, and communities.
Allow groups to present their responses and justify their predictions using concepts discussed in class.
Facilitate a synthesis discussion by highlighting connections among carrying capacity, resource limitations, and environmental sustainability.

Guide Questions:
1. Distribute the "What If?" Scenario organizer containing hypothetical situations related to overpopulation and environmental issues.
2. What if the population of your barangay doubled within 10 years while the water supply remained the same?
3. What if agricultural lands in your province continued to decrease due to housing developments?

concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.
The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set.

Note to Teachers: Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	4. What if waste production increased while waste management systems remained limited? 5. What if urban migration continued without proper city planning? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	Option 2: Concept Mapping – Overpopulation Web	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Construct the required map or organizer. Include the key concepts, connect them with appropriately labeled links or arrows, and explain the most important relationships shown. **Activity Proper:** Provide each group with a large sheet of paper or digital tools such as Canva, MindMeister, or Google shared digital board. Ask learners to place "Overpopulation" at the center of the concept map.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are

	Instruct learners to create branches showing: Population-change drivers (births and deaths; migration affects local totals but not the global total) and contextual factors such as planning, governance, consumption, and infrastructure that influence carrying capacity and outcomes Processes (e.g., urban congestion, waste accumulation, resource strain) Possible outcomes or pressures (e.g., waste generation, pollution, resource demand, or land conversion), each linked to evidence and mechanisms involving per-capita consumption, infrastructure, governance, technology, distribution, hazards, and ecosystem capacity Solutions / Mitigation Strategies (e.g., rights-based, voluntary access to education and reproductive-health information and services; waste and water management; sustainable consumption; equitable services; and sustainable urban planning) Require learners to connect ideas using arrows and linking phrases to show relationships among concepts. Example: Population change + per-capita waste + collection practices + drainage capacity + rainfall → possible changes in blockage and flood risk; test each link with data rather than assuming one cause Encourage learners to include at least one local example from their community or region.	required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Allow groups to present their concept maps to the class. Facilitate a synthesis discussion by highlighting accurate relationships, correcting misconceptions, and emphasizing sustainable solutions to overpopulation issues. **Guide Questions:** 1. What did you observe, identify, or conclude from the activity? 2. How does your response or result connect to the scientific concept discussed in the lesson? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
C. Demonstrating Knowledge and Skills	***C.1. Finding Practical Application***	
	Option 1: Structured Debate – "To What Extent Does Overpopulation Contribute to Environmental Problems?"	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Use evidence from secondary sources to prepare a clear position, present the claim and supporting evidence, respond respectfully to counterarguments, and write a balanced conclusion.	The activity targets Learning Objectives 2 and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted.

	Activity Proper: Divide the class into two groups: Group A: Argue that population size, population distribution, per-capita consumption, production systems, technology, governance, and inequality interact to shape environmental outcomes. Group B: Argue that other factors (e.g., governance, technology, consumption patterns, waste management) contribute more significantly. Provide learners with time to review class notes, graphs, articles, and other secondary sources discussed during the lesson. Instruct each group to prepare: at least three evidence-based arguments supporting examples or data possible solutions related to the issue Allow each group to present opening statements followed by rebuttals and response arguments. Encourage learners to support claims using evidence from: graphs and charts articles or reports local community observations concepts discussed during class	The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

<table>
<tr><td></td><td>After the debate, facilitate a synthesis discussion using the following guide questions:
Guide Questions:
1. To what extent does overpopulation contribute to environmental problems?
2. What other factors influence environmental degradation?
3. Why is it important to examine multiple causes of environmental issues?
4. What solutions can help address both population-related and environmental concerns?

Expected Output/Product:
Oral or group presentation supported by accurate scientific explanations and relevant evidence.
Rubric:</td><td></td></tr>
<tr><td>Demonstrating Knowledge and Skills</td><td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>All scientific ideas are accurate, complete, and well explained.</td><td>Scientific ideas are mostly accurate with minor gaps.</td><td>Some correct ideas are present, but important errors or omissions remain.</td><td>Scientific content is largely inaccurate or incomplete.</td></tr>
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	Required Content and Evidence	Includes all required elements and supports the message with relevant evidence/examples.	Includes most required elements and appropriate supporting evidence.	Includes some required elements; evidence is limited or weakly connected.	Many required elements are missing; little supporting evidence is provided.
	Communication and Organization	Message is exceptionally clear, logical, and appropriate for the audience.	Message is clear and generally well organized.	Message is partly clear but organization is uneven.	Message is unclear, disorganized, or difficult to follow.
	Presentation/Design Quality	Presentation or design strongly supports understanding and is purposeful and polished.	Presentation or design supports understanding with minor weaknesses.	Presentation or design only partly supports understanding.	Presentation or design does not support understanding.

Option 2: Community Problem-Solving Workshop

Materials/Resources Needed:
- Notebook or paper
- Pen or pencil

Directions:
Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal.

The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence.
The pedagogical strategy used is guided investigation, supported by teacher modeling,

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Activity Proper:
Divide learners into small groups (4–5 members).
Ask each group to identify one environmental or community issue related to population growth that can be observed locally.
Examples:
Waste accumulation
Flooding
Water shortage
Traffic congestion
Housing overcrowding
Deforestation

Provide each group with the problem-solving template below:
<table>
<tr><th>Community Problem</th><th>Causes</th><th>Effects</th><th>Proposed Solution</th><th>Expected Outcome</th></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table>

Instruct learners to discuss and complete the template using concepts learned during the lesson.

Encourage groups to propose solutions that are:
practical
sustainable
community-based
realistic for their locality
</td>
<td>
structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

Note to Teachers: Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.
</td>
</tr>
</table>

	Ask each group to present their proposed solutions to the class and explain why these solutions are feasible for their community. Facilitate a synthesis discussion by highlighting how scientific understanding can help communities develop sustainable responses to overpopulation-related issues. **Guide Questions:** 1. What evidence in the case or scenario is most relevant to the problem? 2. Which scientific concept best explains the situation, and why? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	C.2. Making Generalization	
	Option 1: 3-2-1 Reflection	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required response in your own words. Use accurate scientific concepts, address every part of the prompt, and support your main idea with an appropriate example or explanation.	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to organize key relationships, explain connections, and express an evidence-based generalization. It applies the Constructivist, Reflective, and Integrative approaches because learners connect new ideas with prior knowledge and communicate a coherent synthesis.

	Activity Proper: Instruct learners to complete the following prompts individually: 3 important insights they learned about overpopulation and ecosystems 2 effects of overpopulation on communities or ecosystems 1 realistic action they can personally do to help address overpopulation-related issues Ask learners to briefly explain why their chosen action is important in promoting environmental sustainability. Allow volunteers to share selected responses with the class. Facilitate a short synthesis discussion connecting learners' reflections to the lesson objectives and real-world environmental issues. **Guide Questions:** 1. What is the most important scientific idea you developed from the activity? 2. What example or evidence best supports your explanation? **Expected Output/Product:** Completed written reflection that connects the activity to the relevant scientific concepts. **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	The pedagogical strategy used is concept synthesis, supported by a structured organizer, individual reflection, peer sharing, and teacher feedback. Literacy is integrated through summarizing relationships and explaining conclusions using accurate scientific vocabulary. Numeracy is integrated through organizing quantitative evidence or interpreting values when the synthesis includes data. EdTech is integrated through a concept-mapping or shared-document tool when available, with a paper-based alternative. **Note to Teachers:** Ask learners to explain the evidence behind each connection. Address misconceptions before accepting the final generalization.

	Option 2: Group Generalization Writing	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Write the required synthesis in your own words, state the central scientific idea, connect it to evidence or an application, and respond to every prompt in complete sentences. **Activity Proper:** Divide learners into small groups (5–6 members). Provide each group with chart paper, markers, or digital collaborative tools. Ask groups to discuss and write a 2–3 sentence generalization answering the following question: Instruct learners to: use appropriate scientific terms include at least one local example mention at least one sustainable practice or solution Allow groups to post or present their outputs to the class. Conduct a short gallery reading or synthesis discussion highlighting common ideas, accurate scientific concepts, and practical solutions presented by the groups. **Guide Question:** How does overpopulation affect ecosystems and communities locally and globally, and why is sustainable resource management important?	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	Assessment Criteria: • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	
	C.3. Evaluating Learning	
	Option 1: Community Action Proposal	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal. **Activity Proper:** Divide learners into small groups (4–5 members). Ask each group to identify one community issue related to overpopulation and environmental sustainability. Examples: Flooding caused by improper waste disposal Water shortages Housing congestion Deforestation Waste accumulation Traffic congestion	The activity targets Learning Objectives 2 and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available.

	Provide the following proposal template: **Community Issue** | **Evidence Observed** | **Proposed Solution** | **Scientific Basis** | **Expected Impact** | | | | | | Instruct learners to complete the template using concepts discussed during the lesson. Require learners to include: at least one local observation or example one scientific explanation supporting the solution one sustainable practice or strategy Allow groups to present their proposals to the class. Facilitate a synthesis discussion emphasizing how scientific knowledge and community participation contribute to sustainable environmental management. **Guide Questions:** 1. What scientific idea is communicated most clearly in your output? 2. How does the evidence, example, or design feature in your output support that scientific idea? **Expected Output/Product:** Completed proposal that identifies the problem, presents a feasible response, and justifies it using scientific evidence.	**Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

Demonstrating Knowledge and Skills

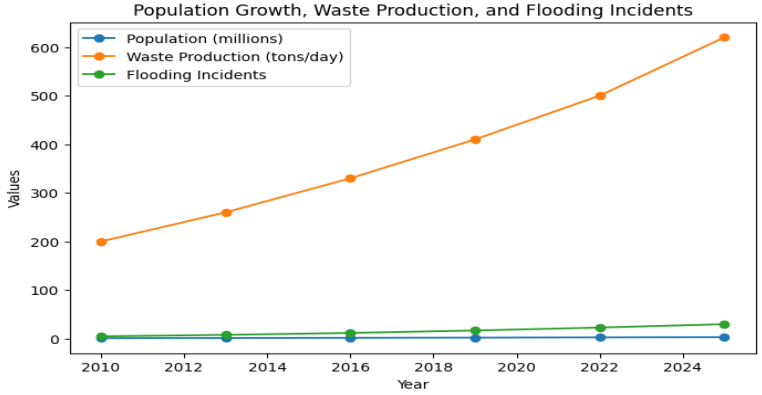
Rubric

Criteria	4 – Excellent	3 – Proficient	2 – Developing	1 – Beginning
Scientific Accuracy	Design decisions are fully consistent with accurate scientific principles.	Design is scientifically sound with minor gaps.	Design shows partial understanding with some inaccuracies.	Design is poorly supported by scientific principles.
Functionality/Feasibility	Solution is coherent, realistic, and directly addresses the task.	Solution is workable and addresses most task requirements.	Solution addresses the task only partly or has feasibility problems.	Solution is incomplete, unrealistic, or does not address the task.
Evidence and Justification	Every major design choice is clearly justified with relevant evidence.	Most design choices are justified with appropriate evidence.	Some design choices are justified; evidence is limited.	Design choices are largely unsupported.
Completeness and Clarity	All required elements are complete, labeled/organized, and easy to understand.	Most required elements are complete and clear.	Several elements are incomplete or unclear.	Many required elements are missing or unclear.

Option 2: Scientific Literacy Assessment

Materials/Resources Needed:
- Notebook or paper
- Pen or pencil

The activity targets Learning Objectives 1, 2, and 3 by requiring learners to conduct or analyze a guided investigation, record observations, and

	Directions: Read the scenario and analyze the graph/table carefully. Choose the best answer or provide a short explanation where required. **Activity Proper:** Scenario A local-government dataset shows that population, household waste, and reported flooding incidents increased over 15 years while drainage and waste facilities changed little. This correlation does not by itself prove that population growth caused flooding; rainfall, land cover, drainage condition, waste collection, and reporting practices must also be examined. The city's drainage systems and waste management facilities remained largely unchanged during the same period. A graph is provided showing the changes in population growth, waste production, and flooding incidents:  	use evidence to explain the relevant scientific process. It applies the Constructivist, Collaborative, and Inquiry-Based approaches because learners build explanations from observations, work with peers, and test ideas against evidence. The pedagogical strategy used is guided investigation, supported by teacher modeling, structured observation, and evidence-based questioning. Literacy is integrated through reading procedures, recording observations, and explaining results using accurate scientific terms. Numeracy is integrated through measuring quantities, comparing results, and interpreting tables or graphs when these are required. EdTech is integrated through digital timers, sensors, spreadsheets, simulations, or presentation tools when available. **Note to Teachers:** Confirm the materials, safety controls, and disposal procedure before the activity. Ask learners to explain the evidence behind each conclusion.

	Questions a. Population growth decreased while flooding increased b. Waste production decreased as population increased c. Population growth, waste production, and flooding incidents increased together d. Flooding incidents remained unchanged despite population growth a. Increased population has no effect on flooding b. One plausible pathway is that total waste can rise when population and/or per-capita waste rise, and uncollected waste can block drainage; the claim requires waste, drainage, rainfall, and land-use evidence c. Flooding only occurs because of heavy rainfall d. Waste management automatically improves as population increases a. The population remained stable for 15 years b. Drainage systems and waste facilities expanded rapidly c. Population and waste increased while infrastructure remained limited d. Flooding incidents completely stopped over time a. Biodiversity recovery b. Cleaner waterways c. Waste accumulation and urban flooding d. Increased agricultural land availability	

	a. Ignoring waste management issues b. Expanding recycling programs and improving drainage systems c. Increasing urban migration without planning d. Allowing waste to accumulate in waterways Explain why sustainable waste management is important in highly populated communities. **Guide Questions:** 1. What trend can be observed from the data presented? 2. Which statement BEST explains the relationship between population growth and flooding incidents? 3. What evidence from the scenario suggests that the city's carrying capacity may be under pressure? 4. If the current trend continues, which environmental problem is MOST likely to worsen? 5. Which solution would MOST likely help reduce the environmental effects described in the scenario? **Assessment Criteria:** • Scientific accuracy and relevance of ideas • Completeness or depth of response • Clarity of explanation	

	C.4. Additional Activities	
	Option 1: Create an Infographic	
	Materials/Resources Needed: • Paper, cartolina, or Manila paper • Pen or pencil • Markers or colored pencils (if available) • Computer, tablet, or other available digital device (optional) **Directions:** Study the information and data provided. Identify relevant patterns or trends, support each interpretation with specific evidence, and use these findings to create the infographic and answer the guide questions. **Activity Proper:** Ask learners to create a one-page infographic about overpopulation and its effects on ecosystems and communities. Allow learners to choose a target audience such as: students families barangay residents youth organizations Instruct learners to include the following in their infographic: causes of overpopulation effects on ecosystems and communities	The activity targets Learning Objectives 1, 2, and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

	at least one local environmental issue at least one statistic or data point sustainable solutions or practices a slogan or call to action Learners may use: paper and markers Canva PowerPoint other digital design tools Display selected outputs on the bulletin board, classroom wall, or online class platform. Facilitate a short sharing session where learners explain how their infographic promotes environmental awareness and sustainability. **Guide Questions:** 1. What pattern, trend, or relationship is shown by the data? 2. What specific evidence from the data supports your interpretation? **Expected Output/Product:** Completed infographic with accurate scientific content, clear visual organization, and a brief explanation or presentation.	

Demonstrating Knowledge and Skills

Rubric

Criteria	**4 – Excellent**	**3 – Proficient**	**2 – Developing**	**1 – Beginning**
Scientific Accuracy	All scientific ideas are accurate, complete, and well explained.	Scientific ideas are mostly accurate with minor gaps.	Some correct ideas are present, but important errors or omissions remain.	Scientific content is largely inaccurate or incomplete.
Required Content and Evidence	Includes all required elements and supports the message with relevant evidence/examples.	Includes most required elements and appropriate supporting evidence.	Includes some required elements; evidence is limited or weakly connected.	Many required elements are missing; little supporting evidence is provided.
Communication and Organization	Message is exceptionally clear, logical, and appropriate for the audience.	Message is clear and generally well organized.	Message is partly clear but organization is uneven.	Message is unclear, disorganized, or difficult to follow.
Presentation/ Design Quality	Presentation or design strongly supports understanding and is purposeful and polished.	Presentation or design supports understanding with minor weaknesses.	Presentation or design only partly supports understanding.	Presentation or design does not support understanding.

	Option 2: Community Awareness Campaign	
	Materials/Resources Needed: • Notebook or paper • Pen or pencil **Directions:** Identify the assigned local problem and develop an evidence-based output that states the goal, recommended actions, needed resources or roles, and a way to evaluate the result. Present and justify the proposal. **Activity Proper:** Divide learners into small groups (4–5 members). Ask each group to design a simple awareness campaign focusing on one environmental issue related to overpopulation. Possible Topics: waste segregation water conservation sustainable consumption urban gardening flood prevention responsible resource use Allow learners to choose the format of their campaign material such as: poster or infographic digital publication material (pubmat) short video script social media awareness post	The activity targets Learning Objectives 2 and 3 by requiring learners to interpret information from graphs, tables, cases, or secondary sources and connect the evidence to the scientific concepts in the objectives. It applies the Constructivist, Inquiry-Based, and Reflective approaches because learners analyze evidence, compare interpretations, and revise conclusions when warranted. The pedagogical strategy used is evidence-based analysis, supported by guided source evaluation, data interpretation, and teacher questioning. Literacy is integrated through reading technical information, identifying claims and evidence, and writing justified conclusions. Numeracy is integrated through reading scales, comparing quantities, and interpreting trends or proportions shown in the evidence. EdTech is integrated through digital graphs, curated online sources, or presentation tools when available, with an equivalent offline source set. **Note to Teachers:** Provide traceable and accessible sources. Ask learners to distinguish observation, inference, correlation, and causation.

<table>
<tr><td></td><td>slogan campaign
mini advocacy plan
Instruct learners to ensure that their campaign:
uses accurate scientific information
addresses a realistic community issue
promotes sustainable practices
encourages community participation
Ask each group to present their campaign material to the class.
After the presentation, ask learners to answer the following reflection question:
Facilitate a short synthesis discussion emphasizing the role of science communication, environmental responsibility, and community action in promoting sustainability.

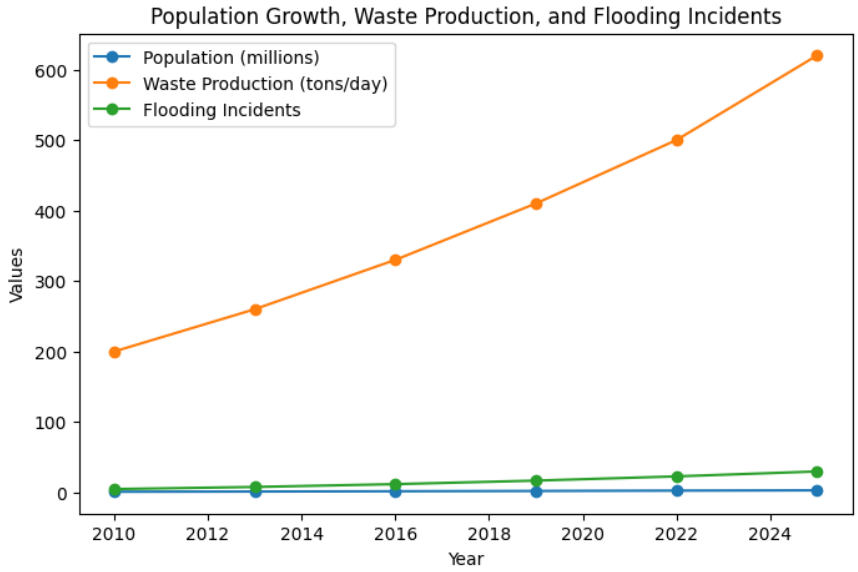
Guide Question:
"How can awareness campaigns help communities address environmental problems related to overpopulation?"

Expected Output/Product:
Completed advocacy or awareness output that communicates accurate scientific information and an appropriate call to action.</td><td></td></tr>
<tr><td>Demonstrating Knowledge and Skills</td><td colspan="2">Rubric
<table>
<tr><th>Criteria</th><th>4 – Excellent</th><th>3 – Proficient</th><th>2 – Developing</th><th>1 – Beginning</th></tr>
<tr><td>Scientific Accuracy</td><td>All scientific ideas are accurate,</td><td>Scientific ideas are mostly accurate with minor gaps.</td><td>Some correct ideas are present, but</td><td>Scientific content is largely inaccurate or incomplete.</td></tr>
</table></td></tr>
</table>

		complete, and well explained.		important errors or omissions remain.	
	Required Content and Evidence	Includes all required elements and supports the message with relevant evidence/examples.	Includes most required elements and appropriate supporting evidence.	Includes some required elements; evidence is limited or weakly connected.	Many required elements are missing; little supporting evidence is provided.
	Communication and Organization	Message is exceptionally clear, logical, and appropriate for the audience.	Message is clear and generally well organized.	Message is partly clear but organization is uneven.	Message is unclear, disorganized, or difficult to follow.
	Presentation/ Design Quality	Presentation or design strongly supports understanding and is purposeful and polished.	Presentation or design supports understanding with minor weaknesses.	Presentation or design only partly supports understanding.	Presentation or design does not support understanding.
V. ASSESSMENT *(Assessing Learnings)*	**Directions: Read each situation carefully. Analyze the graphs, tables, or scenarios provided and answer the questions that follow. Choose the best answer or provide a short explanation when required.**				

Situation 1: Population Growth, Waste Production, and Flooding Incidents

Study the graph showing the relationship among population growth, waste production, and flooding incidents from 2010 to 2025.



Questions

1. Between 2010 and 2025, which variables show upward trends? Do not compare raw increases across variables with different units unless the graph uses a common normalized scale.
   a. Population only
   b. Flooding incidents only
   c. Waste production only
   d. Population, reported flooding incidents, and waste production

	2. What association does the graph show between waste production and reported flooding incidents? Why does this association not establish causation? Identify possible confounding variables and the additional evidence needed to test a causal claim. a. Flooding decreases as waste production increases b. Waste production and flooding incidents both increase over time c. Waste production has no connection to flooding d. Flooding incidents remain stable despite population changes 3. Which additional evidence is needed to evaluate whether reported flooding increased because of waste blockage or other factors? a. Rainfall, drainage condition, land cover, waste generation and collection, infrastructure changes, and reporting practices b. Temperature only c. Population count alone d. No additional evidence 4. Which conclusion is best supported by the graph alone? a. The three reported variables increased over time, but the graph alone does not identify a cause. b. Population growth always improves environmental quality. c. Flooding incidents decrease in highly populated communities. d. Waste management becomes easier as population increases. 5. Which next step would make a future-risk assessment more scientifically defensible? a. Extrapolate all lines without checking assumptions. b. Combine population projections with per-capita waste, collection, drainage, land-cover, rainfall, and infrastructure data. c. Assume past correlation proves future causation. d. Ignore uncertainty.

	6. Suggest one sustainable practice that communities can implement to reduce flooding and waste-related problems in densely populated areas. Explain your answer briefly. **Situation 2: Agricultural Land and Population Growth** A province experiences rapid population growth while agricultural land continues to decrease due to housing developments and commercial expansion. **Questions:** 7. What is the MOST likely long-term effect of this situation? a. Increased biodiversity b. Greater pressure on local food supply and land-use trade-offs, depending on yields, imports, food loss, distribution, and access c. Reduced demand for food production d. Improved ecosystem balance 8. Which concept BEST explains why problems occur when population grows faster than available resources? a. Carrying capacity b. Biodiversity c. Photosynthesis d. Ecological succession 9. Which action would BEST help communities address food scarcity caused by population growth? a. Protecting productive land, supporting locally suitable sustainable farming, reducing food loss, improving equitable access, and using evidence-based land-use planning b. Increasing deforestation for settlements c. Ignoring agricultural land conversion d. Removing waste management systems

	Situation 3: Carbon Emissions and Urbanization Some datasets show that urban population, industrial activity, energy use, and CO_2 emissions can rise together. Per-capita emissions vary greatly, so population alone should not be treated as the cause; energy sources, income, consumption, technology, and policy also matter. 10. What conclusion can BEST be drawn from this information? a. Population growth has no connection to environmental changes b. Urbanization can be associated with environmental stress or with lower per-capita impacts, depending on energy, transport, housing, industry, infrastructure, and policy c. Carbon emissions decrease as cities expand d. Ecosystems are unaffected by industrial activities 11. Why is sustainable urban planning important in highly populated areas? a. To increase pollution levels b. To reduce access to public services c. To manage resources and environmental impacts effectively d. To encourage uncontrolled settlement expansion **Part C. Evidence-Based Reasoning and Solutions** 12. A community experiences frequent flooding due to clogged waterways, improper waste disposal, and increasing population density. Which solution would MOST likely provide a sustainable long-term response to the problem? a. Expanding waste segregation and improving drainage systems b. Ignoring illegal dumping practices c. Allowing settlements near waterways to continue expanding d. Increasing waste production without proper disposal systems 13. Why is it important for communities to balance population needs with ecosystem sustainability?

14. A barangay plans to launch an environmental program to address overpopulation-related issues. Which proposal would MOST likely promote long-term sustainability?
    a. Encouraging improper waste disposal
    b. Implementing recycling programs, urban gardening, and water conservation campaigns
    c. Expanding settlements into protected forest areas
    d. Ignoring environmental management practices

15. Based on the lesson, what is the MOST important role of scientific literacy in addressing overpopulation-related environmental issues?
    a. Memorizing scientific terms only
    b. Making evidence-based decisions and proposing sustainable solutions
    c. Avoiding community participation
    d. Ignoring environmental data and trends

Assessment specification: Revise items 2, 12, and 14 to remove unsupported causation and ambiguity. Include the answer key, explanations, rubric, and total-score formula, and do not compare unlike units on one y-axis.

Rubric

Criteria	5 points	3 points	1 point	Total
Scientific accuracy	Accurate and complete; contains no scientific misconceptions.	Mostly accurate; minor errors do not affect the main explanation.	Major errors, unsupported claims, or misconceptions.	____
Evidence and application	Uses relevant evidence and applies concepts appropriately.	Uses some relevant evidence; application is partly developed.	Uses little evidence or gives unsupported applications.	____

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<tr><td>Clarity and completeness</td><td>Clear, organized, and complete.</td><td>Generally clear but partly incomplete.</td><td>Unclear, disorganized, or substantially incomplete.</td><td>____</td></tr>
<tr><td>Total Score</td><td></td><td></td><td></td><td>____ / 15</td></tr>
</table>
</td></tr>
<tr><td>VI. REFLECTION
(Feedback and Continuous Improvement)</td><td>Use the following reflection prompts to guide your evaluation of the lesson after implementation. Reflect on learners' performance, determine which activities and lesson parts were most and least effective, identify learners who need enrichment or remediation, analyze the assessment results, and note possible improvements to enhance future lesson delivery.
1. How many learners successfully demonstrated the learning objectives based on the assessment results?
2. Which activity helped learners understand the lesson the most? Which activity helped the least?
3. Which part of the lesson was easiest for learners? Which part was most difficult?
4. How many learners needed enrichment or additional challenge? How many learners needed remediation or additional support?
5. What did the assessment results show about learners' understanding of the lesson?
6. What improvement would you make if you taught this lesson again?</td></tr>
<tr><td>VII. USE OF GENERATIVE AI</td><td>In preparing this Learning Exemplar (LE), the author(s) used ChatGPT to make the instructions clear and ensure a smooth flow of the lesson. The author(s) reviewed and finalized the writing of the content. The author(s) take(s) full responsibility for the content of this LE.</td></tr>
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