

ACADEMIC ELECTIVE



Learning Activity Sheets for Earth and Space 1

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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/sshsfeedbackform>.

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LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	1	Date	
Lesson Title/Topic:	The Historical Development of the Theories on the Origin of the Universe		
Name		Grade & Section	

I. Activity No. 1: The Historical Development of the Theories on the Origin of the Universe

II. Objective(s): Construct a simple, chronological timeline of the historical development of theories explaining the origin of the universe.

III. Materials Needed:

- Coupon bond
- Pen or pencil
- Coloring materials (optional)
- Reference materials as such textbooks, journals, or internet sources

IV. Directions:

1. Using the reference materials available, research on the different ideas, explanations, or theories that explain the origin of the universe.
2. Classify each theory according to its type: **religious, philosophical, or scientific.**
3. For each theory, identify the following information:
 - Name of the theory
 - Main Idea or explanation of the theory
 - Proponent, philosopher, or scientist
 - Date or period when it was established
4. Arrange the theories in chronological order, from the oldest to the most recent, or from the most recent to the oldest.
5. Construct a simple timeline that shows the historical development of these theories. Your timeline may be presented in either horizontal or vertical format.
6. Make sure your timeline is clear, organized, neat, and easy to read.
7. You may add simple illustrations, symbols, or colors to make your work more creative and visually appealing.
8. Use the rubric provided below as your guide in completing the activity.

Criteria	Excellent (4 points)	Good (3 points)	Fair (2 points)	Needs Improvement (1 point)
Accuracy of Information	All theories, proponents, dates, and explanations are correct and clearly presented.	Most information is correct with only minor inaccuracies.	Some information is incorrect or unclear.	Many inaccuracies; information is mostly incorrect or missing.

Chronological Organization	The timeline is logically arranged in correct chronological order and is easy to follow.	The timeline is mostly in the correct order with minor placement errors.	Several events are incorrectly ordered, but the timeline is still understandable.	The timeline lacks chronological order or is confusing to follow.
Classification of Theories	All theories are correctly classified as religious, philosophical, or scientific.	Most theories are correctly classified with minor mistakes.	Some theories are incorrectly classified.	Classification is mostly incorrect or missing.
Completeness of Required Elements (theory, main idea, proponent, date)	All required elements are present and clearly explained.	One element is missing or not clearly explained.	Two elements are missing or incomplete.	Most elements are missing.
Creativity, Neatness, and Presentation	The timeline is very neat, organized, readable, and visually appealing with creative elements.	The timeline is neat and readable, with some creative elements	The timeline is somewhat neat but lacks creativity or organization.	The timeline is messy, difficult to read, or poorly presented.

V. Synthesis

1. How do religious, philosophical, and scientific explanations differ from one another?

2. Why is it important to study the historical development of these theories?

3. Which theory do you find most interesting, and why?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	2	Date	
Lesson Title/Topic:	The Characteristics of Celestial Objects Present in the Solar System		
Name		Grade & Section	

- I. Activity No. 1:** The Characteristics of Celestial Objects Present in the Solar System
- II. Objective:** At the end of this activity, you should be able to classify different celestial objects present in the solar system that include their key characteristics and examples using a table or chart.
- III. Materials Needed:**
- Reference materials (textbooks, internet, or handouts)
 - Pen or pencil
 - Coloring materials (optional)
 - Blank classification table (provided below or drawn on paper)
- IV. Directions:**
1. Using your reference materials, research information about the following celestial objects: Asteroid, Moon, Meteoroid, and Comet.
 2. For each object, identify its:
 - Composition
 - Location
 - Orbit
 - Activity
 - Examples
 3. Fill in the classification table below with the correct information. Use colors or symbols if it helps you organize the data better.

Celestial Object	Compositio n	Location	Orbit	Activity	Example

Synthesis

1. Compare the characteristics of all the celestial objects you classified.

2. Answer the following:

- Which objects orbit a planet rather than the Sun?

- Which objects are primarily icy, and which are primarily rocky or metallic?

- How do the activity and composition of comets differ from asteroids and meteoroids?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	3	Date	
Lesson Title/Topic:	Earth's Position Within the Solar System		
Name		Grade & Section	

I. Activity No. 1: Planet Habitability Investigation

Instructions

1. Students will examine how the positions of selected exoplanets relative to their star (similar to the Sun) affect their environmental conditions and ability to support life.
2. Using information provided by the teacher, learners will compare four hypothetical exoplanets (labeled A, B, C, and D) in terms of:
 - Relative position from their star
 - Amount of stellar energy received
 - Temperature conditions
 - Presence or absence of conditions necessary for life
3. After completing the table, learners will answer the guide questions using evidence from their comparison.

Exoplanet	Relative Position from Star	Likely Temperature Condition	Key Effect of Position on the Planet	Does the Planet have Conditions Favorable for Life?
A				
B				
C				
D				

Guide Questions

- 1. How does a planet's position relative to its star affect the amount of stellar energy it receives?**
- 2. Why do planets closer to the star tend to have different conditions from planets farther away?**
- 3. Among the exoplanets compared, which one has the most favorable position for supporting life? Why?**

Rubric:

Criteria	4	3	2	1
Table Accuracy	Complete and correct	Minor errors	Some correct	Mostly incorrect
Understanding of Position & Temperature	Clear and correct explanation	Mostly correct	Partial understanding	Incorrect
Habitability Analysis	Well-justified answer	Some explanation	Weak reasoning	No justification
Use of Evidence	Uses clear evidence	Some evidence	Limited evidence	No evidence

Scoring

- 13–16** Outstanding
- 9–12** Satisfactory
- 5–8** Needs Improvement

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	4	Date	
Lesson Title/Topic:	Earth's Position Within the Solar System		
Name		Grade & Section	

I. Activity No. 1: Philippines Tectonic Setting Investigation

II. Objective(s)

At the end of this activity, you should be able to:

1. Characterize the tectonic environment of the Philippines.
2. Illustrate the interactions of tectonic plates surrounding the Philippines using maps and diagrams.
3. Explain how the tectonic setting of the Philippines leads to earthquakes and volcanic activity.

III. Materials Needed:

- Pen or pencil
- Printed tectonic maps provided by the teacher
- Activity sheet or notebook

IV. Procedure

1. Study the tectonic map showing the plates surrounding the Philippines.
2. Observe the locations of trenches, earthquake epicenters, and active volcanoes.
3. Compare the maps and identify patterns.
4. Complete the table below based on your observations.
5. Answer the guide questions after completing the table.

Tectonic Feature	Interacting Plates	Types of Boundary	Associated Geologic Event	Example in the Philippines
Philippine Trench				

Manila Trench				
East Luzon Trough				

V. Synthesis

1. Where are most earthquake epicenters and active volcanoes located on the map?

2. How are these locations related to trenches or plate boundaries?

3. How does the process of subduction lead to the formation of volcanoes?

4. How does the movement of tectonic plates cause earthquakes?

Rubric for Assessment (Total: 12 points)

Criteria	3 pts	2 pts	1 pt
Completion of Table	All parts of the table are correctly filled based on the maps.	Some parts of the table is correct, but incomplete.	The table is mostly incomplete or incorrect.
Identification of Plate Interaction	Correctly identifies interacting plates and the type of boundary.	Shows partial understanding of plate interaction.	Shows little or incorrect understanding.
Explanation of Earthquakes and Volcanoes	Clearly explains how plate movement causes earthquakes and volcanoes.	Explanation is partly correct but lacks detail.	Explanation is incorrect or unclear.
Answers to Synthesis Questions	All answers are clear, complete, and based on the activity.	Answers are partly correct but incomplete.	Answers are mostly incorrect or missing.

Total Score: _____ / 12

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	5	Date	
Lesson Title/Topic:	Earth's Origin: Nebular Hypothesis and Planetesimal Formation		
Name		Grade & Section	

EVIDENCE TABLE

Directions: The learners will fill out the Evidence Table, which serves as their “Miner’s Ledger,” as they use secondary sources to identify key ideas about the Earth's origin.

Miner’s Ledger

<i>Theory About Earth’s Origin</i>	<i>Key Terms / Concepts The “What”</i>	<i>Summary of Process / The “How”</i>
Nebular Hypothesis		
Planetesimal Formation		

The Miner’s Final Check

Directions: This is a tool for learners to review their work before submitting their Ledger. The learners will assess themselves according to the indicators by writing a check mark (✓) on the appropriate spaces.

Nebular Hypothesis: Check that your Ledger explains how the solar nebula collapsed and formed the protoplanetary disk.

- [] Did I identify the starting cloud of gas and dust?
- [] Did I mention the role of gravity in the collapse?
- [] Did I describe how the cloud flattened into a protoplanetary disk, with the Sun forming at the center?

Planetesimal Formation: Check that your Ledger explains how material in the disk built the planets and other bodies of the Solar System.

- [] Did I explain how small dust grains became solid planetesimals through accretion?
- [] Did I distinguish between electrostatic forces (early stage) and gravity (later stage) in the growth of planetesimals?
- [] Did I explain how planetesimals eventually became the planets and other bodies of our Solar System?

The Miner’s Validation Rubric

This is a tool for rating learners' Evidence Tables. Let learners use this scoring rubric as their guide.

Criteria	Exceeding (3)	Meeting (2)	Approaching (1)
Key Terms	Identifies 5+ major terms from both theories (e.g., angular momentum for the nebular hypothesis; electrostatic forces for planetesimal formation).	Identifies 3–4 major terms from either or both theories.	Identifies 1–2 terms; mostly common words with no clear connection to either theory.
The “How”	Clearly explains the mechanism behind each theory (e.g., gravity pulling the nebula inward; electrostatic forces causing dust grains to stick).	Describes the event but misses the force or mechanism behind it.	Provides a vague summary of what happened only, without explaining how.
Source Integration	Uses evidence from multiple sources to compare ideas across both theories.	Accurately summarizes one source at a time.	Information is disorganized or not tied to a specific source or theory.

Guide Questions

Directions: After completing the Evidence Table (regardless of “Case File” format), answer the following questions.

Nebular Hypothesis

1. The Trigger (The Beginning)

- According to your source, what was the “starting material” of our solar system? _____
- What physical force caused it to change its shape? _____

2. The Flattening (The Shape)

- As the nebula collapsed and spun faster, what specific shape did it take? _____
- How does your source describe this transition? _____

3. The Outcome (The Solar System)

- Based on your source, how did the collapse and flattening of the nebula set the stage for the Solar System we have today? _____
- What was the result of this process? _____

Planetesimal Formation

1. The Clumping (The Building)

- According to your source, how did tiny, individual particles eventually become solid planetesimals? _____

- What was the “How” behind their growth? _____

2. The Growth (The Forces)

- What caused planetesimals to grow large enough to become planets eventually? _____

- What forces were involved at different stages of their growth? _____

3. The Completion (The Solar System)

- How did the growth of planetesimals through accretion ultimately lead to the formation of the planets in our Solar System, including Earth? _____

THE SCRAMBLED SEQUENCE

Cut along the dashed lines.

A large, diffuse, and slowly rotating interstellar cloud of gas and dust begins to condense. Gravity pulls the material inward, triggering the collapse of the cloud and setting the entire process of Solar System formation in motion.

As gravity pulls the cloud inward, it contracts and spins faster due to the conservation of angular momentum. This increasing rotation causes the cloud to flatten into a rotating structure known as a protoplanetary disk.

As the center of the disk grows denser and hotter, a protosun begins to form. The remaining material orbits in the protoplanetary disk, where it is hotter near the center and cooler toward the outer edges.

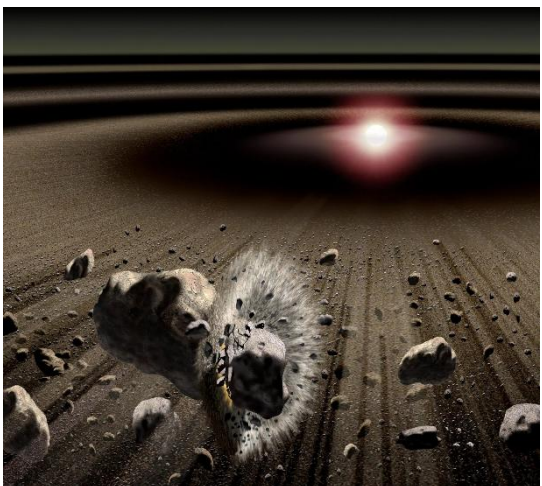
Within the protoplanetary disk, dust grains collide and stick together through electrostatic forces, gradually growing into kilometer-sized rocky bodies known as planetesimals.

Planetesimals collide and merge through accretion, eventually forming larger bodies known as protoplanets. Repeated collisions and merging build up increasingly massive bodies, including the early Earth.

Solar wind from the now-active Sun blows away remaining gas and dust. The planets, having formed through accretion, settle into stable orbits around the Sun, completing the formation of our Solar System.

FROM CLOUD TO BLUE MARBLE

Part 1: The Image Set. Cut along the dashed lines.



Part 2: Description Cards (Descriptions). Cut these out and place them on the correct image.

A massive, swirling cloud of gas and dust slowly pulled together by gravity	A large, cooling, and spherical body formed from the gradual accumulation of colliding planetesimals.
The spinning cloud flattens into a glowing disk as material begins to spread	
A bright, dense core forms at the center of the disk, giving rise to the early Sun surrounded by rotating material	
Irregular, rocky clumps and boulders colliding and sticking together in space.	
The planets settle into stable, orderly orbits around the fully formed Sun.	

Part 3: Keyword Cards (Physical Drivers). Cut these out and place them on the Connector Arrows between the images.

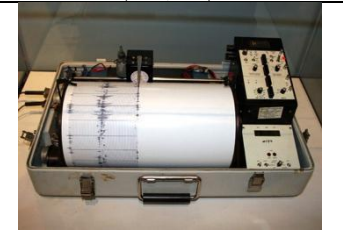
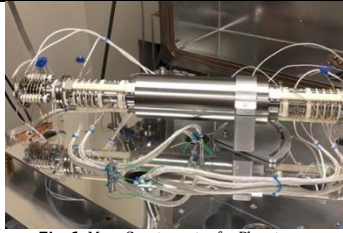
GRAVITY	ACCRETION
ACCRETION	GRAVITY
CONSERVATION OF ANGULAR MOMENTUM	ELECTROSTATIC FORCES

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	6	Date	
Lesson Title/Topic:	The Structure and Composition of the Earth		
Name		Grade & Section	

- I. Activity #1:** *Finding tools in Decoding the Earth, Sky, and the Shock*
- II. Objective(s):**
- Identify scientific instruments associated with volcanoes, meteorites, and seismic waves.
 - Group the instruments into distinct event zones.
 - Explain how each instrument functions within its specified fields.
- III. Material Needed:**
- Activity Sheet and Pen for Writing; Personal mobile phone or digital device; Access to the Internet.
- IV. Instructions:** Identify the functions of the scientific instruments and group them into Event Zones: V (Volcano), M (Meteorite), or S (Seismic Wave). Then, explain their function in each zone.

Illustration	Event Zone <i>(Write the letter only)</i>	Function
 <p>Fig. 1. A tiltmeter on the flank of Mauna Loa to monitor ground surface deformation (USGS, 1987).</p>		
 <p>Fig. 2. A handheld metal detector being used to locate coins buried in soil (Zandane, 2005).</p>		
 <p>Fig. 3. A high-precision GPS receiver station for monitoring tectonic movements at Iceland (Sveinsson, 2023).</p>		

 <p>Fig. 4. Gas sensor used to detect lava channels during the 2018 Kilauea eruption in Hawaii (USGS, 2018).</p>		
 <p>Fig. 5. A Kinematic seismograph used for recording the vibrations and timing of seismic waves (Gringer, 2008).</p>		
 <p>Fig. 6. Mass Spectrometer for Planetary Exploration instrument (NASA/JPL-Caltech, 2017).</p>		

I. **Activity #2:** Investigating the Earth's Interior: Analyzing Evidence

II. **Objective(s):**

- Determine how mantle composition is revealed by analyzing xenoliths, magma chemistry, and mineral inclusions;
- Contrast the chemical profiles of Earth's crust with chondritic and iron meteorites to infer the composition and density of Earth's core;
- Analyze the refraction and reflection of seismic waves to identify internal boundaries (discontinuities) and the physical states of matter within Earth's layers.

III. **Materials Needed:**

- Activity Sheet and Pen for Writing; Personal mobile phone or digital device; and Access to the Internet

IV. **Procedure:**

- Each member of the group will have their own role in this activity.
 - The Lead Scientist-** Reads the evidence and guides the discussion.
 - The Data Analyst** - Finalize the answers and conclusion.
 - The Learning Advocate-** Provides thought-provoking questions.
 - The Presenter-** Shares the findings during the Gallery Walk.
- For each station, the students must analyze the evidence given and deduce it to answer the questions.

Station A: Message from the Mantle (Volcanic Evidence)

Volcanoes are nature's elevators. As magma rises to the surface, it sometimes carries passengers' chunks of the rock it passed through, minerals that only form under extreme pressure, and a chemical 'fingerprint' from deep inside the Earth.

<p>1. Xenoliths — The Hitchhikers</p> <p>Xenoliths are rock fragments ripped from the mantle walls as magma forces its way upward (Nixon, 1987). Because they did not fully melt on the journey, they preserve original mantle minerals (Halдар, 2020). The most common xenolith type is peridotite, a greenish rock rich in magnesium and iron, confirming that the upper mantle is solid and chemically distinct from the crust (Nixon, 1987; Halдар, 2020).</p>	<p>1. What layer of the Earth did the magma most likely pass through to collect this xenolith?</p>
<p>2. Magma Chemistry — The Fingerprint</p> <p>Rocks do not all melt at the same temperature; instead, they undergo partial melting, with specific minerals liquefying before others. When mantle rock partially melts, the resulting magma carries a specific chemical signature. By analyzing the ratios of silica (SiO₂), magnesium (Mg), and iron (Fe) in volcanic basalt, scientists can calculate the temperature and pressure at which that melt originally formed, effectively mapping conditions hundreds of kilometers underground (Putirka, 2008; Putirka, 2016).</p>	<p>2. Could the peridotite have formed in the crust instead of the mantle? How?</p>

Station B: Blueprints from Space (Meteorite Evidence)

Earth and meteorites are like siblings, both formed from the same cloud of dust and gas 4.6 billion years ago. This means their overall chemical properties should match. Comparing what we find on Earth's surface to what we find in meteorites reveals what must be hiding deep inside our planet.

<p>1. Chondrites — The Master Recipe</p> <p>Chondrites are ancient, unmelted stony meteorites that have remained largely unchanged since the solar system's formation (McSween, 1999). While these meteorites contain significant amounts of iron and nickel, Earth's crust consists primarily of lighter elements like oxygen and silicon, with a notable depletion of iron (Dalton, 2012). This discrepancy suggests that during Earth's early molten phase, denser metals like iron sank to the center while lighter silicates floated to the surface, a process known as planetary differentiation (McSween, 1999; Dalton, 2012).</p>
<p>2. The Density Gap — Something Heavy Must Be Inside</p> <p>We can calculate Earth's average density from its mass and volume: about 5.5 g/cm³. But surface rocks only have a density of 2.7–3.0 g/cm³ (Lutgens, Tarbuck, and Tasa 2017). To raise the average, something much denser must be at the center. Iron meteorites have a density of about 8.0 g/cm³ — a perfect match for what must be hiding inside! (McSween, 1999).</p>
<p>Group Challenge:</p> <ol style="list-style-type: none"> 1. Why are iron meteorites (density ≈8.0 g/cm³) considered a model for Earth's core? 2. The Advocate asks: "But those meteorites came from a different planet. How do we know Earth's core looks the same?"

Station C: The X-ray of the Earth

When an earthquake strikes, it releases energy in waves that travel through the entire planet. By placing seismographs around the globe and tracking how these waves behave — where they speed up, slow down, bend, or disappear — scientists have essentially “X-rayed” Earth's interior.

P-Waves (Primary) Push-pull (longitudinal) waves. They are FAST and can travel through solids, liquids, and gases. (Think of them like sound waves or pushing and pulling a slinky.)	Refraction — The “Bent Straw” Effect Just like light bends when it passes from air into water, seismic waves bend when they pass into a rock of different density. In 1909, Andrija Mohorovičić noticed waves suddenly accelerating at a certain depth — a discovery that revealed the Moho, the boundary between the thin crust and the much denser mantle.
S-Waves (Secondary) Side-to-side (transverse) waves. They are SLOWER and can ONLY travel through solids. They cannot move through liquid. (Key fact: If S-waves stop, it proves they hit a liquid layer!)	Shadow Zones — The Smoking Gun Scientists noticed 'dead zones' on the opposite side of the Earth from earthquakes, where certain waves never arrived. The S-wave shadow zone: S-waves completely disappear through the core, proving the outer core is LIQUID. The P-wave shadow zone: P-waves bend sharply through the core, but in 1936, Inge Lehmann noticed some P-waves bouncing off something solid at the very center, revealing the SOLID inner core.
Group Challenge: <ol style="list-style-type: none"> 1. S-waves from an earthquake in Japan do NOT arrive at seismographs on the opposite side of the Earth. 2. P-waves from the same earthquake DO arrive, but they arrive at unexpected angles, as if bent. 	

Station D: The Gallery Walk

Each group's Presenter will display their Station's synthesis conclusion on the board.

 Station A	 Station B	 Station C
<i>One thing I learned</i>	<i>One thing I learned</i>	<i>One thing I learned</i>

Rubrics for Assessment (Total of 20 points)

Criteria	4 — Excellent	3 — Proficient	2 — Developing	1 — Beginning
Scientific Accuracy	All evidence is correctly explained with no misconceptions.	Most evidence is correct; minor errors that don't affect meaning.	Some correct information; notable misconceptions present.	Major errors in the understanding of content.
Use of Evidence	Specific evidence from all three stations was used effectively.	Evidence from 2–3 stations used; mostly specific.	Some evidence cited is vague or from only one station.	Little or no evidence was used.
Scientific Reasoning	Clear logical chain from observation to conclusion throughout.	Logical reasoning present; minor gaps.	Reasoning attempted but not always connected.	Conclusions not supported by reasoning.
Synthesis / Big Picture	All three evidence types are woven into a cohesive, compelling argument.	Two evidence types are connected; some synthesis.	Evidence types treated separately; little synthesis.	No connection between evidence types.
Group Participation	All roles fulfilled; all members contributed actively.	Most roles fulfilled; most members participated.	Some roles unfulfilled; uneven participation.	Minimal participation; roles not followed.

I. Activity #3: Virtual Investigation: Exploring Earth's Interior

II. Objective(s):

- Determine how mantle composition is revealed by analyzing xenoliths, magma chemistry, and mineral inclusions.
- Contrast the chemical profiles of Earth's crust with chondritic and iron meteorites to infer the composition and density of Earth's core.

- c. Analyze the refraction and reflection of seismic waves to identify internal boundaries (discontinuities) and the physical states of matter within Earth's layers.

III. Materials Needed:

- Activity Sheet and Pen for Writing; Personal mobile phone or digital device; Access to the Internet

IV. Instructions

In this activity, you will act as a geoscience detective using real digital tools to gather virtual evidence about what lies deep beneath the Earth's surface.

PART 1- The Virtual Volcanic Probe

OVERVIEW: Volcanoes are more than just spectacular eruptions; they are natural elevators that carry rock and mineral samples from deep within the Earth all the way to the surface. The materials they bring up give scientists a window into layers that no drill has ever reached.

VIRTUAL TOOL: <https://volcano.si.edu>

PROCEDURE:

- Go to <https://volcano.si.edu> and find your assigned volcano (Mount St. Helens or Mauna Loa).
- Click on the volcano name to open its profile page.
- Navigate to the “Rock Types” or “Geology” section.
- Record your Observation.

OBSERVATION:

1. Rock type produced by your volcano? _____
2. Describe the appearance of the rock (color, texture, density).

3. Mineral crystals found inside the rock: _____
4. Where do these minerals originally form (mantle or crust)? _____

PART 2- The Solar System DNA

OVERVIEW: About 4.6 billion years ago, the solar system was a cloud of gas and dust containing all the raw building blocks of the planets, including iron, nickel, silicates, and other elements. Meteorites are the leftover fragments of this original material. Studying their composition is like reading the DNA of the solar system's formation.

VIRTUAL TOOL: NASA Meteorite Portal (3D Virtual Samples)

<https://curator.jsc.nasa.gov/antmet/index.cfm>

PROCEDURE:

- Using the meteorite portal, open “**Iron Meteorite and Stony Chondrite.**”
- Rotate the 3D model and examine the external structure.
- Switch to cross-section view. Observe the internal structure.
- Record your findings:

OBSERVATION:

Observation	Iron Meteorite	Stony Chondrite
Main color/appearance		
Primary minerals or metals		
Estimated density		
Internal structure notes		

PART 3- The Seismic X-Ray Simulation

OVERVIEW: Earthquakes release enormous amounts of energy in the form of seismic waves that travel through the entire Earth. Scientists use a global network of seismographs to detect these waves. Like a medical X-ray, the way these waves slow down, speed up, or stop entirely tells scientists what materials they are passing through, without ever drilling there.

VIRTUAL TOOL: IRIS Seismic Waves Viewer: <https://www.iris.edu/app/seismic-monitor/map?lat=16.4657&lng=-67.5192&zoom=2>

PROCEDURE:

- Open the simulation and click "Start Earthquake" at any point.
- Observe how P-waves and S-waves travel.
- Turn off the S-wave and observe how the P-wave travels alone, then turn the S-wave back on.
- Analyze the "Shadow Zone," the region on the opposite side of Earth where no S-wave arrives.
- Record your observations.

OBSERVATION:

1. What happens to S-waves on the far side of the Earth from the earthquake?
2. Describe the "Shadow Zone"

V. Synthesis

After completing all three virtual investigations, collaborate with your partner and share your findings on a class Padlet as directed by your teacher.

Virtual Evidence	What We Saw	What It Proves About Earth
Volcano Probe		
NASA 3D Meteorite		
Seismic Simulator		

Rubrics

Criteria	4 — Excellent	3 — Proficient	2 — Developing	1 — Beginning
Volcano Probe — Rock & Mineral ID	Correctly identifies rock type and mineral; clearly links to Mantle composition.	Identifies rock type and mineral with minor errors.	Identifies one element correctly.	Attempts, but mostly incorrect.
Meteorite Analysis — Core Formation	Fully explains density differentiation and iron/nickel Core formation.	Explains Core formation with minor gaps.	Partial explanation of Core composition.	Minimal or inaccurate response.
Seismic Simulation — Wave Behavior	Accurately explains S/P wave differences and Shadow Zone significance.	Explains Shadow Zone with minor errors.	Identifies the Shadow Zone, but with a limited explanation.	Vague or missing explanation.
Evidence Log & Summary Paragraph	Coherent, well-supported paragraph connecting all three pieces of evidence.	Paragraph addresses 2 of 3 evidence types clearly.	Paragraph addresses 1 evidence type.	Evidence Log incomplete; no paragraph.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	7	Date	
Lesson Title/Topic:	The Structure and Composition of the Earth		
Name		Grade & Section	

I. Activity #1: Earth's Layers: Composition and Physical Properties

II. Objectives:

- Identify and describe the four major layers of Earth according to their name, composition, and physical state.
- Explain the types of evidence scientists use to figure out the composition of each layer.
- Compare the properties of Earth's layers using data from scientific studies.

III. Materials:

- This Learning Activity Sheet (printed or digital copy)
- Ruler and pencil
- Access to the internet for USGS or DepEd resource links (optional)

IV. Instruction:

Overview: Scientists have never directly visited Earth's interior — the deepest borehole ever drilled (Kola Superdeep Borehole, Russia) only reached about 12 km, barely scratching the crust. Instead, geoscientists use three major types of indirect evidence:

 Volcanology	 Meteorites	 Seismic Waves
Magma and lava bring material from the mantle to the surface. Basaltic lava from oceanic volcanoes matches expected mantle chemistry.	Iron-nickel meteorites (siderites) are believed to be fragments of other planetary cores. Their composition closely matches models of Earth's core.	P-waves and S-waves change speed and direction at layer boundaries. S-waves stop at the outer core, revealing it is liquid.

Procedure:

1. Study Figure 1 and 2 below carefully before proceeding to the tasks:

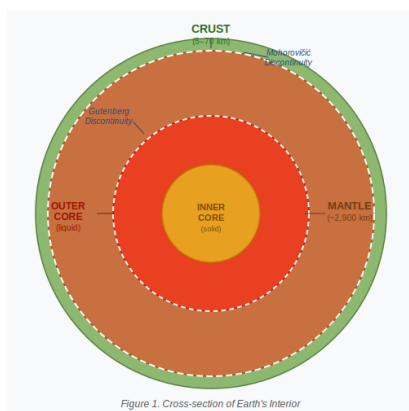


Figure 1. Cross-section of Earth's Interior (Original illustration for educational use)

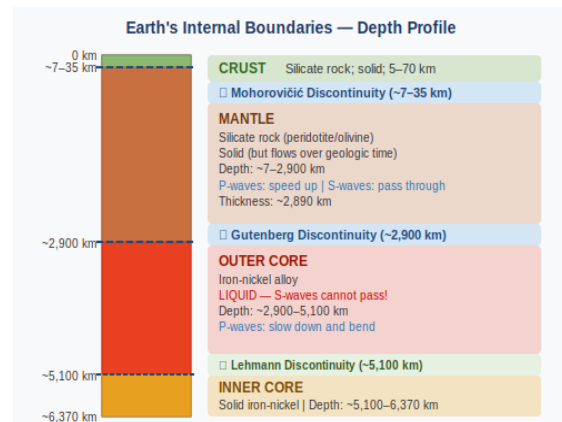
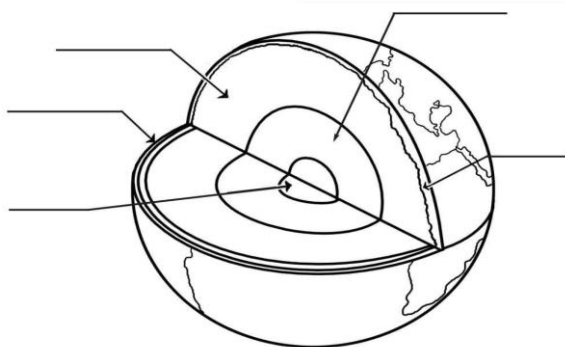


Figure 2. Earth's Internal Boundaries- Depth Profile (Original illustration for educational use)

Instruction: Using the blank cross-section diagram below, color and label each of Earth's four layers. Use the color guide provided. Write the name of each layer inside or beside it.

Layer	Suggested Color	Depth Range	Your Label Color
Crust	Green	0 to ~7–70 km	_____
Mantle	Orange/Brown	~70 to 2,900 km	_____
Outer Core	Red	~2,900 to 5,100 km	_____
Inner Core	Yellow	~5,100 to 6,370 km	_____

Instruction: Use pencils/markers to color and label directly on this diagram or on a separate printed copy.



Instruction: Fill in the missing information in the table below. Use your textbook (pp. 62–70) and Figure 4 above for reference.

Layer	Main Composition	Physical State	Thickness	Key Evidence Source
Crust	Granite (continental); Basalt (oceanic)	_____	5–70 km	Drilling; volcanic rocks
Mantle	_____	Solid (plastic over time)	~2,890 km	_____
Outer Core	Iron-Nickel alloy	_____	~2,200 km	S-wave shadow zone
Inner Core	_____	_____	~1,270 km radius	_____

Instruction: Answer the following questions in complete sentences. Write your answers on the lines provided.

Synthesis

1. In your own words, what is the most compelling piece of evidence that tells scientists what Earth's interior is made of? Explain why you think so.

2. If you were a geophysicist presenting findings to a community worried about earthquakes, how would you explain what Earth's layers mean for earthquake safety?

Rubrics

Criteria	Excellent (5)	Proficient (4-3)	Developing (2)	Beginning (1)	Score
Diagram Labeling	All 4 layers are correctly colored, named, and placed with accurate approximate depths.	3 layers correctly labeled; 1 has a minor error in name or color.	2 layers correctly labeled; noticeable placement errors.	Fewer than 2 layers are labeled correctly, or the diagram is incomplete.	___/5
Properties Table	All missing blanks are correctly and completely filled in.	4-5 of 6 blanks filled correctly.	2-3 blanks filled correctly; remaining left blank or incorrect.	Fewer than 2 correct answers; table mostly incomplete.	___/5
Evidence Matching	All 5 items matched correctly.	4 items correct.	2-3 items are correct.	0-1 correct; matching not attempted seriously.	___/5
Synthesis Reflection	Reflections show deep understanding and personal connection, thoughtful and specific.	Reflection shows understanding with some depth.	Reflection is present, but it is general or superficial.	Reflection is missing or does not address the question.	___/5
TOTAL					___/20

I. Activity #2: Seismic Analysis

II. Objectives:

- Apply knowledge of wave behavior to interpret seismogram data from a simulated real earthquake event.
- Calculate the distance between an earthquake epicenter and a seismic station using the P-S time interval formula.
- Use seismic data to infer Earth's interior structure and layering.
- Apply understanding to real-world applications such as earthquake risk assessment and building safety

III. Materials:

- This Learning Activity Sheet
- Calculator (scientific or basic)
- Pencil, ruler, and colored pencils
- Graph paper (optional, for the epicenter triangulation extension task)

IV. Instruction:

Situation: A magnitude 6.8 earthquake has just occurred somewhere in the Philippine Sea. Three seismic stations in the region: Station A (Manila), Station B (Davao), and Station C (Cebu). All record data from the event. As junior geophysicists at the Philippine Institute of Volcanology and Seismology (PHIVOLCS), your team must analyze seismic data, determine the approximate location of an earthquake, and brief a panel of engineers on what the wave patterns reveal about Earth's interior structure.

Instruction: Study the seismic data table below and Figure 3 (seismogram) before beginning:

Station	P-wave Arrival Time	S-wave Arrival Time	P-S Time Difference (Δt)	Distance from Epicenter
---------	---------------------	---------------------	------------------------------------	-------------------------

A – Manila	12:04:35	12:04:55	20 seconds	
B – Davao	12:04:55	12:05:25	30 seconds	
C – Cebu	12:04:45	12:05:10	25 seconds	

Formula to Use: Distance = $\Delta t \times (V_p \times V_s) \div (V_p - V_s)$
; where $V_p = 6.0 \text{ km/s}$ (P-wave) and $V_s = 3.5 \text{ km/s}$ (S-wave)

Calculate Distances from Each Station

Using the P-S time difference formula, calculate the distance (in km) from the earthquake epicenter to each seismic station. Show all solutions clearly.

Station	P-S Interval (Δt)	Final Distance
Station A — Manila	$\Delta t = 20 \text{ seconds}$	Distance = _____ km
Station B — Davao	$\Delta t = 30 \text{ seconds}$	Distance = _____ km
Station C — Cebu	$\Delta t = 25 \text{ seconds}$	Distance = _____ km

Instruction: Answer the following analysis questions based on the seismic data provided and your calculations:

a) Which station is FARTHEST from the earthquake epicenter? Which is NEAREST?

b) Station B (Davao) records both P-waves and S-waves clearly. Based on the theory of the S-wave shadow zone (103° – 180° from epicenter), what can you conclude about the angular position of Station B relative to the earthquake?

c) Suppose a fourth Station D, located far away, records only P-waves and absolutely no S-waves. What does this tell you about:

- The location of Station D relative to the earthquake source:
- Which internal Earth boundary does this observation confirm:
- The physical state of the layer beyond that boundary:

V. Synthesis

Instruction: Answer the following questions to connect the data analysis back to your understanding of Earth's layers and boundaries:

1. You analyzed seismic wave data from a real earthquake event. Which seismic boundary (Moho or Gutenberg) is most directly responsible for the existence of the S-wave shadow zone? Explain in your own words.

2. How does the fact that the outer core is LIQUID (and not solid) affect the way seismic waves travel through Earth? Give at least TWO specific effects.

3. PHIVOLCS uses real seismic data, like what you analyzed today, to issue earthquake warnings and building guidelines. Based on what you now know about seismic waves and Earth's interior, write one sentence that summarizes the most important reason why Filipinos should study geophysics.

Rubrics

Criteria	Excellent (5)	Proficient (4-3)	Developing (2)	Beginning (1)	Score
Calculations	All 3 distances correctly calculated; solutions clearly shown with formula, substitution, and final answer with units.	2 distances correctly calculated; minor arithmetic error in 1.	1 correct; formula attempted for others, but errors present.	No correct calculation; formula not applied or missing.	___/5
Wave Data Analysis	All analysis questions answered with accurate reasoning and correct application of the shadow zone concept.	Mostly correct; one answer lacks depth or has minor errors.	Some scientific reasoning is present but incomplete; the shadow zone is misapplied.	Answers are missing or showing a fundamental misunderstanding.	___/5
Reflection Questions	All questions answered with specific scientific detail; connection to boundaries and real-life context is clear.	Most questions are well-answered; one lacks specificity or depth.	Some correct content; connections to Earth's interior are present but loose.	Answers are missing, very brief, or scientifically incorrect.	___/5
Synthesis Reflection	Exceptional synthesis: triangulation logic explained clearly; personal community connection made; generalization accurately and creatively stated.	Good synthesis; all three prompts addressed with understanding.	Two of three synthesis prompts addressed; generalization is vague.	One or fewer prompts are addressed; responses are minimal.	___/5
TOTAL					___/20

I. **Activity #3: Seismic Wave Relay**

II. **Objectives:**

- Demonstrate how P-waves and S-waves travel differently through Earth's layers.
- Explain why S-waves stop at the outer core and what this tells us about that layer.
- Record relay observations and connect them to Earth's internal structure.
- Identify the S-wave shadow zone on a diagram and name the boundary responsible

III. **Materials:**

- P-wave card (blue) and S-wave card (red) — Page 2
- 4 Station Cards — cut and place around the room
- This LAS sheet (one per learner)
- Colored pencils: blue and red

IV. **Instruction:**

1. Each member of the group will have a specific group:



2. The Teacher must provide these cards to each group:

EARTHQUAKE SOURCE CARD	P-WAVE CARD	S-WAVE CARD
Event: M 7.2 — Philippine Sea Depth: 35 km below seafloor <i>"A magnitude 7.2 earthquake has struck. Seismic waves are traveling outward through Earth. Messengers — begin!"</i>	- Travels through solids AND liquids Push-pull motion (parallel) Arrives FIRST — faster wave PASS TO ALL 4 STATIONS ✓	Travels through SOLIDS ONLY Side-to-side motion (perpendicular) Arrives SECOND — slower wave ⚠ STOP at STATION 3 ✗

PROCEDURE
GET READY — Read your role card. Member 1 holds the Source Card. Member 2 holds the blue P-wave card. Member 3 holds the red S-wave card. All group members stand at the center of the room.
START — Member 1 reads the Earthquake Source Card aloud, then says: "Waves released — messengers begin!" Both messengers start moving at the same time.
P-WAVE MESSENGER (Member 2) — Visit all 4 stations in order. At each station, read the station card aloud. The P-wave card passes through every station.
S-WAVE MESSENGER (Member 3) — Visit Station 1 (Crust), then Station 2 (Mantle). At Station 3 (Outer Core), STOP. Say clearly: "S-wave blocked — the Outer Core is LIQUID!" Place the red card face-down. Do NOT go to Station 4.
RECORDER (Member 4) — Follow both messengers and fill in the Observation Chart (Part C) as the relay happens.
DETECTIVE (Member 5) — Watch where the S-wave stops. Then complete the Shadow Zone Diagram (Part D).
DEBRIEF — As a group, answer the 3 Discussion Questions at the bottom of Part C before the class share-out.

Observation Chart:

Station / Layer	P-wave?	S-wave?	What happened at this station?	What does this reveal about this layer?
Station 1 — CRUST	YES / NO	YES / NO		
Station 2 — MANTLE	YES / NO	YES / NO		
Station 3 — OUTER CORE	YES / NO	YES / NO (blocked)		
Station 4 — INNER CORE	YES / NO	YES / NO (blocked)		

Group Discussion Questions *(Discuss as a group before the class share-out)*

1. Which wave passed all four stations? Why was it able to do so?
2. At which station did the S-wave stop? What is the name of the boundary at that depth?
3. What does the stopping of S-waves at Station 3 tell us about the physical state of the outer core?

V. SYNTHESIS

Complete the generalization statement in your own words:

"In the Seismic Wave Relay, the P-wave messenger passed through _____ stations while the S-wave messenger was blocked at Station _____ (_____). This shows that Earth's outer core is _____ because _____. The boundary where this happens is called the _____ Discontinuity, found at _____ km depth. This discovery is important because _____."

VI. Rubrics

Criteria	Excellent (4)	Proficient (3)	Developing (2)	Beginning (1)	Score
Role Performance (x2)	Relay completed correctly; all roles performed; S-wave stopped at Station 3.	Minor error in one role; relay essentially correct.	Relay had errors; roles were unclear for 2 members.	Relay not completed or largely incorrect.	___/8
Observation Chart (x2)	All 4 stations are correct with accurate observations and clear reasoning.	3 stations correct; reasoning mostly clear.	2 stations correct; observations vague.	Mostly blank or inaccurate.	___/8
Synthesis	Generalization is complete, accurate, and in its own words.	Mostly complete; 1–2 blanks vague.	Partially filled; lacks scientific depth.	Not completed.	___/4
TOTAL					___/20

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	8	Date	
Lesson Title/Topic:	Earth's Layers: Structure, Composition, and Tectonic Significance		
Name		Grade & Section	

I. Activity No. 1: Classify and Complete

II. Objective(s): At the end of this activity, you should be able to classify the physical property zones of the Earth and describe their characteristics.

III. Materials Needed:

- Notebook
- Textbook/ Online resources
- Paper and pen

IV. Instructions:

Directions: Fill in the table below using your class notes, textbook, and/or online resources.

Physical Zone	State of Matter	Temperature (°C)	Pressure Level	Thickness	Mechanical Behavior
Lithosphere					
Asthenosphere					
Lower Mantle					
Outer Core					
Inner Core					

V. Synthesis: Answer each question in 2–3 complete sentences.

1. How are the Lithosphere and Asthenosphere different in terms of physical properties? Why does this difference matter?

_____.

2. Why does the Outer Core remain liquid while the Inner Core is solid, even though both are made of similar iron-nickel materials?

_____.

3. Which physical property zone has the highest pressure? How does extreme pressure affect its state of matter?

_____.

Rubric for Assessment:

Criteria	5 Excellent	4 Very Good	3 Good	2 Fair	1 Poor
Correctness of Answer	Answer is scientifically accurate and complete.	Answer is mostly correct with minor gaps.	Answer is partially correct.	Answer shows little understanding.	Answer is incorrect or missing.
Use of Evidence / Explanation	Uses specific facts or concepts to support the answer.	Uses some facts; explanation mostly clear.	Some attempt to explain but vague.	Little to no explanation given.	No evidence or reasoning provided.
Sentence Construction	Written in 2–3 complete, grammatically correct sentences.	Complete sentences with minor grammar errors.	1 complete sentence; others are fragments.	Mostly incomplete sentences.	Written in words or phrases only.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	8	Date	
Lesson Title/Topic:	Earth's Layers: Structure, Composition, and Tectonic Significance		
Name		Grade & Section	

I. Activity No. 2: Two-Column Diagram

II. Objective(s): At the end of this activity, you should be able to draw and compare the compositional layers and physical property zones of the Earth.

III. Materials Needed:

- Class notes or textbook
- Printed copy of this LAS or paper and pen

IV. Instructions:

In the boxes below, draw a simple cross-sectional diagram of the Earth twice. On the **LEFT**, label the four compositional layers. On the **RIGHT**, label the five physical property zones and annotate each zone with its state of matter, temperature range, and pressure level.

LEFT: Compositional Layers	RIGHT: Physical Property Zones

V. Synthesis: After drawing, write a short paragraph below comparing the two classification systems. Are they the same or different? Use specific examples.

Rubric for Assessment:

Criteria	5 – Excellent	4 – Very Good	3 – Good	2 – Fair	1 – Poor
Accuracy of Labels	All layers/zones correctly labeled.	1–2 minor errors.	About half correct.	Few correct.	Mostly wrong or blank.
Completeness of Annotations	All 5 zones have state of matter, temperature, and pressure.	4 zones complete.	3 zones or some details missing.	1–2 zones only.	No annotations.
Diagram Clarity	Both diagrams clearly show distinct cross-sections.	Mostly clear; minor issues.	Recognizable but lacks clarity.	Hard to interpret.	No recognizable diagram.
Synthesis Paragraph	Clearly compares both systems with specific examples and science terms.	Mostly clear with minor gaps.	Vague comparison; few examples.	Little understanding shown.	Off-topic or not attempted.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	8	Date	
Lesson Title/Topic:	Earth's Layers: Structure, Composition, and Tectonic Significance		
Name		Grade & Section	

I. Activity No. 3: Reading the Earth Beneath Southeast Asia

II. Objective(s): At the end of this activity, you should be able to describe the Earth's layers in relation to tectonic and seismic activity in Southeast Asia.

III. Materials Needed:

- Class notes or textbook
- Printed copy of this LAS or paper and pen

IV. Instructions:

Observe the tomographic cross-section below. Describe what you see, then answer the guide questions.

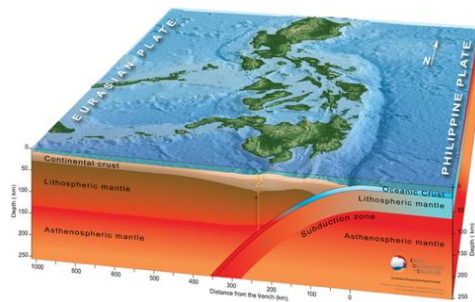


Image 1. Philippine-Eurasian plate subduction cross-section

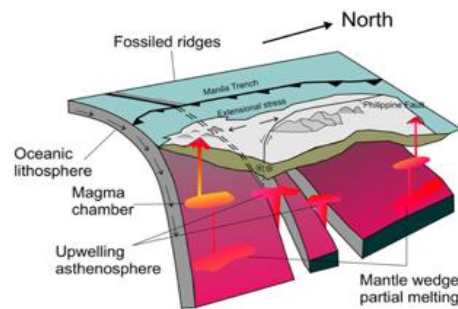


Image 2. Manila Trench subduction and volcanic arc formation

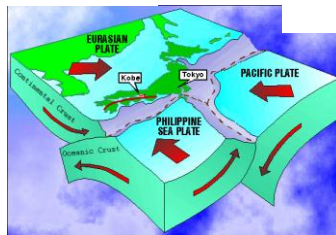


Image 3. Eurasian, Pacific, Philippine Sea Plate interactions near Japan

Sources:

- <https://www.coolgeography.co.uk/GCSE/Year11/Managing%20Hazards/Earthquakes/kobeplates2.gif>
- <https://earthobservatory.sg/earth-science-education/multimedia/graphics/subduction-zone-beneath-the-philippines>
- Nguyen et al., "Slab Tearing and Lithospheric Structures in Luzon Island, Philippines: Constraints From P- and S-Wave Local Earthquake Tomography."

V. Synthesis: Answer each question in 2–3 complete sentences.

1. Based on image 1, what causes earthquakes in the Philippines and the rest of Southeast Asia?

2. Based on images 1-3, which layers of the Earth and tectonic features can you identify? Describe what you see.

3. What happens when the dense rock of the Philippine Sea Plate collides with the Eurasian Plate? Using the image and your understanding of Earth's layers, explain what occurs at the boundary and where the subducting rock eventually goes.

4. Which layer of the Earth do you think is most responsible for the frequent earthquakes and volcanic eruptions in the Philippines? Explain how this layer influences plate movement in Southeast Asia.

Rubric for Assessment:

Criteria	5 Excellent	4 Very Good	3 Good	2 Fair	1 Poor
Correctness of Answer	Answer is scientifically accurate and complete.	Answer is mostly correct with minor gaps.	Answer is partially correct.	Answer shows little understanding.	Answer is incorrect or missing.
Use of Evidence / Explanation	Uses specific facts or concepts to support the answer.	Uses some facts; explanation mostly clear.	Some attempt to explain but vague.	Little to no explanation given.	No evidence or reasoning provided.
Sentence Construction	Written in 2–3 complete, grammatically correct sentences.	Complete sentences with minor grammar errors.	1 complete sentence; others are fragments.	Mostly incomplete sentences.	Written in words or phrases only.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	9	Date	
Lesson Title/Topic:	Identifying Minerals Through Their Physical Properties		
Name		Grade & Section	

I. Activity No. 1: Match the Technique to the Scenario

II. Objective(s): At the end of this activity, you should be able to select and justify the most appropriate mineral identification technique for a given field scenario.

III. Materials Needed:

- Completed Technique Profile Cards from Activity No. 1
- Printed copy of this LAS or paper and pen

IV. Instructions:

Directions: Read each detective scenario. Write the name of the BEST field technique to use and explain why in one sentence. You may use each technique more than once.

	Detective Scenario	Best Technique	Why this technique?
1	A mineral appears gold colored. You suspect it might be either pyrite or actual gold. How do you tell them apart quickly without damaging the sample?		
2	A white mineral fizzes slightly when you put acid on it. What does this reaction tell you?		
3	You have two clear, glass-like minerals. One scratches glass easily; the other does not. What technique are you using, and what does the result tell you?		
4	A mineral has flat, mirror-like surfaces where it has broken. What technique identifies this, and what does it indicate about the mineral's internal structure?		

5	You want to determine in the field whether a pale mineral contains carbonate using the simplest possible test. Which technique do you choose?		
6	You need to place a mineral at exactly hardness 4 on the Mohs Scale. Describe the exact procedure to confirm this using available scratch tools.		

V. Synthesis: Answer each question in 2–3 complete sentences.

1. Which scenario in the table above was most difficult to answer? Explain what made it challenging and how you arrived at your final answer.
2. Scenario 6 asked you to confirm a hardness of exactly 4 using scratch tools. Which scratch tools are available to you that span the hardness range around 4? Describe the two tests needed and what result would confirm hardness 4.
3. Based on the scenarios, which single technique would you call the "least sufficient" for mineral identification on its own? Justify your answer with evidence from at least two scenarios.

Rubric for Assessment:

Criteria	Excellent (4 pts)	Proficient (3 pts)	Developing (2 pts)	Beginning (1 pt)
Correct Technique Selected	All 6 scenarios correctly matched the best technique.	4–5 correctly matched.	2–3 correctly matched.	0–1 correctly matched.
Quality of Explanation	All explanations are specific, scientific, and clearly linked to the technique's purpose.	Most explanations are clear; 1–2 lack specificity.	Some explanations are vague or partially correct.	Explanations are absent, incorrect, or unrelated.
Scientific Reasoning	Responses show evidence of analytical thinking; limitations of techniques noted where relevant.	Mostly sound reasoning; minor gaps.	Basic reasoning present; limited analytical depth.	No scientific reasoning is evident.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	9	Date	
Lesson Title/Topic:	Identifying Minerals Through Their Physical Properties		
Name		Grade & Section	

I. Activity No. 2: Lab Report

II. Objective(s): At the end of this activity, you should be able to perform or describe the four mineral identification techniques on a sample and use the evidence gathered to identify the mineral.

III. Materials Needed:

- One unknown mineral sample (provided by the teacher) or a printed high-resolution mineral photograph
- Fingernail, copper coin, steel nail, glass plate
- Unglazed porcelain streak plate
- Hand lens and bright light source
- Dilute HCl or white vinegar (acid test, teacher-supervised)
- Mineral Identification Key (see below)

IV. Instructions

Directions: Your teacher will provide a mineral sample. Perform all four field techniques (or describe expected results if samples are unavailable) and complete the Detective Lab Report below. Use the Mineral Identification Key to guide your conclusion.

Mineral Identification Key

Mineral	Luster	Hardness	How It Breaks	Unique Clue
Quartz	Glassy (vitreous)	Hard (>5.5; scratches glass)	Fracture — curved/shell-like (conchoidal)	Often clear or milky; no streak
Feldspar	Pearly / Glassy	Medium-hard (scratches a coin)	Cleavage — flat planes at 90°	May show thin, wavy lines on surfaces
Mica	Shiny / Glassy	Soft (<2.5; scratched by fingernail)	Cleavage — peels into thin, flexible sheets	Can be black (biotite) or clear (muscovite)
Calcite	Glassy (vitreous)	Soft (~3; scratched by a coin)	Cleavage — rhombohedral (tilted cubes)	Fizzes with dilute acid (HCl or vinegar)

Pyrite	Metallic	Hard (scratches a coin, ~6)	Fracture — irregular, jagged	Streak: dark greenish-black powder
Halite	Glassy (vitreous)	Soft (~2.5; scratched by fingernail)	Cleavage — perfect 90° cubes	Tastes salty (rock salt)

Detective Lab Report

Field Technique	Observation / Result	What This Evidence Tells Me
Mohs Scratch Test		
Streak Test		
Acid Test		
Luster Observation		
Cleavage / Fracture Observation		

Based on my Lab Report, I conclude this mineral is _____ because: _____.

V. Synthesis: Answer each question in 2–3 complete sentences.

1. Which property or test was the single most decisive piece of evidence in identifying your mineral? Why was that evidence more convincing than the others?
2. If you could perform only one technique, which would you choose for your specific mineral? Would that single technique have been enough? Explain.
3. How did using all four techniques together give you more confidence in your conclusion than using just one? Use specific results from your Lab Report as examples.

Rubric for Assessment:

Criteria	Excellent (4 pts)	Proficient (3 pts)	Basic (2 pts)	Needs Improvement (1 pt)
Completeness of Tests Performed	All five field techniques were recorded with specific observations.	Four techniques recorded; one missing or vague.	Two to three techniques recorded.	Only one or no techniques were recorded.
Accuracy of Observations	All recorded observations are scientifically accurate and precise.	Mostly accurate; 1–2 minor errors.	Some accurate observations; notable errors present.	Mostly inaccurate or copied without understanding.
Evidence- Based Conclusion	Mineral identified correctly with at least three properties cited as evidence.	Mineral identified correctly; fewer than three properties cited.	Mineral partially identified; evidence weak or vague.	Conclusion absent or not supported by evidence.
Use of Scientific Vocabulary	Correct terms are used consistently (luster, cleavage, fracture, streak, hardness, effervescence).	Most terms are used correctly; minor lapses.	Some terms are used correctly; several are misused or missing.	No scientific vocabulary used.
Neatness and Organization	The report is clearly organized, easy to follow, and all cells are completed.	Mostly organized; minor gaps in cells.	Some organization; several cells left blank.	Disorganized; most cells blank or illegible.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	10	Date	
Lesson Title/Topic:	Mineral Resources and their Economic Significance in the Philippines		
Name		Grade & Section	

I. Activity No. 1: Mineral Resources in My Bag – Show and Tell

II. Objective(s): *At the end of this activity, the learners should be able to:*

- (1) identify common mineral resources found in everyday personal items;
- (2) explain how specific mineral resources are used to produce parts of ordinary objects; and
- (3) appreciate the importance of mineral resources in daily life and modern technology.

III. Materials Needed:

personal items from the learners' bags or pockets (e.g., cellphone, coin, key, bracelet, ballpen, eyeglasses, wristwatch, stainless water bottle), ballpen, reference material or handout on common minerals and their uses, and a display area or board for the group infographic on “Mineral Resources We Use Every Day.”

IV. Instructions: *Read each step carefully and follow all instructions below.*

1. Take out one (1) personal item from your bag or pocket (e.g., cellphone, coin, key, bracelet, ballpen).
2. Examine your item closely and identify the different parts it is made of (e.g., metal casing, wires, screen, tip, clasp).
3. Using the reference handout or textbook, determine which minerals were used to make each part of your item. You may refer to the sample mineral mappings provided below.
4. Record your findings on the table provided. Indicate the personal item, the mineral(s) used, and the specific part or function made from that mineral.
5. Share your findings with the class in a short show and tell. Hold up your item, name the minerals inside it, and briefly explain what each mineral is for.
6. As a class, contribute your item to a simple infographic titled “Minerals We Use Every Day,” which will be displayed in the classroom.

Recording Table: My Items and Their Mineral Resources

No.	Personal Item	Mineral Resource(s) Used	Function
1			
2			
3			
4			

No.	Personal Item	Mineral Resource(s) Used	Function
5			

V. Synthesis:

1. Which mineral resource appeared most often in your classmates' personal items, and why do you think it is so widely used?

2. How would your daily life change if one of these mineral resources (e.g., copper, nickel, or gold) suddenly became unavailable?

3. Based on today's activity, why is it important for the Philippines to manage its mineral resources wisely and sustainably?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	10	Date	
Lesson Title/Topic:	Mineral Resources and their Economic Significance in the Philippines		
Name		Grade & Section	

I. Activity No. 2: Philippine Mineral Resources Map Activity

II. Objective(s): *At the end of this activity, the learners should be able to:*

- (1) locate and plot the major mineral resources of the Philippines on an outline map;
- (2) describe the economic significance of each mineral resource found in the different regions of the country; and
- (3) analyze the geographic distribution of mineral resources and explain why certain areas are richer in minerals than others.

III. Materials Needed:

printed outline map of the Philippines (one per group), colored pencils or markers (at least 6 different colors), legend/key template or blank legend box, ballpen or pencil, reference materials (textbook, module, or printed handout on Philippine mineral resources), ruler, and bond paper or cartolina for presentation.

IV. Instructions: *Read each direction carefully and follow all steps as written.*

1. Your teacher will divide the class into groups of 5–6 students. Each group will receive one (1) printed outline map of the Philippines.
2. Using your textbook, module, or reference handout, review the major mineral resources of the Philippines and the regions or provinces where they are found.
3. Assign a different color or symbol to each of the following minerals: gold, copper, nickel, chromite, coal, and limestone. Draw and fill in a legend or key at the bottom or side of your map to identify what each color or symbol represents.
4. Mark and label the location of each mineral resource on the map by plotting the appropriate color or symbol on the correct region or province. Make sure all markings are neat, accurate, and clearly visible.
5. Below the map, write 1–2 sentences describing each of the six minerals you plotted, including their primary economic use and the specific region or province in the Philippines where they are commonly mined.
6. Once all groups have finished, each group will present their completed map to the class and explain how they plotted the minerals and what they learned about their distribution and significance.

V: Synthesis:

1. Which regions of the Philippines are richest in mineral resources, and what geographic or geological factors do you think contribute to their abundance?

2. Why do you think some areas of the Philippines have more mineral resources than others? Consider the role of the country's geological history, tectonic activity, and rock formations in your explanation.

3. Which mineral do you think is most important for the Philippines? Justify your answer by discussing its economic contributions, the industries it supports, and the communities that depend on it for their livelihood.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	11	Date	
Lesson Title/Topic:	Mitigating Environmental Impacts of Mineral Resource Extraction and Misuse		
Name		Grade & Section	

I. Activity No. 2: Gallery Walk – 5 Strategy Stations

II. Objective(s):

At the end of this activity, the learners should be able to:

- (1) identify and describe the five key environmental management strategies used in responsible mining in the Philippines;
- (2) explain the environmental impact that each strategy addresses and the specific law or regulation that mandates or supports it; and
- (3) evaluate the effectiveness and enforceability of each strategy and justify which strategy has the greatest impact on sustainable mining practices.

III. Materials Needed:

5 printed Station Cards (one per station), Gallery Walk Recording Sheet (one per student or group), ballpen or pencil, manila paper or cartolina (optional, for group summary outputs), markers, masking tape for posting station cards around the room, and reference materials or module on responsible mining and Philippine environmental laws.

IV. Instructions:

Follow all the steps below carefully and record your answers neatly on your Gallery Walk Recording Sheet.

1. Your teacher will divide the class into groups and post 5 Station Cards around the room, each describing a different environmental management strategy used in responsible mining.
2. Each group will start at an assigned station. When your teacher signals, read the Station Card thoroughly and record the following in your sheet: (a) the name of the strategy, (b) the environmental impact it addresses, and (c) the supporting law or regulation, if stated.
3. Groups rotate to the next station every 2–3 minutes as directed by the teacher. Continue recording information at each station until all five stations have been visited.
4. After visiting all stations, return to your seats. As a group, discuss and compare the five strategies.
5. Answer the Guide Question provided at the end of this activity individually, using evidence from the station cards and your prior knowledge. Be prepared to share your answers during the class debrief.

V: Synthesis:

1. Among the five strategies — Progressive Mine Rehabilitation, Tailings Containment, Watershed Buffer Zones, Multipartite Monitoring Team (MMT), and Mercury-Free Artisanal Mining, which do you think is the MOST EFFECTIVE in protecting the environment? Explain your answer using specific details from the station cards.

2. Which strategy do you think is the HARDEST TO ENFORCE in the Philippine setting? Consider factors such as geographic challenges, resource limitations, community cooperation, and government capacity in your explanation. Support your answer with concrete reasoning.

ATTACHMENT 1: Station Cards

Station 1 – Progressive Mine Rehabilitation

Progressive mine rehabilitation is a responsible mining practice where restoration of disturbed land begins **while mining operations are still ongoing**, rather than waiting until the mine closes. This approach ensures that environmental damage is minimized and ecosystems begin to recover as early as possible.

Mining companies restore the land by **replacing the topsoil that was removed during excavation**, which allows plants to grow again. Native tree and plant species are replanted because they are well-adapted to the local climate and help restore biodiversity. Additionally, **slopes and excavated areas are stabilized** using engineering techniques and vegetation to prevent landslides and soil erosion.

Through progressive rehabilitation, mined lands can gradually return to productive uses such as **forests, agriculture, or wildlife habitats**, demonstrating that responsible mining includes long-term environmental care.

Station 2 – Tailings Containment

Mining operations produce waste materials called **tailings**, which are the leftover rock and slurry after valuable minerals are extracted. If not properly managed, these wastes can contaminate soil and water systems.

To prevent this, mining companies construct **Tailings Storage Facilities (TSFs)**—large, engineered containment areas specifically designed to safely store mine waste. These facilities are built with **protective liners, dams, and drainage systems** that prevent harmful substances from leaking into rivers, groundwater, or surrounding ecosystems.

Engineers continuously monitor these facilities to ensure their stability and safety, especially during heavy rains or earthquakes. Proper tailings containment protects nearby communities, preserves water quality, and prevents environmental disasters.

Station 3 – Watershed Buffer Zones

Watersheds and rivers are vital sources of water for communities, agriculture, and ecosystems. To protect these resources, mining regulations establish **buffer zones**, which are protected areas where mining activities are prohibited.

In many cases, mining is **not allowed within at least 50 meters of riverbanks and streams**. This buffer area serves as a natural barrier that helps filter sediments and pollutants before they reach the water.

Tree planting and vegetation growth within these zones play an important role in **reducing soil erosion, preventing siltation, and maintaining water quality**. Healthy watershed buffer zones help preserve aquatic life, reduce flooding risks, and ensure that nearby communities continue to have access to clean water.

Station 4 – Multipartite Monitoring Team (MMT)

The **Multipartite Monitoring Team (MMT)** ensures transparency and accountability in mining operations. This group is composed of representatives from **local communities, local government units (LGUs), the Department of Environment and Natural Resources (DENR), and non-government organizations (NGOs)**.

The MMT regularly visits mining sites to **inspect environmental practices, review compliance with regulations, and monitor the impact of mining activities**. They collect data, conduct field observations, and prepare monitoring reports.

This monitoring system is mandated under **DENR Administrative Order (DAO) 2010-21**, which requires mining companies to operate responsibly and remain accountable to the public. By involving multiple stakeholders, the MMT promotes **community participation, transparency, and environmental protection**.

Station 5 – Mercury-Free Artisanal Mining

Small-scale or artisanal gold mining traditionally uses **mercury** to separate gold from ore. However, mercury is highly toxic and can contaminate rivers, soil, and even the food chain, posing serious health risks to miners and nearby communities.

To address this issue, the **DENR promotes the Borax Method**, a safer and mercury-free technique for gold extraction. In this process, **borax (a natural mineral) is used during smelting to help separate gold from other materials**, eliminating the need for toxic mercury.

The Borax Method not only protects the health of miners and the environment but also improves gold recovery efficiency. By adopting mercury-free mining practices, small-scale miners can contribute to **sustainable and responsible resource extraction**.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	12	Date	
Lesson Title/Topic:	The Rock Cycle		
Name		Grade & Section	

Experiment 1: Demonstrating Melting and Cooling Materials

Follow the procedures your teacher provided. Write your observations in the space provided.

Sugar prior to heating

Sugar while being heated

Sugar while cooling down

Sugar after cooling down

Guide Questions

1. What happened to the sugar when exposed to heat?

2. How is this similar to what happens to rocks beneath the Earth's surface?

3. What changes did you observe after the molten sugar is cooled for some time?

4. How is this similar to what happens to molten rocks exposed at the Earth's surface?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	12	Date	
Lesson Title/Topic:	The Rock Cycle		
Name		Grade & Section	

Experiment 2: Jar of Erosion

Directions: Follow the procedures provided by your teacher. Draw your observations then answer the questions below.

Part 1

Part 2

Part 3

Part 1.

1. What happened to the rocks after the jar was shaken?

2. What particles formed in the water during the shaking process?

3. How does this activity represent the weathering of rocks in nature?

4. What natural forces could cause rocks to break apart in the environment?

Part 2

1. What happened to the small rock fragments when the contents are poured?

2. How did the water affect the movement of the rock particles?

3. What process does the movement of sediments in the water represent?

4. How is the movement of sediments in the tray similar to erosion in nature?

5. What natural agents cause erosion in the environment?

Part 3

1. What happened to the rock particles when the jar was left undisturbed?

2. Which particles settled first?

3. What layers formed at the bottom of the jar?

4. How does this settling process represent deposition in nature?

5. How can these layers eventually form sedimentary rocks over time?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	12	Date	
Lesson Title/Topic:	The Rock Cycle		
Name		Grade & Section	

Experiment 3: Crayon Metamorphic Rocks

Directions: Draw what happened to the crayons during the activity.

Before Heating	After Heating	When Heat and Pressure are Applied

Guide Questions

Answer the guide questions below:

1. After opening each foil, what changes did you observe in the crayons after applying heat and pressure?

2. What role did heat play in changing the crayons during the activity?

3. What role did pressure play in changing the crayons during the activity?

4. How do heat and pressure work together to form metamorphic rocks in nature?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	12	Date	
Lesson Title/Topic:	The Rock Cycle		
Name		Grade & Section	

Generalization Activity

Directions: Write the geological process described below. Write your answers in the space provided.

- _____ occurs when molten magma solidifies and forms igneous rocks after a volcanic eruption.
- _____ happens when sediments settle and accumulate in valleys, lakes, or coastal areas.
- At Mayon Volcano, molten magma _____ undergoes _____ as it turns into solid igneous rock.
- Rocks are gradually broken into smaller fragments by wind and rain through the process of _____.
- Rivers transport rock fragments from mountains to valleys through _____.
- Rocks buried deep underground experience intense _____, which can transform them into metamorphic rocks.
- Deep beneath the Earth's surface, rocks may turn into molten magma through _____.

The Rock Cycle in the Philippines: From Volcanoes to Mountains and Hills

In the Philippines, the rock cycle can be clearly seen in different landscapes. At Mayon Volcano in Albay, molten magma erupts and cools into igneous rocks like basalt and andesite. Over time, these rocks undergo weathering and erosion, with rivers carrying sediments downhill. These sediments are deposited in valleys and coastal areas, eventually compacting into sedimentary rocks.

A similar process is visible in the Chocolate Hills of Bohol, where ancient marine sediments formed limestone, a sedimentary rock, which was uplifted and weathered into the iconic hills. If limestone is buried deeper underground, heat and pressure can transform it into marble, a metamorphic rock. In the Cordillera Mountains of Northern Luzon, tectonic forces uplift ancient metamorphic rocks, while rivers erode them, depositing new sediments that form fresh sedimentary layers.

Meanwhile, volcanic activity in places like Taal Volcano in Batangas continues to produce igneous rocks, which also enter the cycle through weathering, erosion, and deposition. These examples show how rocks in the Philippines continuously transform through melting, cooling, weathering, erosion, deposition, heat, and pressure, completing the rock cycle.

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	13	Date	
Lesson Title/Topic:	Types of Rocks		
Name		Grade & Section	

Activity 1: Rock Observation

Directions: Using the pictures (samples), complete the rock sample table. After this, answer the following questions.

Rock Sample	Color	Texture	Grain Size	Layers	Mineral Composition	Rock Type
Basalt						
Diorite						
Limestone						
Sandstone						
Marble						
Slate						

Guide Questions

- What is the specific color of each rock, and are there speckles or bands?

- Does the rock feel smooth and polished or rough and abrasive?

- Are there visible pores/holes, or is the rock's mass solid and continuous?

- Are individual grains or crystals large enough to see without a magnifier?

- Are components interlocked crystals or cemented fragments like sand/shells?

- Is the texture coarse (large grains) or fine (uniform/glassy)?

- Does the rock show flat, wavy, or bent parallel sheets?

- Comparing dark Basalt to light Marble, what do their colors suggest about the minerals inside?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	13	Date	
Lesson Title/Topic:	Types of Rocks		
Name		Grade & Section	

Activity 3: Messenger Rotation Sheet

Type of Rock: Igneous

1. How is this rock type formed?
2. What are its characteristics that you can observe?
3. What are examples of this rock type?

Type of Rock: Sedimentary

1. How is this rock type formed?
2. What are its characteristics that you can observe?
3. What are examples of this rock type?

Type of Rock: Sedimentary

1. How is this rock type formed?
2. What are its characteristics that you can observe?
3. What are examples of this rock type?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	13	Date	
Lesson Title/Topic:	Types of Rocks		
Name		Grade & Section	

Activity 4: Messenger Rotation Sheet

Directions: Observe the rock samples or pictures given by your teacher. Write whether the rock is Igneous, Sedimentary, or Metamorphic in the classification column.

Rock Classification Table

Rock Sample	Classification (Igneous/Sedimentary/Metamorphic) and Reason
Basalt	
Diorite	
Sandstone	
Limestone	
Marble	
Slate	

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	14	Date	
Lesson Title/Topic:	Characteristics, Formation, and Profile of the Types of Soil in the Philippines		
Name		Grade & Section	

Activity Title: **UN-EARTHING SOIL'S SECRETS!**

Objective: To identify and describe the characteristics of different types of soil.

Materials:

- soil samples (loamy, sandy, clayey, silty)
- clear plastic cups or small containers
- water droppers or spoons
- ruler
- hand lens/magnifying glass (optional)
- observation worksheet

Procedures:

1. Form a group with your assigned members.
 2. Receive the soil samples provided to your group.
 3. Carefully observe each soil sample. Determine the particle size, texture (gritty, smooth, or sticky), and ability to retain moisture.
 4. Perform a simple water test on each soil sample as instructed.
- ✓ Determining Particle Size
1. Place a small amount of dry soil sample (about 1–2 teaspoons) on a plate or in a clear cup.
 2. Observe the size of the particles carefully and compare each from one another.
 3. Use a hand lens or magnifying glass if needed to see fine differences.
You may also use the ruler to validate your comparison.
- ✓ Determining Texture
1. Take a small pinch of soil and add a few drops of water gradually.
 2. Rub the soil gently between your fingers. Is it gritty? Smooth? Sticky? Balanced texture?
 3. Observe how the soil sticks together or crumbles.

✓ Determining Water Retention

• Setup:

1. Use a clear cup with a small hole at the bottom.
2. Each cup should have a pre-determined amount of soil (e.g., 50 g) to ensure consistency.
3. Use a pre-determined amount of water (e.g., 20 mL) for each test.

• Procedure:

1. Place one soil sample inside the cup.
2. Slowly pour the pre-measured amount of water into the soil.
3. Observe whether water passes through the hole. Does it pass quickly, moderately, slowly or barely?

5. Record your observations on the table below:

Table 1: Characteristics of Different Types of Soil

Soil samples	Particle Size	Texture	Water Retention	Possible Soil Type
Soil A				
Soil B				
Soil C				
Soil D				

6. After completing the observations, present your findings and answer the guide questions.

Guide Questions:

1. Which soil has the largest particles?
2. Which soil sample feels smooth or gritty?
3. Which soil sample becomes sticky when wet?
4. Which soil seems to absorb water quickly?
5. Which soil appears to be a mixture of different particles?
6. Based on your observations, how would you describe the characteristics of each type of soil?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	15	Date	
Lesson Title/Topic:	Human Activities that Affect Soil		
Name		Grade & Section	

The Soil Situation

Objective:

Identify the human activities or processes that affect soil by analyzing real-life situations in the Philippines.

Directions

Read each case scenario carefully. Analyze the situation and answer the guide questions that follow. Based on your analysis, identify the human activity or soil-related process affecting the soil in each case. Write your answers in your notebook or on a separate sheet of paper.

Case 1

Farmers in the mountainous areas of the Cordillera region have cleared large portions of vegetation on steep slopes to expand their vegetable farms. During the rainy season, strong rainfall washes large amounts of soil downhill, leaving the land less fertile and causing sediments to accumulate in nearby rivers (<https://essc.org.ph/content/cordilleras-forests-green-water-and-watersheds>).

Guide Questions:

1. What problem is happening to the soil in this situation?
2. What human activity contributed to this problem?
3. What soil-related process is illustrated in this case?
4. How might this situation affect the environment and people if it continues over time?

Case 2

In parts of the Sierra Madre mountain range, the longest mountain range in the Philippines, large areas of forest have been cleared to make way for farming and settlements. Over time, the removal of trees has left the soil exposed to heavy rains and strong winds, making the land more vulnerable to soil loss (<https://www.facebook.com/sciencekonek>).

Guide Questions:

1. What human activity is happening in the area?
2. What role do trees play in protecting the soil?
3. What might happen to the soil when trees are removed?
4. What activity affecting soil is shown in this case?
5. How would continued deforestation affect the environment and people living in the area?

Case 3

In the Caraga region of Mindanao, the mining capital of the Philippines, open-pit mining operations extract minerals such as nickel from the ground. Large sections of land are excavated, removing the topsoil and leaving large pits and exposed rock

surfaces. Communities nearby are concerned about the damage to the landscape and environment (<https://www.scribd.com>).

Guide Questions:

1. What activity is being conducted in the area?
2. What happens to the topsoil during this process?
3. How does this activity change the landscape?
4. What human activity affecting soil is described in this case?
5. How might surface mining affect the long-term productivity of the land?

Case 4

Many rice farmers in Central Luzon, where the “Rice Granary of the Philippines” (Nueva Ecija) is located, use large amounts of chemical fertilizers to increase crop yield. Over time, some farmers have noticed that their soil becomes less productive and requires even more fertilizer to maintain production (<https://edepot.wur.nl/79848#:~:text=Page%201,had%20come%20from%20'technicians>),

Guide Questions:

1. What farming practice is described in the case?
2. How might excessive fertilizer use affect the soil?
3. What change may happen to the soil's pH level?
4. What soil process is illustrated in this situation?
5. What could happen to crop yield and soil health if the practice continues over time?

Case 5

In some coastal farming areas in the Visayas, farmers rely heavily on irrigation and groundwater for their crops. Over time, saltwater from nearby coastal areas seeps into the soil, leaving white salt deposits on the surface and making it difficult for crops to grow (<https://www.bswm.da.gov.ph/wp-content/uploads/Salinity-2020-Technical-Report-Cebu.pdf>).

Guide Questions:

1. What problem do farmers observe in their soil?
2. What might be causing the salt buildup in the soil?
3. How does salt affect plant growth?
4. What soil-related process is happening in this case?
5. What long-term effects might salinization have on farming and food production in the area?

Case 6

In some grassland areas of Mindanao, continuous land clearing, overgrazing by livestock, and repeated soil erosion have gradually reduced vegetation cover. Over time, the land becomes dry and less productive, making it difficult for farmers to grow crops (<https://www.unccd.int/sites/default/files/naps/philippines-eng2004.pdf>).

Guide Questions:

1. What changes are happening to the land in this situation?
2. What human activities may have contributed to this condition?
3. What happens when land continues to lose vegetation and soil quality?
4. What process affecting soil is illustrated in this case?
5. How might desertification affect the livelihood of farmers and the local community in the long term?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	16	Date	
Lesson Title/Topic:	Discovering Soil-related Problem		
Name		Grade & Section	

I. Activity No. 1: Discovering Soil-related Problem

II. **Objective(s):** At the end of the activity, you should be able to identify the soil-related problems.

III. Materials Needed:

- Printed photos
- Ballpen
- Worksheet

IV. Instructions:

1. Analyze each picture of the soil-related problem
2. Briefly describe each picture and identify the soil-related problem.
3. Complete the table below and answer the guide questions.

Pictures	Brief Description	Soil-related Problem
		
		
		
		
		

V. Guide Questions:

1. Based on our activity, what do you think are the relevance of this topic to our society?

2. Why do we need to study this topic?

3. Do you think this topic pose threat to our existence?

Rubrics for Assessment (30pts)

Criteria	Excellent (5)	Very Good (4)	Good (3)	Fair (2)	Needs Improvement (1)	Score
Analysis of the Picture	Thoroughly analyzes the picture with clear and accurate explanation of what is happening	Analyzes the picture well with minor details missing.	Shows general understanding but explanation is somewhat limited.	Shows minimal analysis; explanation is unclear.	No clear analysis of the picture.	/10
Identification of Soil-Related Problem	Correctly identifies the soil-related problem and clearly explains its cause or effect.	Correctly identifies the problem with a brief explanation	Identifies the problem but explanation is incomplete	Attempts to identify the problem but shows misunderstanding.	Incorrect or no identification of the soil-related problem.	/10
Response to Guide Questions (Relevance, Importance, Threat to Society)	Provides complete, insightful answers showing strong understanding of the topic's relevance to society.	Answers all guide questions clearly with good understanding.	Answers most questions but ideas are somewhat limited.	Answers only some questions with unclear explanations	Responses are missing or show little understanding.	/10

LEARNING ACTIVITY SHEET (LAS)

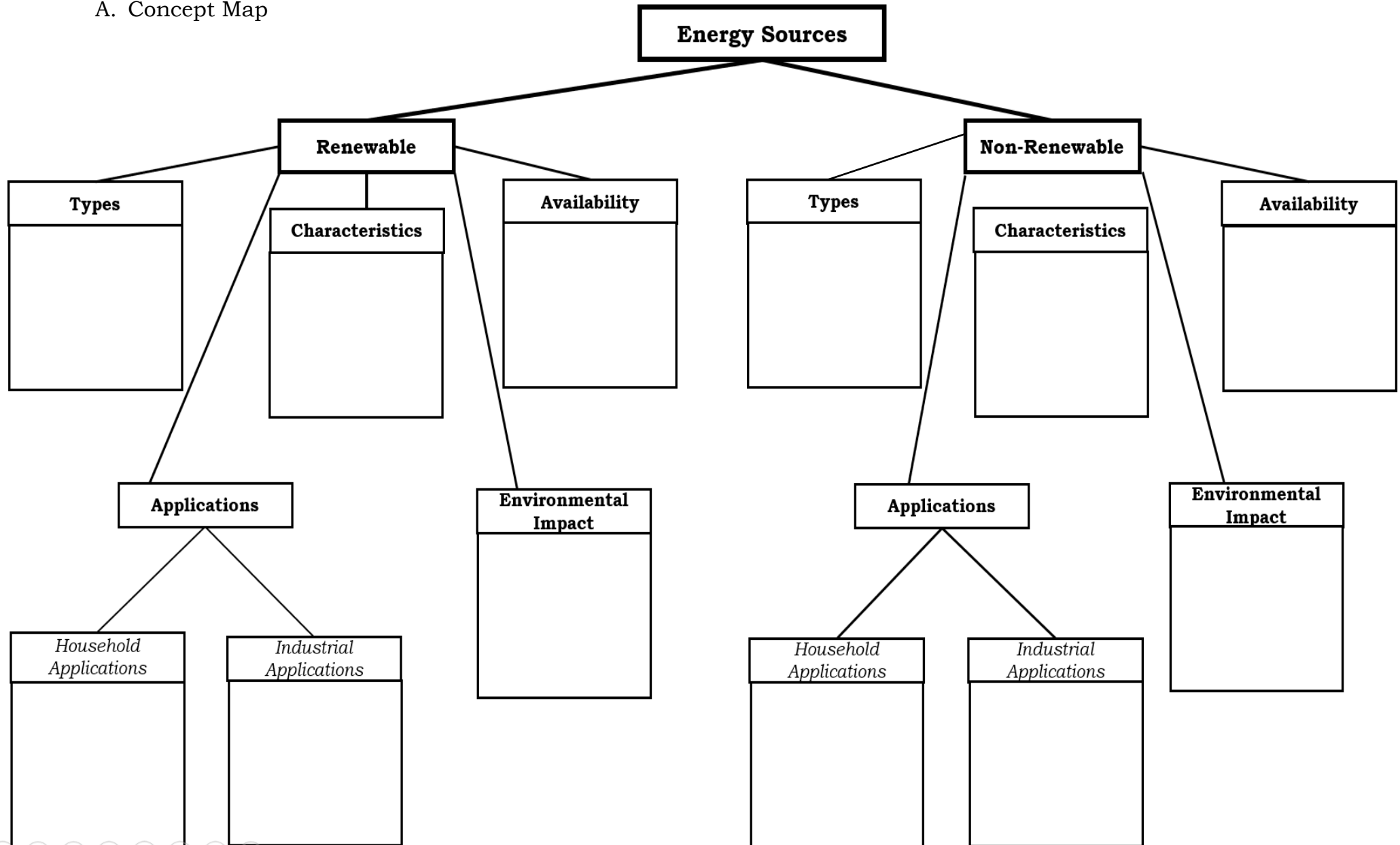
Lesson Exemplar	17	Date	
Lesson Title/Topic:	Energy Sources		
Name		Grade & Section	

- I. Activity: “Energy in Focus: Discovering Connections Among Energy Sources”
- II. Objective: Students will synthesize their learning by identifying patterns, relationships, and key principles between renewable and non-renewable energy sources. They will identify key features and visually organize their insights using a concept map.
- III. Materials needed:
 - Manila paper or worksheet
 - Markers or colored pens
 - Reference: Completed comparison chart from the previous day
- IV. Instructions:

Complete the concept map below and answer the following questions:

 1. Review the outputs and comparison chart from the previous activity.
 2. Create a concept map with the central theme: “Energy Sources – Renewable vs. Non-Renewable.” Branch into the two main categories: Renewable and Non-Renewable energy sources. Further branch into Types, Characteristics, Availability, Household Applications, Industrial Applications, and Environmental Impact for each category.
 3. Use the concept map to summarize your understanding of energy sources.
 4. Answer the guide questions in the reflection section.

A. Concept Map



A. Reflections:

1. What patterns or connections do you notice between renewable and non-renewable energy sources in terms of their types and availability?

2. How do renewable and non-renewable energy sources differ in terms of their characteristics?

3. How do these energy sources differ in their use in households and industries?

4. What advantages and limitations can you identify for each type of energy source in terms of availability, efficiency, and environmental impact?

5. Based on your concept map, what general principle can you conclude about the responsible use of energy resources?

LEARNING ACTIVITY SHEET (LAS)

Lesson Exemplar	18	Date	
Lesson Title/Topic:	Conserving Energy Sources		
Name		Grade & Section	

- I. Activity: “Energy Conservation Proposal”
- II. Objective: Develop a proposal for conserving energy sources to promote economic and environmental sustainability, using insights from secondary sources.
- III. Materials needed:
 - Laptop or desktop with internet access
 - Notebook or paper for drafting proposals
 - Pens/pencils, markers, and colored paper (optional for visual aids)
 - Access to secondary sources (websites, journals, articles)
 - Energy Conservation Proposal Template (provided in LAS)

IV. Instructions:

GRASPS Model

G – Goal: To develop a clear, realistic, and evidence-based proposal that addresses energy consumption issues and promotes sustainable energy use.

R – Role: You are energy consultants tasked with advising a community, school, industry, or organization on how to reduce energy waste and improve energy efficiency.

A – Audience: Your proposal will be presented to your classmates and teacher, who will act as stakeholders or decision-makers evaluating the feasibility and impact of your solutions.

S – Situation/Scenario: Each group will analyze a real-world energy-related situation. Using secondary sources, you will identify problems and propose practical and sustainable solutions.

Scenarios:

Group 1 – Residential Energy Challenge

A group of boarding houses is experiencing rising electricity bills due to outdated appliances and inconsistent energy-use practices among tenants. The owner must decide whether to invest in energy-efficient upgrades or focus on stricter energy-use policies to reduce costs while maintaining tenant comfort and affordability.

Group 2 – School Energy Management

A public school faces high electricity costs caused by old lighting systems, continuously operating classroom equipment, and inefficient cooling systems. School administrators are considering whether to upgrade facilities, install renewable energy systems, or implement stronger energy monitoring practices.

Group 3 – Industrial Energy Efficiency

A food processing company is expanding production but continues to use energy-intensive, outdated machinery. Management is evaluating options such as upgrading to energy-efficient equipment, integrating renewable energy sources, or optimizing production schedules to balance cost, efficiency, and environmental responsibility.

Group 4 – Urban Transport Sustainability

A city is experiencing rising fuel costs, traffic congestion, and air pollution due to reliance on old diesel-powered public transport. The local government is considering solutions such as shifting to electric vehicles, improving existing engines, or redesigning transport systems to include more sustainable mobility options.

Group 5 – Community Energy Operations

A community center has increasing electricity expenses due to continuous use of lighting, cooling systems, and water pumps even during low occupancy. Management is exploring options such as installing solar energy systems, using automated energy controls, or combining infrastructure upgrades with energy-saving practices.

P – Product/Performance: Each group will submit and present a written proposal containing:

1. Introduction – Brief description of the assigned situation
2. Problem Statement – Identification of key energy issues and their economic and environmental impacts
3. Proposed Solution(s) – Evidence-based and practical strategies to improve energy efficiency and conservation
4. References – Credible secondary sources cited in APA 7th Edition format

S – Standards/Criteria for Success: Your proposal and presentation will be evaluated based on:

- Clarity and organization: Introduction, Problem, Proposed Solution
- Use of secondary sources to support claims
- Feasibility and practicality of proposed solutions
- Relevance to economic and environmental sustainability
- Presentation skills: Engagement, clarity, teamwork

You will be rated based on the rubric below:

<i>Rubric for Energy Conservation Proposal</i>				
Criteria	Excellent (4)	Good (3)	Fair (2)	Needs Improvement (1)
Clarity & Organization	Proposal is well-structured with clear Introduction, Problem, and Solution	Proposal mostly organized; minor gaps in structure	Proposal somewhat organized; some confusion in sections	Proposal poorly organized; hard to follow
Use of Secondary Sources	Uses at least 2 reliable sources to support solutions	Uses 1–2 sources, some may be less reliable	Uses 1 source, not fully relevant	No sources or sources unreliable
Feasibility & Practicality	Solutions are realistic, actionable, and clearly explained	Solutions mostly feasible; minor gaps in explanation	Some solutions feasible but not practical	Solutions unrealistic or unclear
Economic & Environmental Relevance	Clearly explains how solutions impact both economy and environment	Explains either economic or environmental impact	Explains impact vaguely	No clear connection to sustainability
Presentation Skills	Clear, confident, engaging; good teamwork	Clear and confident; minor teamwork issues	Some clarity issues; uneven participation	Hard to follow; poor teamwork or participation

Energy Conservation Proposal Template

Group Number: _____

Members: _____

Scenario Assigned:

1. Introduction (3–4 sentences).

(Briefly describe the context of your scenario. Explain why energy conservation is important in this situation.)

2. Problem Statement (4–6 sentences)

(Identify the main energy issues in your scenario. Explain the economic and environmental impacts of current energy practices.)

[illegible]

3. Proposed Solution (5–7 sentences)

(Suggest practical strategies to conserve energy. Include at least two solutions backed by secondary sources (websites, journals, articles). Explain how your solutions will benefit both the economy and the environment.)

This image shows a single sheet of white paper with horizontal ruling lines. The lines are evenly spaced and run across the width of the page. There are no margins, text, or other markings on the paper.

4. References

(List the secondary sources you used to support your proposal.)
