

Earth's Spheres Lesson 1: *The Solve* Educator's Resource Guide

Objective

In *The Solve*, students will:

1. Work collaboratively to complete a Mind Map using new terms, definitions, and visuals relating to essential Earth Spheres vocabulary.
2. Solve a mystery that shows that Earth is made of four interconnected spheres: the geosphere, hydrosphere, atmosphere, and biosphere.
3. Communicate understanding that an event in one of Earth's spheres affects other spheres.

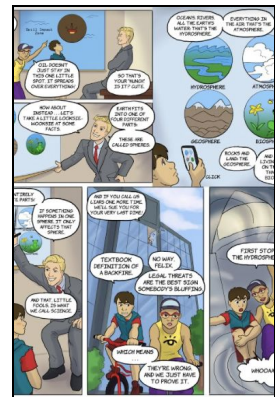
Time Required: 40–75 minutes

Materials Required	Safety Considerations	Science & Engineering Practices
• Student Guide ◦ includes <i>Student Agenda and Mind Map</i> • Earth's Spheres Mosa Mack Comic Book or Motion Comic Episode • Computer with speakers (for projecting video) or headphones (for student viewing on laptops) • Scissors • Glue or tape	None	• Developing and Using Models • Constructing Explanations or Arguments From Evidence

Mosa Mack Mystery Episode Description

Petro-Proud Petroleum has just spilled oil into the ocean! The company released a commercial telling its customers not to worry, because the spill is contained, only impacting a small portion of the ocean. Observers Felix and JoJo don't believe the claim, as they spot a bird in the background covered in oil. So they embark on a mission to prove that an oil spill impacts more than just the hydrosphere.

Felix and JoJo visit the hydrosphere, biosphere, geosphere, and atmosphere to learn about the properties of and oil's impact on each sphere. Through their journey, they learn how Earth's spheres interact with one another and how a problem in one sphere simply cannot be contained. Felix and JoJo present their findings to Petro-Proud Petroleum in an effort to disprove this corporation's claim.



Inquiry Scale: Leveling Information

The Solve can be completed in various settings, including presentation-style, small groups, or individually. In the case of a flipped or blended classroom, it can be completed entirely at home.

Level 1: Most teacher-driven *(recommended for grades 4–5)*

Project and complete the Mind Map as a class-wide activity. This can be done digitally or on paper. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion.

Then, read through or watch the mystery twice as students follow along: once in full, and a second time along with the discussion questions, pausing as needed to answer the episode questions as a group.

Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 2 *(recommended for grades 5–6)*

Direct students to complete the Mind Map in small groups, either digitally or on paper. Come back as a class to review correct answers, as needed. Have students informally quiz each other on the vocabulary until you feel they're familiar with the terms. Use the discussion questions at the bottom of the Mind Map to have a group discussion.

Then, if reading the comic, assign students roles for the different characters in the comic. Read through the comic as class, with students reading out for their specific roles. Alternatively, watch the episode video. After, have students answer the episode questions in small groups, either online or on paper.

Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 3 *(recommended for grades 6–7)*

Have students complete the Mind Map in table groups, either digitally or on paper. Have students quiz each other on the vocabulary until you feel they're familiar with the terms. In table groups, have students go through the discussion questions on their own, and review answers as a class.

Provide students with the mystery (either in comic or video form) and have students read and/or watch in small groups. Have students answer episode questions in their table groups to the best of their ability, either online or on paper. Then, as a class, review the mystery again in either format, pausing as needed to discuss questions in a think-pair-share format. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 4 *(recommended for grades 7–8)*

Have students complete the Mind Map in pairs, either digitally or on paper. Have students quiz each other on the vocabulary until they feel they're familiar with the terms. Have these same pairs go through the discussion questions.

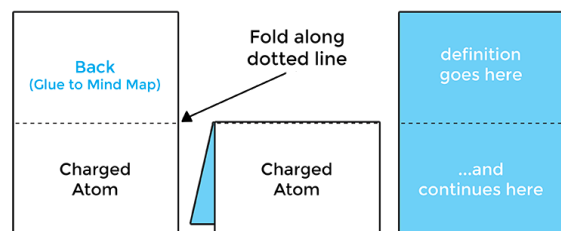
Provide students with the comic or episode and have them read and/or watch in small groups or pairs. Students answer episode questions either online or on paper. Have students review their answers with a neighboring table group. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Agenda

I. Warm Up: Vocabulary Mind Map (15–45 minutes)

Differentiation Tip: The Mind Map can be done as a class, in small groups, individually, or completed for homework. It can be done digitally or on paper.

1. Students may complete the Mind Map **digitally**. Follow directions below (15 minutes).
 - a. Go to <https://mosamack.com/home/spheres>
 - b. Select **Lesson 1: The Solve**.
 - c. Select **Vocabulary** and complete **Part 1**: matching terms with definitions.
 - d. Complete **Part 2**: matching terms and definitions with images on a diagram.
2. To complete the Mind Map **on paper**, follow the directions below (45 minutes).
 - a. Print and pass out the Student Guide: Earth's Spheres Lesson 1: *The Solve*.
 - b. Introduce the warm up task: students will be making a Mind Map of the vocabulary for this Earth's Spheres unit.
 - c. Model the directions carefully, emphasizing the following. Students should:
 - **cut** out the vocabulary cards on the solid lines only
 - **fold** the cards at the dotted lines
 - write the definition of the term on the inside of the card using definitions provided.
 - d. Students use the clues from the Mind Map images, definitions, and terms to place the cards in the correct location in the Mind Map.
 - e. Check that the students have matched their cards correctly before moving on.
 - f. Students use glue or double-sided tape to connect the back of the vocabulary card to the correct place on the Mind Map.
 - g. Students discuss the questions with their group or as a class when they have completed the Mind Map.



Teacher Tips:

- Since this is the first time many of the students will have seen these vocabulary terms, have students work together to use the images, definitions, and collaborative thinking to figure out where the terms go.
- Check in on student groups through this process. When you see a student or group who has placed a card in the correct place, ask a facilitating question such as, “Why do you think that term goes there?” or “What evidence leads you to believe that term goes there?” When students explain their thinking, this is a great opportunity to provide positive reinforcement. Then, encourage students to share their reasoning to the class or to other groups who may have trouble identifying the location of that specific term.

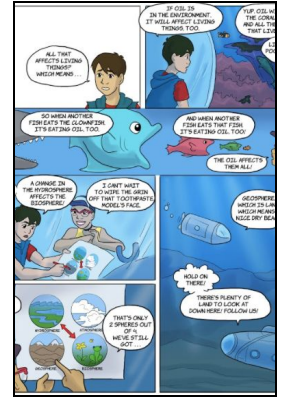
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- If you do not have access to a color printer, provide students with black and white copies and project the colored version of the Mind Map at the front of the room so that students can reference both images.

II. Solve the Earth's Spheres Mosa Mack Mystery (20 minutes)

Differentiation Tip: The comic book and motion comic video can be read/watched as a class, in small groups, individually, or completed for homework. For additional support, students can read or watch the comic/episode twice: once before completing the questions, and once with teacher guidance, pausing to discuss each answer.

- Read/watch the Mosa Mack Mystery on Earth's Spheres.
- Students answer the questions in their Student Guide as they read/watch. Encourage students to cite the specific page numbers/time codes in the Comic Mystery to promote writing with supporting evidence. Answers can be found in the key below.



III. Exit Ticket: Check for Understanding (10–15 minutes)

Differentiation Tip: This can be done in groups, pairs, individually, or more formally as a quiz online.

- Students complete the exit ticket to check for understanding. This can be done online by selecting the **Quiz** button in Lesson 1 or on paper in the Student Guide. Answers are in the Answer Key section below.

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III. Exit Ticket: Check for Understanding
Complete the exit ticket below or you can take the quiz online!

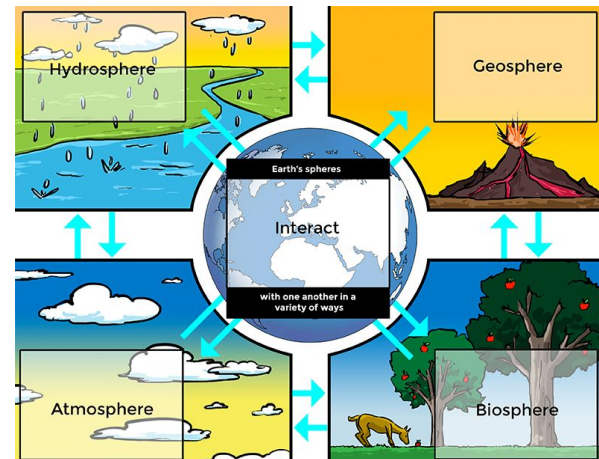
Name: _____ Date: _____

- Which of the following is an example of a non-renewable resource?
a. Wind
b. Solar (Sun)
c. Trees
d. Petroleum
- Resources are equally distributed throughout the world. True or false?
a. True
b. False
- How long does oil take to make?
a. Hundreds of millions of years
b. 40 years
c. A few years
d. 1 million years
- Burning fossil fuels releases which gas into the air, making the Earth warmer?
a. Oxygen
b. Water
c. Nitrogen
d. Carbon Dioxide
- Which of the following does not show a quick "cycle"?
a. Wind
b. Water
c. Carbon

Answer Key

Answers to Mind Map Discussion Questions

- Which sphere contains rain? *Rain is part of the hydrosphere, which contains the water on Earth.*
- Which sphere contains pebbles? *Pebbles are part of the geosphere, which contains the land on Earth.*
- Which sphere contains oxygen gas? *Oxygen gas is part of the atmosphere, which contains the gases on Earth.*
- Can you think of an example of an event on Earth that may impact more than one sphere? *Student answers will vary. An example answer could include: A volcanic eruption releases gases into the air and lava into the environment. Gases such as carbon dioxide and sulfur dioxide impact the atmosphere. Lava flows from the volcano, moving across the land destroying vegetation, insects and animals, which are all part of the biosphere. A volcanic eruption can impact the geosphere, atmosphere, and biosphere.*



Episode Questions

1. Why are Felix and JoJo upset about the Petro-Proud Petroleum commercial? *The Petro-Proud commercial claims that the oil spill has been contained and only impacted the water temporarily. However, while watching the commercial, the boys spot a bird coated with oil and realize that the advertisement is false.* (Page 1 and 0:30 in the video)
2. Explain what makes up each of Earth's spheres. (Page 2, 1:34 in the video)
 - a. Hydrosphere: *Oceans, rivers, and all of Earth's water makes up the hydrosphere.*
 - b. Atmosphere: *Everything in the air makes up Earth's atmosphere.*
 - c. Geosphere: *Rocks and land make up Earth's geosphere.*
 - d. Biosphere: *All the living things on Earth make up the biosphere.*
3. What causes the oil to move in the water? *Ocean currents carry oil across the ocean.* (Page 3, 2:50 in the video)
4. Give an example of how oil can affect the biosphere (hint: think about the coral reef). *Once oil enters the biosphere (coral reef), it impacts the organisms living there. For example, if a clownfish ingests oil and then is eaten by a larger fish, the larger fish is also ingesting the oil. Oil contaminates the entire coral reef food web.* (Page 5, 3:40 in the video)
5. How does an oil rig impact the geosphere? *An oil rig is connected to a drill that drills into the ocean floor to pump oil from underneath, thus impacting the geosphere.* (Page 6, 5:30 in the video)
6. How can oil impact the atmosphere? Explain.) *Oil can evaporate from the surface of the ocean and enter the atmosphere. Once in the atmosphere, oil pollutes the air. This creates harsh breathing conditions for birds.* (Page 8, 6:26 in the video)
7. What did Felix and JoJo figure out? Does an oil spill only affect one sphere? Explain. *Through their journey, Felix and JoJo learn that all spheres are connected and that something that happens in one sphere can impact every other sphere.* (Page 9, 8:30 in the video)

Quiz:

1. The sphere that consists of water is called the:
 - a. Atmosphere
 - b. Geosphere
 - c. Biosphere
 - d. Hydrosphere**
2. Lava erupts from a volcano and later cools into rock. This newly formed rock would be part of the:
 - a. Atmosphere
 - b. Geosphere**
 - c. Biosphere
 - d. Hydrosphere
3. If oil spills in the ocean, it washes up onto a beach. What spheres are the ocean and sand a part of?
 - a. Atmosphere and Hydrosphere
 - b. Hydrosphere and Geosphere**
 - c. Geosphere and Atmosphere
 - d. Biosphere and Atmosphere
4. A deer is viewed drinking water from a stream. The deer and stream are part of which sphere(s)?
 - a. Biosphere
 - b. Hydrosphere
 - c. Atmosphere
 - d. Both a. and b.**
5. Oil from the ocean can enter into the atmosphere through what process?
 - a. Evaporation**
 - b. Digestion
 - c. Migration
 - d. Rain
6. True or False: If something happens in one sphere, it only affects that sphere.
 - a. True
 - b. False**