MOSA MACK SCIENCE

Rock Cycle Lesson 1: *The Solve*
Educator's Resource Guide

Objective

In *The Solve*, students will:

1. Solve a mystery involving the rock cycle as well as the forces involved in creating igneous, sedimentary, and metamorphic rocks.
2. Create a Mind Map to explore relationships among complex Rock Cycle vocabulary.
3. Communicate understanding of weathering and erosion.

Time Required: 40–75 minutes

Materials Required	Safety Considerations	Science & Engineering Practices
• Student Guide (*includes student agenda and Mind Map)* • Rock Cycle Mystery: comic or video format • Scissors • Glue or tape	None	• Developing and Using Models • Constructing Explanations or Arguments From Evidence

Episode Description

At an estate sale, Mosa uncovers the book of a lifetime: an old guide book that provides directions to finding the most wanted crystal in the world—the Sunset Topaz. A series of clues take her and the team on a wild adventure through erupting mountains, crumbling cities, and ancient rivers in search of the Sunset Topaz, all while being chased by the evil Zog, who is seeking the same treasure. Through the adventure, Mosa explores the rock cycle, discovering the properties of different rocks and using this knowledge to escape Zog and keep possession of the Sunset Topaz.

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)*

View the animated mystery twice: once in full, and a second time along with the discussion questions, pausing the video as needed to answer the episode questions as a group. 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. Finally, have students complete the quiz digitally or on paper as an exit ticket.

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

View the animated mystery in full. Afterwards, have students work through the episode questions to the best of their ability in small groups. Play the mystery a second time, pausing the video to discuss each question. 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. Finally, have students complete the quiz digitally or on paper as an exit ticket.

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

Provide students with their student URL and have students view the animated mystery in small groups. Have students play the animated mystery once in full and then answer episode questions in their table groups to the best of their ability. Then, as a class, project the mystery, pausing, as needed, to discuss episode questions in a think-pair-share format. 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. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Level 4: Most student-driven *(recommended for grades 7–8)*

Provide students with their student URL and have students view the animated mystery and complete episode questions in pairs. Have students review their answers with a neighboring table group. 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. Finally, have students complete the quiz digitally or on paper as an exit ticket.

Agenda

I. Solve the Rock Cycle Mosa Mack Mystery (20 minutes)

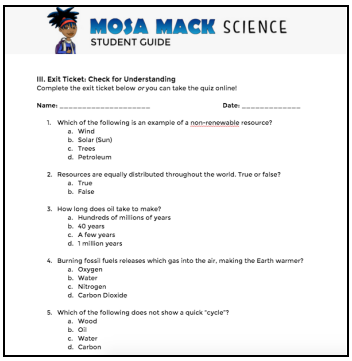
Differentiation Tip: The comic and motion comic video can be read/watched as a class, in small groups, individually, or completed for homework. For additional support, students can read or watch the comic/episode twice: once before completing the questions, and once with teacher guidance, pausing to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

1. Read/watch the Mosa Mack Mystery on Rock Cycle.
2. 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.

II. Vocabulary Mind Map Activity (15–45 minutes)

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

1. Students may complete the Mind Map **digitally**. Follow directions below. (15 minutes)
    a. Go to https://mosamack.com/home/rock-cycle-earth-s-history
    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.

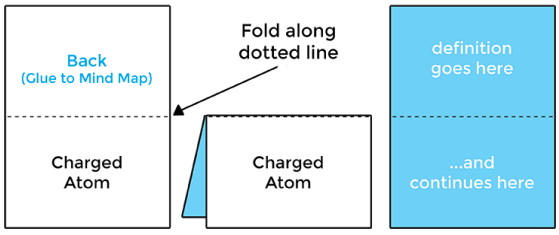

MOSA MACK SCIENCE
STUDENT GUIDE

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

Name: _____ Date: _____

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

2. To complete the Mind Map **on paper**, follow the directions below (45 minutes).
    a. Print and pass out the Student Guide: Rock Cycle Lesson 1: *The Solve*.
    b. Introduce the warm up task: students will be making a Mind Map of the vocabulary for this Rock Cycle 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.
- 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.

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.

1. 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 key below.

Answer Key

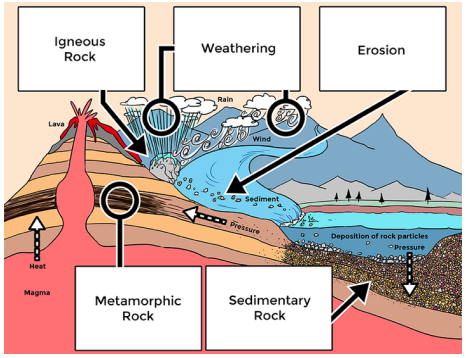
Mind Map

Mind Map Discussion Questions:

a. How do igneous, sedimentary, and metamorphic rocks form? *Igneous rocks form from cooled and solidified lava. Sedimentary rocks form from layers of sediment being deposited and compressed. Metamorphic rocks form when rocks experience tremendous amounts of heat and pressure, thus changing the rock properties.*

b. What happens when rain or wind continually hits against a rock over time? What is this process called? *The rock begins to weaken and break down. This is called weathering.*

c. How does heat from below the Earth's crust impact rocks in the Earth's crust? *Magma from below the Earth's crust is responsible for the heat that creates metamorphic rock and igneous rock.*



Episode Questions

1. At the estate sale, Mosa buys an old guide book that provides instructions for finding what type of "treasure"? *The guide book provides instructions for finding the Sunset Topaz.* (p. 1)
2. When Mosa and her crew studied Clue #1, "Climb up the Erupting Mountain", the volcano was not erupting. How did they figure out they were at the correct location? *Mosa saw that the rocks nearby appeared dark and smooth. Knowing that lava flows out of volcanoes, the team reasoned that lava had once flowed from the volcano. That lava cooled, which formed igneous rocks.* (p. 4)
3. What caused the towers to crumble at the "Crumbling City"? *The towers crumbled due to wind and rain hitting the rock, thus breaking it down over a long period of time.* (p. 5)
4. How does sedimentary rock form? *Sedimentary rock forms when newer sediment settles on top of older sediment. Over time, pressure causes the sediment to stick together, forming sedimentary rock.* (p. 6–7)
5. Billy compares spilling juice on a sand mountain to the formation of a canyon. How are they similar? *When Billy spills juice on a sand mountain, the juice carves out a river. When water continuously washes over a region of rock over time, a canyon can form.* (p. 8)
6. How is it possible that fish, which are animals that live in water, had fossils found at the bottom of the canyon? *This could be because the small river now at the bottom of the canyon used to be an ocean filled with fish. Fish that died settled to the bottom and layers of sediment piled on top of the fish remains.* (p. 9)
7. Explain the process that turns sedimentary rock into metamorphic rock. *Sedimentary rock becomes metamorphic rock when it is exposed to heat and pressure.* (p. 11)
8. What did Mosa and her crew discover about what happens to rock at this depth/area when they "Entered the Meltdown"? *While in the Magma Submarine, Mosa and her crew observed that metamorphic rock, sedimentary rock, and the fossils inside the rock melt down into liquid magma.* (p. 13)
9. Explain how volcanoes play a role in the rock cycle. *Volcanoes provide a path through which magma travels from below the Earth's crust to the Earth's surface. Magma cools and solidifies into igneous rock, continuing the rock cycle.* (p. 14–15)
10. In which rock was the Sunset Topaz located? Which rock did Mosa hand over to Zog in order to fool him? Why did Mosa choose this type of rock and not one of the other types of rock? *The Sunset Topaz was in the igneous rock. Mosa chose to hand over the metamorphic rock. She didn't want to give him the sedimentary rock because it could easily be broken, revealing the Sunset Topaz was not inside. So, Mosa handed Zog a metamorphic rock.* (p. 17–18)

Exit Ticket

1. Which of the following is NOT a type of rock?
    a. Igneous
    b. Sedimentary
    c. Metamorphic
    d. Canyon
2. The Sunset Topaz is a crystal found inside a(n) _____.
    a. Sedimentary rock
    b. Igneous rock
    c. Metamorphic rock
    d. Volcano
3. Which of the following best describes how an **igneous** rock forms?
    a. Hot lava from a volcano cools into rock
    b. Sedimentary rock deep in the surface is pressurized and heated
    c. Layers of sediment stick together due to pressure
    d. Remains of an animal are covered in soil and compressed over time
4. **True** or False: Rain and wind can cause weathering of rock.
5. Water can move sediment from one location to another. This process is known as _____.
    a. Sedimentary rock
    b. Erosion
    c. Weathering
    d. Crystal formation
6. When walking through a canyon and observing rock layers, the oldest rock would be found at the _____ of the canyon.
    a. Top
    b. Middle
    c. Bottom
    d. Center
7. Which of the following below best describes how **metamorphic** rock forms?
    a. Hot lava from a volcano cools into rock
    b. Rock deep in the surface is pressurized and heated
    c. Sediments layer on top of one another and pressure causes them to stick together
    d. Remains of an animal are covered in mud and soil and are compressed over time
8. **True** or False: Heat can melt rock into magma.
9. Which structure brings magma from below the Earth's crust to the Earth's surface?
    a. Geyser
    b. Canyon
    c. Glacier
    d. Volcano