

Sedimentary Rocks and Fossil Fuels

Teacher Facilitation Notes

In General . . .

- Project the slide deck in edit mode—do not show it as a slideshow.
- Hide the speaker notes before projecting. (View/Show Speaker Notes)
- Hide the filmstrip to the left. (View/Hide Filmstrip.)
- Hide the toolbar. (Click on the up arrow at the right end of the tool bar.)
- Call on students to read the various content shown on slides.

Materials Needed:

Engage:

Let's Get WED!

Tape or glue

Scissors

Explore (per group):

Clear, plastic cups, 2

Coffee grounds, 40 mL

Small bowls, 4

Beaker, 100 mL, 1

Snack baggies, 4

Large plastic baggie, 1

Cocoa Krispies™, 100 mL

Bran Flakes, 40 mL

Sharpie™, 1

Sprig of rosemary, parsley, etc., 1

Water

Plastic teaspoons, 4

Sandwich baggie, 1

Cheerios™, 40 mL

Froot Loops™, 40 mL

Explain

Chart paper or poster board, 6 pieces

Sharpie™

Tape or sticky tack

Elaborate (per student):

Foil strip

Mini-marshmallows, 4-6

Snack baggie, 1

½ Graham cracker

Chocolate chips, 4-5

Mini M&Ms™, 4-5

Other Materials

Student Recording Sheets

Student Summative Evaluation

Card stock

Pencils

Science notebooks

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Teacher Facilitation Notes, p. 2

Advanced Preparations

Explore

- Prepare a set of materials for each group:
 - Place about 100 mL of the chocolate cereal in a sandwich bag. Place about 40 mL of the coffee grounds and the other 3 cereals in separate snack baggies.
 - Have the other materials in a central location for ease of distribution.

Explain

- Duplicate the weathering/erosion/deposition cards, the formation of sedimentary rock cards, and the formation of fossil fuel cards on cardstock. Cut apart.
- Label the six pieces of poster board or chart paper as follows:
 - Weathering
 - Erosion
 - Deposition
 - The Formation of Sedimentary Rocks
 - The Formation of Coal
 - The Formation of Oil and Natural Gas

Elaborate

- Tear off lengths of foil (2-3 inches) for each student.
- Place ½ of a graham cracker, 6-8 mini-marshmallows, 4-5 mini M&Ms™, and 4-5 chocolate chips in a snack baggie for each student.

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Teacher Facilitation Notes, p. 3

Engage

- Read the question on the opening slide of this section of the slide show.
- Discuss as desired.
- Engage students in a See, Think, Wonder* thinking routine:
 - Show the slide with the photograph of Bryce Canyon. Call on a volunteer to read the first question. Ask students to make observations about the photograph.
 - Next, read the second question and ask student to infer what they think might have happened to cause the rocks in the canyon to look this way.
 - Finally, read the last question and have student think about what the picture makes them wonder about sedimentary rocks and fossil fuels.
- Before viewing, introduce the video**:
 - Remind students that WED stands for weather, erosion, and deposition. Give students a brief synopsis of what they are about to view. For example, *this video will review the processes of weathering, erosion, and deposition. It will also discuss how these processes relate to the formation of sedimentary rocks and fossil fuels.*
 - Highlight specific information you want them to look for as they watch the video.
 - Read the essential question on the slide. Have students write the question in their science notebooks.
- Create an atmosphere of accountability by setting the expectation that they will have something to do while the video is running. Tell them that they will need to record any vocabulary terms that they think are important to the topic in their science notebooks as they watch the video.
- Read the final bullet to set the purpose for watching the video.
- Watch the video. Create a whole-class summary of the video by calling on students one at a time to retell a section of the video. Discuss the important vocabulary terms they recorded as they watched the video.
- Have students complete the folded graphic organizer as detailed on the final engage slide.

*[See, Think, Wonder](#) is a thinking routine developed through Project Zero at the Harvard Graduate School of Education.

**[8 Ways to Help Students Watch Videos Critically \(Instead of Zoning Out\)](#)

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Teacher Facilitation Notes, p. 4

Explore: "Cereal" Actions and Reactions

- Read and discuss the introductory slide entitled "*Cereal*" Actions and Reactions.
- Discuss the lab question, the background, and the materials as desired. Remind students of relevant lab rules.
- Use the provided script to facilitate the exploration, or have students follow the directions on the slide. Emphasize the terms compaction and cementation.
- Discuss the diagrams that show the steps in the formation of sedimentary rocks and fossil fuels.
- Remind students that coal most often formed at the bottoms of swamps from the remains of dead plants, but petroleum (oil) and natural gas formed at the bottom of oceans and seas from the remains of dead animals. However, the processes that led to their formation and the formation of sedimentary rock are basically the same: weathering, sedimentation, erosion, deposition, compaction, and cementation.
- Discuss how different sediments led to different layers of sedimentary rock.
- Have students answer the questions on their recording sheet. Discuss as desired.

*This activity is based on the YouTube video [Fossil Fuel and Sedimentary Rock Formation](#).

Explain

- Read and discuss the explain slides as desired.
- Place the 6 prepared posters in the classroom so that they are visible to all of the students.
- Divide the class into 5-6 teams (depending on the number of students in the class). Tell the students that they are going to playing a game.
 - The goal of the game is to accumulate the most points.
 - They will read a card that describes weathering/erosion/deposition or a step in the formation of sedimentary rocks, coal or oil/natural gas.
 - As a group they must decide what the card is describing or if it is a step in the formation of fossil fuels or sedimentary rocks.
 - If their answer is correct, they will receive 5 points and they get to attach the card to the correct poster.
 - If their answer is incorrect, the next team gets a chance to answer the question and get the 5 points.
 - If both of the groups are incorrect, any remaining team gets to "steal" the points. (The stealing team still gets a chance to place a card when it is their normal time.)
 - Display the cards, one at a time. Rotate through the groups giving each group equal chances to place the cards.
 - Play continues until all of the cards have been read and placed.
- Discuss as desired.

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Teacher Facilitation Notes, p. 5

Explore: "Cereal" Actions and Reactions Script

- Today we are going to explore and model the processes that lead to the formation of sedimentary rocks and fossil fuels. We will be using different types of cereal and coffee grounds to represent sediments that are formed in nature as rocks are weathered and eroded.
- We will begin by making a model of a swamp. Millions of years ago, many organisms—both plants and animals—lived in swamps. Swamps are low, spongy land filled with water and covered with trees.
- Pour 2 tablespoons of water into one of the empty, plastic cups. Add the plant sprig to the water in the cup. This sprig represents plants that died and dropped to the bottom of the water in the swamp.
- Over time, sediments were eroded and deposited in the swamp. Pour the Cocoa Krispies™ into a bowl. Sprinkle the coffee grounds over the cereal. Add 2 tablespoons of water to the mixture in the bowl and stir well.
- Spoon this mixture into the glass over the water and the plant sprig. This mixture represents COAL that formed when dead plants sank to the bottom of swamps and were covered with mud and sediments.
- As time passes, another layer of sediments are deposited in the swamp. The other 3 baggies of cereal represent rocks on Earth's surface that were weathered over time. The Froot Loops™ represent sandstone rocks; the Bran Flakes represent Shale; and the Cheerios™ represent limestone rocks.
- To illustrate the weathering that took place during this time, place the bag of Froot Loops™ in the large plastic bag. Use your hand to press down and crush the cereal in the baggie. Do the same thing for the other two cereals.
- We broke down the cereals in the baggies into sediments. Erosion is the process that moves those sediments to a new location. In our model, we will "erode" the sediments and deposit them in our model swamp.
- Pour the "sandstone sediments" (Froot Loops™) into the glass on top of the "coal". On top of that, pour in the "shale sediments" (bran flakes) and the "limestone sediments" (Cheerios™).
- Over the thousands of years that weathering, erosion, and deposition take place, our swamp land has changed. It does not look like a swamp anymore. It might now be a desert or a forest. If a scientist started digging in this area, they might find a fossil of our plant sprig that fell into the swamp millions of years ago.
- All of the layers of sediment lying on top of each other for millions of years create huge amounts of pressure. As the sediments piled up in the swamp, pressure from each new layer began to squeeze and push down the lower layers.
- To model this, put your fist in the second cup and push down HARD on the top layer of the model.

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Teacher Facilitation Notes, p. 6

Explore: "Cereal" Actions and Reactions Script, p. 2

- This pressure causes the layers to compact and cement together. Remember, compacted means to be pressed together, and cemented means to be glued together. The minerals that make up the cement, or glue, are usually dissolved in water in the ground (like salt dissolved in seawater). The water with dissolved minerals trickles through the sediments. As the water evaporate, it makes the sediments stick together to form rocks.
- One thing missing from this model is the thermal energy that is also necessary to change sediments and dead organisms into sedimentary rock and fossil fuels. Push the palms of your hands together as hard as you can. Can you feel the heat that is trapped between your hands? Does it seem to get hotter the longer you push? This is what happens as the top layers of sediment push down harder and harder on the bottom layers.
- This intense heat in the rock layers also contributes to the formation of petroleum and natural gas.

Sedimentary Rocks and Fossil Fuels

Teacher Facilitation Notes, p. 7

Elaborate

- Display the procedures for making the edible “sedimentary rocks”.
- Discuss as desired.

Evaluate

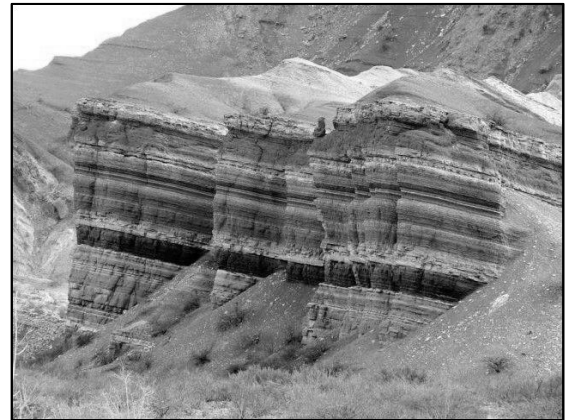
- Have students complete the quiz independently.

Sedimentary Rocks and Fossil Fuels

Name: KEY

Evaluation

1. The layers of rock shown in this rock formation provide evidence that these rocks formed by the compacting and cementing together of sediments that were broken down from other rocks. Based on this evidence, which of the following is the most reasonable conclusion that can be drawn? The rock formation—



- A** will not contain any fossils.
 - B** is most likely located in a cold climate.
 - C** formed in just a few months.
 - D** is made up of sedimentary rock.
2. A man walking on a beach picked up a rock. He observed that the rock was made up of several dark-colored and light-colored layers. He also saw a small fossil in the top of the rock. How was this type of rock most likely formed?
- F** Lava from two different volcanoes cooled and hardened very quickly.
 - G** A bigger rock was deposited on the beach and eroded by the waves.
 - H** A slow-moving glacier compacted several different rocks to form one rock.
 - J** Different kinds of sediments were slowly compacted and cemented together to form the rock.
3. Which of the following is the first step in the formation of sedimentary rocks?
- A** The weathering of rocks and rocky surfaces into small pieces
 - B** The heating of different kinds of rocks until they melt
 - C** The deposition of many layers of sediment causing extreme pressure
 - D** The eroding of sediments by moving ice

Sedimentary Rocks and Fossil Fuels

Name: KEY

Evaluation, page 2

4. The formation of coal, oil, and natural gas all begin with which of the following processes?

F The weathering of rock material

G The burning of manmade fuels

H The death and burial of living things

J The breaking down of crystals underground

5. Put the statements in order to show how oil and natural gas are formed. Put a letter A next to the thing that happens first. Put an F next to the last step. Put the letters B-E on the other blanks.

 E The remains of the sea creatures turned into oil and natural gas after millions of years of heat and pressure.

 F Workers drill down through layers of rock to reach the oil and natural gas.

 C The animal remains were squashed down and buried deeper by more layers of mud and sand.

 A Small creatures died and fell onto the sea floor millions of years ago.

 D All the layers of mud and sand put pressure on the dead sea creatures and caused the temperature around them to rise to 90°C - 120°C.

 B These dead sea creatures were covered in mud and sand which prevented them from decaying.

6. Over millions of years, layers of sediment can be changed into sedimentary rocks due to-

F weathering and erosion

G compaction and cementation

H cooling and hardening

J erosion and deposition

Sedimentary Rocks and Fossil Fuels

Name: KEY

Evaluation, page 3

7. Tiny fragments of weathered rock will form sedimentary rocks if which of the following processes occur?
- A** They are exposed to temperatures great enough to melt them.
 - B** They are carried long distances by a fast-moving body of water.
 - C** They are buried and then compressed and cemented together.
 - D** They are continuously weathered until the fragments are microscopic.
8. Some students visited a science museum. They saw an exhibit that showed how plants that lived millions of years ago were buried and changed into material that we can burn for energy. This exhibit is most likely designed to teach about which of the following?
- F** How dinosaurs became extinct
 - G** The processes that create fossil fuels
 - H** How mountains are built up over time
 - J** How Earth's climate is slowly changing
9. Some students modeled the formation of sedimentary rocks by mixing together sand, small pebbles, glue, and a little bit of water. Then, they placed the mixture between some pieces of waxed paper and cardboard. The picture shows what they did next. What natural process does rolling the mixture with the rolling pin represent?



Sedimentary Rocks and Fossil Fuels

Name: KEY

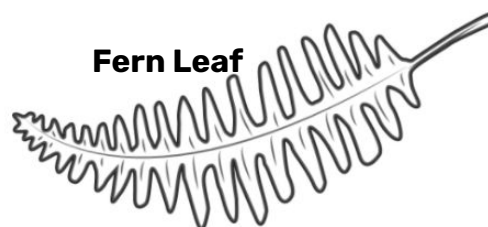
Evaluation, page 4

10. Some students listed the steps that lead to the formation of sedimentary rocks.

- A. A large rock breaks off the side of a rocky cliff.
- B. The rock is weathered and broken apart by wind, water, or ice.
- C. ???
- D. The sediments are deposited in layers in a new area.
- E. After millions of years, the sediments are compacted and cemented together to form a new rock.

What step did they leave out?

- F The sediments are eroded by wind, moving water, or glaciers.
 - G The sediments harden as they are blown around by the wind.
 - H Hot lava from volcanoes buries the sediments deep underground.
 - J Small pieces of rock become frozen in glaciers and icebergs.
11. Fossil fuels formed over millions of years because heat and pressure were applied to-
- A plant roots deep underground
 - B decomposed bacteria that sank in water
 - C molten rock in the Earth's crust
 - D the buried remains of organisms
12. Ferns grow in warm, moist habitats. Plants like ferns have been around for millions of years. For a fern to become coal, what must happen to it?
- F It must be buried in sediments.
 - G It must produce offspring.
 - H It must be eaten by an animal.
 - J It must decay completely.



Sedimentary Rocks and Fossil Fuels

Weathering, Erosion, Deposition Cards

<p>Flood water pounding against a canyon wall and wearing it down</p>	<p>Rain washing soil down the side of a hill</p>
<p>Layers of sediment dropping to the bottom of the ocean</p>	<p>A mudslide flowing down a steep hill</p>
<p>Glaciers scraping rocks across Earth's surface</p>	<p>Waves dropping sand on a beach</p>
<p>Dunes forming in the desert as the wind drops blowing sand in a new place</p>	<p>Deltas forming at the mouths of rivers</p>

Sedimentary Rocks and Fossil Fuels

Weathering, Erosion, Deposition Cards, p. 2

<p>Water freezing in the cracks of rocks and breaking them into smaller pieces</p>	<p>Wind blowing sand from one location to another</p>
<p>Wind banging rocks and sand against rocky mountain sides</p>	<p>Plant roots growing in the cracks of rocks making the cracks larger and larger</p>
<p>Mud and rocks being carried away by a fast-moving river</p>	<p>Rocks being smoothed out as they tumble along the bottom of a river</p>
<p>Ponds filling up with sediments and becoming marshes</p>	<p>Trenches forming in bare ground as flood waters move across it</p>

Sedimentary Rocks and Fossil Fuels

The Formation of Sedimentary Rocks and Fossil Fuels Cards

<p>About 300 million years ago, dead plants fell into swampy water on the land.</p>	<p>The dead plants were covered in mud and other sediments before they could decay.</p>
<p>More layers of mud and sediment squashed the dead plants and buried them deeper and deeper.</p>	<p>Millions of years of pressure and heat from the layers of sediment turned the plant remains into coal.</p>
<p>Millions of years ago, small sea creatures died and fell onto the floor of the oceans and seas.</p>	<p>These dead marine creatures were covered in mud and sand before they could decay.</p>
<p>More and more layers of mud and sand buried the sea creatures deeper and deeper.</p>	<p>Millions of years of heat and pressure from the layers of sediment turned the organisms into oil and natural gas.</p>

Sedimentary Rocks and Fossil Fuels

The Formation of Sedimentary Rocks and Fossil Fuels Cards, p. 2

<p>Rocks and rocky surfaces on the Earth's surface are weathered and broken apart.</p>	<p>Sediments and small rocks are eroded and deposited at the bottom of different bodies of water.</p>
<p>Over time, more and more layers are deposited, compacting the lower layers of sediment.</p>	<p>Melted minerals in the sediments cement, or glue, the particles together, forming a layer of rock.</p>

Sedimentary Rocks and Fossil Fuels

Name: _____

Engage: Let's Get WED!

Weathering, Erosion, and Deposition

WEATHERING

EROSION

DEPOSITION

Sedimentary Rocks and Fossil Fuels Name: _____

Explore: "Cereal" Actions and Reactions

1. What rock layer does the mixture of Cocoa Krispies™ and coffee grounds represent? _____
2. In your model, which layer is the oldest? The youngest? _____

3. What is compaction? _____

4. What is cementation? _____

5. What evidence do you see in this photograph that makes you think it is a layer of sedimentary rock?



- _____
- _____

6. The sentences below show the steps that lead to the formation of coal. However, they are in the wrong order. Put the steps in the correct order by writing an A, B, C, D, or E in the blank in front of the sentences. Start sequencing the steps with A. The final step will have an E.

_____ The dead plants were covered in mud and other sediments which prevented them from decaying.

_____ Further layers of mud and sediment compacted the dead plants and buried them deeper and deeper.

_____ About 300 million years ago, dead plants fell into swampy water.

_____ These layers put pressure on the dead plants and exposed them to very hot temperatures.

_____ After millions of years of pressure and heat, the plant remains changed into coal.

Sedimentary Rocks and Fossil Fuels Name: _____

Explain: Life Stories of Rocks and Fossil Fuels

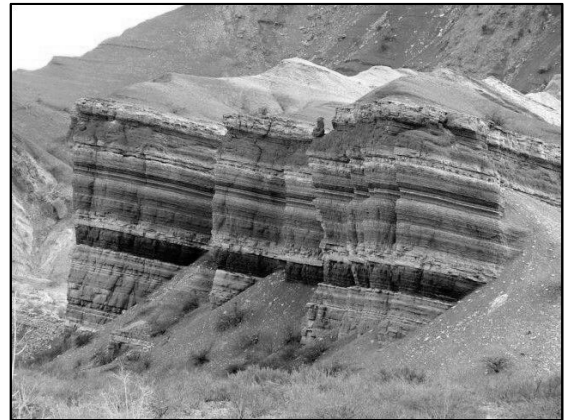
1. What is the correct order for the following statements to explain how sedimentary rocks are formed? _____
 - A. As more layers are deposited, the pressure on the bottom layers increases
 - B. The sediments are eroded mainly by wind, water, or ice.
 - C. The increased pressure pushes out water and compacts the sediments.
 - D. Rocks on the Earth's surface are weathered and broken apart into sediments.
 - E. More and more layers of sediment are deposited on top of each other.
 - F. Cementation occurs when the sediments are "glued" together by melted minerals that harden as they cool, forming sedimentary rocks.
2. The sentences below show the steps in the formation of petroleum and natural gas. Some terms have been left out of the sentences. Choose terms from the Term Bank to complete each step.

Term Bank		
decaying	natural gas	petroleum
sea creatures	sediments	temperature

- A. Millions of years ago, small _____ died and fell into the seabed.
- B. These dead creatures were covered in mud and sand which kept them from _____.
- C. Further layers of mud and _____ compacted the remains and buried them deeper and deeper.
- D. The pressure of these layers created extremely high _____.
- E. After millions of years of pressure and heat, the remains of the sea creatures turned into _____ and _____.

Sedimentary Rocks and Fossil Fuels Name: _____

Evaluation



- The layers of rock shown in this rock formation provide evidence that these rocks formed by the compacting and cementing together of sediments that were broken down from other rocks. Based on this evidence, which of the following is the most reasonable conclusion that can be drawn? The rock formation–

 - A** will not contain any fossils.
 - B** is most likely located in a cold climate.
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- A man walking on a beach picked up a rock. He observed that the rock was made up of several dark-colored and light-colored layers. He also saw a small fossil in the top of the rock. How was this type of rock most likely formed?

 - F** Lava from two different volcanoes cooled and hardened very quickly.
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Evaluation, page 2

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_____ The remains of the sea creatures turned into oil and natural gas after millions of years of heat and pressure.

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Evaluation, page 4

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