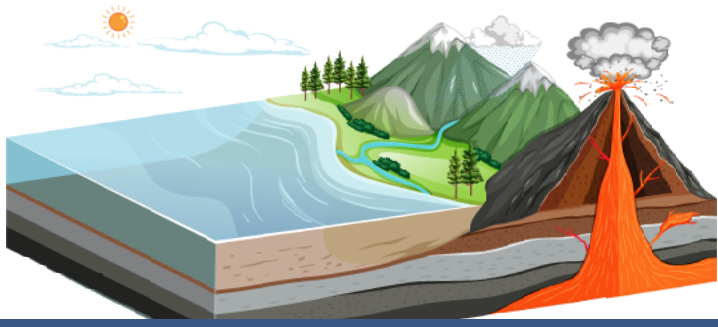
STEM Careers Coalition



CLASSROOM ACTIVITY

Under the Earth

OBJECTIVE

Students will combine what they learn about oil, water, and the rocks beneath Earth's surface to create a model of where petroleum can be found deep underground.

MATERIALS

- For the *Engage* demonstration:
  - Recycled two-liter bottle, one
  - Water, about 1.5 cups
  - Vegetable oil, about 1.5 cups
  - Food coloring, any color
- Rock Diagram, one copy for the instructor to project or share
- Under the Earth handout, one per student
- For pairs of students:
  - Four different colors of play dough or clay, one handful per color
  - Four toothpicks
  - Four sticky notes

ENGAGE

- Ask for three student volunteers to help you with a demonstration, and instruct the students to:
  - Fill the two-liter bottle about one-third full with water.
  - Fill another one-third of the bottle with oil.
  - Place three drops of food coloring into the bottle.
- Hold the bottle up and encourage the class to observe what is happening to the water, oil, and food coloring.
- Then place the top on the bottle, shake it, and instruct the class to continue observing what happens. It may be helpful to pass the bottle around so every student can get a closer look.

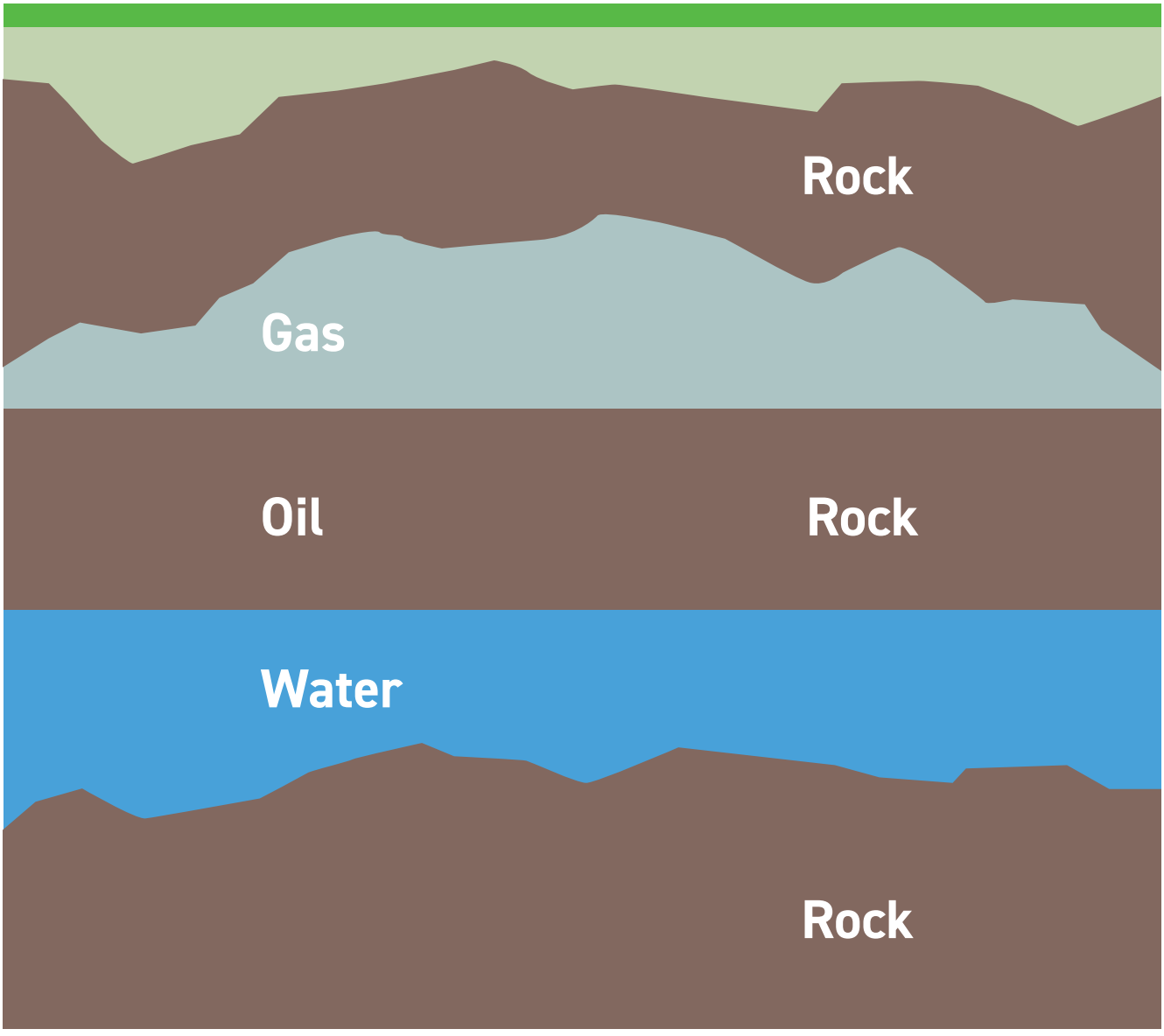
EXPLORE

- Project or share the Rock Diagram. Explain that this diagram shows where petroleum can be found underground.
    - If needed, take a moment to explain:
        - Petroleum is a fossil fuel.
        - It is called a fossil fuel because it forms deep underground from the remains of ancient marine organisms like algae and plants.
        - Humans can get petroleum by using drilling machines that go deep into the Earth.
        - Once petroleum is removed from the ground, it is sent to a refinery or industrial plant where it is cleaned and separated into different useable parts.
- Hold up the bottle from the demonstration again, and ask students to consider how their observations from the demonstration connect to this diagram of where petroleum is located in Earth's crust. They should be able to connect that the oil sits above the water in both circumstances, because oil is less dense.
- Then point to the rocks in the image, and explain that these also play a key role in where petroleum can be found underground. Explain that students will be spending the rest of class exploring the role that these three different rock types play in the formation of petroleum.
- Pass out one Under the Earth handout to each student, and divide students into pairs.
- Instruct them to read the handout and annotate (highlight or underline) for details that help them understand where these rocks are located. Explain that after this reading, they will be using clay to create a model of these rocks and petroleum under Earth's surface.

APPLY

- As students are completing their annotations, pass out four different colors of clay or play dough, four toothpicks, and four sticky notes to each pair.
- Challenge pairs to use their annotations to create a model that demonstrates where petroleum can be found underground. Explain that groups should:
    - Use one color of clay for the petroleum, and the three other colors for the source rock, reservoir rock, and cap rock.
    - Label each of the colors using the toothpicks and sticky notes so viewers can understand what they created.
- Wrap up the activity by encouraging students to walk around and observe the models that their peers created.
- Then conclude the session by acknowledging the differences between the groups' designs. Explain that all of these models could theoretically exist beneath the ground or sea, because Earth's crust looks different everywhere! For this reason, geologists need to have an idea of what is underground before they drill. To do this, they commonly use a technique called seismic imaging, which sends sound waves into the ground through the rock layers. They then study the waves that bounce back to the surface. Based on their speed, they are able to interpret what kinds of rocks are beneath the surface and where petroleum is likely to be found!

Under the Earth Image: Rock Diagram



Directions

As you read about the role that rocks play in creating petroleum, annotate (highlight or underline) details that help you understand *where* these rocks and petroleum can be found under Earth's surface.

There are three main types of rocks needed in order for petroleum to form and accumulate under the surface of the Earth:

Source Rocks

These are the rocks where petroleum is created.

Petroleum is formed from the remains of ancient marine organisms like algae and plants. When these marine organisms died, they sank to the floor of the ocean and were eventually buried under sand and other debris. When some of the ancient seas dried up over time, these marine remains stayed deep underground. Today, these marine remains can be found beneath the Earth's land and sea.

Source rocks are rocks found deep in the Earth that are still made of at least one percent of this organic sea matter. When heated enough from the temperature of Earth's core, this type of rock can create oil. When it is heated even more, it can create natural gas. Limestone is a rock you may have heard of that can be a source rock. Another main type of source rock is called shale, which is made mostly of clay.

Reservoir Rocks

After the source rocks create petroleum, pressure from the Earth pushes the petroleum upwards or sideways toward the reservoir rocks. Reservoir rocks are highly porous, which means they have holes or empty space where liquid can be stored. Reservoir rocks are also highly permeable, which means liquid can flow through them. The more porous a rock is, the more permeable it usually is! Petroleum can accumulate in reservoir rocks and be stored here.

Sandstone is a rock you may have heard of that is a reservoir rock. Another main type of reservoir rock is called carbonate.

Cap Rock

This is the final rock involved in the petroleum process. A cap rock is non-porous and impermeable. Impermeable rocks prevent liquid from flowing through them. Cap rocks surround the top or sides of reservoir rocks to help prevent oil from leaving the reservoir rock and escaping up to the surface of the Earth.

Cap rocks can be made out of shale (which can also be a source rock), rock salt, or a mineral called anhydrite.

Source: https://glossary.oilfield.slb.com/