

Topic

Oil traps

Source

Oil and Natural Gas, pages 24-25

Objective

Students will learn that some rocks are **porous**, which allows oil to collect in the rock.

Lesson Preparations

1. Collect materials from the list provided
2. Make copies of the lab packets, one for each group
3. Make copies of the exit questions, one for each student
4. Read through the "Teacher Information" section
5. Before the lesson begins, take the students outside to find 3 rocks each. Make sure that you put a size limit on the rocks so that they are not too small or too big.

Vocabulary Words

Oil traps - places where oil collects underground after seeping up through the surrounding rocks.

Permeability - the ability of liquids and gases to move through pore spaces in rocks

Porous - having pore spaces

Porosity - the ability of the rock to hold liquid and/or gas in its pores, much like water collects in a sponge.

National Science Education Standards

Process Standards
(Grades 3-6)

Earth/Space Science Content Standards
(Grade 3)

Physical Science Content Standards
(Grades 5-6)

Physical Science
(Grades K-4)

Materials

- 5 rocks collected by each group
- Additional samples of rock (ie. Limestone, sandstone, shale and granite)
- 1 eyedropper or pipette per group
- Markers
- Water
- Paper towels

Engagement

You have probably heard the expression “solid as a rock.” Do you think rocks are solid or do they have **porosity** (spaces)?

Teacher Demo: Use a small clear plastic cup full of marbles or rocks. Pose the following question: If I add water to this container, how much water do you predict it will hold? Measure 100ml of water in a graduated cylinder,. Start by pouring 20ml of the water into the cup. After observing the cup, have students decide how much water you should add. Continue this procedure until the cup is full of water (a tray may be needed for spills). How does this demonstrate porosity? Where does the water collect?

Do you think rocks could store things other than water? Under the right conditions, pores inside rocks may also hold oil and natural gas. The more porous the rock, the more oil and natural gas it can hold.

Exploration

Day 1

1. Split the students into groups of four. Assign each student a job from the list below.

Recorder: the student who writes down the information from the experiment

Reporter: the student who presents their group’s findings to the class

Material Getter: the student who gathers and puts away the materials for the experiment

Facilitator: the student who oversees the experiment and ensures their group stays on task.

2. Pass out one “Seeping Stones” lab packet to each group. Have students read through the lab instructions once.
3. Teacher says: “Today we are going to learn how some rocks are **porous**. They have pores that allow oil to collect in the rocks.”
4. Let the students begin their experiment. Monitor the students to make sure that everyone is participating.
5. Once the students have completed the experiment, have the students present their charts and graphs on what will happened if ten drops are dropped on each rock.
6. After the presentations, discuss with the students again the concept of porosity and the rocks ability to hold a liquid and/or gas.
7. Have the students individually complete the “Seeping Stones” exit questionnaire.

Explanation

Teacher Information

Some sedimentary rocks are **porous**, like a sponge. Tiny particles of sand are held together with rock "cement." Pressure, time and sediments create this natural type of "cement."

Oil and natural gas form from decayed plant and animal material. Over time, the many layers of sand and sediments are compacted into sedimentary rock. Tiny spaces, or pores, exist between the particles that enable the rock to hold a liquid. Oil and natural gas become trapped inside the pores. Many pores may be connected to form a pore passage. Rocks that contain pores and pore passages are identified as **porous** and permeable. **Permeability** is the ability of the rock to let liquids and gases flow through pore spaces in the rock. A rock may be porous, but if the pore spaces are not connected together, the liquids will not be able to pass through the rocks.

Trough drilling and pumping, oil and natural gas are extracted from the inside of porous rock. This is contrary to the belief that oil is formed in puddles or pools underground.

Read to students from *Oil and Natural Gas*, page 24

*When oil companies drill for oil, they look for **oil traps**. These are places where oil collects underground after seeping up through the surrounding rocks. This slow seepage, called migration, begins soon after liquid oil first forms in a "source" rock. Shales, rich in solid organic matter known as kerogen, are the most common type of source rock. The oil forms when the kerogen is altered by heat and pressure deep underground. As source rocks become buried even deeper over time, oil and gas may be squeezed out like water from a sponge and migrate through permeable rocks. These are rocks with tiny cracks through which fluids can seep. The oil is frequently mixed with water and, since oil floats on water, the oil tends to migrate upward. Sometimes, though, it comes up against impermeable rock, through which it cannot pass. Then it becomes trapped and slowly accumulates, forming a reservoir.*

Evaluation

1. Students should complete the exit questionnaire worksheet.

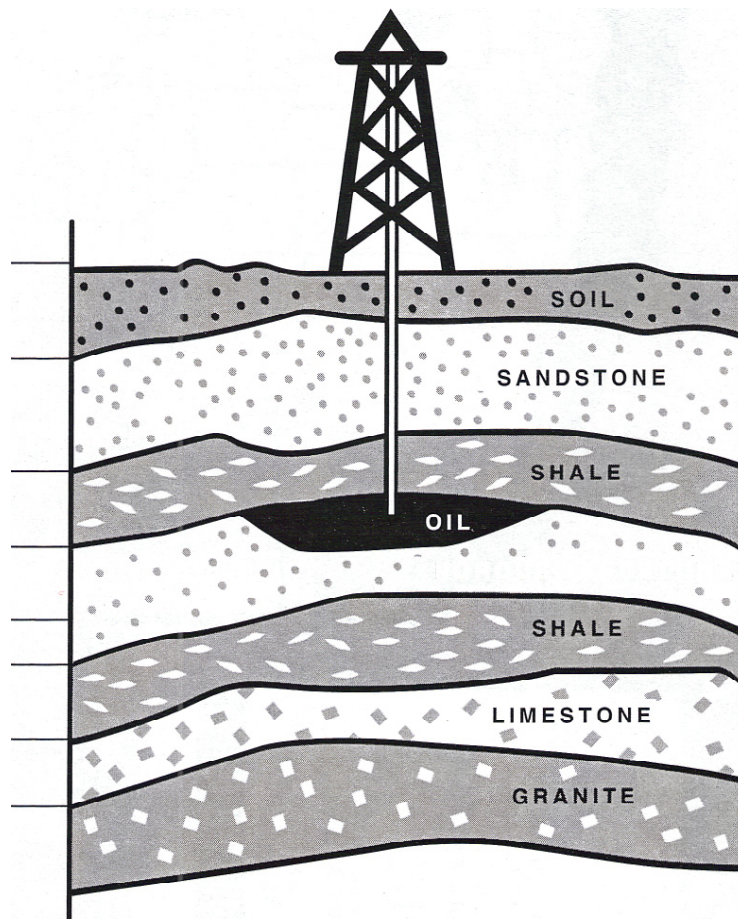
Elaboration

1. Construct a T-Chart of foods you eat that are porous and nonporous.

Example:

Porous	Nonporous
Cake	Flavored gelatin
Cornbread	Hard Candy
Rice Cake	Hershey Chocolate Bar

2. Design a texture collage of an oilfield cross-section for a bulletin board or poster display. Suggestions are given for textured layering, but your class may have additional solutions. Example:



Texture Suggestions

- Potting Soil = Soil
- Sand = Sandstone
- Pencil Shavings (coal colored) = Shale
- Sand = Porous Sandstone
- Oil = Coffee grounds
- Pencil Shavings = Shale
- Egg Shale = Limestone
- Ice Cream Salt = Granite

Exit Questionnaire Answer Key

- When oil companies drill for oil, they look for **oil traps**. These are places where oil collects underground after seeping up through the surrounding rocks.
- The more porous the rock, the more oil and natural gas it can hold.
 - True**
- Porosity**: the ability of the rock to hold liquid and/or gas in its pores, much like water collects in a _____.
 - Sponge**

Seeping Stones Experiment Lab Packet

Reporter _____

Recorder _____

Material Getter _____

Facilitator _____

Seeping Stones Experiment

Materials

- 5 rocks collected by each group
- Additional samples of rock (ie. Limestone, sandstone, shale and granite)
- 1 eyedropper or pipette
- Markers
- Water
- Paper towels

Instructions

1. Place the rocks that were collected outside in the middle of table. Decided as a group on the best 5 rocks. Place the remaining rocks that will not be used in a container at the materials workstation.
2. The material getter should collect the following rocks from the materials workstation: sandstone, limestone, shale and granite. Collect paper towels, a cup of water, pipette, and a marker as well. The group should now have a total of 9 rocks and all the materials needed to begin the experiment.
3. Using the marker, place a number (1-5) on the rocks that were found outside. This is so we can identify the rocks through out the experiment.
4. Fill in the group's predictions of what they think will happen when five drops of water are dropped on each rock.

Predictions

Rock Samples	Will the rock absorb the water?	Will the rock repel the water?
Rock #1		
Rock #2		
Rock #3		
Rock #4		
Rock #5		
Sandstone		
Limestone		
Shale		
Granite		

5. Conduct the experiment. Place the rocks on the paper towels; carefully drop 5 drops of water on each rock.

Results

Rock Samples	Did the rock absorb the water?	Did the rock repel the water?
Rock #1		
Rock #2		
Rock #3		
Rock #4		
Rock #5		
Sandstone		
Limestone		
Shale		
Granite		

Record what happens to the water.

6. Select and sort the rocks that "drank" or absorbed the water.
7. What happened to the water that was not absorbed into the rocks? Why do you think some rocks absorbed the water while others repelled it?

8. Where do you think the water went if it "disappeared?"

9. Using collected data, hypothesize what will happen if ten drops of water are used. Make your own chart and test your hypothesis.

10. Chart and graph the number of water drops absorbed by each rock. Be prepared to share your findings with the class.

Name: _____

Questions

1. When oil companies drill for oil, they look for _____ . These are places where oil collects underground after seeping up through the surrounding rocks.
2. The more porous the rock, the more oil and natural gas it can hold.
 - a. True
 - b. False
3. **Porosity:** the ability of the rock to hold liquid and/or gas in its pores, much like water collects in a _____.
 - a. Cup
 - b. Sponge
 - c. Lake