Title: What is Porous, Exactly?

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Course: Science

Grade Level: K-1

Duration: 3 days

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

Summary of Lesson:
The students will predict and experiment using 9 different types of rocks to discover which rocks are porous and which ones are not porous. Through the understanding of the key concept, the students will discover that oil and natural gas are absorbed in the rock and become trapped inside the pores.

Standards: CCSS, Arkansas State Frameworks, Next Generation Science Standards, Other

Code:	Standard:
PS.6.K.1	Demonstrate spatial relationships, including but not limited to • over • under • left • right
ESS.8.K.4	Identify ways natural and man-made materials can be reused or recycled
ESS.8.1.2	Identify common uses of Earth's resources

Teacher Excellence and Support System:
1a: Demonstrating knowledge of content and pedagogy, 1c: Setting instructional outcomes, 1d: Demonstrating knowledge of resources, 1e: Designing coherent instruction, 1f: Designing student assessments, 3b: Using questioning/prompts and discussion, 3c: Engaging students in learning, 3d: Using assessment in instruction,

Instructional Strategies and Practices:
Checking for understanding, t-chart, grouping students, hands-on activities, cooperative learning groups, probing questions, modeling, student presentations, partners, experimenting,

Bloom's Level(s): (*Highest Only)*
Creating

Materials and Resources:

Day 1

- Sprout and Grow Window or clear cup with marbles
- 100 ml beaker with water
- Tray to catch water from cup and marbles
- Porous and non-porous rocks

Day 2:

- 5 rocks collected by each group (3 per student)
- Additional samples of sedimentary rock (i.e. Limestone, sandstone, shale and granite) http://scienceenterprises.com/browseproducts/Sedimentary-Rock-Study-Kit.HTML $15.95
- 1 eyedropper or pipette per group
- Markers
- Water
- Paper towels

Day 3:

- 1 package of chocolate cream cookies
- 1 gallon of vanilla ice cream
- Squeeze fudge ice cream topping or drink mix
- 1 bag of crushed peanuts
- 1 can of whipped cream
- Sprinkles
- Graded cylinder

Formative Assessment:

Exploration and Prediction Handout (See Student Handout section)

- Seeping Stones Prediction/Result Chart
- Sort By Porous and Non-porous
- Porous/Non-porous Foods We Eat
- LaPorous Ice Cream Sundae

Teaching Notes:

Lesson Preparations

1. Collect materials for each day from the lists provided.
2. Make copies of the lab sheets (See Student Handout) One for each student
   - Seeping Stones Prediction/Result Chart
   - Porous/Non-porous Foods We Eat
   - Sort By Porous and Non-porous
   - LaPorous Ice Cream Sundae
3. Read through the "Teacher Background" section below prior to the lesson.
4. 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.

5. If you do not have accounts already for Brainpop.com or BrainpopJr.com, ask librarian if she can purchase the license.

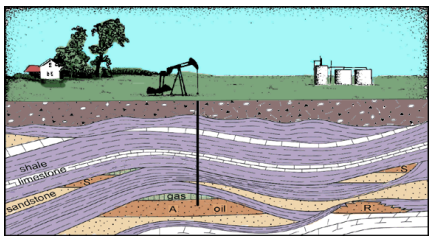
Vocabulary Words

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 a liquid and/or gas to collect in pores of rocks much like water collects in a sponge.

Teacher Background:

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 liquids and gases to move through pore spaces in rocks. 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. Through 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.

Student Activity:



Day 1: Engagement

Materials:

Sprout and Grow Window or clear cup with marbles
100 ml beaker with water
Tray to catch water from cup and marbles
Porous and non-porous rocks

Probing Question:

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 Sprout and Grow Window (shown to the right) or clear plastic cup full of marbles or rocks.

Pose the following questions:

1. If water is added 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 should be added.
    - Continue this procedure until the cup is full of water (a tray may be needed for spills).

2. How does this demonstrate porosity? Where does the water collect?
   Possible answers: The water soaks into the soil (Sprout and Grow Window) or moves into the spaces between the marbles (cup with marbles). The water collects in the small spaces within the soil (or between the marbles.)

3. Do you think rocks could store things other than water?
   Possible answer: 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

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 Manager: 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. Teacher says: "Today we are going to learn that some rocks are **porous**. They have pores that allow oil to collect in the rocks." Show a rock that is porous and one that is not porous.

3. Let the students begin their exploration and prediction charts. Once the students have completed the chart, have the students present as a group the prediction charts: Pose the question: "Will the rock drink the water?"

4. After the presentations, discuss with the students again the concept of porosity and the rocks ability to hold a liquid and/or gas.

5. Show YouTube clips**:** http://www.youtube.com/watch?v=w9Vj0jjd4ms, http://www.youtube.com/watch?v=trAsnAC9D6k

Day 2: Seeping Stones Experiment

Materials

- 5 rocks collected by each group
- Additional samples of sedimentary rock (i.e., limestone, sandstone, shale and granite)
- 1 eyedropper or pipette
- Markers
- Water
- Paper towels
- Prediction Sheet with Experiment Sheet on back

Instructions

1. Place the rocks that were collected outside in the middle of table. As a group, decide on the best 5 rocks and leave those in the middle of table. Place the rocks that will not be used in a container at the materials workstation.

2. The Material Manager 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 students can identify the rocks throughout the experiment.

4. Fill in the group's predictions on the Seeping Stones Prediction/Result Chart handout (See Student Handout) Predict: what they think will happen when five drops of water are dropped on each rock. Use a ☺ if they believe the rock will absorb water; use a ☹ if they believe the rock will not absorb water.
5. Conduct the experiment: place the rocks on the paper towels; carefully drop 5 drops of water on each rock.

After Experiment

6. Sort the rocks on the Student Handout "Sort by Porous and Non-porous" On the smiley face place the rocks that "drank" or absorbed the water and place a ☺ beside that number in the Result section of the handout. Place the ones that did not "drink" the water on the frowny face and place a ☹ beside that number in the Result section.
7. With a buddy the students will complete the following:

    - Partner 1: Ask and answer a question about the experiment
    - Partner 2: Decide if the answer is correct using a thumbs up or thumbs down.
    - Partner 1: Defend your answer by thinking about what you have learned today.
    - Then Partner 2: Ask and answer a question. Continue until time is called by the teacher.

Day 3: Elaboration

Materials

- 1 package of chocolate cream cookies
- 1 gallon of vanilla ice cream
- Squeeze fudge ice cream topping or drink mix
- 1 bag of crushed peanuts
- 1 can of whipped cream
- Sprinkles
- Graded cylinder

1. Have students work in groups of four to construct a t-chart (See Student Handout) of foods they eat that are porous and nonporous. Non-writers as well as kindergarten students may look in cooking magazines for pictures.

Example:

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

2. Using the ingredients from Day 3 materials list, have students design a LaPorous Ice Cream Sundae that models an oil well and soil layers. (See Student Handout)

- As students are constructing the LaPorous Sundae discuss why the ingredients represent the layers.
- Think of another ingredient that could also represent each layer and list these on the t-chart begun earlier.

See Student Handouts