



<b>Title:</b> Rocks and Sponges			
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<b>Course:</b> Science, Computer Science, Math		<b>Duration:</b> One class period	
<b>Grade Level:</b> 7-8			
<b>Objective:</b> Students will learn how some rocks are porous and/or permeable.			
<b>Summary of Lesson:</b> Students will determine porosity and permeability rates for sand, small gravel, large gravel, and clay.			
<b>Standards: Arkansas State Frameworks</b>			
<b>Subject:</b>	<b>Grade Level(s):</b>	<b>Code:</b>	<b>Standard:</b>
Science	7-8	7-ESS2-1	Develop a model to describe the cycling of Earth's materials and flow of energy that drives this process.
		7-ESS2-2	Construct an explanation based on evidence for how geosciences processes have changed Earth's surface at varying time and spatial scales.
		7-ESS3-1	Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geosciences processes.
		NS.1.8.1	Justify conclusions based on appropriate and unbiased observations.
		NS.1.8.3	Formulate a testable problem using experimental design.
		NS.1.8.5	Analyze scientific data in data tables, circle graphs, and line graphs.



Computer Science	7-8	D.5.7.2 D.5.8.2	Collect data to be used for quality analysis.
		D.5.7.3 D.5.8.3	Evaluate the most effective ways to collect, arrange, and visually represent data.
Math	8	AR.Math.Content.8.EE.B.5	<ul style="list-style-type: none"> <li>• Graph proportional relationships, interpreting the unit rate as the slope of the graph.</li> <li>• Compare two different proportional relationships represented in different ways (graphs, tables, equations)</li> </ul>

**Teacher Excellence and Support System:**

Managing Classroom Procedures, Organizing Physical Space, Communicating with Students, Engaging Students in Learning, Using Assessment in Instruction

**Instructional Strategies and Practices:** Identifying Similarities and Differences, Cooperative Learning, Setting Objectives and Providing Feedback, Generating and Testing Hypotheses, Experiments, Technology, Visuals

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

Analyzing

**Materials and Resources:**

Materials for each group:

- 350 mL each: clay, sand, small gravel, large gravel
- 4 beakers
- 1 graduated cylinder
- 400 mL water
- Porosity/Permeability Data Table
- Stop watch

**Formative Assessment:**

Self and peer assessment, teacher observation and feedback

**Teaching Notes:**

These raw materials are easily accessible. Asking students to bring them to class increases their motivation to learn; however, they can also be purchased in small quantities from building supply stores.

**Student Activity:**

1. **Background:** Oil and natural gas form from decayed plant and animals that were covered with sediments. Over a long period of time, these sediments were compacted and became sedimentary rocks with tiny pores between the particles. The pores allow the rocks to hold oil and natural gas and are called porous. If the pores allow liquids and gases to move, they are permeable. Some sedimentary rocks can be porous, but not permeable. Some rocks are good at holding oil and are called reservoir rocks, while others don't let oil pass through them and are called trap rocks.
2. The class should be divided into groups of 4-6 students. Each group needs 350 mL of sand, small gravel, large gravel and clay. Each group should also have 4 beakers, one graduated cylinder and copies of the Porosity/Permeability Data Table (See Student Handout section) and a stop watch.
3. The students will measure 350 mL of sand in one beaker, 350 mL of small gravel in another beaker, 350 mL of large gravel in another beaker and 350 mL of clay in one beaker. The graduated cylinder needs to be filled to 100 mL of water.
4. While water is poured from the cylinder into each beaker, only until it reaches the top, a time-keeper will use the stop watch to determine how long it takes for water to reach the bottom of the beaker. Each student will complete the Data Table for analysis.
5. Performance Assessment: Create a pie graph comparing the percentage of pore space for each material and a line graph comparing the permeability rate for each material.

**See Student Handout: Printable copies are available at**

<http://www.arkansasenergyrocks.com/educators/lesson-plans-k-8/>



**Student Handout**  
**Porosity and Permeability Data Table**

Type of Material	Volume of Water (mL) in beaker*	Volume of Material (mL)	% of Pore Space**	Permeability Time
Sand		350 mL		
Small gravel		350 mL		
Large gravel		350 mL		
Clay		350 mL		

\*100 mL – amount remaining in graduated cylinder = Volume of water in beaker

\*\*Volume of water (mL) poured into beaker\_ x 100 = % of Pore Space  
Volume of material (mL) in beaker

1. List materials in order of least porosity to greatest porosity.
2. Were any materials porous, but not permeable? Explain.
3. Performance Assessment: Create a pie graph using computer or iPad comparing the percentage of pore space for each material and a line graph comparing the permeability rate for each material.