Title:	Oil NOT In Rocks
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Course:	**Physical Science, Earth Science, Chemistry**
Grade:	9-12
Duration:	One class period

Objective:
Students will learn that some rocks, like shale, go through a change and instead of acting like a sponge; they become a new rock that has properties that prevent oil from penetrating.

Summary of Lesson:
Students will create a model that demonstrates how particles in shale change to create slate.

Arkansas Standards:

CODE	GRADE	SLE	STANDARD
Physical Science	9-12	PSI-ESS1-5	Evaluate evidence of the past and current movements of continental and oceanic crust and the theory of plate tectonics to explain the ages of crustal rocks.
		PSI3-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
Earth Science	9-12	ES-ESS2-2	Analyze geoscience data to make the claim that one change to Earth's surface can create feedbacks that cause changes to other Earth systems
Chemistry	9-12	CI-PS1-4	Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy.
	9-12	CI-PS1-2	Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties

Teacher Excellence Support System (TESS):
3b: Using questioning/prompts and discussion, 3d: Using assessment in instruction

Instructional Strategies and Practices
Experiment, Lab, Model, Visualization and Guided Imagery

Bloom's Level: Highest Level Only
Analyzing and Evaluating

Materials and Resources:
- Modeling clay
- Plastic knife
- Sequins or small beads

Formative Assessment:
Exit Slip:
If you find a foliated metamorphic rock that has grains running in different directions, how could you explain this phenomenon?

Student Activity

Definitions:

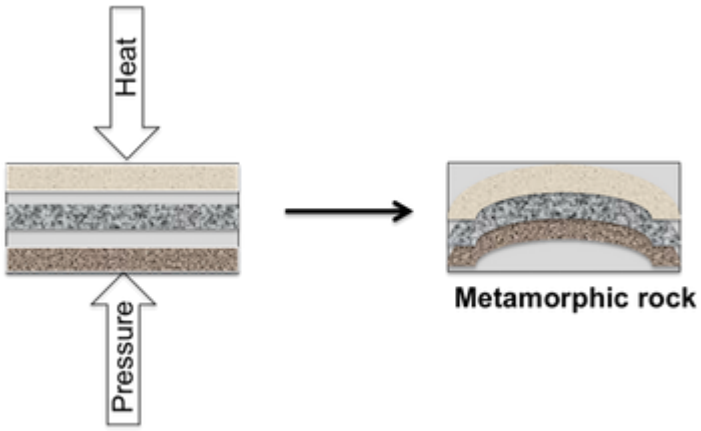
Slate: a fine-grained, **foliated**, homogeneous **metamorphic rock** derived from an original **shale**-type sedimentary **rock** composed of clay or volcanic ash through low-grade regional metamorphism. It is the finest grained **foliated metamorphic rock**.

Shale: is a fine-grained sedimentary rock that forms from the compaction of silt and clay-size mineral particles that we commonly call "mud." This composition places shale in a category of sedimentary rocks known as "mudstones." Shale is distinguished from other mudstones because it is fissile and laminated. "Laminated" means that the rock is made up of many thin layers. "Fissile" means that the rock readily splits into thin pieces along the laminations.

Foliation: caused by the re-alignment of minerals when they are subjected to high pressure and temperature. Individual minerals align themselves perpendicular to the stress field such that their long axes are in the direction of these planes (which may look like the cleavage planes of minerals).

Background:

Throughout nature we can find a variety of rocks. They come in different colors, sizes, and even shapes. Since a rock is made from one or several minerals, scientists can classify it by the way it's formed. In particular, one type of rock is formed when older rocks are exposed to intense heat and pressure. We call this type of rock a metamorphic rock.



Formation of a metamorphic rock

When a rock undergoes this type of stress, the minerals in the rock begin to reorient themselves. As the minerals continue to move around, the rock will change or undergo metamorphosis. You might have seen a metamorphic rock before. Marble is an example of a metamorphic rock. As the minerals in rocks reorient during metamorphosis, a preferred orientation might be favored. The ability to describe this preferred orientation is called foliation.

Procedure:

Divide students into groups and distribute lab materials:

- Modeling clay
- Plastic knife
- Sequins or small beads

Student Instructions:

1. Flatten the clay into a layer about 1 cm thick. Sprinkle the sequins on top of the clay.
2. Roll the clay toward the center to make a ball.
3. Use the plastic knife to cut the ball in half. Observe the position and location of the sequins that were inside the ball.
4. Put the ball back together and smash with cardboard to flatten the ball to about 2 cm thick.
5. Using the plastic knife, carefully slice the clay in several pieces. Document the location of the sequins.
6. Why do you think the mineral grains (sequins) are foliated (in rows)?

7. Explain how the foliation would create a new rock that would not act as a sponge and hold oil?

Student Handouts: Printable copies of the handouts are available at https://arkansasenergyrocks.com/educators/lesson-plans-9-12

Oil NOT In Rocks
Student Handout
Exit Slip

If you find a foliated metamorphic rock that has grains running in different directions, how could you explain this phenomenon?

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