



Fish, Fossils and Fuel

Formation of Oil

Time – approximately 2 to 3 days

Adapted from Fossils to Fuel— An Elementary Earth Science Curriculum, developed for the Oklahoma Energy Resources Board, an agency of the State of Oklahoma

GRADE LEVEL: 3, 5, 6 and 7

SUBJECT: Science, Math

WONDER WHY...

Do you ever wonder why oil and natural gas are referred to as “fossil fuels”? Do you think oil and natural gas can be made from old fossils? How long do you think it takes fossil fuels to form?

CONCEPT

Oil is formed from the remains of microscopic plants and animals found in the ocean.

TEACHER INFORMATION

Additional background information:

Web sites may change over time. If the websites below are unavailable use key terms to look up appropriate resources to provide background information.

Formation of fossil fuels:

<http://www.youtube.com/watch?v=GsggkxbCeXs>

<http://www.youtube.com/watch?v=0PrSZMOCnWU>

Fossils:

<http://www.youtube.com/watch?v=3rkGu0BItKM>

http://www.youtube.com/watch?v=c_DCP4cLVNg

<http://www.discoveringfossils.co.uk/whatisafossil.htm>

Part of what is Arkansas today was under ancient seas millions of years ago. Geologists know this because many rock layers containing fossil remains of marine life have been found throughout the state. Millions of small marine plants and animals lived in the seas and oceans, eventually died and then settled on the ocean floor. The dead plants and animals were often buried by sand and other sediment, much like the bread fossil. Heat from beneath the earth’s crust “cooked” the plant and animal remains forming oil and natural gas deposits within the rock layers. This is why oil that is produced in the sedimentary rock is called a “fossil fuel.”



Today, oil and natural gas companies drill holes in the subsurface rock looking for crude oil and natural gas deposits. These rock formations are sometimes in depths of five miles or more. As oil and natural gas are being depleted from existing wells, geologists are constantly searching for undiscovered sources of petroleum. Many scientists believe that oil and natural gas are possibly forming under the ocean floor. However, the organic matter will not form petroleum until millions of years have passed. That is why oil and natural gas are considered to be non-renewable energy resources.

MATERIALS

- Fish Fossil and Fuels **Student Handout 1**
- Fish Fossil and Fuels **Conclusion Student Handout 2**
- 3 slices of bread (one slice each of **white**, **wheat** and **rye**) per group
- 6 Gummy fish candy or colored fish crackers (or other gummy sea animal or plant) per group
- Heavy books
- Paper towels
- Magnifying lens (at least one per group)
- Clear drinking straws or glass tubing (from a science lab)

DISCOVERY PROCEDURE - TEACHER GUIDED

1. To introduce the activity explain that you will make a model of a fossil today and show how the process of fossil fuel formation begins.
2. Divide the students into groups. Place a paper towel and 6 gummy fish on each group's table. Give each group 3 slices of bread (one each of **rye**, **white** and **wheat** bread). Instruct students to carefully pull the crust from the bread so the layers of the model can be seen. Make small crumbs of the crust and save for step 2.
3. Ask the students, "What eventually happens to the microscopic ocean animals and plants when they die?" Place a piece of white bread on top of the paper towel. Put 3 gummy fish (to represent the microscopic plants and animals) and the crumbs of the bread crust (to represent the sediment) on the bread.
4. As the plants and animals lay lifeless on the bottom of the ocean, the currents deposit sediments on top of the dead marine life. Place a piece of rye bread on top of the white bread layer
5. As millions of years passed, what continued to cover the dead plants and animals?
(Possible answer: *More sand and sediment were deposited by wind and ocean currents.*)
Add another layer of gummy fish and bread crust on top of the rye bread.
6. Now cover the other layers with the wheat bread. Fold the paper towel to cover your bread fossil.



7. Something is still missing to help our fish fossilize. What else could it be?
(*Pressure*)
What could we do to put pressure on the “rock layers” of our “bread fossil”?
(*Place textbooks or other heavy objects on top of the bread to simulate pressure. Leave your model one or two days to represent the passage of millions of years.*)
8. After one or two days, observe the “bread fossil.” Use a clear straw or glass tubing to extract several core samples from your model. Remove the core samples or observe the layers through the straw or tubing. How many extractions were “dry holes” (no evidence of gummy fish) and in how many did you “strike oil” (traces of gummy fish)? On a separate sheet, record your observations and use the data to develop a bar graph to show successful and unsuccessful drilling attempts. Include illustrations of the fossil model, the extracted sample of a “dry hole” and an “oil strike.” Label the parts of the core samples (straw drilling).
9. Try to separate the layers of the bread. Why do you think the layers are difficult to separate?
(*Possible answer: The pressure has fused the layers together.*)
10. Try to extract the fish. Can you identify the mold (impression in the bread) and the cast (gummy) fossil?

One type of fossil forms when an organism dies and its body is covered by layers of sediment. As time passes, the organism itself, particularly when composed primarily of softer materials, is eroded and carried away, leaving a negative imprint of its body. This type of fossil is called a mold.

A cast fossil forms when a mold fossil is filled with some form of mineral, usually through the seepage of water depositing the minerals within the mold. In time, the mold is filled and the materials deposited harden, creating a replica of the original fossil. This is called a cast fossil.
11. Compare the colored residue of the gummy fish in the bread fossil to the remains of the plants and animals that seep into the rock. The residue left by the gummy fish represents oil deposits left behind by dead ocean plants and animals. Over millions of years, these remains are pressurized to become oil and natural gas deposits.
11. Summarize fossil formation with one of the **videos** listed above in the background section or one of your own choosing.

CONCEPT FORMATION

1. As we journey back in time, let’s think about how we can recreate the historical formation of fossils. What eventually happens to the sea animals and plants when they die?



(Possible answer: They fall to the ocean floor. As the plants and animals lay lifeless on the bottom of the ocean, the currents deposit sediments on top of the dead marine life. As these layers increase, the pressure also increases, creating fossils and fossil fuels.)

2. What has changed about our “bread fossils”? What happened to the layers?

(Possible answer: The gummy fish left a visible impression in the bread and layers began to harden.)

VOCABULARY

Fossil—the remains or imprint of marine life embedded and preserved in rock layers deep in the earth

Fossil Fuels—oil and natural gas created from the pressure, heat and plant/animal remains in rock layers deep in the earth (the liquid form of fossil fuel is crude oil, the gas form of fossil fuel is natural gas and the solid form of fossil fuel is coal)

Sediment—sand-like material and debris that settle or is deposited by water, wind or glaciers over time

Microscopic— so small as to be visible only with a microscope

EXPANSION/ APPLICATION

- Compare actual fossils (collected by teacher and/or students) and classify by properties.
- In your journal, record the experience of the life of a fish until it is found as a fossil.

ENRICHMENT

Explore the websites below to learn more about Arkansas Geology. If these websites are no longer available search Arkansas Geological Survey web site to learn more about Arkansas fossils:

<https://www.geology.arkansas.gov/geology/fossils.html> create web archive

http://www.geology.ar.gov/pdf/Fossil_Poster.pdf

http://www.geology.ar.gov/geology/vertebrate_fossils.htm

http://www.geology.ar.gov/geology/invertebrate_fossils.htm

<http://www.geology.ar.gov/geology/pseudofossils.htm>

<http://www.geology.ar.gov/pdf/Collecting%20Fossils%20in%20Arkansas.pdf>



STUDENT HANDOUTS – (See Arkansas Energy Rocks web site for **printable Word documents**. Teacher’s answer keys follow.)

Name _____ **Date** _____

Fish, Fossils & Fuel Student Handout 1 Teacher Key

WONDER WHY...

Do you ever wonder why oil and natural gas are referred to as “fossil fuels”? Do you think oil and natural gas can be made from old fossils? How long do you think it takes fossil fuels to form?

MATERIALS

- 3 slices of bread (one slice of white, wheat and rye)
- Gummy fish candy or crackers
- Heavy books
- Paper towels
- Magnifying lens
- Clear drinking straws

PROCEDURE

1. Carefully pull the crust from each slice of bread. Crumble the crusts in to very fine crumbs.
2. What eventually happens to microscopic ocean animals and plants when they die?
(Possible answer: They fall to the ocean floor.)

To illustrate, place the white bread on the paper towel. Put 3 gummy fish and bread crumbs on the bread.

3. As the plants and animals lay lifeless on the bottom of the ocean, the currents deposit sediments on top of the dead marine life. Place the rye bread on top of the white bread layer.
4. As millions of years passed, what continued to cover the dead plants and animals?
(Possible answer: Sediment)
To illustrate, add another layer of gummy fish and bread crust on top of the bread. Ocean and wind currents deposit more sand and sediment over the dead plants and animals.



5. Cover the other layers with the wheat bread. Fold the paper towel to cover your bread fossil.
6. Place textbooks or other heavy objects on top of the bread to simulate pressure. Leave your model one or two days to represent the passage of millions of years.
7. After one or two days, observe the "bread fossil." Use a clear straw or glass tubing to extract several core samples from your model. Remove the core samples or observe the layers through the straw or tubing. How many extractions were "dry holes" (no evidence of gummy fish) and in how many did you "strike oil" (traces of gummy fish)? On a separate sheet, record your observations and use the data to develop a bar graph to show successful and unsuccessful drilling attempts. Include illustrations of the fossil model, the extracted sample of a "dry hole" and an "oil strike." Label the parts of the core sample (straw drilling).
8. Try to separate the layers of bread. Why do you think the layers are difficult to separate?
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9. Try to extract the fish. Can you identify the mold (impression in the bread) and the cast (gummy fossil)?
(Possible answer: Time and pressure fuse the layers and make them hard to separate.)

JOURNAL

Compare the colored residue of the gummy fish in the bread to the remains of the plants and animals that seep into the rock.

(Answers will vary.)

Vocabulary

Fossil – *the remains or imprint of marine life embedded and preserved in rock layers deep in the earth*

Fossil Fuels – *oil and natural gas created from the pressure, heat and plant/animal remains in rock layers deep in the earth*

Sediment – *sand-like material and debris that settle or is deposited by water, wind or glaciers over time*

Microscopic – *so small as to be visible only with a microscope*



Name _____ Date _____

**Fish, Fossils & Fuel
Conclusion
Student Handout 2
Teacher Key**

1. What are some of the most common types of fossils found in Arkansas?
(Possible answer: Most fossils in Arkansas are marine invertebrates such as echinoderms, mollusks, brachiopods, bryozoan and coral.)
2. After a few days, how did the layers in your bread fossil change?
(Possible answer: The gummy fish left a visible impression in the bread and layers began to harden.)
3. Why did they change?
(Possible answer: It changed because of the pressure of the books and the time that went by.)
1. When you took your core samples, did you strike oil (pieces of gummy fish) or drill a dry hole (no evidence of gummy fish)? Use a bar graph to record your attempts to find oil.
5. Based on what you learned in this activity, why do you think the search for oil and natural gas is so difficult and expensive?
(Answers will)