

# Oil and Natural Gas in Arkansas— Fossil Fuel Resources from the Natural State

## Middle School Lesson Plan 1 : Oil and Natural Gas and How They Form

<b>Science Grades 6-8</b>		<b>3 Class Periods (3 Hours)</b>	
<b>Arkansas State Frameworks</b>		<b>Next Generation Science Standards</b>	
<b>Code</b>	<b>Standard</b>	<b>Code</b>	
NS.1.7.1 NS.1.5.4 PS.5.6.7 PS.7.7.1 ESS.9.5.2	Interpret evidence based on observations Interpret scientific data using data tables/charts Identifying characteristics of chemical changes Identify natural resources used to supply energy needs Analyze fossil record evidence about plant and animals that lived long ago	MS-ESS2.A MS-ESS3.A MS-ESS1.C	Earth's Materials and Systems Natural Resources The History of Planet Earth
<b>Instructional Strategies</b>		<b>Blooms Level</b>	
Cooperative Learning Generating and Testing Hypothesis Brainstorming and Discussion Drawing Word Web Labs		Analyzing Understanding Remembering	
<b>Materials</b>		<b>Resources</b>	
Specific Materials are listed for each Activity/Lab in the Lesson.		Specific Resources are listed for each Activity/Lab in the Lesson.	
<b>Formative Assessment</b>			
Comprehension and Interpretation/Analysis Questions accompany/follow each Activity/Lab.			

## Teacher Notes:

Crude oil and natural gas or petroleum, along with coal, are classified as fossil fuels. What does this mean? A fuel is anything that can be consumed to produce energy. Fossils are the remains of a once living thing. Fossil fuels, therefore, are materials that formed from the remains of once living organisms that can be converted into energy through the process of combustion. Formation of fossil fuels requires processes that require millions of years to complete so are considered a nonrenewable resource. The general sequence of this process includes: death, deposition, burial, decay, heat/pressure, and accumulation. Coal forms from the remains of plants that lived in swampy environments. Oil and natural gas form primarily from the remains of microscopic animals and plants that lived in the water of oceans, lakes, and rivers. Heat and pressure due to burial under many hundreds to thousands of feet of sediment cause the organic material to undergo changes that convert them first to kerogen then to coal, oil, or natural gas. Crude oil is a complex liquid composed of several different hydrocarbon compounds. Natural gas is primarily methane a simple hydrocarbon with the chemical formula  $\text{CH}_4$ . There may also be ethane ( $\text{C}_2\text{H}_6$ ), propane ( $\text{C}_3\text{H}_8$ ) and butane ( $\text{C}_4\text{H}_{10}$ ) found with the methane.

## Student Activities:

- Activity 1—What I Already Know
- Activity 2—What Are Fossil Fuels
- Lab 1—Fossils
- Lab 2—Organic Matter and Natural Gas

## Pre-assessment Questions:

These questions can serve as a means of opening the discussion of oil and natural gas as well as determine the level of knowledge and conceptions that the students already have.

1. What are oil and natural gas?
2. Where do they come from?
3. What are they used for?

## **Background Information:**

This publication is a great introduction to the process of locating and extracting oil and natural gas deposits. It is written for the general public and is highly recommended for any teacher who needs background information on the oil and gas industry.

Curtis, Doris et al. How to try to Find an Oil Field. Tulsa, Oklahoma. PennWell Publishing. 1981.

The following websites are good places to present background/introductory information to the students.

Energizing Life: The Story of Oil and Natural Gas (Introductory video)

<http://www.api.org/story/index.html>

Introductory animations on oil and natural gas and how they form

<http://www.adventuresinenergy.org/What-are-Oil-and-Natural-Gas/index.html>

Animation about oil formation.

[http://www.hk-phy.org/energy/power/source\\_phy/flash/formation\\_e.html](http://www.hk-phy.org/energy/power/source_phy/flash/formation_e.html)

# Student Handout 1

Name _____
Date _____
Class _____

## Lesson 1—Oil and Natural Gas and How They Form Activity 1—What I Already Know

### Instructions:

Brainstorm what you already know about fossil fuels and create a web graphic organizer.

FOSSIL FUELS

# Student Handout 2

Name _____
Date _____
Class _____

## Lesson 1—Oil and Natural Gas and How They Form Activity 2—Fossil Fuels

### Instructions:

Use the following websites and answer the following questions.

Getting Into the Fossil Record—University of California Museum of Paleontology  
<http://www.ucmp.berkeley.edu/education/explorations/tours/fossil/5to8/Intro.html>

Fossil Fuels Study Guide (1 page PDF file)  
<http://energy.gov/fe/downloads/fossil-fuels-study-guide-high-school>

U.S. Energy Information Administration—Nonrenewable Energy Explained  
[http://www.eia.gov/energyexplained/index.cfm?page=nonrenewable\\_home](http://www.eia.gov/energyexplained/index.cfm?page=nonrenewable_home)

American Petroleum Institute—Oil and Natural Gas Overview—Energy Source, Energy Choices  
<http://www.api.org/oil-and-natural-gas-overview/classroom-tools/classroom-curricula/energy-source-choices>

Fossils of Arkansas  
[http://www.geology.ar.gov/education/educational\\_posters.htm](http://www.geology.ar.gov/education/educational_posters.htm)

1. Define fossil.

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2. Describe how fossils form.

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3. What is a fuel?

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4. List the three forms of fossil fuels.

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5. Why are they described as “nonrenewable”?

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6. What are some of the issues related to fossil fuel use?

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7. Are there other types of fuels that are not fossil fuels?

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8. What is the difference between an invertebrate and a vertebrate animal?

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9. Most of the fossils in Arkansas are marine invertebrates. What does this mean?

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10. Why are fossils important?

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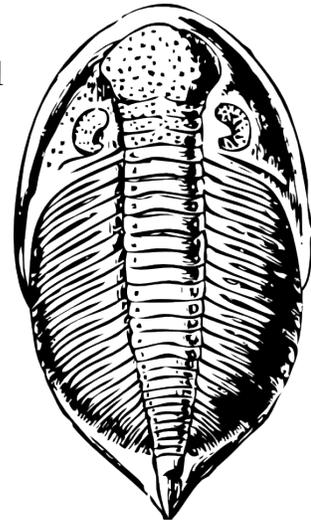
# Student Handout 3

Name \_\_\_\_\_  
Date \_\_\_\_\_  
Class \_\_\_\_\_

## Lesson 1—Oil and Natural Gas and How They Form Lab 1—What are Fossils?

### Introduction

In the previous activities you learned that oil and natural gas are known as fossil fuels. You will now investigate the concept of a “fossil” in more detail. A fossil is the remains of a once living organism. Fossils come in two basic types: body and trace. Body fossils are the organism itself, some part, or an impression of it. Trace fossils are evidence of an organism’s presence like a footprint or trail. In this lab you will observe the characteristics of different kinds of plant and animal fossils.



### Materials

- Bag or box of 8 fossil specimens\*
- Magnifying glass
- Fossil book(s)

(\*Fossil specimens can be obtained through educational supply houses like Wards Natural Science, personal collections can also be made of local fossils by consulting the Arkansas Geological Survey publication *Fossils of Arkansas* by Tom Freeman.)

### Procedure

1. Remove the fossil specimens and lay them out on your desk.
2. Use your senses to carefully observe each specimen, use the hand lens if necessary.
3. Make a detailed drawing of each fossil.
4. Based on your observations, you will hypothesize whether each fossil is a body part or a trace of an organism. Record your hypothesis in the data table.
5. Now use your observations to hypothesize if each fossil represents a plant or an animal. Record your hypothesis in the data table.
6. Use the fossil book(s) to identify each fossil.
7. Use the fossil book(s) to determine if your hypotheses were correct and record the answers in the data table.

Drawing	Hypotheses		Identification	Actual	
	Is the Fossil a Body or Trace Fossil?	Is the Fossil a Plant or Animal?		Is the Fossil a Body or Trace Fossil?	Is the Fossil a Plant or Animal?

Drawing	Hypotheses		Identification	Actual	
	Is the Fossil a Body or Trace Fossil?	Is the Fossil a Plant or Animal?		Is the Fossil a Body or Trace Fossil?	Is the Fossil a Plant or Animal?

## Analysis and Conclusions

1. Which fossils give a more complete image of the entire organism?

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2. What characteristic of the animal fossils allowed them to be preserved?

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3. What do you think was necessary for the plant fossils to be preserved?

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4. Which of the animal fossils are invertebrates? Vertebrates?

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5. What conclusions can you reach about the environment that each of the organisms lived in?

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## References

Freeman, Tom. Fossils of Arkansas. Little Rock, Arkansas: Arkansas Geological Commission, 1989.

Potts, Joanna, ed. Guide to Fossils. Buffalo, New York: Firefly Books, 2003.

Rhodes, Frank H.T., Zim, Herbert S., Shaffer, and Paul R. Fossils: A Guide to Prehistoric Life. A Golden Nature Guide. New York, New York: Golden Press, 1962.

Thompson, Ida. National Audubon Society Field Guide to North American Fossils. New York, New York: Alfred A. Knopf, 1995.

Walker, Cyril and Ward, David. Fossils. Smithsonian Handbooks. New York, New York: Dorling Kindersley, 2002.

## Student Handout 4

Name \_\_\_\_\_

Date \_\_\_\_\_

Class \_\_\_\_\_

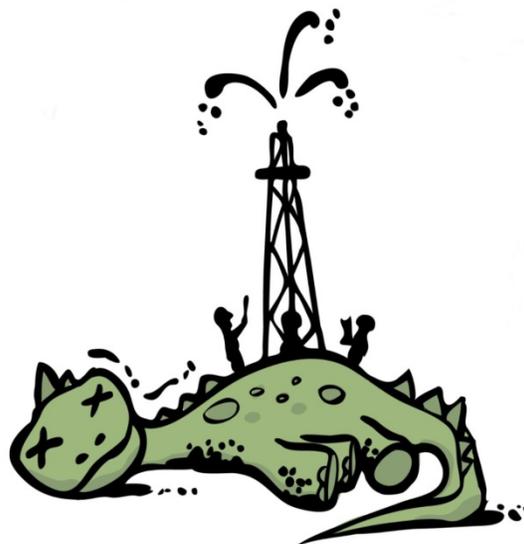
### Lesson 1—Oil and Natural Gas and How They Form Lab 2—Organic Matter and Natural Gas

#### Introduction

In this lab students will observe the connection between the decay of organic material to the formation of natural gas.

#### Materials

- 2 plastic water bottles
- Organic substance (tuna, ground beef, or egg)
- Lettuce
- Sand
- Balloon
- Water
- Masking tape
- Balance scale



#### Procedure

1. Measure 10g of an organic substance (tuna, beef, or egg) and put into bottle.
2. Tear the lettuce leaves into small pieces and put into bottle.
3. Use the balance scale to measure 50g sand. Carefully pour the sand into the bottle so that it covers the organic substance and lettuce. Do not shake the bottle.
4. Measure 10ml of water. Slowly pour the water into the bottle. Try to make it run down the inside of the bottle instead of pouring it directly onto the sand.
5. Stretch the opening of the balloon over the opening of the bottle. Seal with masking tape.
6. Prepare a second bottle without the organics material. This will be a control bottle.
7. Put both bottles in a warm place (preferably outside as contents could produce a strong odor).

8. Over the next several days you will be making observations of both bottles describing changes to the balloon and the material in the bottles.

**Results**

Day	Bottle with Organic Material		Control Bottle	
	Describe Changes to the Balloon	Describe Changes to the Material	Describe Changes to the Balloon	Describe Changes to the Material
1				
2				
3				
4				
5				
6				
7				

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10				

**Analysis and Conclusions**

1. What is causing the balloon to expand?

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2. Is there a difference in the balloons between the two bottles? Why?

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3. Based on the observations of both bottles, what can you conclude about the origin of the gas that filled the balloon?

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See Student Handouts section for printable copies.