Oil and Natural Gas Formation

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Lesson Plan - Page 1

INTERMEDIATE STUDENTS

Topic

Formation of oil and natural gas

Source

Oil and Natural Gas, pages 16-17, 18-19, 20-21

Objective

Students will learn that oil and natural gas taken from the earth's crust today originated as small plants and animals that lived in the ocean millions of years ago.

Lesson Preparations

1. Collect materials for each student from the list provided
2. Read through the "Exploration" and "Explanation" sections

Materials

- Manila Paper (8 ½ in. x 14 in.)- 2 sheets per student; 1 sheet to draw scenes and another for the line activity
- Map Pencils
- Adding machine paper (9-10 yards)

National Science Education Standards

NS.5-8.2
Physical Science

- Properties and changes in properties of matter
- Motions and Forces
- Transfer of Energy

NS.5-8.4
Earth and Space Science

- Structure of the earth system
- Earth's history
- Earth in the solar system

NS.5-8.6
Personal and Social Perspectives

- Personal health
- Populations, resources, and environments
- Natural hazards
- Risks and benefits
- Science and technology in society

NS.5-8.7
History and Nature of Science

- Science as a human endeavor
- Nature of science
- History of science

Reading topics are also included.

Engagement

"FALL IN" –When you hear the words "fall in" what do you think of? On a sheet of paper draw a quick picture of what you see in your mind when you hear the words "fall in."

Exploration

1. Give each student an 8-½ inch x 14-inch sheet of paper. Instruct the students to divide to paper into three equal parts. Label the sections: Scene 1, Scene 2 and Scene 3.
2. Have students clear everything off of their desks except for map pencils and a pencil. Tell the students that their work will be displayed in the halls of the school. They will be listening to a story and drawing their explanation.
3. Read the following story to the students. Tell the students to listen carefully. They can draw while you are reading or at the end of each scene. Let the students decide what is best for them.
4. An example of these three drawings can be found in the handout section of this lesson

Scene One

570 million years ago—during a period known as the "Paleozoic Era" [pey-lee-uh-zoh-ik] a large sea covered the area we now recognize as the southern part of the United States. In this sea lived a vast number of microscopic plants and animals called plankton. This microscopic plankton drifted on or near the surface of the water and became so numerous that it could actually be seen with the naked eye.

Throughout the "Paleozoic Era" the sea was also alive with trilobites, corals, crinoids, brachiopods, and many other plants and animals which evolved over millions of years.

A trilobite was a strange-looking little creature. Small grooves divided its body and hard-segmented shell into three vertical parts. A semicircular shield covered its head.

Coral, which still exists today, came in many different sizes, shapes and colors. The coral polyps were simple animals that were able to take calcium out of saltwater and convert it into a rocklike shelter, in which they lived.

Crinoids anchored themselves to rocks on the sea floor with a root-like structure that supported a stalk or column topped by a cup-like cavity, which formed a protective case for a flower.

Brachiopods were clam-like animals. Their two-piece dorsal and ventral shells enclosed and protected their soft body parts.

Due to their ability to reproduce quickly, the plankton, along with other sea life, was abundant. As these carbon-containing organisms went through their extremely short life cycles and died, their remains sank to the deep sea floor and became covered with the mud, sand and sediment from the eroding mountains and surrounding areas. Because they were buried so quickly on the deep sea floor, the plankton and other sea creatures lacked oxygen, which is necessary for decay or decomposition.

Draw a picture that describes this scene on the first section of your paper.

Scene Two

320 million years passed, and layers of sediment on the sea floor became thousands upon thousands of feet deep. These layers were filled with dead plankton, fossilized sea creatures and eroded rock!

During the time period known as the "Mesozoic Era", [mez-uh-zoh-ik] dinosaurs began to roam the earth and swim in the sea. More than half of the great sea had disappeared because of evaporation, earthquakes, and the filling and layering of sediments on the sea floor.

This heat and pressure was responsible for changing the dead organic material into hydrocarbons (substances containing hydrogen and carbon) and causing the remaining inorganic material to change into sedimentary rock.

Draw a picture that describes this scene on the second section of your paper.

Scene Three

250 million years later brings us to present day-the "Cenozoic Era. [see-nuh-zoh-ik,] People now walk the earth and the dinosaurs have long since disappeared. The erosion and other sediments have now completely filled the seas.

The heat and pressure have formed many layers of sedimentary rock, and deep source rock - rock where oil and natural gas form. Much of the water that was in the sea is now in the pore spaces of the sedimentary rock. The remaining water evaporated or was pushed into areas where seas or oceans now exist.

Over millions of years, temperatures ranging from 150-300 degrees Fahrenheit (66-149 degrees Celsius) have "cooked" the organic materials causing a complex chemical change, creating hydrocarbons called oil and natural gas. These hydrocarbons, also known as fossil fuels, have been produced in Texas.

Can you picture this scene? Draw a picture that shows this scene in the third section of your paper.

You have just drawn the formation of oil and natural gas.

As you finish the last scene, keep in mind that there are several theories concerning the formation of oil and natural gas. What you have just heard and drawn is the most widely accepted scientific theory.

Explanation

Teacher Information

Oil and natural gas together make petroleum. Petroleum is a mixture of hundreds of different hydrocarbons—molecules containing hydrogen and carbon—that exist sometimes as a liquid (crude oil) and sometimes as a vapor (natural gas). Hydrocarbons are typically made from the remains of dinosaurs, pre-historic sea creatures and vegetation that have been buried in the earth for millions of years. Layer upon layer of the plant and animal remains built up. This pressure combined with heat from the Earth's processes slowly "cooked" the plant and animal remains into hydrocarbons. These hydrocarbons flowed into empty spaces in the surrounding rocks, called traps. Finally, an oil-soaked rock-much like a wet sponge- was formed. The traps were covered with a layer of solid rock, or a seal of salt or clay, that kept the oil and gas from escaping to the surface. Crude oil is held inside the rock formation, similar to how a sponge holds water.

Read to students from *Oil and Natural Gas*, pages 16-17

Oil and Natural Gas together make up petroleum, which is Latin for "rock oil." Petroleum is dark, oily substance that is typically liquid, but it can also be solid or gaseous. When it comes straight out of the ground as a liquid it is called crude oil if it is dark and sticky, and condensate if clear and volatile (evaporates easily). When solid it is called asphalt, and when semisolid it is called bitumen. Natural gas can be found either with oil or on its own. Petroleum is made entirely naturally, largely from the decomposed remains of living things. Although it looks like a simple gooey mass, it is actually a complex mixture of chemicals. Different chemical groups can be separated out at refineries and petrochemical plants, and then used to make a huge range of different substances.

Read to students from *Oil and Natural Gas*, pages 18-19.

Scientists once thought that most oil was formed by chemical reactions between minerals in rocks deep underground. Now, the majority of scientist believes that only a little oil was formed like this. Much of the world's oil formed, they think from the remains of living things over a vast expanse of time. The theory is that the corpses of countless microscopic marine organisms, such as foraminifera and particularly plankton, piled up on the seabed as a thick sludge, and were gradually buried deeper by sediments accumulating on top of them. There the remains were transformed over millions of years-first by bacteria and then by heat and pressure inside Earth-into liquid oil. The oil slowly seeped through the rocks and collected in underground pockets called traps, where it is tapped by oil wells today.

Show students diagram of the "marine organisms that die and are buried underneath the sea floor" on page 19 of *Oil and Natural Gas.*

Read to students from *Oil and Natural Gas*, pages 20-21

Thousands of years ago, people in parts of Greece, Persia, and India noticed a gas seeping from the ground that caught fire very easily. These natural gas flames sometimes became the focus of myths or religious beliefs. Natural gas is a mixture of gases, but it contains mostly methane-the smallest and lightest hydrocarbon. Like oil, natural gas formed underground from the remains of tiny marine organisms, and it is often brought up at the same wells as crude oil. It can also come from wells that contain only gas and condensate, or from "natural" wells that provide natural gas alone. Little use was made of natural gas until fairly recently. In the early 20th century, oil wells burned it off as waste. Today, natural gas is highly valued as a clean fuel that supplies a quarter of the world's energy.

Evaluation

1. Have each student write a narrative paper explaining his or her drawing, which will be attached and displayed with the drawing. This explanation should tell how oil and natural gas is formed
2. Students should complete the Exit Questionnaire.

Elaboration

Time Line Activity

1. Split the students into groups of two, or they may work alone on this project.
2. Measure a length of adding machine paper approximately 9 yards long. Make a mark every 10 inches. This mark will represent 100 million years of time. On the far right end of the strip of paper, write the word, "Present". Label each line with the units "mya" for million years ago. Stop at 4600 million years ago. (If you are adding extra events included on the following page, add another 10 inches to your time line.)
3. Have students research on the internet when important events in earth's history occurred. Assign each student a particular event to mark on the time line. A list of particular events is located in the handout section of this lesson. Cut the events apart and allow the student to draw from a hat the event that they will be researching.
4. Have students draw pictures of these events along the time line.
5. Students present their findings to the class as they place their picture on the time line.

Exit Questionnaire Answer Key

1. Explain the formation of oil and natural gas

   Answer: As small organisms called plankton die they sink to the bottom of the sea. There they are buried by sediments of the ocean floor. After years and years heat and pressure chemically change the plankton into oil and natural gas.

2. Heat and pressure have formed many layers of _____ rock, a deep source rock where oil and natural gas forms.
   Answer: B Sedimentary Rock

3. As tiny _____die and sink to the bottom of the sea, they add the carbon containing chemicals in their bodies to the sediment and mud on the ocean floor. Over time the mud becomes solid rock. Under great heat and intense pressure chemical reactions change the _____ into _____ _____.
   Answer: Plankton, Plankton, Fossil Fuels

Elaboration

Time Line Activity - Additional Events

Cut these events into strips and place in a hat for students to draw.

First Bird

First Dinosaur

First Tree

First Flower

First Plankton that appeared on Earth

Babylonian Empire

First Oil Drills

First Oil Lamps

Persian Empire

Rule of King Nebuchadnezzar

First offshore drilling operation

First car runs off of gas

First discovery of oil in North America

First oil rig in Texas

First natural gas production in North America

Paleozoic Era

Mesozoic Era

Cenozoic Era

These are only a few events in history that the students can research. Allow the students to research different events that they are interested in as well after completing their assignment. You may want to research certain events that you are studying in history class or events that are special to the city in which you live.

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Exit Questionnaire

INTERMEDIATE STUDENTS

Name:_____

Questions

1. Explain the formation of oil and natural gas.

   _____

   _____

   _____

2. Heat and pressure have formed many layers of _____ rock, a deep source rock where oil and natural gas forms.

   a. Volcanic
   b. Sedimentary
   c. Igneous
   d. Metamorphic

3. As tiny _____die and sink to the bottom of the sea, they add the carbon containing chemicals in their bodies to the sediment and mud on the ocean floor. Over time the mud becomes solid rock. Under great heat and intense pressure chemical reactions change the _____ into _____ _____.