

Lesson #1-What is oil, and where does it come from?

With this lesson plan students will learn that fossil fuels are derived from energy from the sun that has been stored in the bodies of plants and tiny animals that died millions of years ago. They will also be introduced to the three forms of fossil fuels: solid (coal and oil sands), liquid (crude oil) and gas (natural gas).

This lesson plan was developed by The Black Gold Regional Division No. 18 and teachers Margaret Lyall and Kimberly Epp.

Black Gold: the Story of Oil

Section Two

**What Is Oil?
and
Where Did It Come From?**

Black Gold: The Story of Oil

Section Two: What is Oil? Where Did It Come From?

Purpose:

- ◆ Students will recognize that fossil fuels are energy from the sun, stored in the bodies of plants and tiny animals that died millions of years ago.
- ◆ Students will understand that fossil fuels are found in three forms: solid (coal and oil sands), liquid (crude oil) and gas (natural gas).

Materials:

- ◆ examples or pictures of fossils
- ◆ crude or refined oil samples or pictures of them
- ◆ What is Oil Worksheets
- ◆ brick or building block
- ◆ glazed tile or plate

Procedure:

1. Review:

Have the students write three reasons why oil is important to them on a piece of scrap paper. Share their reasons with one person sitting near them. (Allow only 2-3 minutes.) Have a few students share their ideas aloud with the rest of the class.

2. What is Oil?

Show the students some fossils if possible. Review fossils by asking the following questions. This could be done orally, as a class, or in partners. The purpose is to have students realize why coal, crude oil and natural gas are called **fossil fuels**.

- ◆ *What are fossils? --Prints or the bodies of plants and animals that lived and died millions of years ago*
- ◆ *Where are fossils usually found? --In rock, either deep underground, or close to the surface*
- ◆ *Knowing these answers, why do you think coal, crude oil, and natural gas are called fossil fuels? --Fossils because they are found in rock, under the ground, and they are the remains of plants and tiny animals that died millions of years ago. Fuels because we burn them to get energy.*

3. Where Did Oil Come From?

- a. Write the words **crude oil, natural gas, oil** on the board.

If possible, show the students samples of crude oil, and note the color, smell and thickness. If you are not able to obtain samples of crude oil, show the students some of its refined products such as motor oil, diesel fuel, and furnace oil. Speculate on why it is called "crude". (**Because it has not yet been cleaned or refined in order to be used in cars, trucks, furnaces and so on. It is just as it is when it comes out of the ground.**)

Extend this concept to natural gas, and ask what the term "natural" means. (**Natural gas is a mixture of gasses, which have not been separated.**)

2. Complete the student reading and activity regarding the Devonian Period on the What is Oil Worksheet.

(Section 2, cont.)

4. Simulation of How Oil Soaks Into Porous Rock¹

Have the students examine a porous rock, such as a brick or a building block, and a nonporous, dense rock, such as a glazed tile or plate, and describe what they see, feel, and smell. Point out the numerous holes in the porous rock and the absence of holes in the nonporous rock.

Measure some oil that was displayed in #3 and slowly let it drip onto the porous rock.

(Cooking oil would do, if necessary.)

Have individual students tell the others what they observe.

Repeat this with nonporous (impervious) rock.

Have the students answer the following questions in their notes:

- ◆ Did the oil go into the porous rock (brick)? *Yes*
- ◆ Did the oil go into the nonporous/impervious rock (tile)? *No*
- ◆ Crude oil often moves long distances from the place where it is formed. How would it do this? *It seeps from one porous rock to another.*
- ◆ How does crude oil sometimes become trapped? *It reaches a layer of rock that is very solid, not porous, and can go no further.*

Have the students chart their observations:

	Holes	No holes	Oil went in	Oil ran off
Porous				
Nonporous (Impervious)				

5. Worksheet Activity & Evaluation:

Distribute the remaining sections of the What is Oil Worksheets. Have students read and answer the questions.

Petro point:

The oil in the Leduc field comes from the Devonian Period, but don't give the students the idea that all oil comes from that time. Oil comes from other periods as well.

¹This adapted activity is taken from SEEDS: Society, Environment & Energy Development Studies Foundation, 1981

What is Oil?

Name _____

On February 13, 1947, Leduc #1 struck oil. Where did this oil come from? The answer goes back more than 350 million years.

The **Devonian Period** lasted from 395 million years ago until 345 million years ago.

There were plants and animals on the land, but there were no reptiles, no birds, and no mammals. We often call it **The Age of Fishes**, because the seas were teeming with new kinds of fish. Shallow seas covered large parts of the continents that are now dry land, and shallow seas are a wonderful place for coral reefs to grow. There were huge coral reefs in many parts of the world.

Most of what is now Alberta was under one of these shallow seas, and a great coral reef grew in the sea where now we find the County of Leduc.

Questions:

- ◆ The time from 395 million years ago until 345 million years ago is called the _____ period.
- ◆ It's sometimes called the Age of _____
- ◆ Most of what is now Alberta was under a shallow _____

Plants and animals died around these reefs, and fell to the bottom of the shallow sea. Some were covered with sand and mud. More plants, animals, sand, and mud fell on top, and then more again. So much fell down, that everything got squished.

Let's time warp back to grade three: do you remember studying rocks?

- ◆ If you squish sand enough, it becomes a rock called *sandstone*.
- ◆ If you squish mud enough, it becomes a rock called *shale*.
- ◆ If you squish animal shells enough, they become a rock called *limestone*.

All three kinds are called **sedimentary rocks**, and whenever you find them, you can be sure that once they were at the bottom of a sea, lake, or river.

Some sedimentary rocks can be *porous*. Some rocks are like sponges: they have holes in them that can be filled with water or oil or gas. These are called **porous** rocks. Some rocks don't have these holes: they are not porous. Rocks without these tiny holes are called **impervious**.

Questions:

- ◆ Sandstone, shale, and limestone are _____ rocks.
- ◆ A rock that is like a sponge, and has holes for water and oil and gas, is called _____
- ◆ A rock that is “as solid as a rock” and won’t hold oil and water, is called _____

For millions and millions of years, the rocks in the Devonian reef were covered with more layers of sand and mud, animals and plants. Now they are far below the surface.

No one really knows just how these plants and animals changed into oil when they were buried deep under the ground, but somehow it happened. We think that they were squished and squished as more and more rock piled up on top. This pressure and the heat turned some into oil and some into natural gas. The pressure that made the oil also caused it to move.

The porous rocks have tiny holes, and these holes can trap water, oil, and gas.

Question:

- ◆ The rocks that used to be a reef in the sea are now far beneath the _____ of the land.

In the hundreds of millions of years since the Devonian reef was really a reef in the sea, the land in Alberta has gone through many changes. For example, in the last hundred million years, the land in the west has been buckling up to make the Rocky Mountains. Land that once was flat is often twisted today.

Question:

- ◆ 350 million years ago, in the Devonian Period, did the Rocky Mountains exist?

We usually find oil and gas trapped in porous rock that is sandwiched between layers of impervious rocks. If they are not trapped by the impervious rock, the oil and gas leak to the surface, and spread over the land (or into the sea).

Here are some ways that the land may be twisted, so that the oil and gas are trapped:

The land may be arched.
The porous rock is sandwiched between two layers of impervious rock.
The gas is lightest, so it rises to the top. Oil comes next, then water is at the bottom.

Picture of land being arched (anticline) and of a fault

<http://www.sjgs.com/exploration.html>

A fault is a split or a crack in the earth's crust. Sometimes, when this happens, some of the porous rock containing oil is trapped by impervious rock. The oil that's in the part of the rock that's not trapped, seeps to the surface.

Questions:

- ◆ We find oil and gas trapped in _____ rock.
- ◆ It's usually sandwiched between layers of _____ rock.
- ◆ When the porous rock is trapped, what rises to the top of the rock?

- what's next? _____
- what's at the bottom? _____
- ◆ If oil is in porous rock that is not trapped, it seeps to the _____

The land may not buckle much at all. The reef may lie fairly flat, and be covered by impervious rock.

Porous rock tapering off (Pinchouts)

<http://www.sjgs.com/exploration.html>

Sometimes the porous rock just tapers off. Perhaps this was where the ancient sea ended? This is common in Alberta and Saskatchewan oil fields.

Fill in the Blanks:

The _____ Period was sometimes called the Age of _____. Most of Alberta was covered with shallow _____ that had huge coral _____.

Plants and animals died and fell to the bottom of the sea. They were covered with sand and mud. The plants, animals, sand, and mud were squished to make kinds of rocks called _____ rocks. For millions and millions of years, these rocks were covered with more rocks, so that today they are far beneath the _____ of the earth.

Somehow, some plants and animals turned into oil (and gas). Some rocks are like sponges, and can soak up oil, gas and water. These rocks are called _____ rocks.

Petro Point...

Sometimes oil just seeps out of the ground, making pools of oil. If lightning sets these on fire, they can be pretty impressive to people who don't understand! The Persians once built temples around oil seeps that were set on fire.

In Ancient Greece, the sacred Oracle at Delphi was built around an "everlasting flame" that was really a natural gas fire.

Petro Point...

Petroleum products have been used for at least 8000 years. They were used to waterproof boats, hold bricks together, and to lubricate (make things slippery).

Petro Point...

If oil and gas are not trapped by impervious rocks, they will escape to the surface. In the Athabasca Oil Sands in northern Alberta, all the natural gas has escaped, and the lighter oils (like gasoline and kerosene) have *evaporated* into the air.

What's left are the heavy oils, like tar. Sometimes we call them the *Tar Sands*.

Native Canadians used to use these heavy oils to make their canoes waterproof.

Petro point questions:

1. The "sacred oracle" at Delphi in ancient Greece was probably built around a fire that was lit by

_____.

2. Name three things that people used petroleum products for in ancient times:

a. _____ b. _____

c. _____

3. In the Athabasca Oil Sands, the _____ have escaped,

and the _____ have
evaporated, leaving heavy oils.