Formation of Oil

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Lesson Plan – Page 1

Secondary Pupils

Topic: Formation of oil and natural gas

Topic Overview: Formation of crude oil and natural gas from remains of plants and animals that lived in the ocean millions of years ago.

Activity Overview: Pupils will look at pond water under a microscope to identify any plant or animal life.
Pupils will create a time line showing length of time for oil and gas formation alongside other key historical dates.

Core Experience and Outcome:

SCN 3-13a: Using a microscope, I have developed my understanding of the structure and variety of cells and of their functions.

MTH 2-21a/MTH 3-21a: I can display data in a clear way using a suitable scale, by choosing appropriately from an extended range of tables, charts, diagrams and graphs, making effective use of technology

Learning Intention:

I am learning that oil and gas are formed over millions of years from tiny water dwelling organisms. The timescale for oil and gas formation is many times larger than other familiar historical events.

Success Criteria:

I can use a microscope to look at a slide of pond water and draw the organisms present.
I can produce a time line with an accurate scale.

Resources

Formation of Oil Elicitation Activity Story

Formation of Oil Experiment Record

Book reference:
Oil and Natural Gas,
Pages 16-21

Materials for elicitation activity:

- A4 paper
- Colouring pencils

Materials per pair for Activity 1:

- Microscopes,
- Microscope slides,
- Cover slips
- Pond water,
- Dropper

Materials for Activity 2:

- Adding machine paper or similar
- Metre sticks
- Pens,
- Coloured pencils

Key Vocabulary

Names of parts of microscope – **eyepiece, objective lens, stage, focus knob**
Paleozoic era – 542-251 million years ago, from Greek, meaning ‘old life’
Mesozoic era – 252 – 66 million yeas ago, meaning ‘middle life’ also known as the age of reptiles
Cenozoic era – 66 million years ago – present, meaning ‘new life’

Developed for *Curriculum for Excellence*
by Aberdeen City Council and Satrosphere Science Centre
with support from The Society of Petroleum Engineers

Formation of Oil

Teacher Information:

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 scientists believe 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.

Additional 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 vapour (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.

Formation of Oil

Establishing Prior Knowledge

- Are all living things big enough to see with the naked eye?
- What is oil and gas made from?
- What is an era?

Concept Introduction

The oceans were teeming with life millions of years ago. When tiny sea animals and plants died, they fell to the ocean floor where they formed a thick sludge. Further deposits of sand and silt built up on top which put pressure on the dead remains. Along with heat from the earth's crust, this resulted in the change from dead remains to oil and gas that we find today. This process took millions of years.

Elicitation Activity

Ask pupils divide a sheet of paper into 3 panels and draw representations of the Paleozoic, Mesozoic and Cenozoic eras, one in each panel as you describe them or after they do some research on the internet or using books.

Activity 1: Viewing microorganisms

1. Demonstrate how to set up and use a microscope. Introduce key terms.

2. Have pupils write their names in very small writing on a piece of paper. They can then set up the microscope to view their names to become familiar with working the microscope.

3. Pupils collect pond water samples and use microscope to view and draw anything interesting that they see as outlined in pupil experimental record sheet.

4. Provide some identification keys or charts to allow pupils to identify the organisms they find.

5. Draw comparisons to the microorganisms identified and those that would have been present in the oceans millions of years ago that would have lead to the formation of oil deposits.

Answers for Assessment Questions

1. What happened to sea creatures and plants in the oceans after they died millions of years ago?

Answer: the dead organisms fall to the ocean floor and over time form a sludge which is buried under layers of sand and rock. Over time the pressure of these added layers 'cooks' the sludge and it eventually forms oil and gas deposits.

2. Why should we try not to waste oil and gas today?

Answer: the time scale of the formation of oil and gas means that it is a non- renewable resource.

Activity 2: Time line

1. Draw a time line on the board of last 1000 years showing some key historical events. Explain to pupils that they are going to draw a timeline over a much longer time scale.

2. Write some key dates on the board including Paleozoic, Mesozoic and Cenozoic eras.

3. Give pupils a strip of paper that is approximately 10 m; have pupils make a mark every 25 cm to represent 100 million years of time.

4. At far right have pupils label present day and then label the marks in mya (million years ago) units.

5. Allow pupils to research important events in Earth's history and add them to the time line to fill it in as much as possible.

Here are a few events in history that the pupils can research. You may also want to research certain events that pupils are learning about in history.
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 UK
First oil rig in UK
First natural gas production in UK
Paleozoic Era
Mesozoic Era
Cenozoic Era

Extension Ideas:

- Find out more about sea creatures from the Paleozoic era.
- Investigate the 'Door to hell' gas field in Turkmenistan.

Home Links

- Challenge pupils to identify 'living fossils', organisms that have changed very little in millions of years

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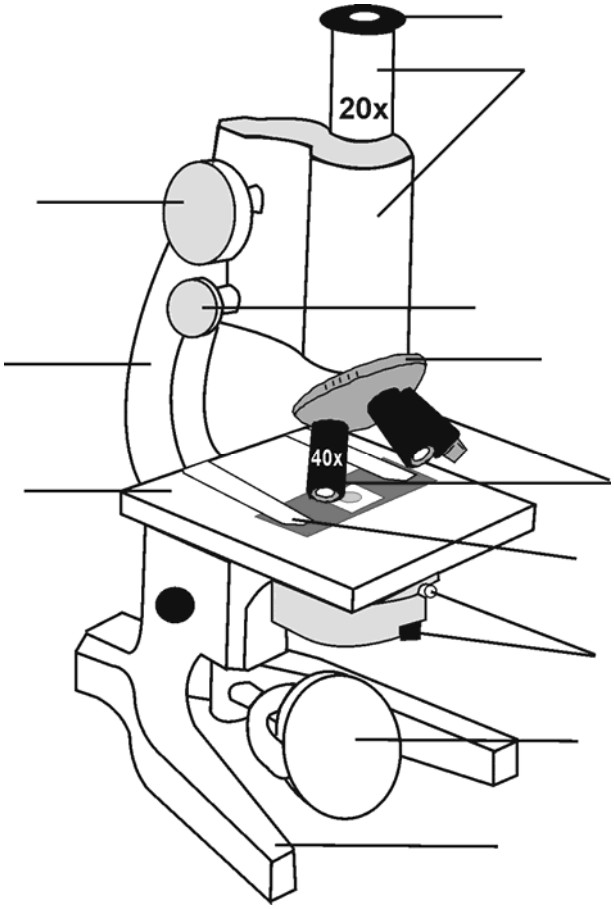
Experiment Record

Secondary Pupils

Materials per pair:

- Microscope and light
- Slide and cover slip
- Dropper
- Pond water



Instructions:

1. Watch demo on how to set up and operate microscope
2. Set up your own microscope and label all the part in diagram above
3. Write you name in very small writing and practice using the microscope to view it.
4. Collect a sample of pond water and put a drop on your slide, cover with cover slip (try to avoid air bubbles) and view on low power lens.
5. Make a drawing of anything you think could be alive in the spaces provided, be sure to include a scale with your drawings.
6. Repeat with medium and high power lens- be careful you don't break the slide with the high power lens.

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Experimental Record

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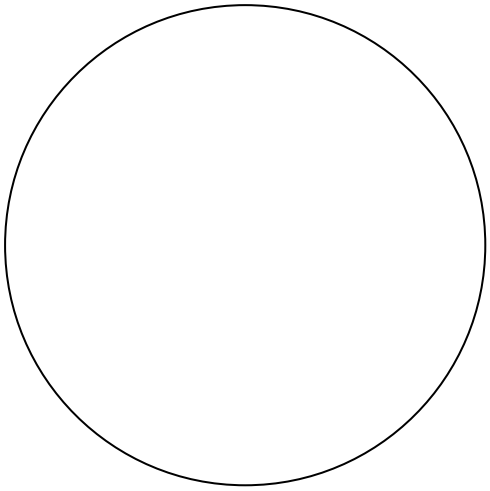

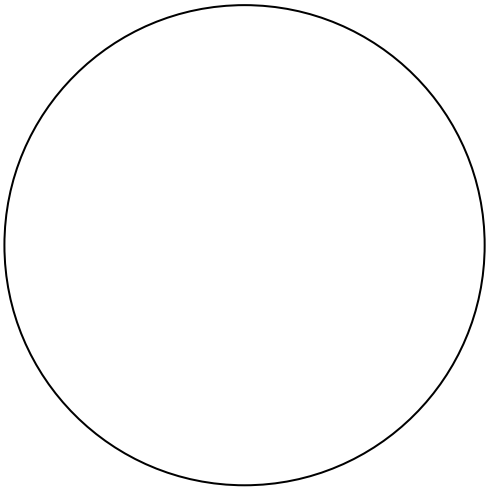

Assessment Questions:

1. What happened to sea creatures and plants in the oceans after they died millions of years ago?

_____

_____

2. Why should we try not to waste oil and gas today?

_____

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Elicitation Activity Story | **Teacher**

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 colours. 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 66-149 degrees Celsius have “cooked” the organic materials causing a complex chemical change, creating hydrocarbons forming oil and natural gas.

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.

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