

Teacher's Guide

Elementary

Developed by



With the support of



Resource Authors: Kathryn Wagner, Inside Education
Melissa Tesche, Inside Education
Melissa Ziebart, Inside Education
Lyndsay Conrad, Inside Education

Project Manager: David Rauscher, Inside Education

Teacher Reviewer: Cathy King, Foothills School Division

Poster Author: Jim Martin

Poster Artist: Mauritz Flinkfelt

Special Thanks to: Alberta Chamber of Commerce April Dias, Compton Petroleum
Barb Arnau, Alberta Energy June Warren Publishing
Devon Canada Colleen Killingsworth, Centre for Energy

Inside Education gives permission for reproduction of this teaching resource for non-commercial, educational uses only. Inside Education must be cited as the copyright holder.

Copyright 2010 - Inside Education

Tell Us What You Think!

Inside Education would like to know what you think about this resource and how you use it. We ask that you please consider completing an online survey. It will only take a few minutes of your time but it will help us to continue to provide you with quality products.

www.insideeducation.ca/Surveys/Petroleum_Kit.html

About the poster kit

Poster

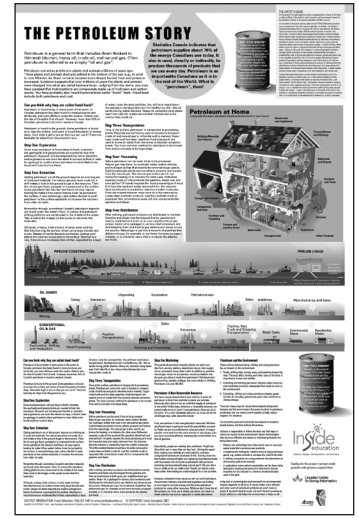
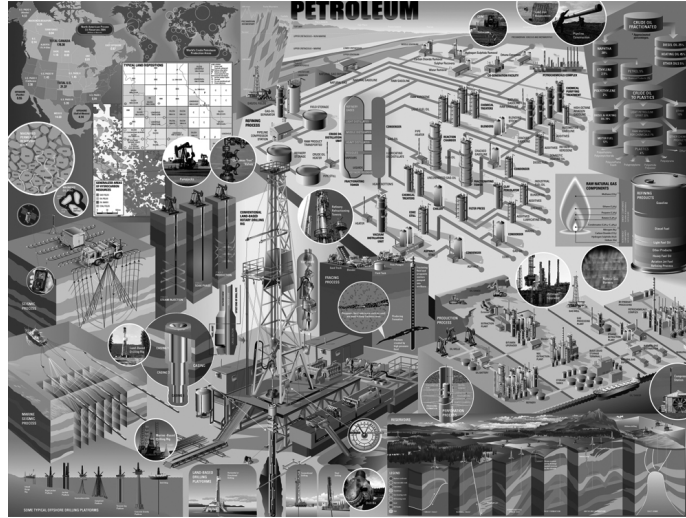
The kit contains five *Petroleum* posters to allow for small group activities. Digital copies of the poster are also available on the resource CD included in the kit. Because of the amount of material visually presented on the poster, it is recommended that teachers review the poster description on the following page.

Poster views are as follows:

FRONT (split-panel)

INSIDE

BACK



Student Worksheets

Student worksheets can be found throughout this teacher's guide as well as on the resource CD. Answer keys are in this guide as part of the activity outline or following the student worksheets.

Background Information

The book *Our Petroleum Challenge* contained in the kit is a valuable source of background information on petroleum. The glossary terms and websites listed at the back of this guide and on the resource CD provide additional information.

About the poster

On the front split-panels, the poster features a conglomeration of some of the direct and indirect effects of the political, social, economic and environmental impacts of the petroleum industry on the general population and their environment. With the poster flaps closed, the top quarter of the poster shows multiple land use. Activities such as forestry, trapping, mining, agriculture and recreation all take place in the area, sometimes on Alberta government or Crown land.

The next quarter of the poster goes into a little more detail on petroleum exploration and development – from the rig workers in the centre, to the oil sands and coal mines below, to the seismic exploration and land reclamation on the left, all are activities that have direct impact on our quality of life.

The bottom half of the poster transitions between petroleum exploration and production to processing and transport of the product. To the right are examples of renewable energy sources (solar, wind, biofuels) which are helping us reduce our consumption of fossil fuels. The bottom left of the poster demonstrates the process behind petroleum exploration: consultation and regulation. The regulatory process is a vital part of the petroleum story – any company or group performing activities on the land must follow government guidelines and they must have the proper plans in place (see the list on the binders, bottom left). The bottom right demonstrates the refining and transportation of the final product – in this case, from an ocean port. Given the absence of sea ports in Alberta, all of our refineries are located near major rail lines, highways or pipeline hubs to help distribute the petroleum product to consumers throughout our country and across North America.

On the inside of the poster, starting under the PETROLEUM banner, a cross-section of the main source of petroleum in Canada – the Western Canadian Sedimentary Basin – is highlighted. Grouped to the left are maps illustrating typical hydrocarbon locations and field activity sectors based on geological surveys and industrial data. The adjacent map of the world displays the world's major oil producers and North America's proven oil reserves. Grouped with the maps are graphics of porous rock and oil sands details. Underneath, the main rig illustration is surrounded by examples of seismic survey, stimulation, fracturing (commonly referred to as fracing, pronounced FRAK-ing), perforation, casing, some rig component details and a variety of rig platform profiles – all tied to drilling. At the bottom right we see drilling for the petroleum reserves in a variety of geological formations. Grouped directly above are several components: first, a simplified flow chart of oil and gas production processes, above that, a simplified product flow chart of the complex refining/fractionization process of by-products and their subsequent uses. Tied to that, on the right, there is a schematic of the fractionization/processing of crude oil for refining and for the petrochemical industry, which feeds the manufacturing sector for the creation of a wide variety of commercial and consumer goods. Below that, a simple diagram shows a breakdown of natural gas to its raw components and various uses.

Scattered throughout the poster are photo bubbles that highlight some of the petroleum industry's activities to provide a more realistic perspective of the subject matter. The back of the poster features the "Petroleum Story" and "Did You Know?" facts. The graphics there are included for general information to show pipeline construction – the main transportation vehicle for oil and gas – and a simplified flow chart following the product to market and the steps required to make that happen (similar to the 3D process on the inside of the poster). Also included is a breakaway diagram of a house to illustrate products used in the home and/or in the manufacturing of materials for consumer goods.

Alberta Curriculum Connections

GRADE 4 Social Studies – Alberta: The Land, Histories and Stories

4.1 Alberta: A Sense of the Land

Students will:

4.1.1 value Alberta's physical geography and natural environment:

- Appreciate how Alberta's fossil heritage contributes to the province's unique character
- Appreciate the variety and abundance of natural resources in Alberta
- Appreciate the environmental significance of national and provincial parks and protected areas in Alberta
- Appreciate how land sustains communities and quality of life
- Demonstrate care and concern for the environment through their choices and actions

Students will:

4.1.2 examine, critically, the physical geography of Alberta by exploring and reflecting upon the following questions and issues:

What are the significant natural resources in Alberta, and where are they located (e.g., mineral deposits, coal, natural gas and oil, forests)?

- How are Alberta's provincial parks and protected areas and the national parks in Alberta important to the sustainability of Alberta's natural environment?

4.1.4 analyze how Albertans interact with their environment by exploring and reflecting upon the following questions and issues:

- In what ways do the physical geography and natural resources of a region determine the establishment of communities?
- How are natural resources used by Albertans (i.e., agriculture, oil and natural gas, forests, coal)?
- How do Albertans deal with competing demands on land use (e.g., conservation, solar and wind power, recreation, agriculture, oil exploration, forestry)?

GRADE 5 Social Studies – Canada: The Land, Histories and Stories

5.1 Physical Geography of Canada

Students will:

5.1.1 value Canada's physical geography and natural environment:

- appreciate the variety and abundance of natural resources in Canada
- appreciate the environmental significance of national parks and protected areas in Canada
- appreciate how the land sustains communities and the diverse ways that people have of living with the land
- appreciate the influence of the natural environment on the growth and development of Canada
- demonstrate care and concern for the environment through their choices and actions

5.1.2 examine, critically, the physical geography of Canada by exploring and reflecting upon the following questions and issues:

- How do landforms, bodies of water and natural resources affect the quality of life in Canada?

5.1.3 analyze how people in Canada interact with the environment by exploring and reflecting upon the following questions and issues:

- In what ways do natural resources and the physical geography of a region determine the establishment of communities?
- How are natural resources used, exchanged and conserved in Canada?
- Whose responsibility should it be to ensure the preservation of Canada's national parks and protected areas?

GRADE 5 Science – Topic C: Classroom Chemistry

Students will:

5–7 Describe the properties and interactions of various household liquids and solids, and interpret their interactions.

1. Recognize and identify examples of the following kinds of mixtures:

- Two or more solids; e.g., sand and sugar
- A solid and a liquid; e.g., sugar and water
- Two or more liquids; e.g., milk and tea.

3. Distinguish substances that will dissolve in a liquid from those that will not, and demonstrate a way of recovering a material from solution.

6. Produce carbon dioxide gas through the interaction of solids and liquids, and demonstrate that it is different from air.

Quickest Eyes in the Bunch - Part I

Time: 15 Minutes

Curriculum Connections

Grade 4 Social Studies – Alberta: A Sense of the Land

Grade 5 Social Studies – Physical Geography of Canada

Objectives

Students will become familiar with terms related to natural resources in Alberta and Canada, as well as the *Petroleum* poster itself.

Rationale

Between these two activities (Part I and II), the students will not only become familiar with the landscape of the poster, but also with the key terminology to be encountered later on in this guide.

Part I is a quick, fun, interactive (sometimes rowdy) introduction to the *Petroleum* poster.

Materials

Petroleum posters

Activity

Anticipatory Set (15 minutes)

1. Divide students into small groups, providing each group with a copy of the *Petroleum* poster. You may wish to group desks into pods.
2. Have each group come up with a sound they might hear if they worked in the oil & gas industry (i.e. “grinding” of a drill bit, the “drip” of an oil drop, “phsshhhh” of natural gas, the “creak” of the pumpjack, “ching” of the gas pump, etc.).
3. Read the questions aloud and award points to the team with the correct answer. Teams indicate they have the answer by *buzzing in* with their word or sound.

Quickest Eyes Clues

Use the poster front to find:

- Tree planter (2 total: top left, middle, near reclamation sign and pumpjack photo)
- Bear (top right)

- Train engine (middle right)
- Scarecrow (middle, left of horses)
- Recycling centre (left side, under railroad)
- Whale (bottom right)
- Wetland conservation area (bottom left)
- Campers (top right, near “Be a Safe Steward” sign)
- Grocery store (centre)
- Helicopter (lower right, below train tracks)
- Coal mine (centre, right of reclamation sign)
- Seagulls (7 total: 6 bottom right, 1 top right)
- School (towards bottom left, across from wetland conservation area)
- Airport (bottom left, near recycling centre)
- Sail boats (5 total: bottom right)
- Employment centre (top right)
- Drilling rigs - land based (8 total: various locations)
- Wildlife (bear, elk, caribou, mountain goat, birds, deer, whale)
- Research station (top left, above pipeline construction crossing river photo)
- Canada geese (bottom left, in wetland conservation area)
- Wind turbine (4 total: centre right, above train tracks)

Using the poster inside find:

- Alberta (top left)
- Refining products - gasoline, diesel fuel, etc. (right centre)
- Marine-based drilling rig (bottom left)
- Satellite (left centre, above seismic process)
- Oil sands mining (centre right, above pumpjacks)
- Drill bit (bottom centre)
- Tractor (upper right, in coalbed methane photo)

Quickest Eyes in the Bunch - Part II

Time: 40 Minutes

Curriculum Connections

Grade 4 Social Studies – Alberta: A Sense of the Land

Grade 5 Social Studies – Physical Geography of Canada

Objectives

Students will become more familiar with the terminology commonly used in the oil and gas sector.

Materials

Petroleum posters

Quickest Eyes PowerPoint (resource CD)

Optional: computer/LCD projector/computer lab

Activity

Anticipatory Set (15 minutes)

It is recommended that students complete *Quickest Eyes in the Bunch* Part I before moving on to this activity.

Main Activity: *Quickest Eyes* Part II (30 Minutes)

1. With students still in their groups and familiar with the *Petroleum* poster, project the *Quickest Eyes* PowerPoint in front of the class.
2. Have students arrange the poster in front of their groups.
3. On the screen, project the *Quickest Eyes* PowerPoint. Stopping on each image, ask students to find it on the poster (either on the front or the inside). The students will “buzz in” using their group sounds from *Quickest Eyes* Part I.
4. There will be three parts to each slide:
 - a. “Find this image on the poster.”
 - b. “What is it?”
 - c. “What is its function/definition?” (The definition/function will appear below each slide image on subsequent click)
5. Assign points to each group as desired – for image, name, and/or function.

Extension

Ask student groups to choose one item from the *Petroleum* poster and ask their peers to locate it, following the same format.

Have students develop one or two PowerPoint slides per group, with the required information (image, location, name, function). Compile the slides, present the PowerPoint to class, and have groups try to locate the images chosen by their peers.

Teacher Tip: The book *Our Petroleum Challenge* is a good resource for definitions.

Quickest Eyes Activity - Part II

PowerPoint Slide List/Definitions

Section I: Poster Front

Pipeline compressor station – a facility that compresses the natural gas (increasing its pressure) to push the gas through the pipeline.

Coalbed methane – a natural gas (principally methane) contained in coal seams formed when plant material was converted into coal over millions of years.

Oil sands – naturally occurring mixtures of bitumen, water, sand and clay that are found in various parts of the world.

Public consultation – meetings involving community members where industry groups discuss their plans for natural resource development in a specific area.

Natural gas – a naturally-occurring mixture of hydrocarbons found in sedimentary rock in the Earth's crust. It is considered a cleaner-burning fuel, compared to coal and oil.

Solar power – energy from the sun that comes in two main forms: light and heat.

Pumpjack – a large pivoting pumping unit located above ground that helps to bring oil up a well from underground reservoirs.

Wellsite – the location of an oil or gas well where a rig drills for petroleum.

Reclamation – the process of restoring an area back to a natural state after it has sustained environmental damage or industrial activity (wellsite, road, etc.).

Environmental impact assessment – an assessment of the potential influence an industrial project may have on the environment.

Section II: Poster Back

Permeable reservoir rock – rock that contains cracks or holes that allow liquid to flow from one area to another, or to fill completely.

Drill bit – the cutting portion of a drilling rig that bores a hole through rock, clay or sand to access the petroleum reservoir.

Land-based drilling rig – a rig erected on land that is used to drill for petroleum.

Marine-based drilling rig – a rig used to drill for petroleum products located in a reservoir under the ocean floor. The rig is usually based on a permanent platform or on a drilling ship anchored in place.

Bitumen upgrader – a component of the refinery that takes raw bitumen and begins to separate the components into more usable products.

Petroleum reservoirs – an area of porous rock (rock with holes and cracks in it) that contains petroleum deposits.

Cogeneration facility – a plant that produces both steam for the refining process and electricity that can be used to power the facility or sold to other consumers.

Petroleum Trivia

Time: 20 minutes

Curriculum Connections

Grade 4 Social Studies – Alberta: A Sense of the Land

Grade 5 Social Studies – Physical Geography of Canada

Objectives

Students will become familiar with the terminology commonly used in the oil and gas industry.

Rationale

This activity is a fun way to introduce or summarize the above-mentioned units that discuss petroleum as a natural resource. Using the poster as a visual aid, students are able to conceptualize processes by creating links between terminology and images depicted on the poster.

Materials

Petroleum posters

Trivia sheet (see resource CD for a reproducible PDF, answer key on following page)

Activity

1. Divide the students into groups and provide one poster per group.
2. Have each group come up with a sound they might hear if they worked in the oil and gas industry (i.e. “grinding” of a drill bit, the “drip” of an oil drop, “phsshhhh” of natural gas, the “creak” of the pumpjack, “ching” of the gas pump, etc.). This sound will be the buzzer to call in when the group knows the answer.
3. Ask students the trivia questions.
4. Record points on the board.

Petroleum Trivia: answer key

Poster Front (2 point questions)

1. Name the method of transportation shown on the poster that uses petroleum products to build the vehicle, but not to power its movement. **sailboats**
2. How are solar power, wind power, coal and natural gas different?
solar and wind – above ground, renewable; natural gas and coal – below ground, non-renewable
3. Name three methods of petroleum transportation pictured on the poster.
rail, truck, pipeline, ocean tanker
4. After companies develop lands they are required to return them to a natural state. What is this process called? **reclamation**
5. Name three types of wildlife pictured on the poster that could be potentially affected by oil and gas development.
caribou, mountain goats, bears, ducks, geese, deer, whales, sea birds
Note: livestock doesn't count as wildlife
6. Four of Alberta's major industries are **oil and gas, agriculture, forestry, tourism/recreation**
7. Of all the ecoregions pictured on the poster, which type is not found in Alberta? **ocean/marine**

Poster Inside (2 point questions)

1. The Canadian province with the largest oil reserves is **Alberta**.
2. The largest use of each barrel of oil is for making **gasoline**.
3. Petroleum exploration uses sound waves shot into the ground to indicate if and where petroleum deposits are found. What is this exploration process called? **seismic exploration or seismic process**
4. Rock that is able to contain oil and gas in tiny gaps is called permeable.
What are the gaps within rock called? **pores**
5. Seismic exploration uses Global Positioning System (GPS) technology that receives signals from what?
satellites
6. Rock that does not allow flow of oil or gas, trapping oil and gas in reservoirs, is called **impermeable**.
7. Name the two layers surrounding the sand particles in the oil sands. **water and bitumen**

Petroleum Rocks Maze

Time: 15 minutes

Curriculum Connections

Grade 4 Social Studies – Alberta: A Sense of the Land

Grade 5 Social Studies – Physical Geography of Canada

Objectives

Students will develop an understanding of how petroleum deposits look underground.

Rationale

By solving the mystery word hidden in the maze, students can visualize that petroleum is not found in large pools beneath the surface, but rather in the tiny spaces between sand and rock particles.

Materials

Petroleum posters

Petroleum Rocks Maze sheet - one per student
(see following page or resource CD)

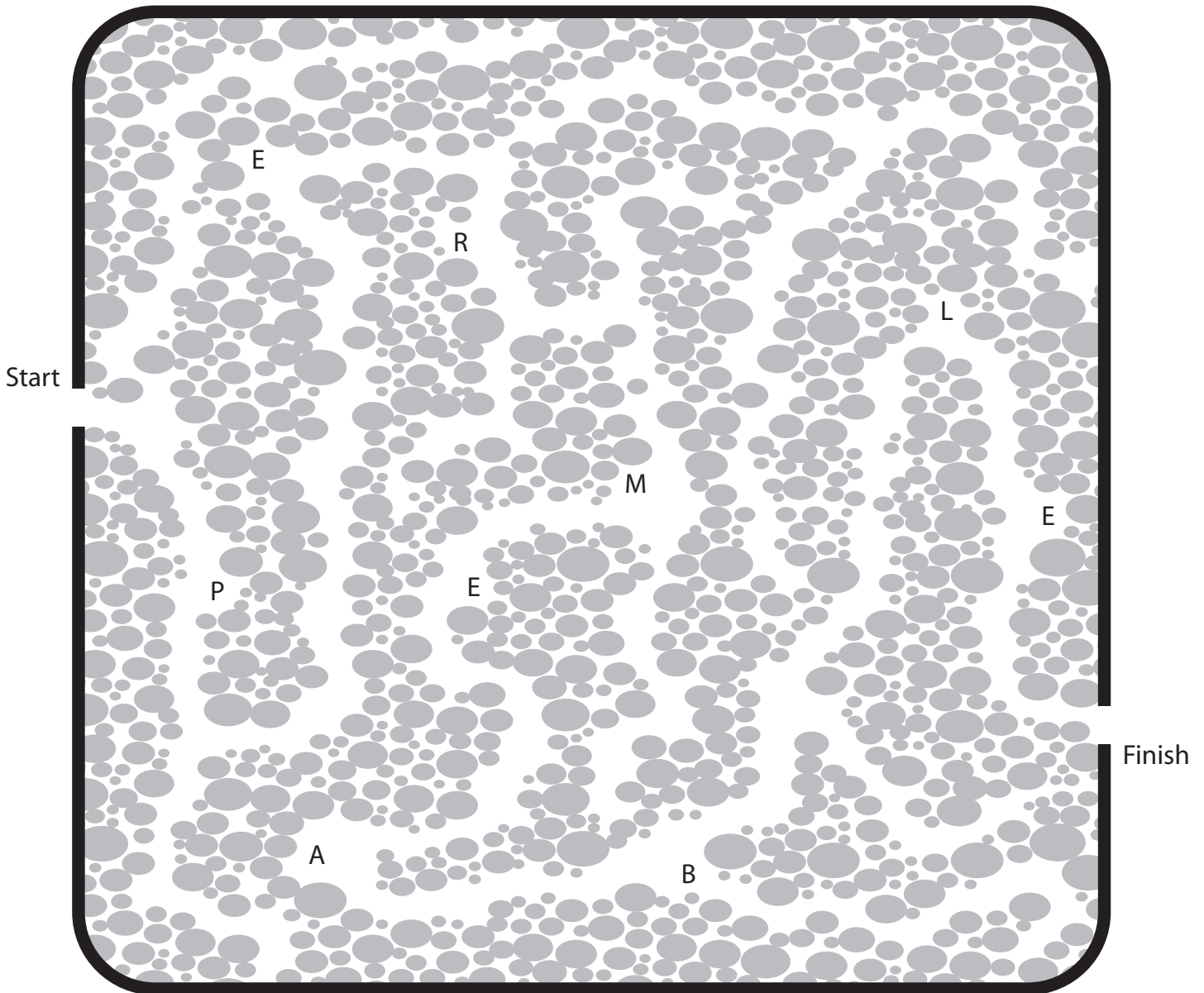
Activity

1. Using the *Petroleum* poster, highlight section “Magnified Permeable Reservoir Rock” (poster inside), explain that petroleum is not located in big underground pools, but actually fills the spaces between the rocks and sand.
2. Hand out *Petroleum Rocks Maze* and have students work through the maze to solve for the mystery word. (Mystery Word = PERMEABLE)

Petroleum Rocks Maze: student worksheet

Petroleum is not located in big underground pools, but actually fills the tiny spaces between the sand and rock. A petroleum reservoir can be thought of like a bowl of breakfast cereal where the cereal represents the sand, rock and other underground materials and the petroleum is the milk filling up the spaces in between.

Work your way through the petroleum reservoir to solve for the mystery word hidden in the maze of sand and rock.



Petroleum can flow from start to finish because the rocks and sand are _____.

Petroleum In Your Home

Time: 30 minutes + homework

Curriculum Connections

Grade 4 Social Studies – Alberta: A Sense of the Land

Grade 5 Social Studies – Physical Geography of Canada

Objectives

Students will identify household and everyday items that are derived from petroleum and other natural resources.

Rationale

This activity is designed to help make students more aware of the diverse role that petroleum plays in our everyday lives. As students brainstorm and inventory petroleum products around their homes, they will begin to appreciate that fossil fuels are turned into more than just gasoline. This activity fits well as an introduction to discussing Alberta's petroleum industry and as a precursor activity to some of the other lessons in this guide.

Materials

Petroleum posters

Petroleum in Your Home student worksheet - one per student (see following page or resource CD)

Background Information

Petrochemical companies treat and process petroleum to create a vast number of everyday products — everything from chewing gum and crazy glue to crayons and clothing. Other petroleum-based products include: ammonia, antiseptics, denture adhesives, eyeglass frames, fertilizer, guitar strings, heart valves, insect repellent, liquid detergent, makeup, paint, plastic beverage containers, sneakers, telephones and many more!

For more information on products made with petroleum see pages 14 and 16 in *Our Petroleum Challenge*.

Activity

1. Using the back of the poster and the student worksheet, focus on the "Petroleum at Home" section. Have each student record on their worksheet a minimum of three items they find in each room/area pictured in the home.
2. Students will take their checklists home, examine the items and record on the worksheet if they think the items are petroleum-based or come from other natural resources.

Teacher Tip: For petroleum-based products, it may be necessary to provide a clue to students as to what to look for. Although not applicable to all petroleum-based products, if an item looks to be plastic or has plastic features it is probably made with petroleum.

3. Review students' findings together as a class. Discuss which natural resource they found the most of in their home.

Petroleum In Your Home student worksheet

Look at the *Petroleum at Home* picture on the back of the poster. List three items that you see in each room of the house and that you will also find in your own home.

At home, examine the items you have listed. Place a check mark in the petroleum column for those items you think might be made with petroleum. If you think it is made from a natural resource other than petroleum, write down what resource it might be made from. (Note: some items may be made of a combination of different natural resources. Record what natural resource you think was used the most to make the product.)

Room/Area:	Items found:	Natural Resources	
		Petroleum:	Other: wood, plants, animals, minerals, metal
Example:	Polar Fleece Blanket	X	
	Kitchen cupboard		Wood
Bedroom:			
Bathroom:			
Living Room:			
Kitchen:			
Other:			

Which natural resource did you find the most of in your home? _____

Fossil Fuels in a Cup

Time: 45 minutes

Curriculum Connections

Grade 4 Social Studies – Alberta: A Sense of the Land

Objectives

Students will become familiar with the basic steps in the formation of petroleum deposits by modeling geological processes.

Rationale

This hands-on lab activity provides a fun introduction to the formation of fossil fuels, particularly oil deposits. It gives students an idea of the time scale, elements, and processes involved, and it works well as an introduction to Alberta's geology, paleontology and natural resources.

The lab is complemented by a KWL worksheet that asks students to evaluate their knowledge prior to and after completing the activity.

Information on the formation of fossil fuels is available on pages 3-4 in *Our Petroleum Challenge*.

Materials

Clear plastic cups

Sand

Water

Salt

Eyedropper

*Several different colours and/or sizes of pea gravel or rocks

*Playdough

Oil Origins worksheet – one per student (see the following page or the resource CD)

***Teacher Tip:** use clean sand and rocks available at a hardware or garden supply store. To minimize expenses, homemade playdough can be used (the recipe is available on the resource CD).

Activity

Pre-lab set up (10 minutes, prior to class period)

1. In each plastic cup, pour a layer of small rocks.
2. Cover the rocks with a layer of sand.
3. Pour water over sand and rocks to create a prehistoric mini-ocean.

Anticipatory set (10 minutes)

1. Hand out copies of the *Oil Origins* student worksheet and introduce the term fossil fuels.
2. Ask students what they know about the origins of oil. Have them list these facts in the *what I know* section.
3. Ask students what kind of information they would like to know about the origins of oil and get them to record this information in the "what I want to know" section.

Lab Activity (20 minutes)

1. Hand out one prehistoric mini-ocean (plastic cup) and ping-pong-ball-sized lump of playdough to each student.
2. Have students shape the playdough into a marine plant or animal that might have lived in the Cambrian period.
3. Indicate that when their organism died, it would sink to the bottom of the ocean. Have students place their organism in the prehistoric ocean.

Teacher Tip: students should place their organism against the side of the cup.

4. Take the empty eyedropper around the classroom, dropping one drop of "bacteria" into the cup explaining to students that the bacteria slowly breaks down the organism before it can be turned into a fossil fuel.
5. Have students begin layering sand and gravel over their creatures to represent sedimentation.

Teacher Tip: layer: sand, small rocks, large rocks, small rocks.

Fossil Fuels in a Cup

6. Have students gently squish down on the layered rocks to represent pressure from moving tectonic plates. The playdough organism should be mixed with sand and rock, and pressed against the side of the cup.
7. Review with students the necessary “ingredients” (salt water, prehistoric plants and/or animals, bacteria, soil, layered rocks) and “baking time” (approximately 560 million years, from the Cambrian period to today) required for the formation of fossil fuels.

Conclusion (15 minutes)

1. Ask students to closely examine their prehistoric playdough plant or animal. Direct their attention to the rocks and debris embedded in the organism. Using this visual, explain to students that oil (and natural gas) is not found in underground pools (like many people believe), but is in fact trapped in tiny holes between rocks and sand, or in a reservoir.
2. If necessary, discuss with students the concept of renewable and non-renewable resources. Ask students why they might think that oil is a non-renewable resource.
3. Have students complete the “what I learned” section of worksheet.

Fossil Fuels in a Cup: student worksheet

Oil Origins

What I know

*What I want
to know*

What I learned

Up in Smoke

Time: 45 minutes

Curriculum Connections

Grade 4 Social Studies: Alberta – A Sense of the Land

Grade 5 Social Studies: Physical Geography of Canada

Grade 5 Science: Classroom Chemistry

Objectives

1. Students will recognize that, although air pollution can be invisible, it does exist.
2. Students will learn that air pollution is created from burning different materials.
3. Students will recognize that pollution caused from burning crude oil or natural gas can have an impact on our health.

Rationale

To demonstrate to students that the air we breathe may be polluted due to the burning of materials, including fossil fuels.

Materials

Petroleum poster

Small candle in candle holder

Small clear glass cup

Matches

Paper towel

Up in Smoke worksheet - one per student (see following page or resource CD)

Pens/pencils

Background Information

When the wick and wax of a candle are burned, gases and small particles are released into the air: water vapour, smoke, carbon monoxide and carbon dioxide. Water vapour is harmless, but carbon monoxide is an air pollutant.

Anticipatory Set (5 minutes)

1. Organize a place where your class can have a clear view of your demonstration.
2. Set the candle in the holder.

Procedure (40 minutes)

1. As a class, read “Petroleum and the Environment” on the back of the *Petroleum* poster.
2. Light the candle and ask the students: “What do you see as the candle burns?” Have students describe and draw what they observe (question 1 on the student worksheet).
3. Ask students to predict and record what will happen if the glass cup is placed above the flame (question 2).
4. Place the cup so the flame touches the bottom of the glass and hold it there until soot forms on the glass bottom. Hold the glass up so students can record what happened to the glass (question 3).
5. Ask students: “Where does the smoke go when the glass isn’t above the flame?” (It goes into the air we breathe, we just can’t see it. A good indicator that there are materials in the air, even though we can’t see them, is smell. The smell of burning wax is strong, especially if it is a scented wax.)
6. Ask students to brainstorm and record a list of things they feel may contribute to air pollution. For example: vehicles, factories, fireplaces (natural gas or wood-burning), power plants, lawn equipment, machinery, forest fires, etc. (question 4).
7. Have students complete the remainder of the worksheet, ending the exercise with a discussion on ways people can reduce the amount of emissions that they put into the atmosphere.

Answers

Answers to most of the student questions will be determined from the activity and related observations and discussions.

6. How does the glass in this experiment compare to the Earth’s atmosphere?
The glass shows the pollution that goes into the atmosphere from the combustion of different products. Because of the size of our atmosphere, we normally can’t see the pollution like we can on the glass, but it’s still there.

Up in Smoke: student worksheet

1. Describe and draw a picture of what happens as the candle burns.

2. Predict what will happen when you hold a glass above the flame.

3. What actually happened when the glass was held above the flame?

4. Brainstorm a list of things that burn fuel and may contribute to air pollution.

Up in Smoke: student worksheet

5. By observing this experiment, what have you discovered?

6. How does the glass in this experiment compare to the Earth's atmosphere?

7. How can people reduce the emissions that go into the atmosphere?

Petroleum-Related Websites

Petroleum Information/Facts

Government of Alberta

www.energy.alberta.ca

The *Our Business* tab contains definitions and statistics related to energy in Alberta. Topics include natural gas, oil, oil sands, petrochemicals, land access and aboriginal relations.

www.albertacanada.com/about-alberta/oil-and-gas-technology-and-services.html

Contains information on crude oil and oil sands.

Canadian Association of Petroleum Producers

www.capp.ca

A detailed look at the petroleum industry in Alberta. The website contains facts and issues facing the industry as well as current news and publications.

The Pembina Institute

www.pembina.org

Contains a comprehensive overview of the energy sector from an environmental perspective. Information regarding both renewable and non-renewable energy sources is available.

Canadian Society for Unconventional Gas

www.csug.ca

Site contains frequently asked questions, "Did-You-Know?" section, as well as information regarding industry challenges and regulations.

Interactive Websites for Students

Heritage Community Foundation

www.edukits.ca

An educational tool for learning more about Alberta's petroleum heritage. It features teaching units, stories, historical photographs and audio.

Alberta Energy Resources Conservation Board

www.kidzone.eub.ca/petroleumplay.html

An interactive website for elementary students. Contains online games, colouring pages and a workbook.

See the resource CD for additional websites.

Glossary

Biodegradable – substances capable of being decomposed.

Bitumen – a thick, sticky form of crude oil. At room temperature, bitumen is like cold molasses. It must be heated or diluted before it will flow into a well or through a pipeline. It is sometimes called extra-heavy oil.

Carbon dioxide – a non-toxic gas produced from decaying materials, respiration of plant and animal life, and combustion (burning) of organic matter, including fossil fuels.

Conventional oil / gas – oil and gas that can be produced by traditional recovery techniques employed by the oil and gas industry since the 19th century, like drilling wells and pumping.

Crude oil – a naturally-occurring mixture of hydrocarbons trapped underground.

Conservation – the protection and careful use of our natural environment.

Decompose – when dead plants or animals decay and their nutrients are returned to the soil.

Diluents – light liquids used to dilute bitumen and heavy oil so they can flow through pipelines.

Drilling rig – A machine that creates a hole (called borehole or wellbore) in the ground, through which exploration and production of oil or natural gas occurs.

Emissions – substances discharged into the air from factories, chimneys and car exhausts.

Energy – the power necessary for things to function. Energy can be as simple as food nourishment needed by humans, or supplied through non-renewable (fossil fuels) or renewable sources (e.g. wind turbines).

Environment – the surroundings in which people, plants and animals live.

Environmental impact assessment – an assessment of the likely influence an industrial project may have on the environment.

Exploration – the act of searching for potential subsurface reservoirs of gas or oil. Methods include the use of seismic exploration, surface mapping and exploratory drilling.

Extraction – the process of removing natural gas or oil from the reservoir, usually through pressure or by pumping.

Fuels – any substances that provide energy to make things work.

Fossil fuels – fuels, such as crude oil or natural gas, formed from plant and animal remains. The remains were buried in the Earth's crust, hardened and compressed (squeezed) over millions of years. They gradually changed to oil and gas.

Geologist – a person who studies the makeup of the Earth's crust. Petroleum geologists help to locate crude oil and natural gas deposits suitable for drilling.

Hydrocarbon – a large class of liquid, solid or gaseous organic compounds containing only carbon and hydrogen, which are the basis of almost all petroleum products.

Methane – the main component of natural gas; methane is also produced when organic matter decomposes.

Natural gas – a naturally-occurring mixture of hydrocarbons found in sedimentary rock in the Earth's crust. It is considered a cleaner burning fuel.

Non-renewable energy – comes from natural resources that are not naturally replaced within our lifetimes after they have been used (e.g. fossil fuels).

Glossary

Oil – a complex mixture of chemicals containing carbon, hydrogen and oxygen. Oil can be made into different fuels.

Oil sands – naturally occurring mixtures of bitumen, water, sand and clay that are found in various parts of the world. In Canada, oil sands are found mainly in three areas of Alberta.

Oil well – a hole drilled into the Earth for the production (removal) of crude oil or natural gas.

Permeability – the capacity of reservoir rock to transmit fluids; how easily fluids can move through porous rock.

Petroleum – a naturally occurring mixture of hydrocarbons in a gaseous, liquid or solid state.

Petroleum reservoir – an area of porous rock (rock with holes and cracks in it) that contains petroleum deposits.

Pores – spaces within rock that may contain oil or natural gas.

Processing – the series of actions that separate the raw petroleum into major products sold to markets. This can be as simple as removing water and sand from natural gas, or separating out different hydrocarbon molecules, like methane and propane.

Public consultation – meetings involving community members where industry groups discuss their plans for natural resource development activity in a specific area.

Pumpjack – a large pivoting pumping unit located above ground that helps to bring oil up a well from underground reservoirs.

Reclamation – returning an area of land to a natural state similar to or better than its previous state.

Refinery – a large plant that takes raw material such as crude oil and transforms (changes) it into gasoline and hundreds of other products.

Renewable energy – energy that cannot be used up or can be naturally replenished because it is continuously being produced (e.g. solar, wind, water, biomass).

Seismic (surveys) – studies done to gather and record patterns of induced shock wave reflections from underground layers of rock; used to create detailed models of underlying geologic structures.

Smog – comes from the combination of two words “smoke” and “fog.” It is a combination of ozone and other contaminants which tends to produce haze in the atmosphere.

Stakeholder – an individual, group or community that can be affected by the activities of another group, specifically industrial activity.

Trap – reservoir rock formations that halt the natural upward migration of hydrocarbons from the source rock to the surface. There are six main types of traps: thrust fault, normal fault, stratigraphic pinch-out, reef, anticlines, salt dome. (See pg. 37 of *Our Petroleum Challenge* for a detailed description of traps.)

Unconventional gas – natural gas that requires specialized technology to remove it from the ground. Unconventional sources are typically classified as shale gas, coalbed methane or tight sands gas.

printed December 2010



www.insideeducation.ca

