The graphic features a black silhouette of a mountain range at the top. Below it, the words "Petroleum Gum" are written in a large, stylized font where the letters are filled with a pattern of small circles. Underneath this, the words "Teacher's Guide" are written in a bold, black, sans-serif font.

Petroleum Gum
Teacher's Guide

Jr. High

Developed by



With the support of



Resource authors: Kathryn Wagner, Inside Education
Melissa Tesche, Inside Education
Melissa Ziebart, Inside Education

Project manager: David Rauscher, Inside Education

Teacher reviewer: Lina Kantor, St. Albert Protestant Separate School Division

Poster author: Jim Martin

Poster artist: Mauritz Flinkfelt

Special thanks to: Alberta Chamber of Commerce April Dias, Compton Petroleum
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www.insideeducation.ca/Surveys/Petroleum_Kit.html

About the poster kit

Poster

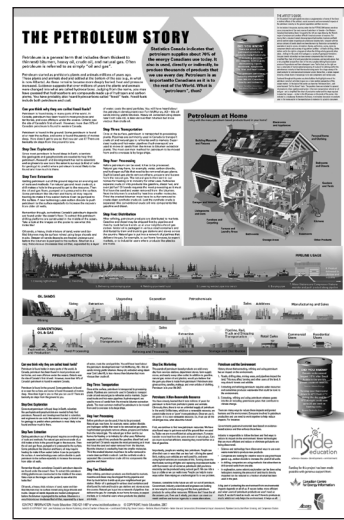
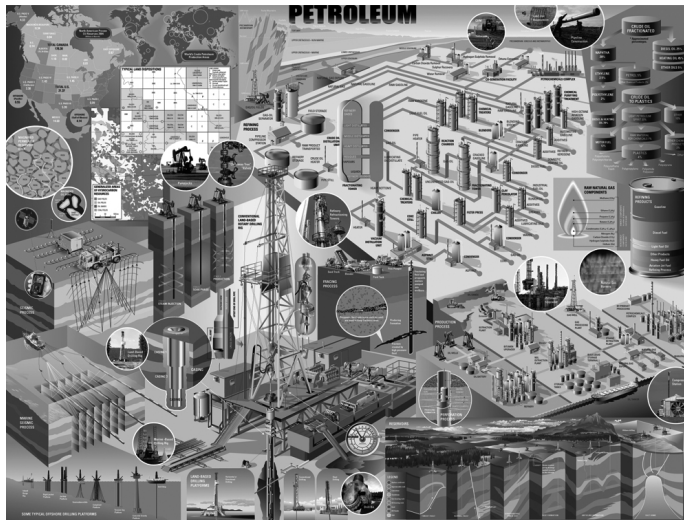
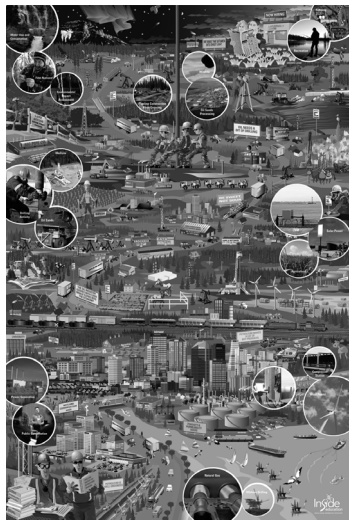
The kit contains five *Petroleum* posters to allow for small group activities. Digital copies of the poster are also available on the resource CD included in the kit. Because of the amount of material visually presented on the poster, it is recommended that teachers review the poster description on the 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, and 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 7 Science

Unit A: Interactions and Ecosystems

Students will:

1. Investigate and describe relationships between humans and their environments, and identify related issues and scientific questions
 - Identify examples of human impacts on ecosystems, and investigate and analyze the link between these impacts and the human wants and needs that give rise to them
4. Describe the relationships among knowledge, decisions and actions in maintaining life-supporting environments
 - Analyze a local environmental issue or problem based on evidence from a variety of sources, and identify possible actions and consequences

Unit C: Heat and Temperature

Students will:

1. Describe the nature of thermal energy and its effects on different forms of matter, using informal observations, experimental evidence and models
 - Describe the effect of heat on the motion of particles; and explain changes of state, using the particle model of matter

Unit E: Planet Earth

Students will:

1. Describe and demonstrate methods used in the scientific study of Earth and in observing and interpreting its component materials
 - Interpret models that show a layered structure for Earth's interior; and describe, in general terms, evidence for such models
 - Identify and explain the purpose of different tools and techniques used in the study of Earth (e.g., describe and explain the use of seismographs and coring drills, as well as tools and techniques for the close examination of rocks; describe methods used in oil and gas exploration)

GRADE 8 Science

Unit A: Mix and Flow of Matter

Students will:

3. Investigate and compare the properties of gases and liquids; and relate variations in their viscosity, density, buoyancy and compressibility to the particle model of matter
 - Investigate and compare fluids, based on their viscosity and flow rate, and describe the effects of temperature change on liquid flow

Unit D: Mechanical Systems

Students will:

1. Illustrate the development of science and technology by describing, comparing and interpreting mechanical devices that have been improved over time
2. Analyze machines by describing the structures and functions of the overall system, the subsystems and the component parts
 - Analyze a mechanical device, by: describing the overall function of the device, describing the contribution of individual components or subsystems to the overall function of the device
 - Identifying components that operate as simple machines
 - Identify the source of energy for some familiar mechanical devices
 - Identify linkages and power transmissions in a mechanical device, and describe their general function (e.g., identify the purpose and general function of belt drives and gear systems within a mechanical device)
4. Analyze the social and environmental contexts of science and technology, as they apply to the development of mechanical devices
 - Evaluate the design and function of a mechanical device in relation to its efficiency and effectiveness, and identify its impacts on humans and the environment

GRADE 9 Science

Unit B: Matter and Chemical Change

Students will:

1. Investigate materials, and describe them in terms of their physical and chemical properties
 - Describe and apply different ways of classifying materials based on their composition and properties, including distinguishing between pure substances, solutions and mechanical mixtures

Unit C: Environmental Chemistry

Students will:

1. Investigate and describe, in general terms, the role of different substances in the environment in supporting or harming humans and other living things
3. Analyze and evaluate mechanisms affecting the distribution of potentially harmful substances within an environment
 - Describe mechanisms for the transfer of materials through air, water and soil; and identify factors that may accelerate or retard distribution (e.g., wind speed, soil porosity)
 - Investigate and evaluate potential risks resulting from consumer practices and industrial processes, and identify processes used in providing information and setting standards to manage these risks

GRADE 9 Social Studies

Topic C: Canada: Responding to Change

Students will:

- Study economic growth and technological change in the Canadian context.
- How should we respond to technological change?
 - How is technological change affecting our quality of life?
 - How is technology affecting the way people work?
 - How is technological change affecting the world of work?

Social Studies 9 (2008)

9.1 Issues for Canadians: Governance and Rights

Students will demonstrate an understanding and appreciation of how Canada's political processes impact citizenship and identity in an attempt to meet the needs of all Canadians.

Students will:

- 9.1.3 appreciate how emerging issues impact quality of life, citizenship and identity in Canada

9.2 Issues for Canadians: Economic Systems in Canada and the United States

Students will demonstrate an understanding and appreciation of how economic decision making in Canada and the United States impacts quality of life, citizenship and identity.

Students will

- 9.2.2 appreciate the relationship between consumerism and quality of life
- 9.2.3 appreciate the impact of government decision making on quality of life
- 9.2.5 assess, critically, the relationship between consumerism and quality of life in Canada and the United States by exploring and reflecting upon the following questions and issues:
 - What are the indicators of quality of life?
 - How does individual consumer behaviour impact quality of life (e.g., environmental issues)?
- 9.2.6 assess, critically, the interrelationship between political decisions and economic systems by exploring and reflecting upon the following questions and issues:
 - How do government decisions on environmental issues impact quality of life (ex.: preservation, exploitation and trade of natural resources)?

Quickest Eyes in the Bunch

Time: 15 minutes

Curriculum Connections

Grade 7 Science – Unit A: Interactions and Ecosystems
– Unit E: Planet Earth

Grade 9 Science – Unit C: Environmental Chemistry

Objectives

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

Rationale

Between the following two activities (Part I & II), 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. The first activity is a quick, fun, interactive (sometimes rowdy) introduction to the *Petroleum* poster.

Materials

Petroleum posters

Activity

Anticipatory Set (15 minutes)

Divide students into small groups, providing each group with a copy of the *Petroleum* poster. You may wish to group desks into pods.

1. 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.).
2. 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.

Using the poster front 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 rail road)
- 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 (left, towards bottom and 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)
- Drilling rigs - offshore (6 total: bottom left)
- Wildlife (non-domestic, bear, elk, caribou, mountain goat, birds, deer, whale)
- Research station (top left, above pipeline construction river crossing photo)
- Canada geese (bottom left, in wetland conservation area)
- Renewable resources (trees, wind turbine, animals, solar)
- Non-renewable resources (oil sands, natural gas, coal, oil)

Using the poster inside find:

- Alberta (top left)
- Reservoirs - rock formations where oil is trapped
- Refining products - gasoline, diesel fuel, etc. (right centre)
- Marine based drilling rig (bottom left)
- Satellite (left centre, above seismic process)
- Drill bit (bottom centre, near reservoirs)
- Oil sands mining (centre right, above 3 pumpjacks)

Quickest Eyes in the Bunch - Part II

Time: 30 minutes

Curriculum Connections

Grade 7 Science – Unit E: Planet Earth

Grade 9 Science – Unit C: Environmental Chemistry

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 for extension activity:

Computer/LCD Projector/Computer lab access

Activity

Anticipatory Set (15 minutes)

It is recommended that students complete *Quickest Eyes in the Bunch* Part I before moving on to the following 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 Riddles / Trivia

Time: 30 minutes

Curriculum Connections

Grade 7 Science – Unit E: Planet Earth

Grade 9 Science – Unit C: Environmental Chemistry

Objectives

Students will become familiar with the terminology commonly used in the oil & 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

Petroleum Riddles and/or *Petroleum Trivia* sheets
(see following pages)

Alternate activity: *Petroleum Riddles* cards (printable PDF available on resource CD)

Activity - Petroleum Riddles

1. Divide students into groups and provide one copy of the poster for each group.
2. Read riddles out loud. Students can find the answers on the *Petroleum* poster where all riddle answers appear in text.

Alternatively, create riddle cards using the sheet available on the resource CD. Each group has three minutes to read the riddle card and come up with the answer; the card is then passed to the next group.

Activity - Petroleum Trivia

1. Divide the students into five 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 & 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 Riddles

1. Natural gas may heat your house when it's cold
On the gas bill you'll see by the gigajoule it's sold
Before it's burned to create that important heat
It has to get to where you live on your street
From deep underground to the gas metre it goes
Now tell me through what the gas travels and flows.
Pipelines (front, top left)
2. Before companies drill for oil or gas
They have to find out what's under the grass
They contract some people to collect information
Then workers make bangs and wait for vibrations
Geophones record data when they are installed
What is this process of finding oil and gas called?
Seismic exploration (inside, centre left)
3. It's important to get oil out of the ground
But first geologists need to understand where it's found
For years they study various rock formations
Which help to decide the drilling locations
Once the oil is extracted, it starts to flow
Then it needs to get broken down, so where does it go?
*Refinery - petroleum processing
(inside, top centre)*
4. In a refinery oil is broken down
This happens in Edmonton and other towns
Diesel and jet fuel come from Alberta's black gold
This, too, comes from oil, and at service stations it's sold
What am I?
*Gasoline and / or diesel fuel
(inside, centre right)*
5. In Canada there are many uses for petroleum
We can make plastics, cosmetics, and linoleum
Sometimes we find resources under layers of rock
It can also be found with sand where it's locked
You may not have known that oil and gas are also found here –
Beneath the waves and the fishes, the answer is clear.
Where am I?
Ocean (front, bottom right)
6. It's important we all take care of the land
To do this it's important to have everything planned
Petroleum companies study plants and the soil
The animals are important, as is the oil
Turning land back to nature is important, you know
More important than drilling, refining and "dough"
Restoration of the land is essential no doubt
What is this other "Re" word that we're talking about?
Reclamation (front, centre left)

Petroleum Trivia

Poster Front (2 point questions)

1. Name the method of transportation shown on the poster that uses petroleum products to make the vehicle, but not to power its movement. **sailboats**
2. Why are petroleum refineries and storage facilities often located near rail lines or the ocean?
ease of transport
3. How are solar power, wind power, coal, and natural gas similar?
All are sources of energy that can produce electricity
4. 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**
5. Oil or gas that contains hydrogen sulphide is called **sour gas**.
6. The ability of a rock to hold and allow flow of oil and gas is determined by which two physical characteristics? **porosity and permeability**
7. Many groups hold an interest in the way that oil and gas exploration and production impact an area. What are these groups called? **stakeholders**
8. What is the name of the study that attempts to predict the effects of oil and gas on the environment?
environmental impact assessment
9. Name three methods of petroleum transport pictured on the poster. **rail, truck, pipeline, ocean tanker**
10. After companies develop lands, they are required to return them to a natural state. What is this process called? **reclamation**
11. Name three stakeholders pictured on the poster. **recreational users, farmers, First Nations groups, nearby residents, environmental non-governmental organizations, industry, municipalities, environment**
12. 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
13. Four of Alberta's major industries are **oil and gas, agriculture, forestry, tourism/recreation**.
14. Of all the ecoregions pictured, which type is not found in Alberta? **ocean/marine**
15. Name the three types of consultations shown on the poster. **public, First Nations, landowner**

Petroleum Trivia

Poster Inside (2 point questions)

1. What is the slang name for above-ground pipeline valves with lots of dials and taps? **"Christmas tree" valves**
2. What is the largest component of raw natural gas? **methane**
3. The Canadian province with the largest proven oil reserves is **Alberta.**
4. What does the abbreviation Bbbls stand for? **billions of barrels**
5. The largest use of each barrel of oil is for making **gasoline.**
6. 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**
7. Rock that is able to contain oil and gas within tiny, internal spaces is called permeable. What are these spaces called? **pores**
8. Pumpjacks are often used for cyclical steam stimulation. The first stage is steam injection. What are the other two stages? **soak phase and production**
9. Name two non-energy components of raw natural gas. **nitrogen, carbon dioxide, hydrogen sulphide, helium**
10. What type of offshore drilling platform has part of the platform underwater? **semisubmersible**
11. Petroleum products can be extracted in solid, liquid, or gas form. What types of deposits can be removed in solid form? **coal and oil sands**
12. The heaviest materials will stay at the bottom of the fractionating tower. What are these heavy materials called? **refinery sludges**
13. Name two types of land-based drilling. **conventional, directional/horizontal, slant**
14. Seismic exploration uses GPS technology that receives signals from what? **satellites**
15. Rock that does not allow flow of oil or gas, trapping it in reservoirs, is called **impermeable.**
16. What percentage of fractionated crude oil will be turned into diesel oil? **25%**
17. If natural gas cannot be further processed or sold, it is burned off. What is this process called? **flaring**
18. Name the two layers surrounding the sand particles in the oil sands. **water layer, bitumen film**

The Race Is On

Time: 60 minutes

Curriculum Connections

Grade 7 Science – Unit C Heat and Temperature

Grade 8 Science – Unit A: Mix and Flow of Matter

Grade 9 Science – Unit B: Matter and Chemical Change
– Unit C: Environmental Chemistry

Objectives

Students will be able to:

1. Visualize and describe the viscosity of different fluids simulating oil products.
2. Make observations and measurements related to the viscosity of different fluids.
3. Recognize that different technologies are required to transport and process petroleum products due to their varying viscosity.

Rationale

This experiment will simulate the different viscosities of oil found in Alberta. Students will be able to compare the viscosity of conventional oil with oil extracted from oil sands. It will also demonstrate how variables such as temperature affect the viscosity of a fluid. This will assist students in understanding different technologies used in fuel extraction and transport.

Background Information

Viscosity is the resistance to flow. For example, water flows easily and therefore has low viscosity. Molasses and honey have a higher viscosity and so they do not flow easily. In general, viscosity of a fluid is determined by the composition, pressure and temperature of the fluid, in addition to the amount and duration of the stress that causes fluids to flow. Petroleum companies face different challenges mining unconventional oil sands compared to drilling for conventional oil and gas. Due to the higher viscosity of the bitumen, special technologies are required to extract, transport and process it. To extract the bitumen, both open pit surface mining and in-situ methods are used.

In-situ is a special extraction method whereby steam is injected into the oil sands deposit. The heat and water vapour help decrease the viscosity of the bitumen. Pumpjacks can then be used to bring the bitumen to the surface, while the sand is left in place. In situ is Latin for “in place.”

Additional information on in-situ is available on page 78 in *Our Petroleum Challenge*, included in the kit.

Teacher Tip: To facilitate a class discussion or lesson on different methods of petroleum production in general, use the Petroleum poster. All of the processes – including offshore oil and gas development in eastern Canada – are identified visually on the poster front, inside or back.

Materials

- *The Race is On* student worksheets (per group or individual, printable PDF available on resource CD)
- Inclined plane (e.g. cookie sheet or board covered with aluminum foil)
- Stirring spoon
- Graduated cylinder (or liquid measuring cup)
- 12 plastic cups
- Stopwatch
- Thermometer
- Ice water bath (or refrigerator)
- Heating device (microwave, hot water bath, or hot plate)

The Race Is On

Simulation Fluids

- water (control fluid)
- liquid honey (simulating crude oil)
- molasses plus sand (simulating oil sands)
- canola oil (simulating natural gas)

Option: This lesson can be done as a class demonstration or in small groups. The method you choose will affect the amount of supplies you will require. The quantities described here are for use as a lab demonstration for the whole class.

Activity

Anticipatory Set (15 minutes)

1. This experiment has the potential to get messy. It is recommended that surface areas be covered with newspaper and cleaning supplies are handy.
2. Make three sets of fluids composed of four plastic cups filled with 50 mL each of the following simulation fluids:
 - mixture of molasses and sand
 - liquid honey
 - canola oil
 - water
3. Keep one of the four sets (one of each sample) at room temperature. Another set should be chilled and the final set should be heated. If using a microwave to heat the fluids, take caution that they are heated for no longer than about 20 seconds.
4. Prepare inclined plane and cover with aluminum foil. Incline the plane at least 15 cm at one end.
5. Draw a horizontal line on the foil near the top of the inclined plane to indicate the starting point. Draw another line about 30 cm "down slope" from the first line to indicate the finish line.

Procedure (45 minutes)

1. Have students record the temperatures of each of the four fluids.
2. Use the water as a baseline control and have students time how long it takes the water to flow down the inclined plane. Students should record

the time on their worksheet.

3. Now, have the students predict which substance will win the race by estimating the amount of time it will take each fluid to flow down the plane. Record predictions on worksheet.
4. In sequence, pour the following fluids onto the foil just above the start line:
canola oil, liquid honey, and molasses and sand.
5. Have students time how long it takes each fluid to reach the finish line. Students should record the times on *The Race is On* student worksheet.
Note: The molasses and sand mixture may not flow. Have students observe for 1-2 minutes and record observations in the event it does not reach the finish line. When heated, flow rate will increase.
6. Repeat steps one to five with the heated and cooled fluids. (Students will notice colder fluids will flow more slowly than warm fluids)
7. Have students complete *The Race is On* student worksheet and discuss results.

Answers

Answers to most of the student questions will be determined from *The Race Is On* activity and related observations and discussions.

6. How are the above materials similar to oil sands? Natural gas? Crude oil?

Oil sands — molasses is thick to begin with, but adding sand to the mix makes it even thicker.

Natural gas — the canola oil is light and thin, flowing easily.

Crude oil — the honey is thick, but will flow more easily as the material is heated.

7. What variable was changed to make this experiment similar to the transport of heavy oil or bitumen?

The viscosity of the material changed. In pipelines, the viscosity can be changed by either altering the temperature or by adding a diluent to thin the crude oil or bitumen.

The Race Is On! student worksheet

Name _____

Class _____

1. Viscosity is _____

2. Use the charts below to record your predictions. In one column, rank the materials from fastest to slowest (fastest 1, slowest 4). Then estimate how long it will take each of the fluids to flow down the plane and record the time (in minutes and seconds) in the other column. Explain your predictions in the space provided.

Room Temperature -Trial 1		
Material	Rank	Est. Time
water		
canola oil		
liquid honey		
molasses & sand		
Explain your predictions		

Heated -Trial 2		
Material	Rank	Est. Time
water		
canola oil		
liquid honey		
molasses & sand		
Explain your predictions		

Cooled -Trial 3		
Material	Rank	Est. Time
water		
canola oil		
liquid honey		
molasses & sand		
Explain your predictions		

3. Record the data from the experiment in the charts below:

Room Temperature -Trial 1		
Material	Rank	Actual Time
water		
canola oil		
liquid honey		
molasses & sand		

Heated -Trial 2		
Material	Rank	Actual Time
water		
canola oil		
liquid honey		
molasses & sand		

Cooled -Trial 3		
Material	Rank	Actual Time
water		
canola oil		
liquid honey		
molasses & sand		

The Race Is On: student worksheet

4. What did you observe during the experiment?

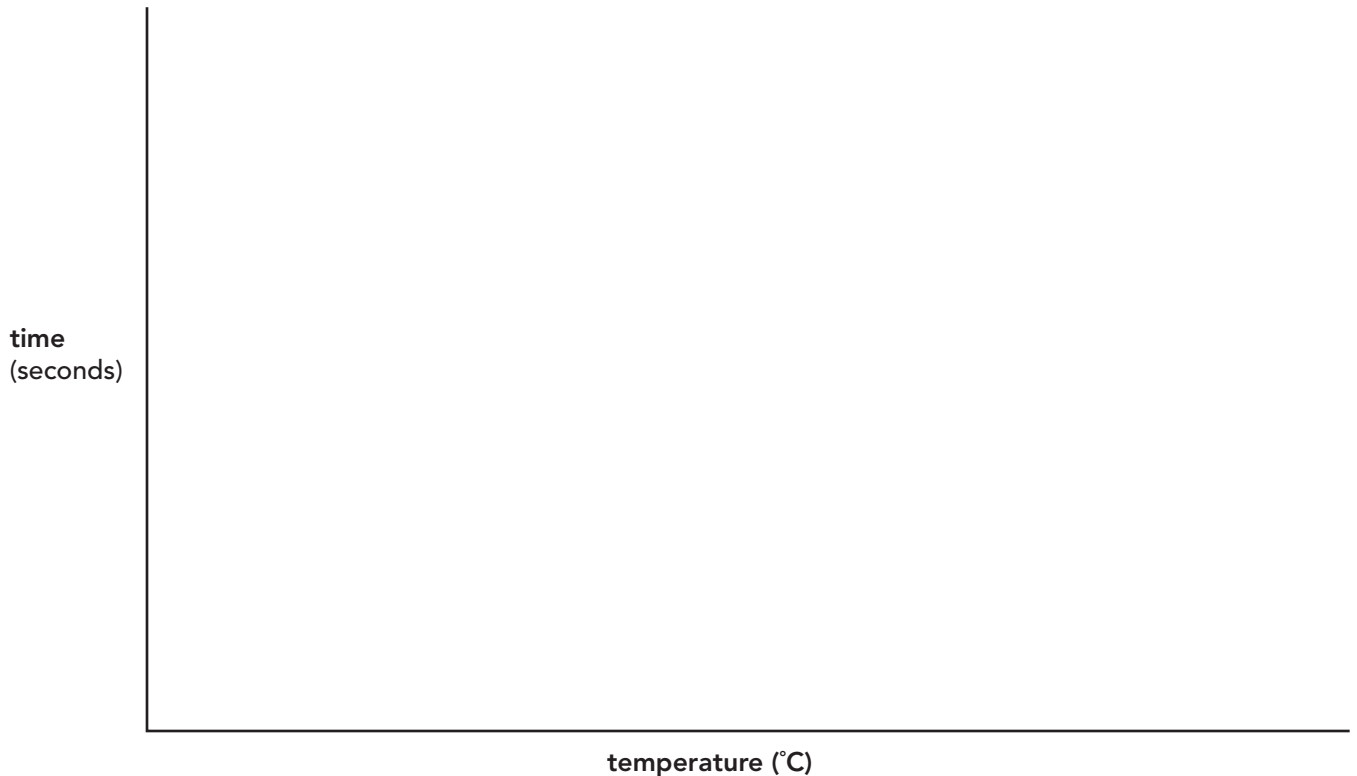
5. How did changing the temperature of the three fluids change the viscosity?

6. How are the above materials similar to oil sands? Natural gas? Crude oil?

7. In this experiment, what variable was changed to make this experiment similar to real-life transport of heavy oil or oil sands?

8. Choose one of the three materials and draw a bar graph using your results. Illustrate and label each trial separately.

Viscosity Bar Graph: Time vs. Temperature



Seismic in a Can

Time: 45 minutes

Curriculum Connections

Grade 7 Science – Unit E: Planet Earth

Grade 9 Social Studies: Canada – Responding to Change

Objectives

Students will investigate the seismic exploration process that oil and gas companies use to locate petroleum reserves. Terms related to the seismic process will be introduced, as well as the basic science behind seismic exploration.

Rationale

This lab allows students to experience a visual and audio representation of seismic exploration. Through the lab demonstration, students see a visual representation of the seismic process as waves reflect within a pool of water. Students then apply the same premise in an activity representing land-based seismic exploration.

Background Information

Seismic exploration is how geologists and geophysicists map underground formations where petroleum resources may be found. Oil and gas companies depend on the data produced by these seismic surveys to help determine the best drilling locations.

Traditionally, for land-based seismic exploration, dynamite charges have been detonated in shallow holes, creating vibrations to reflect off of different rock formations. This is called the seismic reflection method.

In recent years, heavy machinery has been used to create the energy waves. This has helped reduce the impact on the environment and changed how the seismic process works.

Marine-based seismic exploration uses the same basic process. Sound waves generated by air guns near the surface of the water create waves that travel down to different formations below the ocean floor, and reflect back to sensors that trail behind seismic ships.

Additional information on seismic exploration is available on pages 42-47 in *Our Petroleum Challenge*, included in the kit. Both types of seismic exploration are depicted on the *Petroleum* poster.

Materials

Lab Demonstration

Petroleum posters

Waterproof flat object
(clipboard, dissecting tray, cookie sheet, etc.)

Plastic basin

Student Activity

Petroleum posters

loose-leaf paper

4 metal coffee tins (with lids)

1 – empty

1 – half full of sand / soil

1 – half full of water

1 – full of loose coins

Activity

Anticipatory Set (5 minutes)

1. Among the class, discuss possible ways of finding out where minerals below the surface of the earth are located. How can we find out where they are? How can we find out what they are?
2. Distribute or post a copy of the poster. Discuss petroleum exploration methods (seismic) and explain the seismic section on the poster (inside, center left).

Guessing where to drill each well could be very wasteful, not to mention environmentally unfriendly. It's important to know where to drill, and seismic exploration is how companies decide where to drill.

3. Explain to students that sound waves travel down through the ground. When they pass through different layers of rock, they're reflected back to the source at different speeds and intensities, as seen on the poster.
4. Perform the following wave activity lab demonstration.

Seismic in a Can

Lab Demonstration (10 minutes)

1. Fill the plastic basin half-full with water.
2. Gather students, and ask them to watch the direction of wave travel. Remind students that while we can't see sound waves, we can watch the waves travel through the water. These waves are much the same as seismic sound waves.
3. Strike side of basin to create wave source, keeping the point of contact as concentrated as possible. You may want to use a fist or an object like a hammer rather than an open palm, which would diffuse the impact and the integrity of wave point source.
4. Explain that your hand is the seismic sound source, and the waves travel down (away) until they have to reflect back to the source. Repeat as necessary.
5. Once students understand the basic process, insert dissecting tray into basin. Hold vertical, resting on bottom, about mid-way. Ensure the barrier does not transect the entire basin, allowing room on one side for waves to pass. Ask students if the resulting wave will be the same as first attempt. If different, why?
7. Strike side of basin again, noting how some waves will reflect off the tray while others pass and reflect off the opposite side of basin.
 - a. The tray represents a layer of rock that the sound waves cannot pass through. They reflect back to the surface quicker than the other waves traveling through the reservoir.
 - b. The same thing happens on land or in water, depending on direction.
Your hand – seismic equipment
Water – reservoir, soil (terrestrial), water (marine)
Tray – rock layer

can and list the can number, their guess for contents, and how the sounds differ between cans (high pitch sound, low resonance, etc.)

3. The students are to hypothesize the contents of each can by tapping on the sides and top, but they cannot pick up the can.

Teacher Tip: If students are having difficulty, get them to shake the can, while paying attention to the lid.

4. After students have circulated to each can, open each can to display contents. Have students share their guesses and their reasoning behind their choices.
5. Remind students that can scientists estimate the locations of formations based upon how the sound waves bounce off of underground rock, the same way the sound made by the tapping on the cans was absorbed/ reflected by the contents of the can.
6. Ask students for other examples where this technology can be used in everyday life, not counting oil and gas exploration.
 - Geological research: volcanos, tectonic plates, earthquake prediction;
 - Nature: bats [echolocation], sharks [lateral line system helps them detect vibrations in the water]

Extension Activity

Time permitting, have students research the different types of land and marine-based seismic exploration and the equipment used (dynamite detonation, thumper trucks, geophones, hydrophones, streamers, etc.).

Our Petroleum Challenge, included in the kit, will help interested students find out more.

Student Activity

1. Set up four coffee cans with the various contents (noted in materials section above) in different locations around the room.
2. Have students circulate around the room to each

Teacher Tip: You may want to set up multiple samples in more than four cans, depending upon student numbers.

Petroleum: The Big Picture

Time: 30 minutes

Curriculum Connections:

Grade 7 Science – Unit A: Interactions and Ecosystems
– Unit E: Planet Earth

Grade 8 Science – Unit D: Mechanical Systems

Objectives

Students will gain an understanding of the basics of petroleum, from exploration to marketing, and will identify the steps required to transform fossil fuel deposits into the finished products we purchase as consumers.

Rationale

This activity is designed to provide an introduction and overview of the petroleum industry. It is suitable for any unit that discusses petroleum resources and how they are developed.

Background Information

Refer to section 1 of *Our Petroleum Challenge*, included in the kit.

Materials

Petroleum posters

Petroleum: The Big Picture student worksheets
(see following pages or resource CD)

Pencil crayons

Activity

1. Divide students into groups. Provide one copy of the poster for each group.
2. Have students take turns reading “The Petroleum Story” on the back of the poster.
3. In groups, students will examine the front and inside of the poster for images related to each step. They can identify the equipment, technologies and process that were discussed in “The Petroleum Story.”
4. Students will complete the worksheet by summarizing and drawing a representation of each step.

Answers (Locations)

Images related to each step can be found in the following areas of the poster:

1. Exploration: front, top half; inside, centre and left
2. Extraction: front, top half; inside, centre
3. Transportation: front, centre and bottom; inside, centre and bottom
4. Processing: front, bottom right; inside, centre and right
5. Distribution: front, bottom right; inside, centre and right
6. Marketing: front bottom; inside, top right

Extension

Groups select one of the steps in the petroleum process to research more thoroughly and present their findings to the class in the form of a PowerPoint, poster, or play.

Websites provided at the back of this guide and in the *Our Petroleum Challenge* book will be useful.

The Big Picture: student worksheet

Name

Class

Steps	Summarize	Illustrate
One: Exploration		
Two: Extraction		
Three: Transportation		

Steps	Summarize	Illustrate
Four: Processing		
Five: Distribution		
Six: Marketing		

Monster Machines

Time: 40 minutes

Curriculum Connections

Grade 8 Science - Unit D: Mechanical Systems

Objectives

Students will identify the function of simple machines and describe their subsystems.

Rationale

This worksheet can be used as a review to the Mechanical Systems unit. Students are provided with pictures of machines used in petroleum exploration and development to analyze their function. They will determine all the simple machines and subsystems that make up certain machines and identify connections between the subsystems and overall machine function.

Materials

Petroleum posters

Monster Machines worksheet
(see following page or resource CD)

Monster Machine Photos (resource CD)

Poster/flip chart paper

Markers

Computers (optional)

Activity

Anticipatory set (5-10 minutes)

1. Divide class into groups and distribute the poster.
2. On the board write three categories: pipeline construction, oil sands mining, and oil & gas exploration.
3. Ask students to find (and name) some of the machines used for those three processes:
 - Pipeline construction - feller-bunchers, backhoes
 - Oil sands mining - giant dump trucks, electric shovels
 - Oil and gas extraction - pumpjack, drilling rig

What other machines are involved in the

processes?

- Seismic trucks, land based drill rigs, offshore/marine drilling rigs, refining process machines, all machines that use petroleum (cars, trucks, boats, etc.)

Main Activity (30 minutes)

1. Distribute copies of the *Monster Machines* student worksheet to groups.
2. Using the poster and the machine photos from the resource CD, discuss with students how the machines listed on the worksheet would be used in the petroleum industry.
3. Students will analyze the machine, list the subsystems (lever, pulley, wheel & axle, hydraulic) and briefly describe how each contributes to its function.

Extension Activity

It's the students' turn to create a machine of the future. Groups will choose one machine from the worksheet, improve its design and create a poster or PowerPoint on their new and improved machine.

The poster or PowerPoint should contain the following information:

- A picture of the machine
- Subsystems labeled
- Overall explanation of how it works, the efficiency, how it's fueled, its environmental impact.
- How is this machine an improvement over current technology?
- How was science and technology used in developing the machine?

Time permitting, groups can present their machines to the class.

Monster Machines: student worksheet

Name _____

Class _____

Machine	Function Describe the function of the machine in the petroleum industry.	Subsystems How do the following subsystems contribute to the function of the machine?
Feller-buncher (tree cutter)		Lever: Hydraulics: Wheel and axle:
Bulldozer		Hydraulics: Gears:
Backhoe/ Excavator		Lever: Hydraulics: Wheel and axle:
Haul Truck		Gears: Hydraulics: Wheel and axle:
Electric Shovel		Pulleys: Hydraulics: Wheel and axle:
Pumpjacks		Pulleys: Gears: Lever:

Monster Machines: answer key

Machine	Function Describe the function of the machine in the petroleum industry.	Subsystems How do the following subsystems contribute to the function of the machine?
Feller-buncher (tree cutter)	Clears land of trees to lay pipeline.	Lever: moves the arm that grabs and stacks trees Hydraulics: high pressure fluid in the hoses and tubes creates a large amount of power to move the arm Wheel and axle: saw for cutting trees
Bulldozer	Moves large quantities of dirt, rock, & debris short distances. Used to prepare areas for surface mining and in the reclamation process.	Hydraulics: power the shovel Gears: sprockets turn the tracks (tracks allow for better mobility in rough terrain compared to pneumatic tires)
Backhoe/Excavator	Digging bucket on the end of an arm to dig and lift earth. Creates trenches for pipeline.	Lever: control the arm and bucket movement Hydraulics: power working implements of the backhoe Wheel and axle: moves the machine bucket at the end of the arm
Haul Truck	Carries the oil sand from mining area to the extraction plant.	Gears: provide forward/backward movement through transmission axles Hydraulics: power the box at the rear, lifts and empties truck contents Wheel and axle: massive tires move trucks
Electric Shovel	Scoops up oil sand and empties into the giant trucks.	Pulleys: system of cables to lift the shovel Hydraulics: power the bucket scoops and move the arms to unload the oil sands Wheel and axle: move cables and machine
Pumpjacks	Brings crude oil that does not easily flow from underground to the surface.	Pulleys: rotate gears (powered by engine) Gears: rotation causes up and down motion Lever: arm that moves up and down (usually powered by an electric motor)

Piece of the Petroleum Pie

Time: 90 minutes (can be broken into 2 class periods)

Curriculum Connections:

Grade 9 Social Studies
Economic Systems in Canada and the U.S.

Objective

Students will analyze the distribution of revenues generated from natural resources and how these revenues distributed by the government contribute to our quality of life.

Rationale

This activity allows students to explore their own social values and develop an awareness of how revenues from our natural resources impact our quality of life. This activity is structured to be cross-curricular and reinforces some mathematical concepts.

Materials

Petroleum posters

Piece of the Petroleum Pie government information sheet (see resource CD)

Piece of the Petroleum Pie student budget sheet and student worksheet (see following pages or resource CD)

Piece of the Petroleum Pie class budget sheet - reproduced onto a transparency (see resource CD)

14 pennies per student

18 large plastic cups

Weigh scale

Background Information

The people of Alberta own our natural resources. Be it trees, coal, oil sand or water, it belongs to all of us. The Government of Alberta, as our representative, makes decisions as to what can be done with these resources. On our behalf, the government also collects "rent" for developing these resources. In the petroleum industry the two major means for collecting this "rent" is through corporate and personal income tax, and what are called royalties for the production of the oil and natural gas itself.

Royalties and taxes collected from the petroleum

industry have gone a long way to contributing to the quality of life Albertans have come to expect. The important services provided to Albertans (health care, education, roads, etc.) come in part from the money raised through these royalties. In recent years, however, there has been much discussion and debate over the level at which our "rent" is collected. The debate came to a head in 2007 with a government-appointed panel recommending a significant increase in the amount of royalties paid by industry to government. The Alberta government decided to increase petroleum royalty levels over the next several years. This debate will continue as oil prices rise and fall.

More information on Alberta's new royalty framework is available on Alberta Energy's website at www.energy.alberta.ca

Note: It is recommended teachers follow the current events surrounding the royalty debate and encourage the awareness of students of the multiple perspectives in this debate. What are the economic arguments being made for both government and industry? What are the environmental arguments being made? What would/should the government be doing? What can we, as individuals, do to help solve the problems and answer the important questions?

Activities

Introductory Activity

1. Distribute the *Petroleum* posters to small groups of students. Introduce the phrase "quality of life." Ask students to identify the various expectations for a good way of life depicted on the poster – schools, food (or growing food) hospitals, transportation, recreation, clean water, healthy environment, employment, etc.
2. Point out the "Big O & G" (for oil and gas) building on the poster front. "Big Oil" is considered a derogatory term towards Alberta's petroleum industry. Ask students to discuss why. Some see large foreign owned oil companies as uninterested in the concerns of local residents.

Piece of the Petroleum Pie

3. Have students identify the variety of values that people hold towards use and development of our natural resources. Discuss other (possibly competing, but not necessarily) values depicted on the poster that address quality of life for Albertans.

Activity 2

Set-up: label the plastic cups with each of the 18 government ministries listed on the budget sheets and place them throughout the classroom.

1. Discuss where governments get the money needed to sustain a certain standard of living and quality of life (personal and corporate taxes and revenue from natural resources).
2. Tell students they have each been elected to the provincial government and it will be their responsibility to distribute the revenues generated from the petroleum industry. They must decide how to allocate money to government ministries.
3. Place the labeled cups around the room and discuss the meaning of each label using the information provided on the label information sheet. Each cup represents an area to which funds could be distributed as part of the overall budget.
4. **Budget A:** Using the information¹ outlined in question 1, students will calculate the figures to be used to create the first of two budgets. Based on these calculations, distribute 12 pennies to each student. Tell students their 12 pennies represent the royalties and taxes collected by the government from the petroleum industry. They will have to decide how to allocate these funds by completing **Budget A** on the student budget sheet and part 1 of the worksheet.
5. Students will then circulate around the room and deposit their coins in the appropriate plastic cups to represent their budget allocations.
6. Once all the funds have been collected, the teacher weighs the cups to give a representation of the class budget. Complete the chart on the class worksheet transparency and have students complete part 2 of their worksheet.

7. **Budget B:** Using the information on the new royalty regime, students will project the revenue from royalties and taxes collected from the petroleum industry in 2010. Based on these calculations, empty the cups and distribute 14 pennies to each student and have them complete part 3 of the worksheet, which includes repeating steps 5 and 6 from above.
8. Have students complete part 4 of the worksheet.

Extension Activities

1. Compare the current provincial budget to the one that was developed by individuals or the class. (Information on Alberta's current budget is available on the Alberta Finance website: www.finance.gov.ab.ca.) Have students compare their budgets to actual allocations. Have a class discussion on government priorities and the effects on the quality of life for all Albertans.
2. To meet ICT outcomes students can graph their budgets using spreadsheet software.
3. Hold a class debate challenging students to defend the positions outlined in question 12.

Answers

Part 1 Budget A

1. a) \$12.16 billion
b) \$25.84 billion
c) \$12 billion
d) \$26 billion

Part 3 Budget B

5. a) \$14.4 billion
b) \$23.6 billion

Note: Not all provincial ministries are listed on the worksheet.

References

1. The information used in this exercise is from the Canadian Association of Petroleum Producers website www.capp.ca/default.asp?V_DOC_ID=675. Accessed October 8, 2007.

Piece of the Petroleum Pie: Class budget sheet

	Budget A (weight of pennies)	Budget B (weight of pennies)
Petroleum producers		
Government Ministries		
Aboriginal Relations		
Advanced Education and Technology		
Agriculture and Rural Development		
Children and Youth Services		
Culture and Community Spirit		
Education		
Employment and Immigration		
Energy		
Environment		
Finance and Enterprise		
Health and Wellness		
Housing and Urban Affairs		
Infrastructure		
International and Intergovernmental Relation		
Justice and Attorney General		
Seniors and Community Supports		
Service Alberta		
Solicitor General and Public Security		
Sustainable Resource Development		
Tourism, Parks and Recreation		
Transportation		
Treasury Board		

Piece of the Petroleum Pie: Student Worksheet

Name

Class

	Budget A (\$ billions)	Budget B (\$ billions)
Petroleum producers		
Government Ministries		
Aboriginal Relations		
Advanced Education and Technology		
Agriculture and Rural Development		
Children and Youth Services		
Culture and Community Spirit		
Education		
Employment and Immigration		
Energy		
Environment		
Finance and Enterprise		
Health and Wellness		
Housing and Urban Affairs		
Infrastructure		
International and Intergovernmental Relation		
Justice and Attorney General		
Seniors and Community Supports		
Service Alberta		
Solicitor General and Public Security		
Sustainable Resource Development		
Tourism, Parks and Recreation		
Transportation		
Treasury Board		

Piece of the Petroleum Pie: Student budget sheet

Name

Class

Part 1: Actual budget (Budget A)

Plan your budget using the budget sheet provided.

1. First, using data from 2006, calculate a) how much revenue the Alberta government collected from the petroleum industry in taxes and royalties and b) how much of the profit the industry kept.

Profits: \$38 billion = [Total Industry Revenues \$80 billion - Cost of Production \$42 billion]

Per cent of profits paid to province in royalties and taxes: 32%

a) Amount paid to the province: \$_____ billion [petroleum profits x percentage of profits/100]

b) Amount remaining for petroleum producers (profits) \$ _____ billion [petroleum profits – taxes & royalties]

Round the above figures to the nearest whole number.

c) Amount paid to the province: \$_____ billion

d) Amount remaining for petroleum producers: \$_____ billion

2. Complete **Budget A** on your sheet using the figures from questions 1c and 1d. The figure from 1d represents the amount of revenue allocated to the petroleum producers and can be used to fill in the first box on your sheet. 1c represents what you now have left to allocate to government ministries. This revenue will be represented by the appropriate number of pennies, each penny representing \$1 billion. Decide how many pennies you will give to the government ministries that have been put in place to support the quality of life and standard of living in Alberta and record this on your sheet.

3. a) Indicate which area you allocated the *most* revenue to and explain why.

Government ministry: _____

Reason: _____

- b) Indicate which area you allocated the *least* revenue to and explain why.

Government ministry: _____

Reason: _____

4. Move around the class room and distribute your pennies in accordance with your budget.

Piece of the Petroleum Pie: Student Worksheet

Part 2: The Class Consensus

3. What were the top five government ministries chosen by the class?

1. _____
2. _____
3. _____
4. _____
5. _____

Part 3: Projected budget (Budget B)

Royalties are paid by industry to the government for the right to use *our* non-renewable natural resources. In 2007, an independent panel of experts was appointed to conduct a review of Alberta's royalty and tax rules to ensure Albertans were receiving a fair share from energy development through royalties, taxes and fees. The Royalty Review Panel hosted public meetings and gathered input from key stakeholders. Based on the report and many of the recommendations of the review panel, the Alberta government implemented a new royalty system that will see a 20% increase in royalties in 2010.

4. Using this information and the figures from 2006 (see question 1 for petroleum profits and amount paid in royalties and taxes) calculate:
- a) the amount of revenue the government will collect from the petroleum industry in 2010 and
 - b) the amount of revenue that will remain with the petroleum producers.

Note: There are a number of variables that will affect the petroleum industry's profits and the actual amount of taxes and royalties the industry will pay in 2010. For simplicity, this exercise assumes the petroleum profits and taxes from 2006 will be the same in 2010.

5. Round the figures from question 5 to the nearest whole number and use these to complete **Budget B** on your sheet. Once again, the figures will be represented by the appropriate number of pennies, each penny representing \$1 billion. Based on this new revenue, decide how many pennies you will give to the government ministries and record it on your sheet

6. a) Indicate which area you allocated the *most* revenue to and explain why.

Government ministry: _____

Reason: _____

- b) Indicate which area you allocated the *least* revenue to and explain why.

Piece of the Petroleum Pie: Student Worksheet

Government ministry: _____

Reason: _____

7. Move around the class room and distribute your pennies in accordance with your budget.

Part 4: Critical Thinking

8. How did Budget A compare to Budget B?

9. Choose three of the ministries listed in the table and explain how the amount of funding given to each will affect our quality of life.

1. _____

2. _____

3. _____

Piece of the Petroleum Pie: Student Worksheet

10. Petroleum is a non-renewable resource and currently is a major factor in the Alberta economy. How will our quality of life be affected if petroleum reserves are depleted?

11. How can you ensure a good quality of life for your generation and the generations that follow?

Discussion and Debate

12. "Petroleum producers should pay even more royalties to the province." Defend BOTH sides of this statement. Be prepared to discuss either side in class.

AGREE: _____

DISAGREE: _____

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.

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

www.edukits.ca/petroleum

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

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.

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

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

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

Decompose – the process whereby dead plants or animals breakdown into nutrients and minerals, which are then returned to the soil.

Drilling rig – A machine which 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 (e.g. fossil fuels) or renewable sources (e.g. wind turbines).

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

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.

Geophysicist – a person trained in the study of the relations between the physical features of the Earth and the forces that cause them, such as magnetism and seismology.

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

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).

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.

Glossary

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

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

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

Porosity – total volume of spaces within rock that might contain oil and gas. The porosity measures the capacity of the rock to hold natural gas, crude oil or water.

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.

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

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

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

Remediation (environmental) – the process of stopping or reversing environmental damage.

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

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.

Viscosity – the resistance to flow or “stickiness” of a fluid.

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