

A Middle School  
Petro Science  
Curriculum

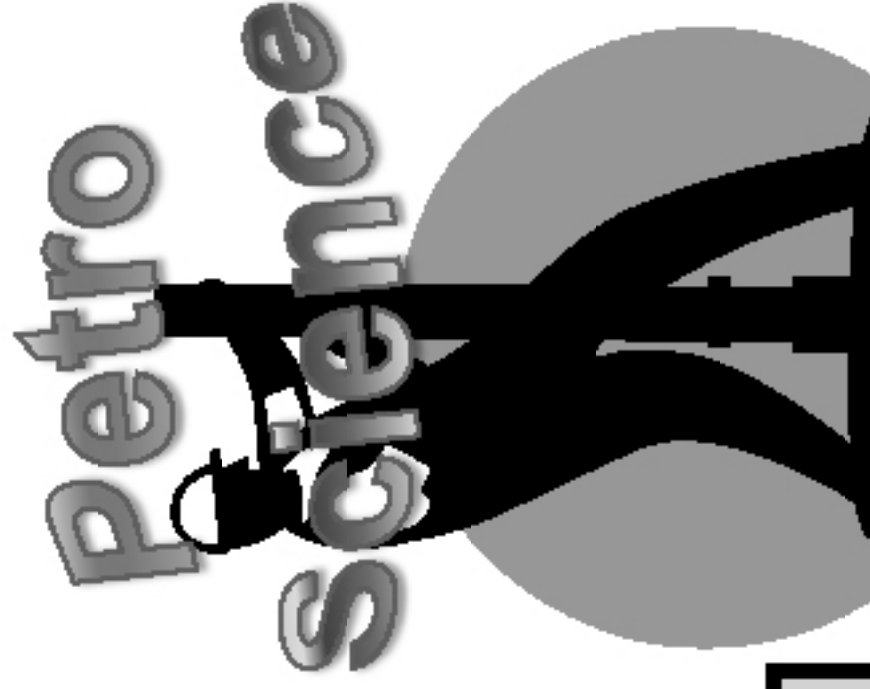
Presented by

Illinois Petroleum Resource Board

Original curriculum courtesy of

Oklahoma Energy Resources Board

Aligned to Illinois Learning Standards



**POWERING EDUCATION**

Updated 1/1/2020



## **What is the IPRB?**

The **Illinois Petroleum Resources Board** formed to provide public awareness, education programs and to restore abandoned well sites throughout the state. Funding for IPRB programs comes from voluntary contributions of oil and natural gas producers and royalty owners in Illinois.

IPRB provides funding and expertise in the reclamation and restoration of abandoned oilfield sites in the State of Illinois. These restoration projects fulfill another goal of IPRB which is to restore abandoned sites previously used for oil and gas production into agricultural or commercial use for current land owners.

For more information about IPRB and the free education programs, please visit the website at [iprb.org](http://iprb.org), contact us at [office@iprb.org](mailto:office@iprb.org) or call the Illinois Petroleum Resources Board at 618-242-2861.

One of our most important missions is Energy Education! Our program serves two primary goals:

**1. To develop and design oil and natural gas education activities for K-12 teachers and students in Illinois.**

**2. To provide teachers with:**

- Workshops statewide that provide free training and resources in energy education
- Educational field trips for students and teachers
- Professional development hours
- Other education resources that help interest students in science and math, energy, and their understanding of how Illinois crude oil and natural gas are an important part of the energy picture and the Illinois economy.

### **Professional development**

The IPRB will provide professional development credits for use of this curriculum. To receive information on professional development sessions, please contact the IPRB at email [office@iprb.org](mailto:office@iprb.org) or 618-242-2861.



# **FREQUENTLY ASKED QUESTIONS**

The activities in this book are designed to teach students through discovery hands-on investigative experiences and open-ended inquiry questions.

## **WHAT IS ENERGY?**

The world is full of movement. Birds fly into the air, trees move in the wind, and ships sail on the sea. People, animals, and machinery move around, but not without a source of energy.

Living things and machines need energy to work. For example, the energy that turns the blade of a windmill comes from the wind.

The sun provides the energy needed to produce the food you eat.

Food provides the energy your muscles need to ride your bike. The energy to make a car, plane or motorboat move comes from the gasoline inside the engine.

## **FROM WHERE DOES ENERGY COME?**

All energy originates from the sun. Without the sun, there would be no life on earth. The energy from the sun is transformed into many other types of energy that we use every day. Important forms of energy are oil, natural gas and coal, also known as fossil fuels.

## **HOW ARE OIL, NATURAL GAS AND COAL FORMED?**

Millions of years ago, the seas were filled with billions of tiny plants and animals. As these plants and animals died, their remains sank to the ocean floor and were buried in layers of sand and sediment. As more and more time passed, heat and pressure worked on the buried remains until they became fossil fuels. These fossil fuels were then trapped in underground rock formations. If rock is porous (containing holes or void spaces), it can accumulate oil, natural gas and coal.

For more than 150 years, man has been exploring and extracting fossil fuels. Today, when we use the products made from fossil fuels, we are releasing the energy that first came to earth from the sun millions of years ago.

## **HOW DO WE FIND OIL AND NATURAL GAS?**

Edwin L. Drake was the first person to drill specifically for oil. In 1859, near Titusville, Pennsylvania, Drake struck oil. Drake's discovery helped make the finding of oil a big business. By 1900, prospectors had found oil fields all over the country, especially in Oklahoma and Texas.



Today, prospecting for oil and natural gas is highly skilled detective work as scientists use computers, satellites, sound waves and high-tech equipment to search both underground and under the ocean floor. Long before drilling can begin, geologists and geophysicists (scientists who explore for oil and gas) gather clues to locate possible sites for drilling. These clues come in many forms . . . from maps to locating fossils to studying sound waves from deep beneath the surface. The scientists make their best predictions, locate the spot and then the exploration begins. However, this process does not proceed without concern for the environment.

For many years, oil and gas companies have devoted considerable time and resources to finding ways of reducing their impact on the environment. In fact, U.S. companies are spending more dollars protecting the environment than drilling new wells. The effects that drilling, as well as any eventual production operations, will have on an offshore environment or a sensitive onshore tract must be anticipated and thoroughly spelled out. Blowout preventers used during the drilling process insure against the potential release of oil or natural gas into the atmosphere making oil "gushers" a relic of the distant past. Steel casing is set and cemented to protect the water table from contamination. Oil companies routinely take all necessary steps to prevent harmful interaction with wildlife and crop production.

In the final analysis, it is a question of balance between the need for energy and the desire to have an undisturbed environment. Oil companies and the government must cooperate to ensure this balance is achieved.

## **HOW IS OIL AND NATURAL GAS TRANSPORTED AND USED?**

Once oil and natural gas are produced and collected, they must be safely transported for their many uses. Oil can be transported by truck, pipeline or ships to factories called refineries. Natural gas can only be transported in large quantities through high pressure pipelines. Consequently, natural gas produced in the U.S. can only be used on this continent. Crude oil can be shipped all over the world where it is made into thousands of products that we use every day. You don't need to leave home to find oil in some of its many forms.

By processing fossil fuels at power stations, stored energy can be converted to electricity. The carpet on your floor and the paint on your walls probably have oil in them. You brush your teeth with a plastic tooth brush which is made from petroleum (oil is the key ingredient of plastic). It is estimated that we have found more than 500,000 uses for oil.



# Learning Cycle

*Petro Science* activities follow the learning cycle format:

## 1. **Wonder Why**

The Wonder Why question focuses on the topic of the activity and engages student interest.

## 2. **Discovery Procedure**

This stage of the learning cycle provides information and procedures for inquiry-based, hands-on investigations.

## 3. **Concept Formation**

Based on the discovery activity, this stage of the learning cycle develops the main idea through questioning and additional resources.

## 4. **Expansion**

This stage of the learning cycle allows for further development of the concept through the use of subject integration, resources, community outreach, creativity and decision-making.



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**NOTICE:** Remember to always wear safety goggles, and other safety protection when doing science experiments.



# **Cooking Up Crude**

## **Illinois Academic Standards-English/Language Arts**

### **Grades 6-8**

#### **Science and Technical Subjects-Reading**

##### Key Ideas and Details

6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

##### Integration of Knowledge and Ideas

6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

#### **Science and Technical Subject-Writing**

##### Text Types and Purposes

6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

##### Research to Build and Present Knowledge

6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation

#### **Speaking and Listening**

##### Presentation of Knowledge and Ideas

6.5 Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information

7.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.



# **Next Generation Science Standards**

## **Grades 6-8**

### **Earth's Place in the Universe**

MS-ESS1-4 Construct a scientific explanation based on evidence from rock strata for how the geologic time scale is used to organize Earth's 4.6-billion-year-old history.

### **Earth's Systems**

MS-ESS2-2 Construct an explanation based on evidence for how geoscience processes have changed Earth's surface at varying time and spatial scales.



# **Petro Pockets**

## **Illinois Academic Standards-English/Language Arts**

### **Grades 6-8**

#### **Science and Technical Subjects-Reading**

##### Key Ideas and Details

6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

##### Integration of Knowledge and Ideas

6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic.

## **Illinois Academic Standards-Mathematics**

### **Grade 6**

#### Reason about and solve one-variable equations and inequalities

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

MP.2 Reason abstractly and quantitatively

### **Grade 7**

Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

7.EE.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities

MP.2 Reason abstractly and quantitatively



# **Next Generation Science Standards**

## **Grades 6-8**

### **Earth and Human Activity**

MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.



# **Traveling Sound**

## **Illinois Academic Standards-English/Language Arts**

### **Grades 6-8**

#### **Science and Technical Subjects-Reading**

Integration of Knowledge and Ideas

6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic

#### **Speaking and Listening**

Presentation of Knowledge and Ideas

6.5 Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

7.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

## **Illinois Academic Standards-Mathematics**

MP.2 Reason abstractly and quantitatively

MP.4 Model with mathematics

## **Next Generation Science Standards**

### **Grades 6-8**

#### **Waves and their Applications in Technologies for Information Transfer**

MS-PS4-2 Develop and use a model to describe that waves are reflected, absorbed, or transmitted through various materials.



# **Seismic Clatter**

## **Illinois Academic Standards-English/Language Arts**

### **Grades 6-8**

#### **Science and Technical Subjects-Reading**

Integration of Knowledge and Ideas

6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic

#### **Speaking and Listening**

Presentation of Knowledge and Ideas

6.5 Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

7.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.

## **Next Generation Science Standards**

### **Grades 6-8**

#### **Earth and Human Activity**

MS-ESS3-1 Construct a scientific explanation based on evidence for how the uneven distributions of Earth's mineral, energy, and groundwater resources are the result of past and current geoscience processes.



# **From the Ground Up**

## **Illinois Academic Standards-English/Language Arts**

### **Grades 6-8**

#### **Science and Technical Subjects-Reading**

##### Key Ideas and Details

6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

6-8.3 Follow precisely a multistep procedure when carrying out experiments, taking measurements, or performing technical tasks.

##### Integration of Knowledge and Ideas

6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic

## **Next Generation Science Standards**

### **Grades 6-8**

#### **Matter and Its Interactions**

MS-PS1-2 Analyze and interpret data on the properties of substances before and after the substances interact to determine if a chemical reaction has occurred.

MS-PS1-3 Gather and make sense of information to describe that synthetic materials come from natural resources and impact society.

#### **Motion and Stability: Forces and Interactions**

MS-PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

#### **Engineering Design**

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.



# **Lucky**

## **Illinois Academic Standards-English/Language Arts**

### **Grades 6-8**

#### **Science and Technical Subjects-Reading**

##### Integration of Knowledge and Ideas

6-8.9 Compare and contrast the information gained from experiments, simulations, video, or multimedia sources with that gained from reading a text on the same topic

#### **Science and Technical Subject-Writing**

##### Text Types and Purposes

6-8.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.

##### Research to Build and Present Knowledge

6-8.8 Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation

#### **Speaking and Listening**

##### Presentation of Knowledge and Ideas

6.5 Include multimedia components (e.g., graphics, images, music, sound) and visual displays in presentations to clarify information.

7.5 Include multimedia components and visual displays in presentations to clarify claims and findings and emphasize salient points.

8.5 Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.



# Precious Pretzels

## Illinois Academic Standards-English/Language Arts

### Grades 6-8

#### Science and Technical Subjects-Reading

Key Ideas and Details

6-8.1 Cite specific textual evidence to support analysis of science and technical texts.

Integration of Knowledge and Ideas

6-8.7 Integrate quantitative or technical information expressed in words in a text with a version of that information expressed visually (e.g., in a flowchart, diagram, model, graph, or table).

## Illinois Academic Standards-Mathematics

### Grade 6

Reason about and solve one-variable equations and inequalities

6.EE.6 Use variables to represent numbers and write expressions when solving a real-world or mathematical problem; understand that a variable can represent an unknown number, or, depending on the purpose at hand, any number in a specified set.

Understand ratio concepts and use ratio reasoning to solve problems.

6.RP.1 Understand the concept of a ratio and use ratio language to describe a ratio relationship between two quantities.

### Grade 7

Solve real-life and mathematical problems using numerical and algebraic expressions and equations.

7.EE.4 Use variables to represent quantities in a real-world or mathematical problem, and construct simple equations and inequalities to solve problems by reasoning about the quantities

Analyze proportional relationships and use them to solve real-world and mathematical problems.

7. RP. 2 Recognize and represent proportional relationships between quantities.

## Next Generation Science Standards

### Grades 6-8

#### Earth and Human Activity

MS-ESS3-3 Apply scientific principles to design a method for monitoring and minimizing a human impact on the environment



# Thinking about your Career path?

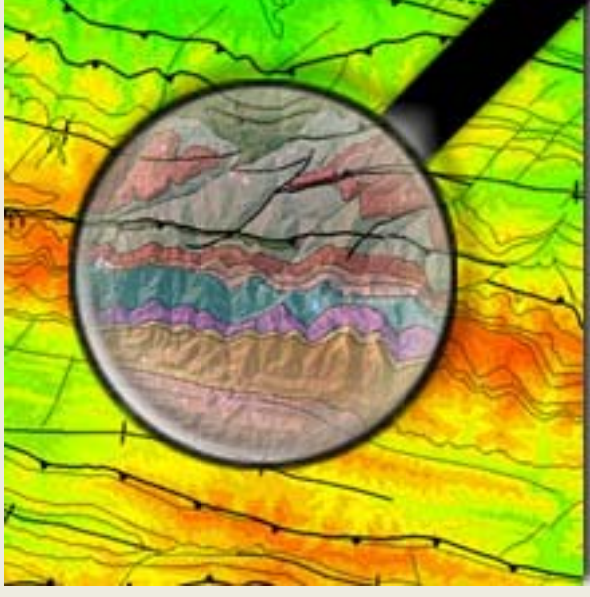


**THINK OIL AND NATURAL GAS**

**CHEMISTS  
MANAGERS  
ENGINEERS  
GEOLOGISTS  
ADMINISTRATIVE  
DRILLING RIG OPERATOR**



**Petroleum is more than just gas. Just about everything we use comes from petroleum or uses petroleum energy in some way. The petroleum industry offers a wide-range of career choices. Take a look.**







## ENGINEERS

There are many career opportunities in the petroleum industry for engineers. Chemical, industrial, electrical, civil and petroleum engineers all play a part in the petroleum industry. Most common are petroleum engineers.

***Petroleum engineers***  
search the world for reservoirs containing oil or natural gas.





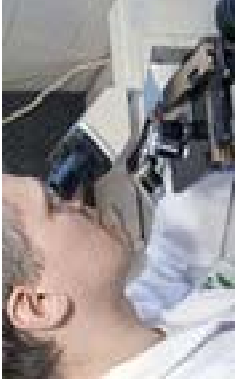


## ***GEOLOGISTS***

Geologists are employed to explore for crude oil and natural gas and to help develop reservoirs. Geologists search for oil and gas by studying rock formations and using microscopes to examine rocks fragments (cuttings) from wells that are being drilled.







## ***GEOSCIENTISTS***

*Geoscientists* study the composition, structure, and other physical aspects of the Earth. Their knowledge can help companies find oil and natural gas.





The Oil and Gas ***Administrative Assistant*** performs a variety of duties in today Petroleum-related offices. They provide support to all of the engineering technicians inside the office and are responsible for gathering information for engineering techs and producing production reports, tracking safety records and booking training based on the information gathered.



**ADMINISTRATIVE**





## ***DRILLING CREWS***



Drillers are directly responsible for the drilling of the hole. They supervise other crew members and operate drilling controls.

Derrickhands handle the upper end of the pipe as it is hoisted out of or lowered into the well hole. They are also responsible of the circulating machinery and the conditioning of the drilling fluid.

Rotary helpers or roughnecks help handle the lower end of the pipe and help maintain the rig.





## ***SCHOOL***



Many schools in Illinois offer excellent programs in engineering and science to prepare you for a career in the Petroleum industry.



## ***THE OIL INDUSTRY.....A LOT OF DIFFERENT PROFESSIONS ENGAGED IN FINDING OIL***

<ul style="list-style-type: none"><li>• Geologists</li><li>• Chemists</li><li>• Engineers</li><li>• Accountants</li><li>• Oil and Gas Attorneys</li><li>• Landmen – leasing of properties</li><li>• Safety and Environmental Workers</li><li>• Secretaries, Receptionists, Data Management, Office Management</li><li>• Regulatory Compliance</li><li>• Drilling - Rig Hands, Tool Pushers</li><li>• Roustabouts, Pumpers</li><li>• Welders, Electricians</li><li>• Mechanics</li><li>• Heavy Equipment Operators, Truck Drivers</li><li>• Service Company Professionals – chemical, logging, cement, fracking, welding, testing, contract services</li><li>• Sales and Service of oil field supplies and equipment</li><li>• Refinery workers</li></ul>	<p><b><u>LEVEL OF EDUCATION</u></b></p> <p>Bachelors, Masters</p> <p>Bachelors, Masters</p> <p>Bachelors, Masters</p> <p>Associates and Bachelors</p> <p>Bachelors + Law Degrees</p> <p>Varies; usually some college</p> <p>Varies; usually some college</p> <p>Varies</p> <p>Associates or Bachelors</p> <p>High School</p> <p>High School</p> <p>High School or Associates</p> <p>High School or Associates</p> <p>Varies; usually High School</p> <p>Varies, depending on job</p> <p>Varies, depending on job</p> <p>Associates preferred</p>
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# *Careers in Geology*

## WHAT DOES A GEOLOGIST DO?

- Search for economic resources:
  - Oil and Gas
  - Coal
  - Uranium
  - Groundwater
  - Precious metals
  - Industrial metals and materials
- Solve problems:
  - Earthquakes
  - Volcanics
  - Groundwater resources
  - Construction (e.g. dams, highways)
  - Physical Hazards (e.g. landslides, floods)
  - Environmental Hazards (landfills, groundwater pollution)
- Other:
  - Education
  - Resource management (state or federal)

## WHAT EDUCATION DOES A GEOLOGIST NEED?

- Bachelor's degree is mandatory; a master's or doctorate is preferred.
- Must be strong in math and sciences.

## WHERE DOES A GEOLOGIST WORK?

- Geology today is largely an indoor job.
- The job market can be volatile; geologists with graduate degrees will have the advantage. Many geologists may change jobs several times in a career.
- Movement is common; a geologist may work in many different regions over the course of a career.



# OIL & NATURAL GAS TECH SHORT CERT



Certificate

Minimum 17.5 Hours

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**Career & Technical Education • Certificate • Minimum 2.0 OGPA • Major Code: CSONT**

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One Semester		Credit Hrs
ONGT 110	Introduction to Petroleum Industry	1
ONGT 111	Oil & Gas Production I	3
DSL 131	Engine Electronics	3
DSL 158	Hydraulics I	3
ONGT 112	Artificial Lift Systems	3
ONGT 113	Oil & Gas Production II	3
CPR 112	Heartsaver First Aid w/CPR	.5
SAFE 133	SAFELANDUSA™ Training	1
Total Hours		17.5

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Occupational information about this program is available at O\*NET online [www.onetonline.org](http://www.onetonline.org). Once at that website enter the SOC Code that is listed for this program.

O\*NET – SOC Code:

47-5071.00

47-5013.00

47-5012.00

47-5011.00

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**Career Opportunities:**

Roustabouts, Service Unit Operators, Drilling Operators

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**Major Employers:**

Oil and Gas Companies, Drilling Companies

02/14