

## *Foreword*

*“The goal is to use conceptual knowledge to develop deep understandings that students will carry beyond the lesson.”*

--H. Lynne Erickson

The rich history of Kern County is tightly interwoven with the growth of the petroleum industry. In order for our citizens to understand the workings of the county, it is important for them to know the historical background and have some knowledge of the current workings of the petroleum industry.

The oil exhibition –“ Black Gold—the Oil Experience” at the Kern County Museum offers teachers and students a rare opportunity to experience history in a way that will bring it to life. This state of the art interactive series of exhibits encourages visitors to become involved in some of the processes that are used in today’s high tech quest for oil and gas. Visitors are also taken back in time to the beginnings of exploration in Kern County with displays, video, and artifacts.

A trip to the oil exhibition provides the classroom teacher with an opportunity to integrate history, language arts, science, and mathematics in real life situations that will captivate their students. The pages of this teacher’s guide offer suggestions for using the information gained during a visit to reinforce many of the State of California Content Standards for these subjects.

Students are curious. Allowing them the opportunity to expand on the knowledge gained from a visit and encouraging them to push forward into new vistas of learning and presentation of information is one of the most effective teaching techniques we can employ. With this curiosity, a visit to the oil exhibition can, with proper guidance, become one of the learning highlights of the student’s year.

The visit to the museum and the use of this guide are only the beginning. What the teacher and students do with the knowledge and insight gained will be the real measure of the success of this joint venture.

Larry E. Reider  
Kern County Superintendent of Schools

Carola Rupert Enriquez  
Director, Kern County Museum

## *Using the Guide*

This guide is intended for the classroom teacher in preparing students of grades 4 - 8 for a tour of the oil exhibition at the Kern County Museum. The content presented for each of the exhibits will provide background knowledge to make the visit more meaningful.

“Pre – visit Activities” have been provided to assist teachers in creating interest in a visit to the oil exhibition, as well as providing teaching moments for the classroom that align with state content standards. The activities are intended to be modified as needed to fit specific classroom needs. Teachers are encouraged to select activities from a variety of exhibits and prepare the students with background material necessary to complete them. In order to meet the needs of students with a variety of learning styles, activities should provide experiences from a variety of learning modalities. Activities before the visit should be expected to raise questions that can be later answered by the information in the exhibit. Students and teachers are encouraged to bring unanswered questions with them on their visit.

“Post – visit Activities” have been designed to assist students in recalling information that was presented during the visit, extending learning beyond the visit, and presenting information to classmates, parents, and others through a variety of genre. Activities are designed to provide real world learning opportunities for students that align with required content standards. After the visit is the time for using the activities and information to challenge students to learn more about the topics they have experienced and careers they have encountered.

Students should be encouraged to re-visit the exhibit with their families to share their experiences and information learned.

## California Content Standards Correlation Chart Grades 4 – 8

(Based on the use of Content Information, Pre-visit Activities, Exhibit Content, and Post-visit Activities)

	Grade 4				Grade 5				Grade 6				Grade 7				Grade 8			
	English Language Arts	History Social Science	Mathematics	Science	English Language Arts	History Social Science	Mathematics	Science	English Language Arts	History Social Science	Mathematics	Science	English Language Arts	History Social Science	Mathematics	Science	English Language Arts	History Social Science	Mathematics	Science
Store	✓	✓			✓	✓			✓				✓				✓			
Map Room	✓			✓	✓				✓	✓		✓	✓	✓		✓		✓		✓
Hippodrome Theater	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			✓	✓			✓
Historic Timeline	✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓		
Diving Bell	✓		✓	✓	✓			✓	✓			✓	✓			✓	✓			✓
Core Samples	✓		✓	✓	✓		✓		✓			✓	✓			✓	✓			✓
Fossils/Porosity/Permeability	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓		✓	✓	✓			✓
Plate Tectonics	✓		✓	✓	✓		✓		✓	✓		✓	✓	✓	✓	✓	✓	✓		✓
Traps	✓				✓				✓			✓				✓				
Seismic Mapping	✓			✓	✓				✓	✓		✓	✓	✓		✓		✓		✓
Land Sat Mapping	✓				✓				✓	✓		✓	✓	✓		✓		✓		✓
Miner		✓			✓	✓			✓			✓	✓			✓	✓			
Drilling	✓			✓	✓	✓			✓			✓	✓			✓	✓			
Downhole Tools	✓			✓	✓				✓			✓	✓							✓
Modern Drilling	✓	✓		✓	✓	✓		✓	✓			✓			✓					✓
Common Means of Recovery	✓			✓	✓			✓	✓			✓	✓				✓			✓
Refinery Operation	✓				✓			✓	✓			✓	✓				✓			✓
Chemistry Is Right	✓	✓		✓	✓			✓	✓			✓	✓				✓			✓
Chem Lab	✓	✓		✓	✓			✓	✓			✓	✓				✓			✓

Additional correlations may be obtained through modification or the addition of pre or post visit activities to fit specific grade- level standards.

# Hippodrome Theater

## Content Information

The Hippodrome Theater presents an overview of the history of the petroleum industry in the southern San Joaquin Valley. Changes to the California landscape and the geological forces that created that landscape are highlighted to build a background of information for the visitor.

The area that we know today as California has changed from land to ocean and back to land. The fossils found here are records of microscopic organisms, marine plants and animals, and land dwellers that inhabited this area. Microscopic organisms and plants and animals (but not dinosaurs) were buried and have formed oil and gas deposits.

Native Americans of this area used the oil that seeped out of the ground to waterproof baskets and boats and to secure stone points to their arrows and spears. The first Europeans to the area were the Spanish explorers from Mexico who visited in the 1770s. The westward migration of the mid-1800s brought gold seekers and new immigrants to the state. Some of these settlers found the southern area of the valley to be a land of opportunity – mining, raising livestock, and farming. Others dug by hand for asphalt that was sold to companies such as the railroads.

Drilling for oil began around 1900. Milton McWhorter drilled the “Discovery Well” near the Kern River northeast of Bakersfield in 1899. The well was drilled to a depth of 256 feet and pumped 15 barrels of oil a day. Drilling methods were based on lessons learned from drilling water wells and farming. Within days, 16 rigs were working and the oil boom was on! People came from all over. Oil promoters, lease hounds, rig builders, drillers, roustabouts, and muleskinners came to work in the oil fields. The first derricks were made of wood using hand tools. Soon, over 200 oil companies were operating in the Kern River Field. The area grew rapidly with saloons, dance halls, stores, and hotels that served the oil companies and their workers.

Other areas of the valley were explored for oil and wells were drilled. The “Lakeview Gusher” drilled in 1910 was the largest producing well of all time in California. The outlying oilfields were far from town and workers and their families had housing on the oil leases. The families provided their own entertainment and had to travel to town for supplies.

The war years placed an increased demand for petroleum products to support the military and the war factories. Oil prices and production needs have fluctuated over the years, along with employment needs.

Technological advances have played an important part in the exploration, production, and transportation of petroleum products. The 1930s saw the beginning of seismic surveys and today computer mapping, satellite imaging, highly efficient equipment, and refining operations reflect the latest technology.

The production of petroleum products and the myriad of items that are made from them are finely interwoven into the daily lives of all people of the southern San Joaquin Valley.

### Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Have students discuss and make illustrations of what the area around their school might have looked like in the late 1700s or early 1800s. What animals might have lived in this area that are not present today? What might the earliest dwellings have looked like? How would people have traveled?
2. Young people in the first half of the 1900s often lived on oil leases and only went to town two or three times each month. What things might they have done to spend some of their free time during the school year and during summer vacation?
3. Discuss and list the types of simple machines that might have been used in the oilfields of Kern County in the early days (example: wheel and axle used for a cable drum)
4. Create a timeline of events that have occurred at the school since the beginning of the school year. Leave enough room to complete the year.

### Post-visit Activities

1. Have your students write about the way that Kern County has gone through geological and geographical changes that have shaped our present landscape. Use some of the information above to assist them in the planning phase of their writing. Suggest to them that their parents or some other family member might be an appropriate audience for their finished work.
2. Discuss and compare the technology that is available today and how industry might have been different 100 years ago, 50 years ago.
3. Encourage students to look up fossils and fossil fuels on the internet and share their findings with the rest of the class.

## *Store*

### Content Information

The Store serves as an introduction to the various parts of the oil exhibition. A spokesperson on a video will give the visitor a brief overview of what is to be experienced beginning with the geological history of the area, the oil pioneers, and continuing through to present day operations of the petroleum industry. Photos on the video screen provide a visual backdrop for the introduction. Visitors are invited to explore further through the oil exhibition with glimpses of the experiences that await them.

The backdrop of the oilfield supply store will provide visitors an opportunity to have a close look at many of the artifacts that have played a part in the development of the industry. The tools in the store represent tools of the oil industry that were used from the early days to the present.

### Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Tell the class that they will be going on a visit to the oil exhibition at the Kern County Museum. Ask them to think about things that they might expect to see or look for. Record their responses on a chart.
2. Have students work with a partner to develop 10 questions that they could ask someone who worked in the petroleum industry many years ago, or someone who is working in the industry currently. Share the questions with the class. Have the students prepare an edited copy of the questions to take along on the visit and see how many of them are answered by the exhibit information.

### Post-visit Activities

1. Refer back to the chart developed during activity #1 above. Ask each student to think of one item that could be added to the chart. Record these responses on a second chart. Go back over the first chart and highlight the responses that were covered by the exhibit.
2. Have the students design and construct a poster advertising the oil exhibition at the museum. Display their posters around the school.
3. Ask the students to compare what life might have been like living on an early oil lease with the way that they live today. List some positive and negative thoughts on both ways of life.
4. Assign students the task of writing a brief report on one of the artifacts that were on display in the store area of the oil exhibition. Edit and publish the reports and share them with other classes at the school.

## Map Room

### Content Information

For centuries, maps have been an important tool in the recording and dissemination of historical, scientific, and economic information. In the map exhibit, the visitor is treated to a geological history of the area through the use of maps and photos. Beginning with the view of Earth from space and moving to the formation of land caused by the collision of the North American plate with the Pacific plate, the narrative explains how the western edge of the continent was formed. Animated video is used to explain the formation of Earth's crust that shaped our mountain ranges and the areas between them that were then covered by oceans.

Microscopic plants and animals settled to the ocean floor and were covered by mud and clay sediments. Over time, heat and pressure turned the remains of these microorganisms into oil and gas. The geologic events that shaped California also created the conditions that trapped the oil and gas in underground reservoirs. The many oil fields of present day Kern County tap these large underground reservoirs to provide oil and gas for the nation's energy needs and to supply the ever-growing number of petroleum-based products.

### Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Have the students look at maps that show the formation of our continents through plate tectonics. Have them look carefully at the development of the North American continent. Have students write a one-page summary of what they know about the formation of the continent (sources: 6<sup>th</sup> Grade science textbooks, an atlas, internet resources, and library materials).
2. Introduce students to topographical maps and work with them to learn how to read them. Have the students create their own map of an imaginary island, and show the elevations with topographical lines on the map, labels and symbols, a map key, and a brief explanation of what the island would look like.

### Post-visit Activities

1. Give each student two 3" X 5" cards. Have them write one fact on each card about the formation of the western part of our continent and California as we know it today. Collect the cards, sort them to remove duplicates, and use one each day as a "California Fact Of The Day." Each day write one fact on the board and have students add that fact to their journals, or use it as a heading for that day's papers.

2. Divide the class into small groups. Give each group plain paper and lined paper to create a picture montage or a series of still film frames representing the events that helped create the western part of the continent. Write a script to accompany the illustrations and present the work to the class with one or more group members reading the script.



## Historic Timeline

### Content Information

The visitor is transported back in time to the early 1900s in this part of the Oil Exhibit. Information on the daily lives and homes of those who lived on oil leases is provided through narrative accounts. The artifacts displayed give a feel for what life was like, and the daily life accounts tell visitors some of the chores that were required to keep a family going. A tent house and vehicles help give a glimpse of what life was like living on some of the early oil leases. “Modern” conveniences such as treadle sewing machines, an icebox, gas stoves and gas lights, a hand pump and a washtub with a scrub board provide a look at life at that time.

Bathing in a galvanized tub with water hauled from the well, heated on the stove, and carried to the tub is another aspect of the life on a lease. Homes with phones were on a party-line connection and calls were placed by cranking the phone, and then telling the operator the number or name of the person you were calling. Entertainment was provided by members of the family singing or playing an instrument or by wind-up phonographs.

### Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Have students make a list of the appliances that are commonly found in their homes. Have them rank the five most important with the most important as number 1. Think about the value of each. Which ones could we easily do without? Which ones seem to be necessary to our daily lives? Share students’ final ranking of the five most important ones. Make a list of the ones selected and graph the number of responses for each.
2. Encourage students to interview an older relative or friend about what life was like when they were children (this could also be done with a visitor to the classroom). Help the students write questions to ask and record the information from the interview. Guide students in writing about their experiences in conducting the interview and what was learned.

### Post-visit Activities

1. In a class discussion, compare and contrast the life on an early oil lease to the students’ lives today. Look for things that might be similar and others that are totally different. Have the students use the names of early “conveniences” and modern appliances to create a poster advertising the appliance and extolling its finer points.

- 
2. Assist students in creating a Power Point presentation on what life might have been like for a student living on an oil lease in the early 1900's. Share the presentation with other classes at the school.

# *Diving Bell*

## Content Information

The diving bell offers visitors an opportunity to experience travel down to the ocean floor and then drill through layers of the Earth to learn about where oil is found.

As the visitor approaches the diving bell, the captain's voice welcomes them aboard and gives the directions to begin the journey. When the doors close, visitors are given information on the layers of the Earth necessary for the formation of oil and gas reservoirs. There are four layers needed:

- Seal or Cap Rock
- Trap
- Reservoir Rock
- Source Rock or Source Bed

The dive begins! Down through the water to the ocean floor. Then the drilling begins. As the diving bell and the passengers "make hole" and go deeper into the Earth, the layers are described. The top layer is the seal or cap rock. This fine-grained layer that acts like a lid and prevents oil from escaping to the surface. The next layer is the trap. The trap is a layer that allows the oil and gas to collect. The third layer, the reservoir rock is a layer that has permeability – that is, it has holes and pores that are connected and allow the oil to move through the layer. The deepest layer is the source rock or source bed. This is another fine-grained layer that prevents the oil from going deeper into the Earth.

The ancient seas that covered the San Joaquin Valley 5 to 25 million years ago teemed with plant and animal life. As the plant and animal matter died and drifted to the bottom of the ocean along with nutrient-rich mud, it formed layers that were transformed by heat, pressure, and time into hydrocarbons – oil and gas. These are the conditions and layers needed to form oil and gas deposits. The San Joaquin Valley has them all!

## Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Have the students discuss and make predictions as to what might be seen in a trip to the ocean floor in a diving bell. Make some illustrations to accompany their ideas.
2. Discuss the layers of the Earth and how the crust is made up of many layers of rock. Have the students research how sedimentary rocks are formed and list some of the different types of sedimentary rocks.

3. Talk with the class about the role of plate tectonics, earthquakes, and volcanic activity in the formation of the landscape. Discuss how layers are pushed up by one plate moving under another.

### Post-visit Activities

1. Have the students write about the part of the “dive” that they liked best and why they liked it. Have them share this information with the class.
2. Create a series of illustrations showing what a dive could be like and write a script to accompany them.
3. Encourage the students to explore the career fields of geology, marine biology, geophysics, and other related occupations. Use the internet as a resource.

## Core Samples

### Content Information

If you were to take a vertical slice of the Earth's crust and look at it, you would see that it is in layers. Each layer was formed and deposited or pushed into position by the forces that mold our landscape. Core drills like the one in this display are used to drill down through the layers of the crust and rock cylinders called core samples are brought to the surface.

The core samples are then studied, compared to other samples, and tested for their specific characteristics. The findings and depths of the samples are recorded and the information is cataloged for further use. Some core samples of specific formations that are displayed:

- Stevens Turbidite Sandstone – one of the reservoir layers of the Monterey Formation that produces oil.
- Sespe Redbeds – a sample from the Sespe Formation that has a low porosity.
- Potter Sandstone – one of the more important reservoir layers of the largest oilfield in the lower 48 states.
- Monterey Shale – Most of the oil produced in California comes from the organic-rich shales of the Monterey Formation.
- Belridge Diatomite – An unusual diatomite reservoir that must be artificially fractured to produce oil. Diatomite reservoirs are now an important source of production on the west side of the San Joaquin Valley.

Have you seen underground oil? Lift the lid of the display and look inside. What you see might be a surprise!

### Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Discuss the different layers of the Earth (crust, mantle, and core) and make a diagram of a cross-section showing all of the layers.
2. Use an apple to represent the Earth. Cut the apple in half. The skin represents the crust, the flesh of the apple represents the mantle, and the core represents the core. All of the wells and core samples drilled are only in the crust.
3. Have students construct their own core samples. Provide each group with two slices of bread, peanut butter, jelly, apple or banana slices, and raisins. Once the sandwich is put together, cut a "core" with a round biscuit or cookie cutter. Have the students diagram and label their "core" before eating it.
4. Have the students research the various types of sedimentary rocks. Write a short report with the information that was found.

### Post-visit Activities

1. Have the students discuss what was learned about the core samples. Was oil found in places where they expected? What properties did the core samples have in common?
2. Have the students research the career fields of the oil industry. Which careers would deal with core samples and their analysis?
3. Have the students write an imaginary “Daily Log Book” page of a drill rig bringing up core samples. What types of information would need to be recorded? What would be the most important things to watch for, and what scientific equipment might be needed?

## Fossils, Porosity, and Permeability

### Content Information

Geologists look at core samples to gather information about that part of Earth's crust. One of the things that they look for are fossils. Many of the fossils found in Kern County are very small. These are called micro fossils. These fossils provide clues about Earth's past. Scientists that study fossils are called paleontologists. Paleontologists can determine the age of rock layers and the presence of oil and gas by identifying specific fossils. Core samples brought to the surface during drilling can yield information of value even when the well does not produce oil or gas.

In this exhibit visitors will see marine fossils representing sand dollars, clams, scallops, giant oysters, shark teeth, and marine mammal bones. Land fossils from the McKittrick area include fragments of horse bones.

Rocks formations with spaces that are connected so that liquids can move through them are called permeable. The hands-on display provides a model of how permeability works.

Some rocks have a characteristic called porosity. This means that the rock will hold liquid somewhat like a sponge. The spaces in the rocks may or may not be connected to each other. Rocks like these are where oil and gas are likely to be found.

### Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Help the students make a chart of animals that live in water and those that live on land. Beside each animal indicate whether it is a mollusk, fish, marine mammal, land mammal, reptile, bird, and so on. Discuss what type of fossil evidence each animal might leave. Were there any on the chart that might leave micro fossils? If not, some might be added.
2. Encourage students to use research to identify some of the fossil remains found in California and in Kern County. The school library and the internet are good places to begin. Share findings with the entire class.
3. Write about the career fields of paleontologists and geologists. In what ways might they be similar? How might they be different?

### Post-visit Activities

1. Have students write a short report to compare and contrast porosity and permeability. Let them work in groups and produce one report for the group. Share the reports with the class and discuss the best points of each report.
2. Divide the class into groups and have each group make a sample of an oil-bearing rock. Take a clear plastic tumbler (about 12 oz.) and fill it with a mixture of aquarium gravel, dry beans of two or three sizes, and marbles. Make sure that it is filled to the top. Place the tumbler in a pie pan to catch any spills. Mix a couple of drops of food color with water in a pitcher. Slowly pour the colored water into the “full” tumbler. How much liquid will it hold? Have the students write about the activity. Be sure they use the words porosity and permeability as they describe what they were able to accomplish with the “full” tumbler. Create a labeled diagram to accompany their writing.
3. Have the class design another experiment using some of the same materials to show how an oil well might pump out most of the liquid from the rock. Select some of their ideas to allow the groups see if their experiment works.



# Plate Tectonics

## Content Information

Earth's crust is made up of plates that fit together – sort of like the pieces of a puzzle. These plates move in relation to each other, sometimes pushing up over or under each other. This movement shapes the landscape of the crust by rearranging layers of rock. New material is added to plate boundaries from the mantle. By measuring the movement of plates and using geological records, scientists can recreate what the plates and land masses may have looked like over time.

The same forces that moved Earth's plates millions of years ago are still at work today. This movement happens so slowly that we usually do not see it. This process is referred to as "Plate Tectonics" or "Continental Drift." This exhibit shows the visitor how the plates have drifted through the different geological time periods.

The collision of the Pacific Plate and the North American Plate along the boundary line known as the San Andreas Fault, has helped create the geologic landscape of California as we know it today. The lifting of the Sierra Nevada and the Coast Range mountains and the erosion and deposition of sediments has created the San Joaquin Valley. California has been crumpled and folded by these forces, creating places in Earth's crust where oil and gas have been trapped.

## Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Have the students take an outline map of the world, label, and color each of the continents. Carefully cut out the continents and lay them out in their proper positions. Slide the continents together, shifting them as needed, to see if they will form one land mass. There will be some gaps and some will not fit exactly, but they should come close. Move them back to their original positions. This movement is similar to the movement that has occurred with Plate Tectonics.
2. Assist students in researching information on faults and types of earthquakes. The library and the internet are good places to begin. Make posters and diagrams showing what was learned. Share the posters with the class or school.
3. On a map of California, identify the major mountain ranges, locate the San Joaquin Valley and Bakersfield, and identify the rivers that have carried sediment to form the floor of the valley.

### Post-visit Activities

1. Have the students form groups or pairs to write a script and design graphics to be made into a Power Point presentation with at least five slides. Use information

- from Plate Tectonics, fault movement, the formation of mountain ranges, and the effects of erosion and deposition. Share the presentations with the class.
2. Using the map pieces from the pre-visit activity, identify the plates that make up the largest part of each continent. Some continents may represent more than one plate. Write about the possible effects of having plate boundaries within a continent.
  3. Discuss what effect continental drift may have had on the animal populations of continents. Would animal populations of the oceans have been affected in the same ways?

# Traps

## Content Information

Traps are underground structures where oil and gas have become trapped in permeable rock formations. There are different kinds of traps. In this exhibit the visitor learns to look for clues that help them find the traps that could hold oil and gas. Interactive parts of the exhibit allow visitors the opportunity to simulate the process that creates traps.

The different types of traps found in the exhibit are:

- Pinch-Out Trap – This trap is formed when a layer of permeable rock is laid underground at an angle with the top end blocked by impermeable rock.
- Unconformity Trap – This is where tops of permeable layers are eroded away and then blocked by an impermeable layer formed later.
- Anticline Trap – In this type of trap the permeable layer is bulged up like an up-side down bowl, trapping the oil and gas at the top.
- Syncline Trap – This trap forms a bowl-shaped layer with the oil and gas trapped at either side of the bowl.
- Kinetic Accumulation Trap – This is the most common trap found in Kern County. As the oil nears the surface it oxidizes forming a thick, impermeable, plug at the top, thus blocking the way for the rest of the oil and gas.
- Fault Trap – This trap is formed at a break in the crust when a permeable layer is lined up with an impermeable one.
- Salt Dome Trap – When large amounts of pressure are pressing down on ancient salt deposits from a seabed, the salt may find a crack in the crust and push towards the surface forming a bulge. The resulting salt dome is impermeable and becomes a trap for oil and gas.

## Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

## Pre-visit Activities

1. Give each student a long, narrow strip of paper, about 3” by 12” long. Have them color a stripe across the bottom edge of the paper with a black crayon, about 1” wide. This will represent the layer of oil and gas. Color other stripes, with other colors (browns, tans, oranges and reds) 1” to 1” wide above the black, until the whole paper is colored in stripes. Cut the paper into two parts approximately in the middle. Use these papers to help the student form approximations of the traps with the colors other than black being impermeable layers.
2. Have the students work in pairs to draw what they think each kind of trap might look like. After the visit compare their earlier idea to what they saw in the exhibit.

## Post-visit Activities

1. Have the students write about one type of trap and how it is formed. Have them include how the trap might make it harder or easier to find the oil and gas. What clues might geologists most likely to look for.
2. The Kinetic Accumulation Trap is the one most commonly found in Kern County. Assist the students in researching other types of traps and major oil producing areas of the world to see which traps are the ones usually found in other areas.
3. Since California is bisected by a plate boundary (at the San Andreas Fault zone), how might that influence the exploration for oil and gas? Think about the Fault Trap as well as some of the others.

# Seismic Mapping

## Content Information

Seismic mapping uses sound and shock waves to create a map showing what the layers of rock that make up Earth's crust are made of. Seismic mapping sends sound waves down through the crust and records the speed with which they bounce back to the surface. Sound waves travel faster through hard rock than they do in soft rock. The speed that they return tells the geologist what type of rock is below the surface as well as how deep and thick the layer is. The information from many carefully controlled explosions is combined to create the map. Sonic devices are towed behind boats to produce seismic maps of the crust beneath the ocean. The maps not only tell the geologist what types of layers are beneath the surface, they also help them determine where the highest parts of oil and gas producing rocks are and the amount that might be available for recovery.

The interactive portion of this exhibit involves the visitor in creating a simulated explosion that helps make a 3D seismic map. Follow the instructions and see how it works.

## Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

## Pre-visit Activities

1. Have the students look at topographical maps and learn to read them. Topographical maps show elevations and the seismic maps of Earth's crust are similar in how they are read.
2. Help the students make a simulated topographical map for a make-believe island. Have the map show small mountains, low swampy areas, and areas with steep terrain.

## Post-visit Activities

1. Have the students work in pairs to organize and outline the steps taken by geophysicists to create a seismic map. Have each pair write a report on what geologists can learn from the maps and mapping process.
2. Help the class make a list of things that produce seismic and sonic waves. Some responses might be: earthquake, dolphins and whales, bats...

## Land Sat Mapping

### Content Information

From the beginnings of the oil industry, oil explorers have looked at the Earth's surface for clues that might lead to oil and gas. Often the only early clues that were to be found were oil oozing out of the ground or in the water of a creek, or in rocks and fossils that show that an area was once covered by an ancient sea or lake, teeming with life. These methods are called "surface geology" and are still used today.

Geologists now have satellite imaging that helps them look for oil and gas. Black and white infrared photos as well as other types of photographs are taken by satellites orbiting hundreds of miles above Earth's surface. The information is sent to computers that transform it into pictures of the crust. These pictures are studied to look for places where the crust has been bent or broken and are likely to contain oil or gas. The pictures are in shades of gray that sometimes make it hard to distinguish between different features.

By using color enhancement of the images, it is much easier to see slight differences in surface texture, rock variations, and topography. The interactive portion of this exhibit invites visitors to try their hand at color enhancement of an image of – their own faces! Visitors follow the prompts given by the exhibit to go through the process of turning their facial images from shades of gray to a color-enhanced image!

### Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Divide the class into small groups. Provide each group with a black and white newspaper photo, a magnifying lens, paper and crayons or colored pencils. Have the students look carefully at the photos with the magnifier and describe and write down what they see. (They should be seeing small dots in varying shades of gray in all but the solid black places.) Students then select appropriate colors to lightly color the image and see what difference it makes.
2. Assist students in doing some research on satellites that take pictures as they travel through space. Some types might be the Hubble Telescope (NASA), Land Sat, weather satellites and others. Share the information with the class.

### Post-visit Activities

1. Have the students write about their experience with the color enhancing process. Encourage them to select a classmate as the intended reader for the piece, use pre-writing planning tools, write, edit, and publish the piece before sharing it with the intended audience.

2. Modern geologists use satellite computer images as well as direct field observations in their search for oil and gas. Have the class chart the advantages and disadvantages of each method. See if using both methods would remove most of the disadvantages.

# Miner

## Content Information

In this exhibit the visitor meets an oil miner – that’s right, an oil miner! In the earliest days of the oil industry in Kern County, men mined for oil by digging tunnels that followed the seams of oil seeping out of the ground. The “oil” that they dug out with pick and shovel was almost like asphalt. Some of it was refined into lubricants and was sold to farmers for greasing machinery and wagon axles. Some of the “oil” was refined into kerosene to use in oil lamps. When the price of kerosene dropped due to cheaper imports from Pennsylvania, digging for oil stopped. It was too much work for too little money.

As automobiles began to come on the market as an affordable form of transportation, the need for oil began to rise, to be refined into fuel for this new invention. This would bring another type of pioneer to the area – the oil driller.

## Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Take the class on a short walk outside to look at an area that has blacktop (asphalt). This could be on the playground, street, or the school parking lot. If there is a place that has crumbled or broken, you might want to bring a small piece back to the classroom. Discuss what the “oil miners” might have done with this type of material.
2. Have the students find pictures and articles of miners and how they used to work with hand tools to bring out their minerals. Share the information with the class through the use of posters, reports, or a historical skit demonstrating what they found.

### Post-visit Activities

1. Have the class create a retrieval chart showing the impact of one invention, the automobile, on people. Explore things like the need for petroleum products, rubber for tires, mechanics to work on the cars, and so on. Help the students brainstorm the new products and materials that were needed, and then organize them into categories for the chart with topics like raw materials, service jobs, changes to community infrastructure (roads, bridges, parking), safety, and so on.
2. Have the students take on the role of an oil miner and write a letter to a friend (as the miner might have done) telling what a typical work day might consist of.



# Drilling

## Content Information

Drilling for oil takes special equipment. In this exhibit the visitor will view the various types of drill bits used and learn about the how oil drillers select the proper bit for each job. Materials used for the drilling surface varies from tool steel to carbide to diamonds. Visitors can walk up to each of the bits and examine them at eye level. An interactive portion of the exhibit allows the visitor to pull a handle and put a drill bit into action.

## Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

## Pre-visit Activities

1. Have the students in the class make a list (either as a class or as small groups) of special tools that are used at the school for special purposes. Some of these might include a bar-code scanner in the library, a video camera, math tools such as protractors and rulers, and so on. If done in groups, bring them back together to share their results.
2. Have students do simple hardness tests on various rocks and minerals. Information on testing rocks can be found in some fourth grade and most sixth grade science texts as well as on the internet and in the school library (look for Mohs' Hardness Scale).

## Post-visit Activities

1. Discuss the drill bits in the exhibit. Make a chart listing some of the differences and similarities that were observed.
2. Have the students write about one of the drill bits, describing how it looked, what it was made of, how it worked, and what results it would produce. Have them begin with an outline, and then work the outline into paragraphs, with a final revision and a published version to share with a partner or group.

## *Downhole Tools*

### Content Information

In this exhibit the visitor listens as a driller explains the cost to drill a well in addition to the procedures and tools used in drilling an oil and gas well. A panel lists the different tools that will be used to complete the process. The driller explains each step of the process and describes the purpose of the tool being used. Tools that are featured are the core bit, rotary drive that turns the drill string, drilling mud, a logging tool, the well casing, and the perforating tool. Pumps and a “Christmas tree” that consists of control valves, pressure gauges, and chokes, control the flow of oil or gas from the well.

### Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Have the class think of questions that might be asked during an interview with a person in charge of drilling a well. Make a chart of the questions that the class comes up with. Organize the questions into categories. Some of the things that might be asked could deal with tools, procedures, and workers.
2. Assist the students in using the internet to do research on oil well drilling, wells drilled, record depth of wells, and methods of drilling. Share the findings with the class.

### Post-visit Activities

1. Divide the class into groups of four students. Have each group develop a set of five questions (and the answers) about the drilling process. Select questions from all of the groups to create a quiz for the class. Have the students take the quiz and discuss the answers as a group.
2. Working in groups or pairs, have students design, draw, and label a poster showing how a well is drilled and the tools that might be used.

# Modern Drilling

## Content Information

Visitors to this exhibit are introduced to the five major components of a modern drilling system and their functions.

- The hoisting system supports the rotating system by raising, lowering, and suspending the drill string. The hoisting system runs the drilling line through the pulleys of the crown and traveling blocks to the hoisting system called the draw-works.
- The rotating system rotates the components of the rotary table and the drill string.
- The circulating system components prepare, store, and maintain the drilling fluids.
- The power system creates and transmits all of the energy needed to run the other systems.
- The blowout prevention system is located at the casing or well head and is designed to control a “blowout” that could happen when formation fluids flow into the well bore under high pressure.

## Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

## Pre-visit Activities

1. List the names of the five systems (hoisting, rotating, circulating, power, and blowout prevention) on a chart. Have the students work in small groups to brainstorm functions that could be performed by one of the systems. The ideas need not apply only to a drilling system, but might perform a related function in a different context (the circulating system has fluids, pipes, tanks and pumps while the human circulatory system contains the heart, arteries, and veins). Share the results with the class.
2. Review the simple machines – pulley, lever, screw, wheel and axle, and inclined plane. Explore how these machines might be used in the drilling system of a modern drilling rig.

## Post-visit Activities

1. Divide the class into five groups. Assign one of the drilling systems to each group. Have the students work together to build a short report using Power Point. Include text explaining the parts of the system, the function of the system, and graphics (if appropriate) to complete the presentation. Share the presentation with the class.
2. Have each student design one question (with an answer) on each of the systems. Select at least one of the questions from each student to create a quiz on the exhibit. Give the quiz to the class and discuss the questions and answers.

## Common Means Of Recovery

### Content Information

When oil does not flow freely from a well or cannot be pumped out, other means are used to obtain the oil. Several common methods of recovering the oil are presented in this exhibit. A second well is used to inject gasses or liquids into the permeable rock forcing the oil to collect at a higher or lower area where it is pumped out.

- Gases are injected above the oil to force the oil to greater depths where it gathers and is pumped out.
- In other cases, water is injected near the bottom of the permeable rock and forces the oil to gather at the higher levels for removal.
- In Chemical Flooding, the chemicals are pumped in below the remaining oil, the chemicals then create a barrier, and the increased pressure of the chemicals below the oil raise the oil to the top of the formation for pumping.
- In Thermal Recovery, heat injected below the oil helps release oil from the permeable layer forcing the oil higher into reservoirs where pumping occurs.
- Injected steam works as a combination of two of these processes. The heat from the steam releases stubborn oil particles, and the water from the condensed steam forms a pool to float the oil up to the producing wells.

### Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Divide the class into small groups. Give each group a small plastic cup half filled with water. Go from group to group placing a few drops of cooking oil in the water. Have the students observe and describe what happened when the oil was added to the water. Where did the oil end up? Help them write the steps of the procedure and explain the result. Encourage them to write down one or more questions that might be answered during the visit.
2. Have the students write a letter to an imaginary oil company asking for an explanation of the methods the company uses to recover oil as completely as possible from their wells. Be sure that the letter follows the form of a business letter, and gives a reason for wanting the information. Assist the students in editing and producing a final copy of the letter.

### Post-visit Activities

1. Have the students refer back to the demonstration from the first pre-visit activity. Using this information as well as the graphic panels from the exhibit, have them design and create a labeled diagram showing a method of recovering oil through injection of a gas or liquid.

2. Discuss the benefits of recovering as much oil as possible from existing wells with the class. Have the students write a one-page report on the process of oil recovery.

# Refinery Operation

## Content Information

Oil is moved to a refinery to turn it into products for specific purposes. Distillation is the first step in the refining process. In this process crude oil is separated into various fractions (compounds that boil within specific temperature ranges). Lighter hydrocarbons, which vaporize at lower temperatures rise to the tops of the towers above the heavier hydrocarbons.

After the oil is separated, blending occurs to form very precise mixtures that meet exacting product requirements. Environmental and performance requirements have necessitated increasingly sophisticated and automated blending.

The heaviest portion of the crude oil is refined in a process called coking. It is a process that uses heat to break down larger molecules into smaller ones, producing products such as gasoline and coke (a material similar to coal).

Laboratory testing of all products assures the uniformity and quality needed to meet product standards. Testing is performed at all stages of the refining process.

All of the refining systems are managed from control rooms where operators monitor and control temperature, pressure, circulation of fluids, catalysts, and other information relayed from the refinery. State-of-the-art tracking, alarm systems, and shutdown systems are displayed on computer screens. These control systems allow operators to monitor and manage all phases of the refining process from start to finish.

## Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Have each student write a set of procedures for performing a classroom task that must be done in a particular order. Have them work with a partner to test whether the steps are accurate and complete and in the proper order. Explain to them that this is similar to the refining of oil. Each step must be completed properly and in the correct order to achieve the desired result.
2. Have students describe what they have seen of refineries around our community. List some of the words that could be used to describe the appearance of a refinery. Save this list for later use in writing about the visit to the oil exhibition.

### Post-visit Activities

1. Have students write about the use of technology in the refining of oil. Think about the control rooms and the safety requirements needed to protect the workers

and the community. What careers in computers and technology might be a part of refineries?

2. Have students work in small groups to add several drops of cooking oil to a small clear jar half filled with water. Observe the drops and record what is seen as the jar is closed and shaken vigorously. Do the drops mix with the water? How could this be somewhat like the refining process?

## *Chemistry Is Right*

### Content Information

What does a soft, cuddly teddy bear have to do with super strong pavement . . . a cheeseburger have to do with a new home? More than you might think!

In this exhibit, the visitor will be introduced to some of the many products we use today and many that may affect our future. Products made of petrochemicals are all around us in our daily lives. You will learn how some of these products are manufactured, how they are used, their effectiveness, and their ability to be recycled and reused. Some of the products featured are the teddy bear and paving material, food packaging and building products, clothing, space exploration materials, in addition to automobile and aircraft components . . . and more.

### Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Ask students to bring in items that have the recycle symbol on them. Group the items by their type of use. Have them explore the opportunities for recycling in their community. Share the information gained with the class.
2. Have the students list products from the classroom and their homes that are made of recycled materials. Have them write about how recycling can help the community and the environment.

### Post-visit Activities

1. Have each of the students in the class plan, write, edit, and publish a one-page paper on products that are made from petrochemicals that were featured in the exhibit. Share the writing with another class or their parents.
2. Make a class chart of all of the petrochemical products used in the classroom. Include building materials, student materials and learning tools, and clothing and accessories. Can you find at least one for each letter of the alphabet?



## Chem Lab

### Content Information

In this exhibit, a lab person encourages you to look around at the new materials that are being produced from petrochemicals. As we look to the future, more and more products will be invented that expand the range of products we use. Recycling will play a major role in our daily lives as new methods and processes are discovered to make new product out of old. Our transportation opportunities will change, our recreational pastimes will be enhanced through better equipment, and our homes and schools will have new materials that need less maintenance. A modern gas pump with a counter shows the visitor the amount of gasoline used in the state so far that day.

### Activities

The activities listed here are suggestions that would relate in some way to the information presented in this part of the oil exhibition. As with any teaching idea, they need to be adapted to the skills and abilities of each classroom.

### Pre-visit Activities

1. Discuss with the class some of the inventions and new materials that were not available 10 to 15 years ago. What did people use in their place? How have they changed our lives? Build a class chart showing some of the items and the changes they have brought about.
2. Invite a speaker to the class to talk to the class about the environmental regulations for solid waste disposal and recycling in your community. Look in the phone book under local government for sources.

### Post-visit Activities

1. Discuss the products featured in this exhibit. Have each student (or a pair of students) design a new product or invention that would utilize a new material. List the process used to design, produce, and market the product. Design an advertisement to promote the product. Share the new inventions with the class.
2. Have the class make a list of items that were invented in the twentieth century. Assign each student one invention to research and compile a written report on the invention. Include the date of the invention, the person or company that invented it, and the impact on society as it came into use. Share the reports with the class.