Give It a Lift

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PRIMARY STUDENTS

Topic

Getting the oil out

Source

Oil and Natural Gas, pages 32-33, 34-35, 38-39

Objective

Students will gain an overall picture of how oil can be recovered from a rock formation using artificial lifting equipment, such as a pumping unit.

Lesson Preparations

1. Collect materials from the list provided
2. Make copies of the lab packets, one for each group
3. Make copies of the exit questions, one for each student
4. Read through the "Teacher Information" section

National Science Education Standards

Process Standards (Grades 3-6)

Physical Science Content Standards (Grade 4)

Physical Science (Grades K-4)

Materials

- Drinking straws
- Masking tape
- Scissors
- Carton of chocolate milk (or any dark liquid to be seen through the straw such as a can of dark carbonated soda or small cup of chocolate syrup)

Presented by
Society of Petroleum Engineers

Engagement

Have you ever wondered how oil is recovered or lifted from rock deep within the earth?

Exploration

Day 1

1. Split the students into groups of four. Assign each student a job from the list below.

    Recorder: the student who writes down the information from the experiment

    Reporter: the student who presents their group's findings to the class

    Material Getter: the student who gathers and puts away the materials for the experiment

    Facilitator: the student who oversees the experiment and ensures their group stays on task.

2. Pass out one "Give it a Lift" lab packet to each group. Have the students read through the lab instructions once.
3. Teacher says: "Today we are going to learn how oil can be recovered from a rock formation using artificial lifting equipment."
4. Have the students begin the experiment. Monitor the students to make sure that everyone is participating.
5. Once the students have completed the experiment, explain how this experiment is related to getting the oil out of ground.
6. Have each student complete the "Give It a Lift" exit questionnaire individually.

Explanation

Teacher Information

Read to students from Oil and Natural Gas pages 32-33

Locating a suitable site for drilling is just the first step in extracting oil. Before drilling can begin, companies must make sure that they have the legal right to drill, and that the impact of drilling on the environment is acceptable. This can take years. Once they finally have the go ahead, drilling begins. The exact procedure varies, but the idea is first to drill down to just above where the oil is located. Then they insert a casing of concrete into the newly drilled hole to make it stronger. Next, they make little holes in the casing near the bottom, which will let oil in, and top the well with a special assembly of control and safety valves called a "Christmas tree." Finally, they may send down acid or pressurized sand to break through the last layer of rock and start the oil flowing into the well.

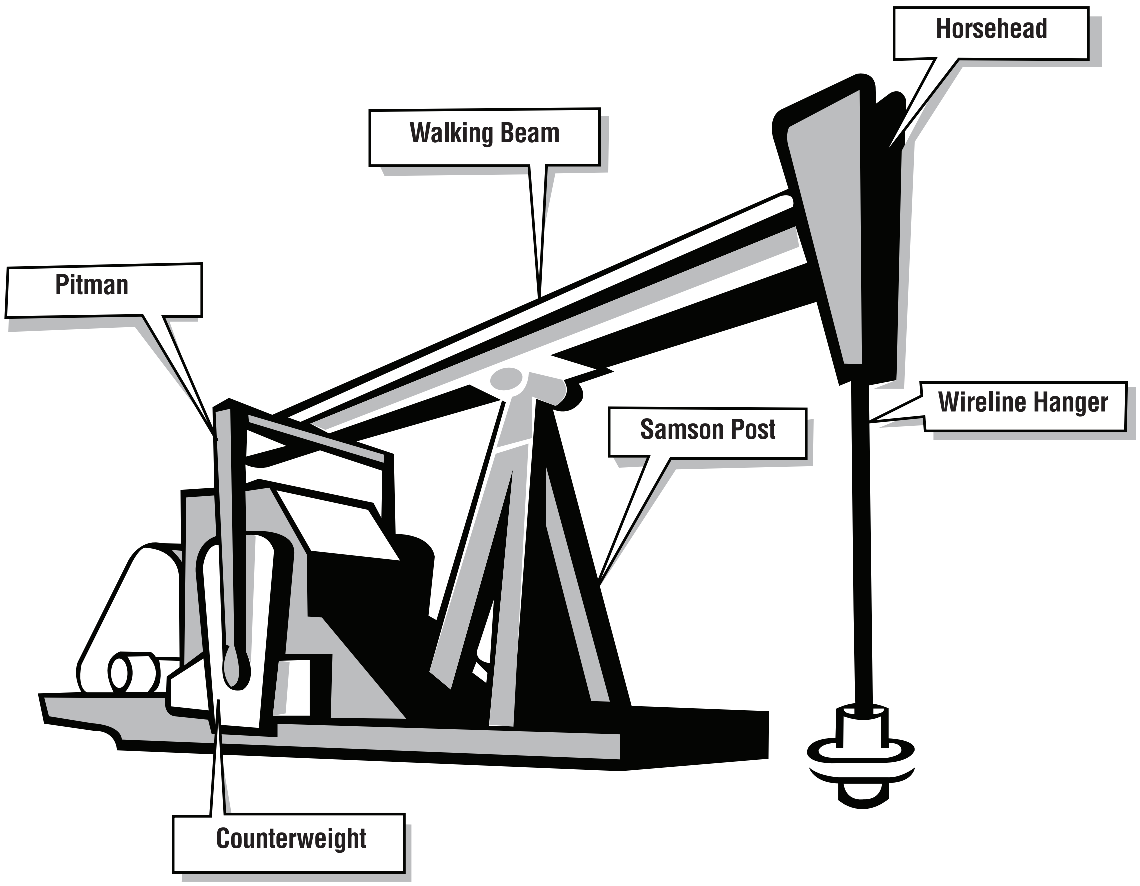
Read to students from *Oil and Natural Gas*, pages 34-35

Sometimes large reserves of oil are found deep beneath the ocean bed. To get the oil out, huge platforms are built far out at sea to provide a base for drilling rigs that bore rights down into the rocks of the seafloor. After processing on the platform, oil is sent ashore via pipelines or held in separate floating storage facilities before being off-loaded into large tankers. Offshore oilrigs are gigantic structures. Many have legs that stretch hundreds of meters from the surface to the ocean flow. The Petronius Platform in the Gulf of Mexico, for example, is the world's tallest freestanding structure, standing some 2,000 ft above the seabed. Rigs have to be immensely strong, able to withstand gale-force winds and relentless pounding by huge waves.

Read to students from *Oil and Natural Gas*, pages 38-39

In the early days of the oil industry, oil was carted laboriously away from oil wells in wooden barrels. The oil companies soon realized that the best way to move oil was to pump it through pipes. Today there are vast networks of pipelines around the world, both on land and under the sea. The US alone has about 190,000 miles (305,000 km) of oil pipes. The pipelines carry an array of different oil products, from gasoline to jet fuel, sometimes in "batches" within the same pipe separated by special plugs. Largest of all are the "trunk" pipelines that take crude oil from drilling regions to refineries or ports. Some are up to 48 inches (122 cm) in diameter and over 1,000 miles (1,600 km) long. Trunk lines are fed by smaller "gathering" lines that carry oil from individual wells.

Because oil, natural gas and saltwater are under extreme pressure below the surface, these fluids sometimes flow up a well without assistance, much like a soft drink that has been shaken and then opened. This is called primary recovery. When the initial pressure is depleted from production, only a portion of the oil and natural gas has been produced. This does not, however, mean the end of the well's life.



Artificial lifting systems, or pumping units, are used to help pull the oil out of the reservoir rock and pump it up the well. A down hole pump in the well is connected to the pumping unit by steel rods, which are screwed together. The pump is activated from the up and down movement of the pumping unit of the surface. As the pump plunges down, fluid from the rock formation flows into the pump chamber. On the upstroke, the fluid in the chamber is forced up the tubing, to the surface.

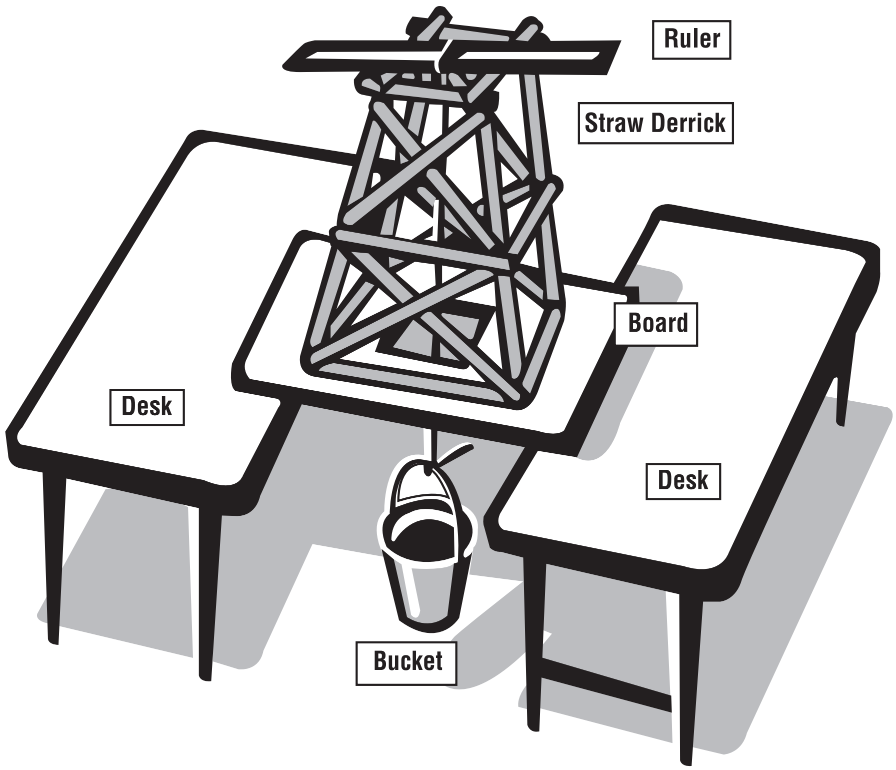
Evaluation

1. Students should complete the exit questionnaire worksheet.
2. After conducting the experiment and then listening to the explanation of the experiment, students will write a paragraph discussing how this experiment is related to getting the oil out of the ground.

Elaboration

1. Present students with the following problem. You are an oil and natural gas producer. At a site you have found, you believe petroleum is at 50,000 feet. You must design a derrick that can support the stress and weight of drilling a deep well.

2. With your team, decide what shape and design you will try first and sketch it. Decide with your team what materials you want to use to build your structure. From your design, estimate if you have enough materials. Students will need to consider the size of the base and opening to ensure that the derrick will not fall through.



Exit Questionnaie Answer Key

1. Because oil, natural gas and saltwater are under extreme pressure below the surface, these fluids sometimes flow up a well ____________________ assistance, much like a soft drink that has been shaken and then opened.

   b. Without

2. _________________________________ are used to help pull the oil out of the reservoir rock and pump it up the well.

   Artificial lifting systems or pumping units

3. What is the first thing that oil companies must do in order to drill on a piece of property?

   Companies must make sure that they have the legal right to drill, and that the impact of drilling on the environment is acceptable .

Getting the Oil Out Experiment
Lab Packet

Reporter____

Recorder____

Material Getter__________________________________

Facilitator_______________________________________

Getting the Oil Out Experiment

Materials

- ❑ 8-10 drinking straws
- ❑ Masking tape
- ❑ Scissors
- ❑ Carton of chocolate milk (or any dark liquid to be seen through the straw such as a can of dark carbonated soda or small cup of chocolate syrup)

Instructions

1. The material getter should get the materials listed above from the material workstation.
2. Using the scissors, cut a 1 centimeter slit at one end of each straw.
3. Join the straws end to end to form one long tube. Place the slit end of the straw into the inside of the adjoining straw.
4. Place masking tape over each connected end to secure the joint and create an air tight seal.
5. Place the carton of chocolate milk on the floor. Insert the extended straw "tubing" into the carton. Try to bring the liquid to the top of the "tubing" using his/her suction.
6. Now, decrease the number of straws used for the "tubing". Same student try to bring the liquid to the top.

Questions

1. Which length of straw required the most effort to bring the liquid to the top? Which length of straw required the least effort to bring the liquid to the top?

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2. Does the length of the straw "tubing" make a difference in the amount of suction needed to lift the chocolate milk?

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3. As a group, discuss and decide what kind of equipment would we need to lift oil from rock 7,500 feet (2286 meters) below the earth's surface.

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Exit Questionnaire

PRIMARY STUDENTS

Name:____________________

Questions

1. Because oil, natural gas and saltwater are under extreme pressure below the surface, these fluids sometimes flow up a well ___________________ assistance, much like a soft drink that has been shaken and then opened.
    a. With
    b. Without

2. ______________________________ are used to help pull the oil out of the reservoir rock and pump it up the well.

3. What is the first thing that oil companies must do in order to drill on a piece of property?

    ____