Give it a Lift

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Lesson Plan – Page 1

PRIMARY STUDENTS

Topic: How is oil extracted from the ground?

Topic Overview: Oil can be recovered from a rock formation using specialist equipment.

Activity Overview: Using readily available materials solve the drilling problem to release the petroleum.

Core Experience and Outcome:

SCN 2-17a : Having explored the substances that make up the Earth's surface, I can compare some of their characteristics and uses.

Learning Intention:

I am learning how oil can be extracted from rock layers under the ground.

Success Criteria:

I can explain how oil is stored in rocks.

I can discuss ways in which oil can be removed from rocks.

I can design, test and adapt an experiment to how oil can be removed from rocks.

Resources

Pupil Role Cards

Challenge Record

Book Reference:
Oil and Natural Gas,
pages 32-35, 38, 39

Materials

Teacher Demo: bottle fizzy juice

Activity 1: (See *Challenge Record* sheet for diagram)

- Drinking straws
- Masking tape
- Scissors
- 75cm piece of string with weight (can be bucket or bottle filled with water) attached to one end and a ruler to the other.
- Sturdy piece of cardboard with hole cut in the middle

Activity 2:

- Small cartons/bottles of chocolate milk
- Drinking straws
- Masking tape

Science Skills

Observing, Predicting, Experimenting, Recording, Reporting

Key Vocabulary

Derrick - A tower above an oil well which supports the drill. The drill makes a hole in the ground to extract oil.

Petroleum - A dark, thick oily substance obtained from rock layers under the ground, from which various substances including petrol, paraffin and diesel oil are produced.

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Teacher Information:

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.

Read to pupils 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 extract process 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 pressurised sand to break through the last layer of rock and start the oil flowing into the well.

Read to pupils from *Oil and Natural Gas* pages 34-35:

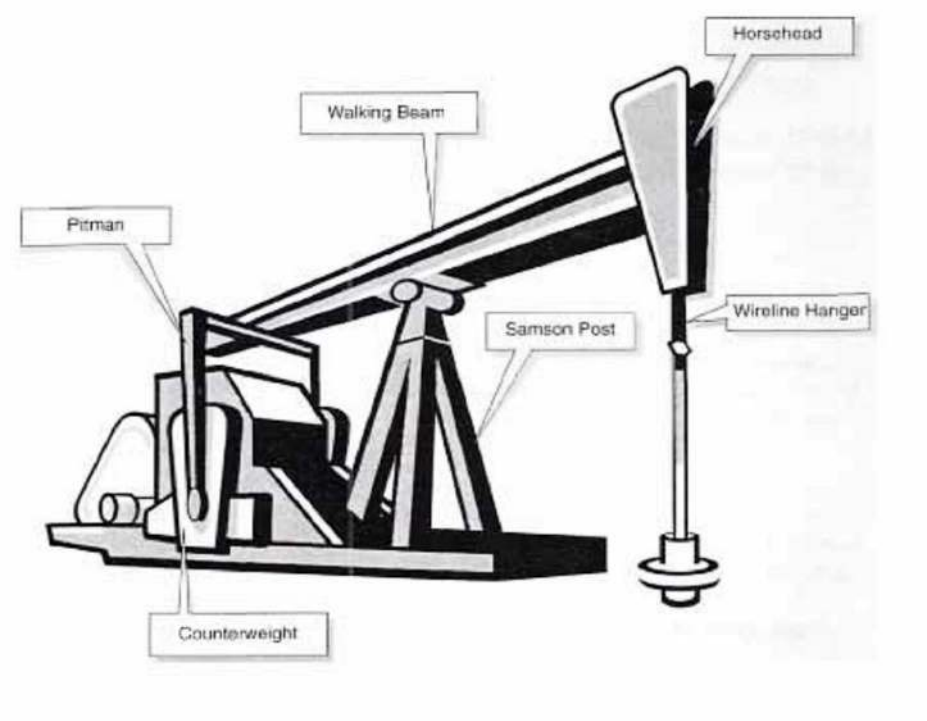
Sometimes large reserves of oil are found deep beneath the ocean bed. To get the oil out, huge platforms are built far out at sea to provide a base for drilling rigs that bore right down into the rocks of the sea floor. After processing on the platform, oil is sent ashore via pipelines or held in separate floating storage facilities before being off-loaded into large tankers. Off shore oil rigs are gigantic structures. Many have legs that stretch hundreds of metres from the surface to the ocean floor. The Petronius Platform in the Gulf of Mexico, for example, is the world's tallest free standing structure, standing some 200ft above the seabed. Rigs have to be immensely strong, able to withstand gale-force winds and relentless pounding by huge waves.

Read to the pupils *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 oils companies soon realised 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 pipelines carry an array of different products, from petrol to jet fuel, sometimes in "batches" within the same pipe separated by special plugs. Largest of all are "trunk" pipelines that take crude oil from drilling regions to refineries or ports. Some are up to 122cm in diameter and over 1,600 km long. Trunk lines are fed by smaller "gathering " lines that carry oil from individual wells.

Teacher Information Continued:

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.



Establishing Prior Knowledge

- How do you get oil from rock layers under the ground?
- What is an oil well?
- What is an oil and natural gas producer?
- What does a strong shape look like?
- What is a derrick?

Teacher Demo: Think about the pressure exerted on the oil held within rocks. Explain what pressure is by shaking a bottle of fizzy drink and then opening it to see what happens.

Main Activities

Introduce the activities by doing the Teacher Demo mentioned above. Encourage pupils to think about strong structures and shapes that could withstand pressure. In Activity 1, plan and create a model derrick, prove that it works and make alterations where necessary. In Activity 2, use straws to construct a pipeline and investigate the challenges involved in bringing oil up out of the ground.

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Teacher Guide and Activities Outline:

Present the pupils with the following problem: `How can oil be extracted from deep below the earth's surface?_

Activity 1: Building a derrick

Show pupils a picture of a derrick in *Oil and Natural Gas*. Pupils will take on the role of oil and natural gas producers who have found what is believed to be petroleum deep underground (16,000 metres). They must design a derrick that can support the stress and weight of drilling a deep well.

1. Hand out the *Challenge Record* and explain that we will test the strength of their derrick by placing a ruler attached to a weight across the top of their structure. Show pupils the size of the cardboard base and the hole to ensure that their derrick will not fall through the hole. **Derrick height should not exceed 45cm.**

2. In groups of 4, pupils will decide how they will use the provided materials (straws, masking tape) to design a derrick and sketch it on their *Challenge Record*.

3. Pupils will build their structures and take turns placing them on the cardboard base using the weight to test their strength, as is shown on the diagram of the *Challenge Record*.

4. Writing on their *Challenge Record*, pupils can note any changes they could make to improve their design.

Activity 2: Getting the oil up!

1. Groups should gather 10 more straws and place the end of one straw into the inside of the adjoining straw to create one long tube. Place masking tape over each connection to secure the joint and create an air tight seal.

2. Place cartons of chocolate milk on the floor. One member from each group should stand, insert the straw `tubing_ into their milk and try to bring the liquid to the top of the `tubing_ using suction.

3. Repeat step 2, but shorten the tubing and have the same pupil try to bring the liquid to the top.

4. Pupils should reflect on what they have experienced and fill out their *Challenge Record* sheets.

Plenary

Share derrick designs, bringing milk up straw tubing and pupil answers recorded on *Challenge Records*. Recap key vocabulary and discuss extension ideas.

Extension Ideas

Repeat the activities but change one of the following variables: the height of the derrick, types of materials that are offered to create the design model, the width of the straws, the type of liquid.

Investigate the conservation of resources by assigning a price to each material offered to the groups and challenge pupils to build their derrick for a certain cost.

Home Links

Research and investigate current designs of drilling systems used in the oil industry today and how they have developed since oil was found. Compare these designs on and off shore.

Examine the historical background of the oil industry and the economic and social impact it has had on Scotland.