Oil Production

Oil is used for:

If you have ridden in a car today, you have used several oil based products. Gasoline, the fuel for most of our cars and trucks, is made from oil, and so are the tires. In addition to gasoline, oil and other hydrocarbons are used to make about 75% of the products we use each day. Just a few of these products include: heating oil, diesel fuel, jet fuel, propane, synthetic rubber, and plastics. It is also used to make many common household products, including crayons, dish washing liquids, deodorant, and eyeglasses.

What is an oil reservoir?:

If you could look down an oil well you wouldn't see a big underground lake. Oil doesn't exist in deep, black pools. In fact, an underground oil formation - an "oil reservoir" - looks very much like any other rock formation. Oil exists in this underground formation as tiny droplets trapped inside the open spaces inside rocks. The droplets cling to the rock, like drops of water cling to a window pane.

The first step to drilling for oil is knowing where to drill. Because it is expensive to drill an oil well, oil producers need to know a lot about an oil reservoir before they start drilling. Scientists learn as much as they can about an oil reservoir before they every drill a well.

Oil recovery can be done in multiple steps:

Crude oil development and production in U.S. oil reservoirs can include up to three distinct phases: primary, secondary, and enhanced recovery.

Primary recovery:

The natural pressure created by the rock layers over an oil reservoir drives oil into the well. Inside the well, pumps bring the oil to the surface where it can be collected and used. Only about 10 percent of a reservoir's original oil is typically produced during primary recovery.

Secondary recovery:

Secondary recovery techniques extend a field's productive life. Secondary recovery is typically done by injecting water or gas to push oil away from the rock holding it and driving it to an oil well. This results in the recovery of 20 to 40 percent of the original oil.

Enhanced Recovery:

Three major categories of enhanced recovery have been found to be commercially successful depending on characteristics of an oil reservoir:

Thermal recovery adds heat in the form of steam to an oil well. This helps the oil flow through the rock formation more easily.
Gas injection uses gases such as natural gas, nitrogen, or carbon dioxide (CO_2) to push additional oil to an oil well.
Chemical injection is used the least often, and uses special chemicals to help oil move more easily to an oil well.

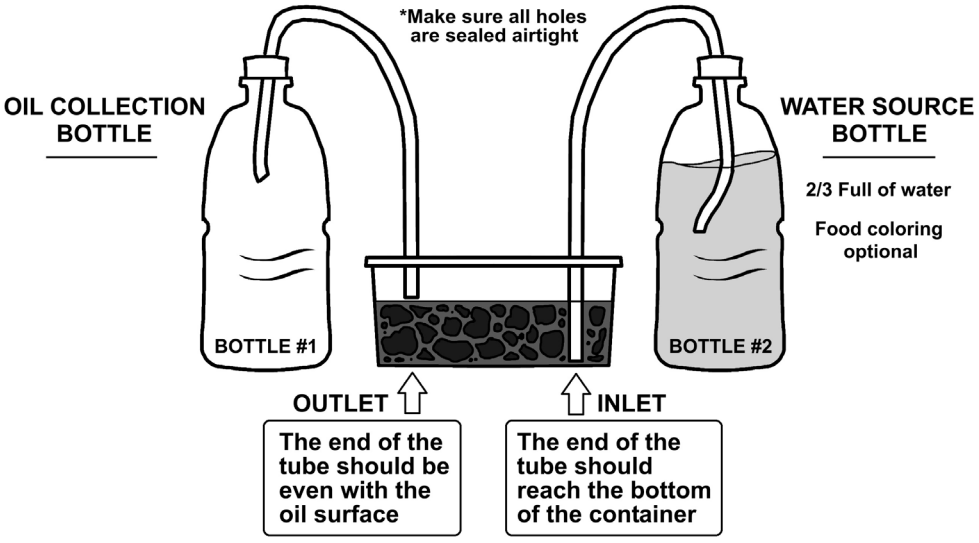
Oil Recovery Instruction Sheet

Required materials:

1. (1) Small disposable plastic container (1-2 cup) with tight-fitting lid
2. (2) Plastic water bottles for injection reservoir and oil collection (one for the "extracted" oil, and one for water. Additional bottles may be needed for alternate design methods.)
3. Rocks or gravel
4. Vegetable Oil
5. ¼ inch plastic tubing (two 30 cm pieces)
6. Material to make a watertight seal (ex: Goop, silicone caulk, hot glue)
7. Food coloring for the inlet water *optional
8. Bucket or container for disposal of liquids
9. Seal-able container for disposal of oil
10. Metric measuring cup or graduated cylinder for liquids
11. Water
12. Additional materials and liquids of your choice use for design challenge

Building the Model:

1. Make two holes in the plastic container lid, spacing them equally apart. They should be the same size as your tubing.

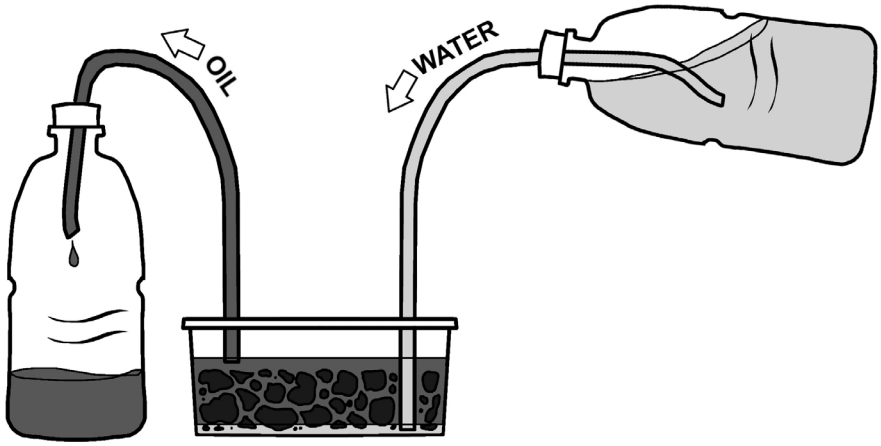


2. Slide one piece of tubing into each hole. Make sure that the first tube (outlet)protrudes at least 1-2 cm from the bottom of the lid. The second tube (inlet) should protrude about 4-5 cm in order to reach the bottom of the oil reservoir.
3. Seal the tubing hole with a type of watertight sealant.
4. Make a hole in the cap of each plastic water bottle. Slide the tubing so 5 cm extends below the lid. Make a watertight seal between the tubing and the lid. Repeat with the second lid.

Oil Recovery Instruction Sheet

5. Fill the plastic container $^{2}/_{3}$ full of rock or gravel to represent bedrock. Place the inlet tubing so it reaches the bottom of the container (manipulate the rocks and tubing accordingly).
6. Pour vegetable oil into the reservoir, enough to cover the rocks in the container.
7. When placing the sealed lid onto the container, the outlet (1-2 cm) tubing should rest at the surface of the oil. (trim it accordingly). Fit the lid onto the first water bottle to serve as the oil collection vessel. This will hold the oil as it is removed from the rocks in the oil reservoir.

Demonstrating Water Flooding



1. Fill the second bottle $^{2}/_{3}$ full of water. You might want to add food coloring to help observe water as it moves through the process to differentiate the water and oil.
2. Place the cap on the water bottle (inlet) tightening the lid.
3. Manipulate the water bottle so the water flows into the oil reservoir. This should cause the oil to flow out of the reservoir into the oil collection bottle.

Oil Recovery Design Challenge

Name:_____

Initial method: Water flooding

Procedure:

Results: _____ mL of oil were extracted.
Other Observations:

Success Criteria:
- We are able to extract more oil

Constraints:
- We can't build a whole new system (the well is already established).
- We can only use materials that we have access to.

Brainstorm modifications that we might make to the oil extraction process in order to increase the amount of oil that we can extract.

Oil Recovery Design Challenge

Method #2:

Procedure:

Results: _____ mL of oil were extracted.
Other Observations:

Method #3:

Procedure:

Results: _____ mL of oil were extracted.
Other Observations: