

UPSTREAM OIL PRODUCTION

Grade Level 6-8

Objectives: Students will gain knowledge through a hands-on activity with a focus on upstream production and measured output of a well.

Introduction: Previous to this lesson, students will have acquired basic knowledge of key terms of the Oil Industry. Included in discussion of terms will be an overview of upstream and down stream production. Students will be introduced to technology that can enhance oil output such as steam.

Problem: Students will measure the output of what is termed a low producing well and experiment with ways to increase output.

Materials: Plastic semi-clear container, various sponges, spray bottle, surgical/polyvinyl tubing, bottle of cooking oil, measuring container, paper cups, water, safety glasses, rubber gloves, food coloring, funnel, duct tape. (See helpful hints and cautions at end.)

Procedures:

1. Have students divide into groups and assign jobs: safety engineer, pump operator, discharge person, and recorder.
2. Assemble items into oil reservoir as demonstrated by instructor (see picture).
3. Fill container with cooking oil. Allow time for oil to saturate into sponge.
4. Have the person assigned to the pump depress lever in increments of five until the pump has begun to discharge into graduated container. Depending on the type/quality of pump water may need to be added to get the oil moving.
5. One student will record the amount produced in between pumping.
6. Each increment of five pumps equals one day's volume of production.
7. After pumps have removed all free oil, have student record their final reading and calculate flow per day. Determine how much oil remains in the sponge.
8. Reclaim oil and have student's rinse and clear graduated container only.
9. As a form of steam injection, tell students they can add up to 1 cup of warm tap water per day of production. They must still measure and record flow of liquids.
10. Students must determine what volume is oil and what volume is water.
11. By allowing the oil and water to sit, it will separate and can be reclaimed.
12. Food coloring can be added to water for easier identification and measurements. It will not mix with oil.

GROUPS:

Safety Engineer (Makes sure there are no spills)

Pump Operator (Assign responsible students as pump operator.)

Discharge Line person (Holds hose making sure all fluid reaches container.)

Recorder (Recorder collects data. No data, No points.)

CONCLUSIONS:

-- Have students hypothesize how much oil might still be in the sponges/rock formation. (After hypothesis and testing squeeze out remaining oil and record amounts)

-- Calculate how long before the oil can be extracted.

-- What must happen to the oil and water mix before it is sent to a refinery? Calculate final totals and record measurements.

-- Have students clean with warm soapy water and dry with paper towels.

-- Place all items back in storage.

-- Turn in production totals/data. (Create a graph showing production.) Optional

-- What did you learn from this experiment?

POST FINDINGS:

Have students compare results.

Future lessons:

Downstream production (refinery)

Products from oil

Transportation of Petroleum

Alternate Fuels

Viscosity/specific gravity

HELPFUL HINTS AND CAUTIONS:

All products except tubing were purchased for less than \$5 at Dollar Tree.

Tubing found at OSH/Home Depot.

Have a mop and bucket on hand.

If using syrup, clean up immediately—look out for ants! Do not use boiling water.

Place tubing over each end of pump. Duct tape can help secure things down.

Have students use safety glasses and rubber gloves.

Either cooking oil or syrup can be used but remember that syrup does not float on water as oil does.

Remove the spray nozzle cap from sprayer.

Different sponges can be used to resemble different types of rock structure/porosity.

Try refrigerating oil/syrup to change viscosity. (Make sure your pump can handle it.)

The more set-up and prep you do to standardize for the students, the easier things will flow.

Conduct your own as a guided demonstration.

Rinse with warm soapy water to clean.

You can develop your rate based on milliliters to equate to a larger scale equivalent. (I.e., 1 ml = 1 barrel)

Amounts vary by the type of pump you use and size of suction line/tubing and temperature.

Warm water will help remove/displace oil from the sponges/rock.

RESULTS AND OBSERVATIONS:

It took a lot of pumping and some water for the pump to initially draw the oil. The suction line was also shortened to help improve flow. Duct tape was used to help seal off leaks. A hand soap pump might be a better low cost solution. Once through the pump the oil contains many small bubbles that change its appearance.

About two cups/500 ml of oil and water were used.

Total volume removed by the pump was about 375 ml after approximately 150 pumps. Of that volume, approximately 125 ml was oil.

After emptying container and wringing out the sponges approximately 300ml of oil was collected. Some spilled onto counter. The pump, tubing, and containers had a thin coat of oil. The sponges still felt as though they contained more oil but time was not taken to completely go after every drop.

See the images in the JPEG folder "P Morrell."