You're Oil I Need

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Field(s) of Interest: Crude Oil, Physics, Engineering, Chemistry

Brief Overview (1-3 sentences):
The lesson will give mentees a brief introduction to some fundamental concepts related to crude oil, including what oil is, where it comes from, how to drill oil, and how to clean oil spill.

Agenda:

- Introduction (5 min)
- Module 1: Oil and Where to find it? (00-00 min)
- Module 2: Oil Extraction (00-00 min)
- Module 3: Oops Oil Cleanup (00-00 min)
- Conclusion (5 min)

Main Teaching Goals/Key Terms:

- ➔ List each concept/idea that you would like mentees to understand.
- ➔ Keep these brief, more detailed overviews should be saved for background for mentors.

Background for Mentors

Module 1 ● What is crude oil? ● Where do we find it? ● Where does it come from?	**What is crude oil?** Crude oil is a naturally occurring petroleum product composed of hydrocarbon deposits and other organic materials. It is pivotal for every modern society as many different products are made from it or at least partly contain it. Examples for this are: fuel, tires (car and bicycle), soap, plastics in general, lipstick, balloons, etc. **Where do we find it?** Crude oil exists in liquid or gaseous form in underground pools or reservoirs, in tiny spaces within sedimentary rocks, and near the earth's surface in tar (or oil) sands. Oil wells can range in depth from a few hundred feet to more than 20,000 feet. Oil either comes up by itself through the pressure that comes from the soil and rocks above it or it is pumped up, if the natural pressure is too low. **Where does it come from?** The beginning of crude oil formation happened millions of years ago. Oil is a fossil fuel that has been formed from a large amount tiny plants and animals such as algae and zooplankton. These organisms fall to the bottom of the sea once they die and over time, get trapped under multiple layers of sand and mud. As time goes by, heat and pressure began to rise as the organisms get buried deeper and deeper below the surface. Depending on the amount of pressure, heat and the type of organisms determines if the organisms will become natural gas or oil. The more heat, the lighter the oil. If there is even more heat and the organisms were made up of mostly plants, then natural gas is formed. Once the oil and natural gas is formed, it migrates through pores in the rock until it gets trapped under cap rock and clay where the oil can no longer get through. This is where we find oil today!

Background for Mentors

Module 2

- Oil Derrick
- Steam Injector
- Steam Pressure

The process of drilling oil is a time sensitive and labor intensive process which can be broken up into multiple stages. The process begins with oil rig setup, moving all the equipment from transport vehicles and onto location. Before the actual rig is installed, first a **drill head** is set up to look into the ground and verify the presence of oil.

If the oil is present at site, then the drilling equipment is removed and an **oil derrick** is installed. The oil derrick is a complex piece of machinery with many important components, it is worth mentioning to the mentees the *up and down motion of the horse head and how it is responsible for pulling oil upwards from the drilled hole.* The horse head is connected to a *bridle* which is the actual component in the drill hole.

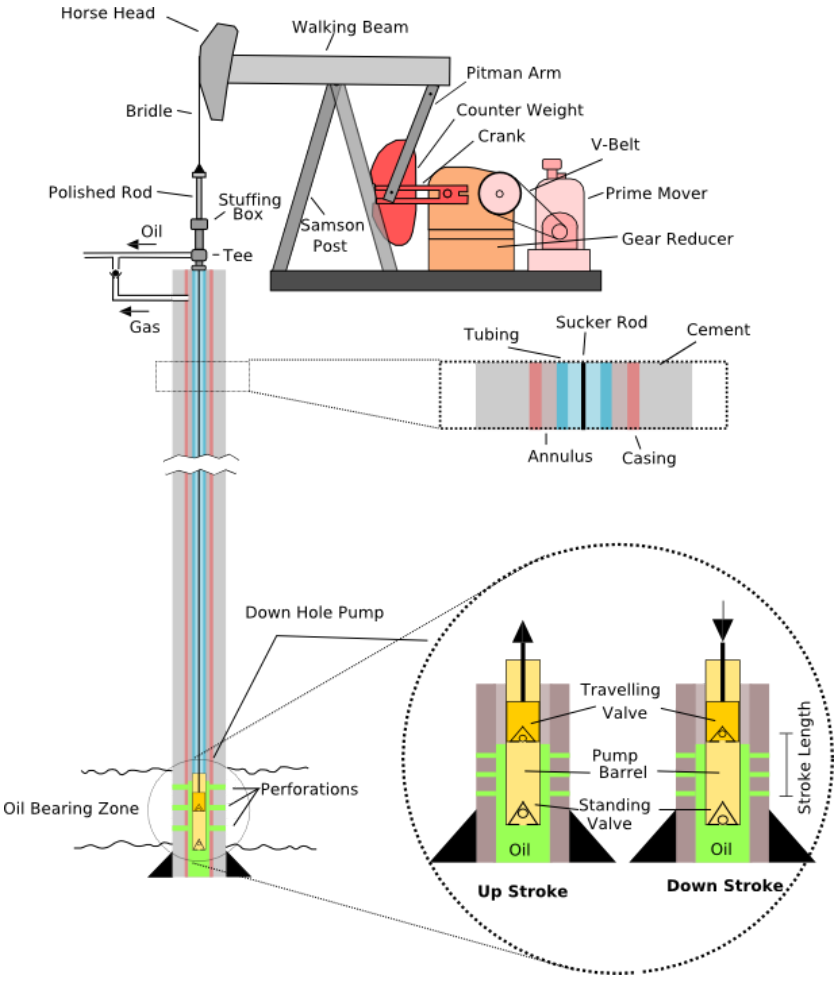

Figure 1: Diagram of an oil derrick and all of its components. Take note of the horse head and the bridle as they may be the most important components to explain to mentees,

The last important point to make to the mentees is the installation of a **steam injector** which also is connected to the oil supply below. *The steam injector pumps steam into the oil pool and coaxes it towards the extractor so it has an easier time pulling up the oil on its end.* Talking about the pressure created by the steam may be a bit complex for mentees so it is recommended to demonstrate this with the module's activity.

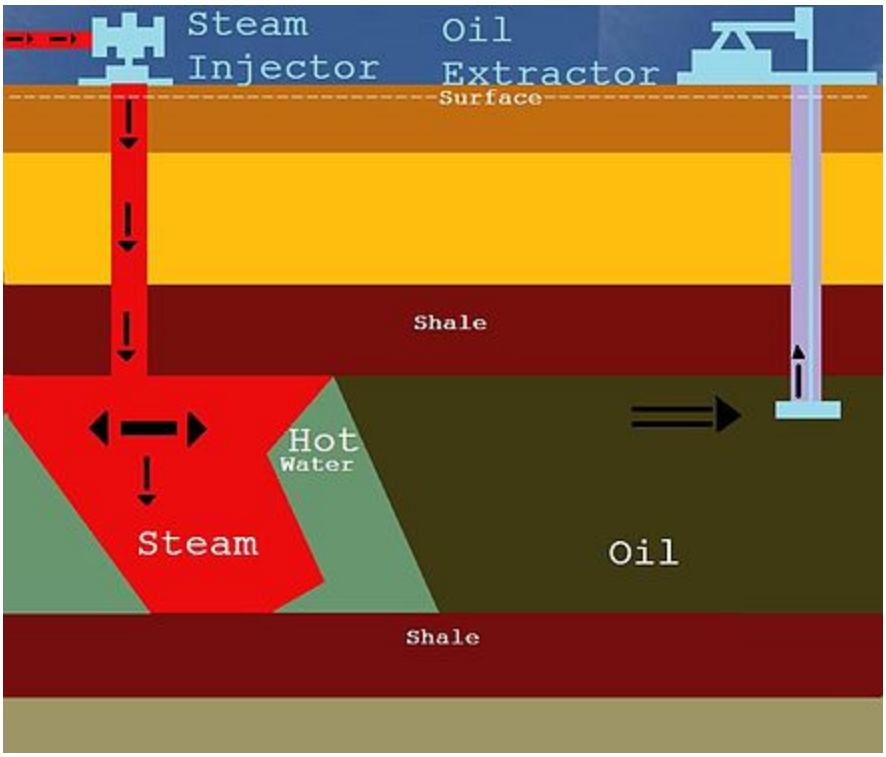

Figure 2: Diagram of oil extraction methodology. Process involves an oil extractor and a steam injector. Pressure from the steam injected causes oil to be pushed out through the extractor end of the diagram.

Background for Mentors

Module 3 ● Pollution ● Oil Spill ● Oil booms	Oil spills occur when typically large amounts of natural petroleum hydrocarbons are released into the environment due to human activity. Although this term is mostly given to marine oil spills, these spills can also occur on land and harm terrestrial wildlife. Oil spills are a major form of pollution and have the potential to cause massive amounts of damage to any impacted organisms and ecosystems. Oil spills can occur in nearly every stage of refined oil production. Oil rigs and wells that gather crude oil can accidentally break and release oil into the nearby environment. Oil tankers that transport oil can malfunction and release oil into the ocean or onto shores. Factories that process crude oils can have leaks that spill oil into nearby environments. There are many approaches to cleaning up oil spills. However, one important step to every approach is to gather the oil into a manageable area that allows for easier collection of oil. Oil booms are popular tools that can be used to accomplish this task. These floating tools gather oil by forming a large ring around the oil spill and slowly dragging the captured oil into a smaller area. Then, the oil can be collected by using either absorbent materials, chemicals, or other processes. In site, mentees will only be exposed to absorbent materials.

Introduction Limit to 1 page

Why is this lesson important to teach? What is interesting or applicable about this lesson? P*rovide mentors with various options to introduce your lesson here.* If you would like to put a demo here to open the lesson, then label this section as Module 0 and create a module page like the others.

Concepts to Introduce ● Crude oil ○ Crude oil is yellowish-black liquid that can be ● Oil extraction ○ The process of getting oil out of the deep underneath the lands ● Oil spill ○ A disaster where oil is released into the environment (ocean and land) and causes pollution	**Questions to Pique Interest** ● How are cars powered? ● Why does the gas price change frequently? ● Where is crude oil coming from? ● Why have there been conflicts between countries due to crude oil?
Scientists, Current and Past Events ● Due to the recent Russian-Ukraine war, the oil prices have been increased a lot. ○ https://www.bbc.com/news/business-60642786 ● The Organization of the Petroleum Exporting Countries (OPEC) was founded in 1960 to “coordinate and unify the petroleum policies of its member countries and ensure the stabilization of oil markets, in order to secure an efficient, economic, and regular supply of petroleum industry.” ○ https://www.opec.org/opec_web/en/about_us/24.htm ● On May 19, 2015, the Refugio oil spill deposited 142,800 gallons of crude oil onto the West Coast of the United States. Nearly 7 miles of shoreline was coated with crude oil. ○ https://darrp.noaa.gov/oil-spills/refugio-beach-oil-spill	**Careers and Applications** ● Drilling engineer ● Exploration geologist ● Geochemist ● Geophysicist

Each module should try to only take 2 pages max. Begin each module on a new page.

Module 1: Title of Module

Summarize the module here. What will kids be doing? How does this module teach/show that?

Teaching Goals	**Materials**
1. **Crude oil:** Crude oil is a naturally occurring petroleum product composed of hydrocarbon deposits and other organic materials. 2. **Where to find it:** Between several hundred and 20,000 feet below Earth's surface 3. **Where does it come from:** It's formed from organic materials that are compressed over millions of years.	• Anything can be used that is made out of oil or contains it. Examples are: • Plastic box • Piece of a tire • Pen • Shoe • Masks • School bags • Class Board

Procedure

1. Explain what crude oil is
2. Explain how important crude oil is in our current society.
    a. Show the objects you brought and ask the mentees which ones they think are made of oil
    b. Reveal that every object was made of oil (wow)
3. Explain that we find crude oil deep in the Earth
4. Explain how oil is formed over millions of years from organic material

Classroom Notes

Make sure you bring interesting pieces to demonstrate how important oil is in our society. You can basically take everything that is made out of plastic.

Each module should try to only take 2 pages max. Begin each module on a new page.

Module 2: Oil Extraction

In this module the mentors will demonstrate how oil is extracted and with a simplified model of a steam injector and an oil derrick. This will also talk about the concept of steam pressure and how it can be used in industrial machinery.

Teaching Goals	**Materials**

4. **Oil Derrick:** The machinery responsible for drawing oil up from the underground well.
5. **Steam Injector:** The machinery responsible for pumping steam into the oil well, and pushing the oil towards the derrick.
6. **Steam Pressure:** The force applied on the oil by the accumulation of steam underground. Responsible for moving the oil towards the derrick.
	• 3 bendy Straws
	• 2 Clear plastic Tupperware
	  ○ ~5.5”x5.5”x3.5” w/ lid
	  ○ And one smaller one with the lid having two straw sized holes poked into it.
	• 2 Cups of ‘olive oil’ (viscous liquid)
	• 2 Cups of dirt
	• Tape
	• 1 Dixie cup

Procedure

5. Pour the viscous oil like liquid into the smaller clear tupperware container.
6. Put a layer of tape covering the two holes on the small tupperware lid and secure it onto the oil tupperware.
7. Pour a thin layer of dirt on the bottom of the larger container.
8. Place the oil tupperware into the dirt tupperware and cover with dirt until oil is no longer visible from top, but can be seen through the side of the larger tupperware.
9. Show mentees the layers, telling them how the oil is below the ground, asking them ways to get it out.
    a. Remember the model is not to scale and the earth layer is much thicker in real life.

Figure 1: *Two tupperware containers, fill the small one with olive oil and the large with dirt or flour.*

10. Poke a hole through the dirt layer into the oil layer with the straw. (Use a skewer to find the holes in the oil tupperware)
    a. Ask the mentees what's next?
11. **Poke another straw into the oil layer and carefully have a mentor blow into the oil so oil comes out the other straw.**
12. **Use leftover large lid to close the system and pack it up and move on with the lesson.**

Figure 2: Lid for smaller tupperware with two straw sized holes taped over.

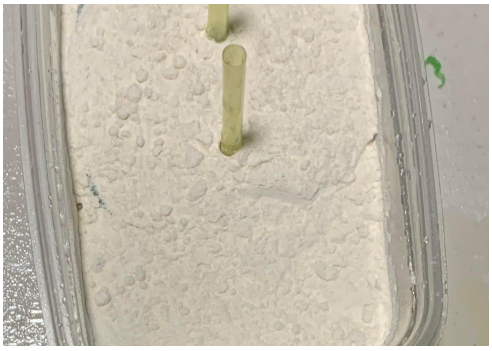

Figure 3: Finished demo with two straws for steam injector and oil derrick.

Figure 4: Blow on one straw and watch the oil come out the other, maybe use a cup to collect the oil.

Classroom Notes

Any additional tips for mentors to make their lives easier? A hint about a certain way to build something? A shortcut? What to do if a student is struggling with something?

Each module should try to only take 2 pages max. Begin each module on a new page.

Module 3: Oil Spills

In this module, mentees will be exploring the concept of oil spills, as well as the different approaches to handling oil spills. Different materials in this demo will be used to clean up a

simulated oil spill.

Teaching Goals	Materials
1. Pollution: Introduction of harmful materials (pollutants) into the environment **2. Oil Spills:** Release of natural petroleum into the environment due to human activity; a form of pollution **3. Oil booms:** a method of handling oil spills by gathering oil spills into an area so that oil collection can be easier	● 1 Clear, plastic tub per group (medium-sized, not too shallow) ● Water (enough to fill half of each plastic container) ● 1 cup of vegetable/olive oil per group ● 2-3 Plastic spoons per group ● 2-3 Cotton balls per group ● 4-5 Paper towels per group ● 2 Sponge balls/cut-up sponges per group ● String ● 2 Paper cups per group

Procedure

Split the mentees into two groups. For EACH group:

1) Fill plastic container halfway with water
2) Add 2 spoonfuls of vegetable oil to the water
3) Use spoon to distribute the oil across the entire layer of water **(allow oil to settle at the top before continuing to step 4)**
4) Cut out a 1-foot long piece of string to give to a mentee volunteer (**make sure the string is long enough so that the mentee does not risk getting his/her hands wet or oily!)**
5) Have mentee attempt to gather all/most of the “spilled oil” into a certain corner or area of the container by circling the oil drops with the string
   ***Mentee should NOT remove string from tub after completing Step 5**
6) Choose another mentee volunteer and have them pick either a sponge, cotton ball, or paper towel to collect the gathered oil by dabbing the material into the oil
   It is okay if the mentee doesn’t collect all of the oil! The main goal is for mentees to understand that it is easier to collect a large pool of oil in one place rather than oil that is spread out.
7) Place oily collection tool into the paper cup
8) Add another spoonful of oil to the plastic container, spread oil across water with spoon, and have a new mentee use string to collect the oil into a corner of the tub

9) Have another mentee volunteer collect the oil with another collection tool
10) Repeat steps 7-9 for the last collection tool
11) If time permits, allow mentees to try out different collection tools

Use string to gather oil

Using cotton ball to absorb oil

Classroom Notes

Before beginning the procedure, clear the work surface of any loose papers or bags to prevent any messy situations. If the plastic container is shallow, place a paper towel underneath the container to absorb any potential spills. Try to have the mentees work slowly, as working too fast may cause spills onto the work surface that will need to be cleaned up.

Conclusion

In this lesson, mentees had the opportunity to learn about crude oil formation, extraction, and how to clean up oil spills. Although crude oil is essential to our lives today, it is not a clean energy source. Mentors can gives the mentees some examples of clean energy sources.

References

- Add references in case your mentors want additional information!
- Title of Source, Author, Organization. http://www.example.com/

Summary Materials Table

Material	**Amount per Site**	**Expected $$**	**Vendor (or online link)**
See Modules			Amazon