



TeachEngineering

STEM Curriculum for K-12

Day 1: Understanding Polarity



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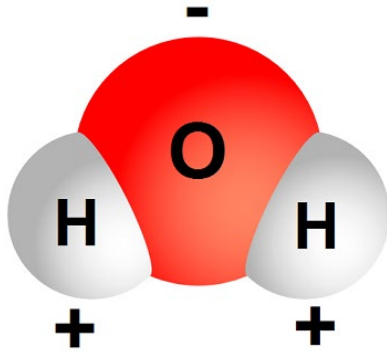
Learning Goals

- Understand what makes molecules polar and nonpolar
- Summarize the interactions between polar and nonpolar molecules
- Evaluate oil spills and their impact on the environment
- Understand methods used to clean up oil spills and their relation to polarity

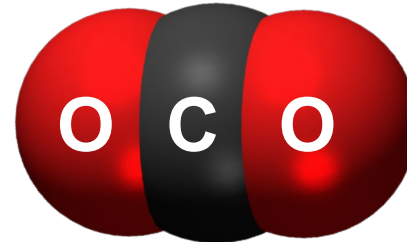


Molecules and Charges

- Substances are made of tiny particles called molecules, and different molecules behave differently.
- Some molecules have parts with charges, which attract and repel each other like magnets.
- Molecules that have charged parts are called **polar molecules**.
- Molecules that do not have charged parts are called **nonpolar molecules**.



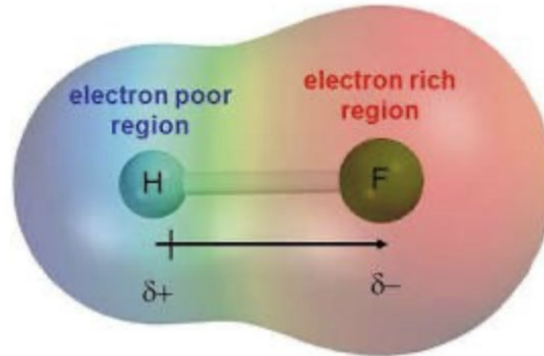
A polar water molecule



A nonpolar carbon dioxide molecule

Polarity

- The charges in polar molecules attract each other, meaning polar things are “stickier” than nonpolar things.
- This also means that polar molecules mix well with other polar molecules, but do not mix well with nonpolar molecules.
- Think again about a magnet: It is more attracted to another magnet than to a piece of plastic or wood?



The positive (left) and negative (right) sides of a hydrofluoric acid (HF) molecule

Oil Spills

What is an oil spill?

A release of liquid petroleum (oil) into the environment.

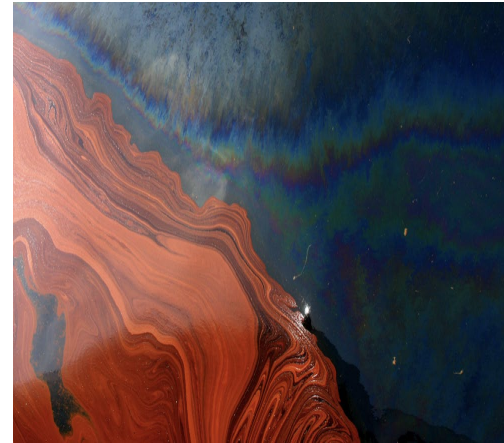
- **Sources of oil spills**
 - Deep sea drills
 - Large tankers
 - Waste disposal
- 706 million gallons of oil spilled into waterways and the ocean worldwide every year

Issue with oil spills:

- Harm to wildlife
- Contamination of food sources
- Damage to shorelines

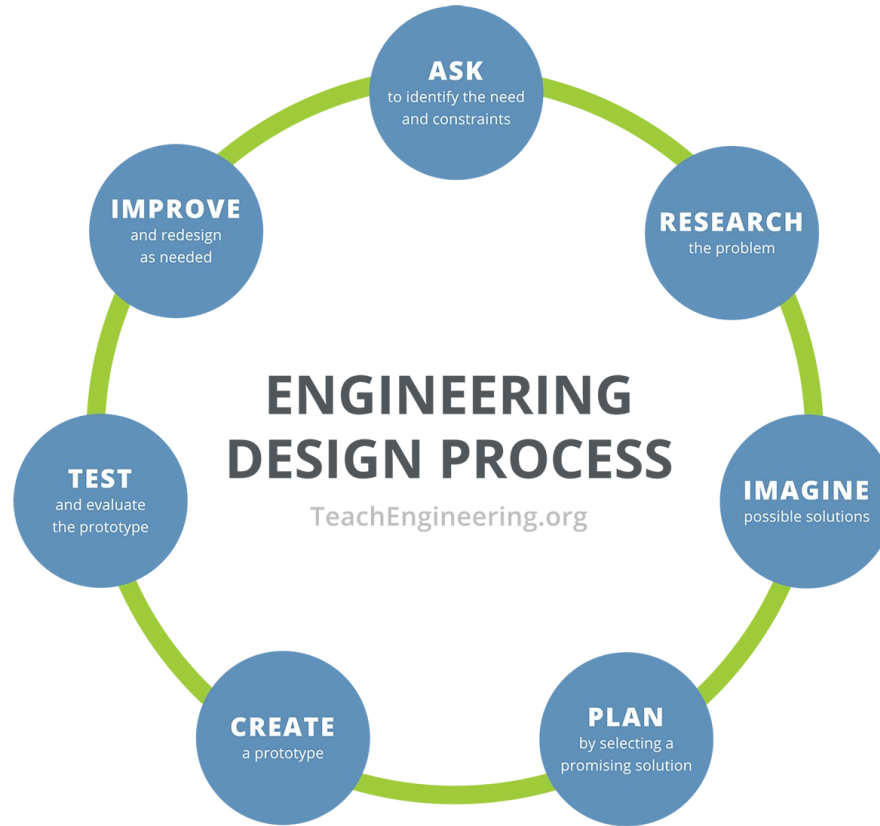


Offshore oil drill



Oil in ocean after Deep Horizon oil spill

Engineering Design Process



Discussion Questions

- You might already know that water and oil do not mix well.
- Which one do you think is the polar molecule: water or oil?
- Get in a group with other students who agree with you and discuss. Why?*
- What can we do to solve the oil spill issue? *Get in a group with other students who agree with you and discuss. Why?*
- What type of wildlife do you think is affected the most by the oil spills?



Workers cleaning up oil spill



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Day 2: Oil Spill Cleanup Activity



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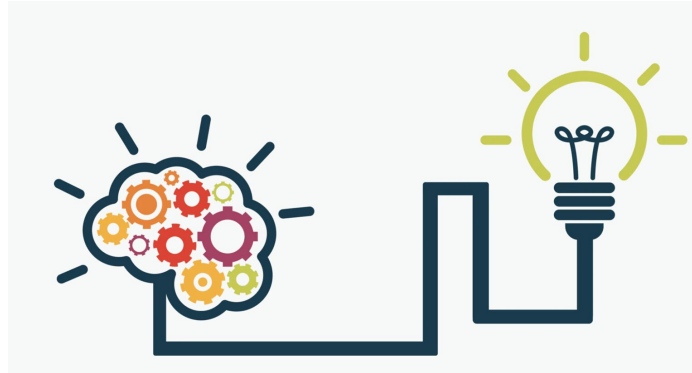
Activity

What are we doing?

We will be demonstrating an oil spill in a body of water.

Activity goals:

Each group will learn engineering principles by using given materials to find a solution to clean up the oil in the water.



Starting the Activity

Refer to the worksheet for detailed instructions.

First step:

Get in your assigned groups.

Second step:

Gather supplies:

- tub
- oil
- cocoa powder
- oil cleanup supplies:
 - spoon, string/rubber band, popsicle stick, and cotton balls
- dish soap



Discussion Questions

- Which material worked the best? Why?
- Which material worked the worst? Why?
- Are there any materials that you DIDN'T try that you think would have worked better to get the oil out of the water?



Use of a rubber band “skimmer” to separate oil and water

Discussion Questions

- If you had all the materials and money in the world, how would you try to get oil out of water? Draw a picture of your plan or machine to remove oil from water. (*Give it an awesome name!*)
- What are other nonpolar substances you can think of that would behave like oil?
- How is oil cleaned up in the real world?
- Is it similar to the ideas you drew?



Oil skimmer at work cleaning up an ocean oil spill

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