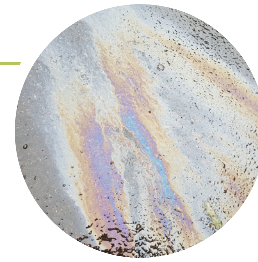
Forces at Work in a Lava Lamp

A Carolina Essentials™ Activity

Student Worksheet



Overview

Maybe you've heard that oil and water don't mix. You need to shake oil and vinegar salad dressings before you use them. So how does this hold true on a large scale in nature? In this activity, you'll gather evidence through observations to help explain the phenomenon of oil and water not mixing.

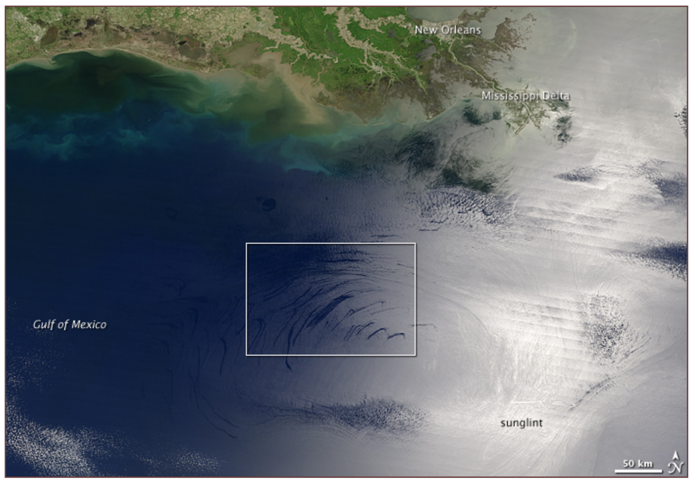
SAFETY REQUIREMENTS

MATERIALS

- 1 beaker, 400 mL or 600 mL
- 1 dropper bottle of food coloring
- 1 antacid tablet
- Tap water
- Vegetable oil (400–500 mL)
- Flashlight or cell phone flashlight
- Magnifying glass (optional)

Phenomenon

This is a picture of the Gulf of Mexico taken from a NASA satellite in 2006. The white area is **sun glint**, where sunlight is being reflected off the ocean surface and scattered. Notice the dark streaks within the box. Dr. Chuanmin Hu, an optical oceanographer, identified these streaks as **oil seeps**, oil that bubbles up naturally from the ocean floor. How can the surface streaks be explained? Share your ideas with your lab partners.



Credit: NASA Earth Observatory, May 13, 2006

Essential Question

How does molecular structure influence the strength of electrical forces between molecules?

Activity Objectives

1. Conduct an investigation to produce data that will help determine the structure of oil and water molecules.
2. Relate molecular structure to intermolecular forces.

Safety Precautions and Disposal

Handle the antacid tablets with dry hands. Dispose of the lava lamp mixture as your teacher directs. Do not pour it down the drain.

Activity Procedures

1. Fill the beaker with tap water until it is one quarter full—about 100 mL for the 400-mL beaker or 150 mL for the 600-mL beaker.
2. Add twice as much vegetable oil as there is water—about 200 mL for the 400-mL beaker or 300-mL for the 600 mL beaker.
3. Make observations and sketches of the beaker mixture and the border between the liquids. A magnifying glass may be helpful.
4. Add 4 to 5 drops of food coloring to the mixture in the beaker.
5. Make detailed observations and sketches as the food coloring falls through both layers.
6. Break the antacid tablet in half and drop it into the beaker.
7. Make detailed observations and sketches as the tablet interacts with each layer.
8. Use your phone flashlight app or a flashlight and shine the light from the bottom of the beaker up through the mixture.
9. Add the remaining half of the antacid tablet and make detailed observations and sketches of the interactions of the tablet with the liquids while the light is on.

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Data and Observations

Observations and Sketches

Oil/Water Mixture	
Oil/Water Border	
Addition of Food Coloring	
Addition of Antacid	
Addition of Antacid with Light	

Analysis and Discussion

1. Did the oil and water mix? Did the oil and water react? What evidence do you have to support your claim?
2. Describe what is happening at the boundary of the oil and water.
3. Sketch what is happening at the boundary of the oil and water on the particle level.
4. Which substance is more reactive, oil or water? What evidence supports your claim?
5. Based on the molecular structure of oil and water below and your observations, which substance appears to have larger intermolecular forces? Justify your claim.

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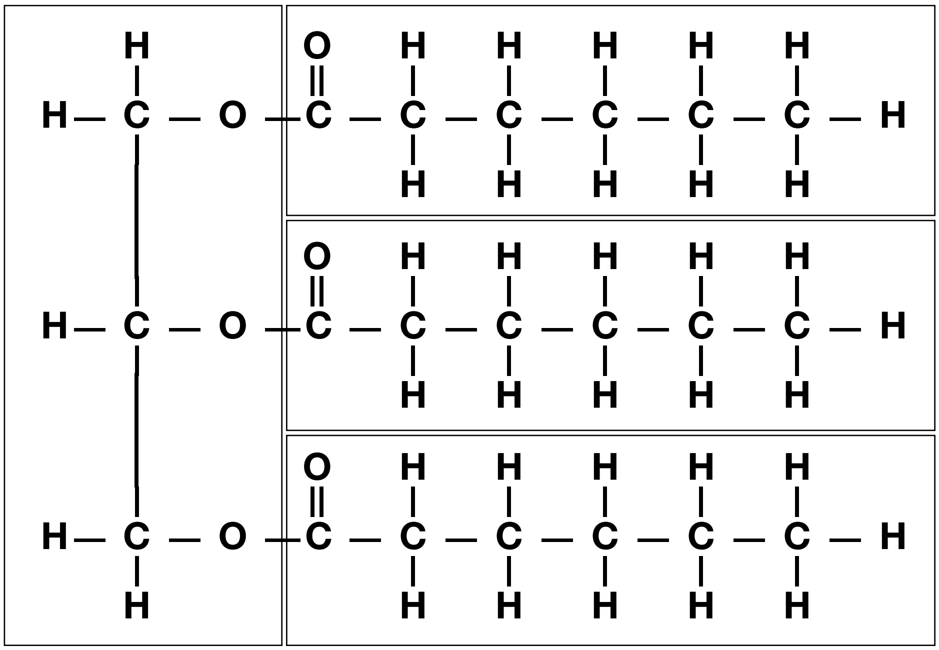
Oil



Water