

# Layers of Liquids

## **OBJECTIVE:**

Students will observe how some liquids “float” on top of each other while others sink into one another.

## **MATERIALS:**

- Honey
- Corn syrup
- Dawn dish soap
- Water
- Vegetable oil
- Isopropyl alcohol
- Food coloring (various colors)
- 12 ¼ cup measuring cups (6 will be used at a time)
- 2 Clear graduated cylinders or slim containers (1 will be used at a time)
- Digital scale

## **TO DO:**

- Measure out one liquid per measuring cup. Be as precise as you can with each liquid.

- If you wish, color the corn syrup and alcohol using the food coloring. Be sure to add the same amount of drops to both as this might change the density slightly.
- Choose six volunteers from your class. In this order – honey, corn syrup, dish soap, water, vegetable oil and alcohol – help each volunteer pour their liquid into the graduated cylinder or clear container. Be sure you pour each liquid slowly and into the center of the cylinder or container and avoid pouring down the side. It's fine if the liquids mix a little while pouring – each one will settle into its own layer after a little time has passed.
- Ask your students why they think each liquid is “floating” on the top of the other. Explain that each liquid has a different weight and that these particular liquids were poured from the heaviest weight to the lightest weight.
- In the second set of measuring cups, measure out one liquid per cup.
- Before pouring these liquids into the cylinder or container measure each liquid on the digital scale so that your students can see that they are different weights.
- Choose six different volunteers and have them pour the liquids into the cylinder or container lightest to heaviest – alcohol, vegetable oil, water, dish soap, corn syrup and honey. This time each liquid will sink into the other because the lighter liquids can't hold the heavier liquids. Ask your students why they think each liquid sinks into the other.

## **WHAT'S GOING ON?**

Density is the mass of a substance divided by its volume – Density = mass/volume. Based on this equation, if the weight (or mass) of something increases but the volume stays the same, the density has to go up. Likewise, if the mass decreases but the volume stays the same,

the density has to go down. Lighter liquids (like water or rubbing alcohol) are less dense than heavy liquids (like honey or corn syrup) and so they float on top of the more dense layers. The density of the above liquids are:

Honey – 1.36

Corn Syrup – 1.33

Dish Soap – 1.06

Water – 1.00

Vegetable Oil - .92

Isopropyl Alcohol - .79

Post-Visit Activity

## Boat Buoyancy

### **OBJECTIVE:**

Students will attempt to keep an aluminum “boat” from sinking from the weight of pennies.

### **MATERIALS:**

- Rectangular pieces of aluminum foil – the foil pieces can be any size, but each piece must be the same size.
- 6 rolls of pennies – more may be needed if you give them large sheets of aluminum.
- Plastic cups

- Clear plastic bucket
- Water

## **TO DO:**

- Fill each bucket with water until it is about halfway full.
- Place a cupful of 100 pennies next to each bucket. If you are giving them large pieces of aluminum foil, you may need more pennies.
- Place a couple of pennies into each bucket so that the students can see that the pennies sink. You might want to give each student a penny to throw in the bucket so that they can watch it sink.
- Pass out an aluminum rectangle to each student. Instruct them to make a boat that can be placed in the bucket of water. Place one rectangle of aluminum into a bucket of water to show them that it floats.
- Partner up the students and send each team to a bucket. Have both students place their boats in the bucket.
- Students will add pennies to their boats until the boat sinks. Once the boat sinks, they will count how many pennies it took to make the boat sink. You can write each student's name on the board so the whole class can see how many pennies each student placed in their boat. Do not let them destroy their boats.
- After each student has had a turn, discuss as a group why some boats were more successful than other boats. Encourage all the students to redesign their boats so that each one can hold more pennies.

## **What's Going On?**

### **Why does the penny sink in the water?**

*Density* is the measurement of how much mass is contained in a given volume of an object. For instance, water has a volume of 1.0 gram/cm<sup>3</sup>.

Copper has a density of 8.92 g/cm<sup>3</sup>. Since the penny has greater density than the water, it will sink in the water. However, if you have an object to support the penny on the surface of the water, the penny will not sink. If you add more pennies than the object can support, it will eventually sink.

### **Why does the boat float on the water?**

*Buoyancy* is the tendency of an object to float or rise when submerged in a fluid. If a buoyant boat is built for this activity, it would hold a lot of pennies. If a boat was not buoyant, it would not hold a lot of pennies.

### **Vocabulary:**

**Float** - Rest or move on or near the surface of a liquid without sinking.

**Sink** - Go down below the surface of a liquid; become submerged.

**Buoyancy** - The ability or tendency to float in water or air or some other fluid.

**Density** - A measure of the compactness of a substance, expressed as its mass per unit volume. It is measured in kilograms per cubic meter or pounds per cubic foot.