

# Floating and Density

## Pre-Lab Activity - Teacher Guide

### Grades – 2<sup>nd</sup> & 3<sup>rd</sup>

#### Overview

This activity demonstrates that by adding different amounts of sugar to water, its density increases.

#### Materials for each group

\*\* For this activity we suggest that your class be divided into small groups of 3 to 4 students per group. **Each group** will need the following items:

- Glass container (at least 32 ounces)
- 4 Small plastic cups (at least 8 ounces each)
- Container of sugar (about 20 tablespoons – placed in a bowl)
- Tablespoons
- Container of water (warm water helps the sugar to dissolve faster)
- Food coloring (red, blue, green, and yellow)
- 4 Metal teaspoons or droppers (pipettes)
- Paper towels (in case of spills)

#### Getting Ready

Write a number on each cup 1-4 (this will need to be completed on each group's supplies). Label each cup with the amount of sugar to be added.

- Cup #1 will have 2 tablespoons of sugar.
- Cup #2 will have 4 tablespoons of sugar.
- Cup #3 will have 6 tablespoons of sugar.
- Cup #4 will have 8 tablespoons of sugar.

Fill each cup with 8 ounces of water. Warm water will dissolve the sugar faster, but room temperature water works fine as well. Place the materials at each team's/group's table.

#### Procedure

Introduce the term DENSITY to the students. Explain that all objects have density, even liquids. The density of an object is determined by how tightly packed the molecules of matter (solid, liquid, or gas) are fitted together in a certain amount of space (volume). Ask which would weigh more a pound of marbles or a pound of marshmallows? (You could have a marble and a marshmallow to show as an example). The answer of course is neither because they both are a pound. BUT the pound of marbles seems heavier

because they are more dense. Their molecules are packed tightly together without much air between them. The marshmallows are lighter because they have air pockets inside which allows for space between their molecules.

Today you will be increasing the density of water by adding sugar molecules to it. What happens to the sugar when it is added to the water? Does it disappear? No, it dissolves. What we can't see is that the sugar molecules are bonding (connecting) to the water molecules and becoming a heavier liquid. With that in mind, what happens to the substance if we add different amounts of sugar to the same amount of water? Write their prediction(s) on the board.

Now you are ready to begin the experiment to test the hypothesis (educated guess) that you just formed.

The students should add a few drops of food coloring to each cup and carefully stir to mix together with the water. You decide which color goes into each cup. If you prefer, you can arrange the layers to be in the order of the colors in a rainbow (red in #4, yellow in #3, green in #2, and blue in #1). **Food coloring will stain clothing and hands. Be careful with this part of the experiment. You could have the students wear protective gloves but be aware of any latex allergies.**

Have the students add the sugar to each cup according to the label on the front of the cup.

- Cup #1 will have 2 tablespoons of sugar.
- Cup #2 will have 4 tablespoons of sugar.
- Cup #3 will have 6 tablespoons of sugar.
- Cup #4 will have 8 tablespoons of sugar.

Stir the water in each cup until the sugar is dissolved. It is crucial that **ALL** the sugar in each cup is dissolved.

Start with the cup that has the most sugar (#4) and carefully pour the first layer into the large glass container. This is the easiest layer to add.

Now it gets challenging. The next cup will be Cup #3. Use a pipette, dropper or teaspoon to carefully add the next layer to your container. If using a pipette or dropper, place it right above the surface of the first layer and against the glass. Slowly drip the next color onto the first color. If using a teaspoon, place the spoon against the container with the bottom facing upwards. Carefully and **slowly** pour the contents of Cup #3 over the top of the first liquid. **This part takes a lot of patience.** Take it slow! The colors

may begin to mix at first but the original color will begin to show. Now repeat this process with Cup #2 and then finally with Cup #1.

## **Explanation**

The sugar molecules will connect or bond with the water molecules and make them more dense, heavier. For the rainbow to form, the most dense solution needs to be on the bottom. The remaining layers will rest on top of each other because each layer has a less dense solution.

## **Assessment**

The student should be able to verbalize why the colored layers formed. On a sheet of notebook paper have the students write a sentence using density in the explanation to explain what they observed during the experiment.

You could ask them follow up questions such as:

- What do you think will happen if the container is shaken? (**Answer:** The colors will not separate and go back to the layers like a rainbow. It will stay mixed together because it is all sugar and water.)
- What are some other liquids that you think would form layers when placed in the same container? (**Answers:** Oil, syrup, honey, molasses, etc.)
- What other substances could be added to the water besides sugar to change the density? (**Answers:** salt, baking soda, cornstarch, etc.)