STARBASE Challenge: Liquid Rainbow

Have you ever wondered why some salad dressings must be shaken before you use them while others don't? Whether you must shake or just pour often depends on the densities of the materials inside the container. **Density** is the amount of mass (or matter) in a specific volume (or amount of space). For this challenge, you will take several different household liquids and pour them into the same container. You will make observations and use them to explore the concept of density.

Materials:

- 1 clear glass jar or large plastic bottle – they must be able to hold at least 3 cups of liquid
- ½ cup of blue dishwashing liquid
- ½ cup of olive or vegetable oil
- ½ cup of rubbing alcohol
- ½ cup of light corn syrup
- ½ cup of water
- Red, green and blue food coloring
- 5 bowls for mixing
- 5 spoons
- Measuring cups
- Towel for spills

This activity can be done without using all the liquids as long as you have **at least 3**.

1. Mix a ½ cup of the light corn syrup with 1 drop of blue and 1 drop of red food coloring to make the Purple Layer.
2. Pour the Purple Layer mixture into the bottom of your jar or bottle.
3. Carefully pour the blue dish soap down the side of the jar, going slowly so the colors don't mix. This is your Blue Layer.
4. Mix ½ cup of water in a bowl with 2 drops of green food coloring to make the Green Layer.
5. Carefully pour your Green Layer slowly down the side of the jar.
6. Gently pour your ½ cup of oil down the side of the jar.
7. Mix ½ cup of rubbing alcohol with 2 drops of red food coloring to make the Red Layer.
8. Carefully pour your Red Layer down the side of the jar.

Pouring a liquid down the side of your container.

Use your observations to answer the following questions:

1. You measured out the same volume of each liquid for this test. Based on your observations:
    a. Do you think all the liquids have the same mass or number of particles?

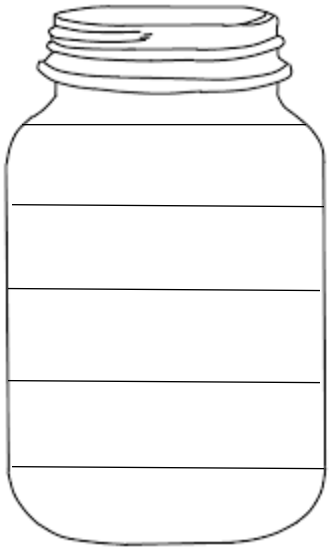
    b. Do you think all the liquids have the same density?

    c. Explain your answers.

This challenge was inspired by Liquid Layers from the 4-H STEM Lab.

2. Color in the layers of your rainbow in the picture below.

   Draw lines to match each density value to the correct layer of the rainbow you created.



1.33 g/mL

1.00 g/mL

1.06 g/mL

0.79 g/mL

0.92 g/mL

3. Can you think of another liquid that would be denser than corn syrup and therefore go all the way down to the bottom of this jar?

4. What do you think would have happened if we put the rubbing alcohol on the bottom, then added the dish soap? Why?

5. What do you think would happen if the liquids mixed?

6. Put a cover on your container and shake it to test your hypothesis. Wait and observe for 5 minutes. Write your observations below.

7. Do you think density is the only property that determines whether or not substances mix? Why do you think so?