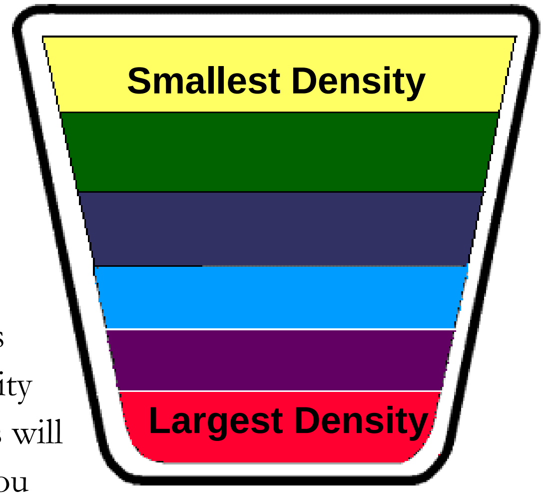
Density Lab   Name ________________



Objectives:

- Calculate density, mass, and volume
- Construct a density column
- Identify unknown metal using density by displacement

Background:

We will be working with many different liquids. Each of the liquids has a different, characteristic density. One way to think about density is how thick or heavy an object is. The liquids with lighter densities will float. The liquids with heavier densities will drop to the bottom. You may have noticed that sometimes, liquids mix together – this is because the chemicals dissolve in each other. During our experiment, the liquids will stay separate because we will add the liquids in order of decreasing density! As long as the materials do not mix or react, the less dense materials will float on top of the more dense ones. This lab will create colorful, layered rows.

Density can be calculated! Density values are often used in scientific calculations!

$$\boxed{\textbf{Density} = \frac{\textbf{Mass}}{\textbf{Volume}}}$$

Mass is related to weight, or how heavy something is, and *Volume* is how much space the liquid takes up. Density is simply the mass of a substance divided by its volume!

Pre-Lab Questions:

1. What are the units for density?

2. Using the density formula, if a scientist has a 2.00 gram sample of zinc and a 20.0 gram sample of zinc, what will be the same? What will be different? Explain your answer. ****HINT: Look at your reference table****

Procedure:

1. <u>Find the density of a piece of wood</u>

   a. Find and record the volume *HINT: You need a ruler* ______________________

   b. Show calculations include units (watch sig figs)

   c. Find and record the mass of the wood ___________________

   d. Calculate the density of the wood (show work) _____________________

2. <u>Find the density of 50.0 mL of water.</u>

   a. Find and record the mass of the empty graduated cylinder __________________

   b. Find and record the mass of the graduated cylinder + water __________________

   c. Find and record the mass of just the water by subtracting the two (Show your work)

   ____

   d. Calculate the density of the water (Show your work) ___________________

   e. The density of water should be 1.0 g/mL, calculate the % error (Show your work)

   ____

3. <u>Find the density of an unknown metal</u>
   a. Using a 100 mL graduated cylinder, add at least 40.0 mL of water and record the volume.

   ____

   b. **<u>CAREFULLY</u>** add the metal into the graduated cylinder and record the new volume.

   ____

   c. Calculate the difference between the two volumes and record the volume. ____________
   (Show your work)

   d. Find and record the mass of the metal cylinder. ______________________
   e. Using part d, calculate the density. (Show your work) _________________________

   f. Using the reference table, identify your unknown metal. _____________________
   g. Calculate the % error. (Show your work) __________________

4. <u>Make a density column</u>
   a. Measure 10.0 mL of each liquid:
   Dishwashing liquid, Molasses, Rubbing alcohol, Vegetable oil, Water
   b. **<u>Without a balance</u>**, observe the masses of all five liquids. Then record your prediction in order of increasing mass, in the table below:

Least massive				Most massive

   c. Using a balance, determine the mass of each liquid. Record in the table below.

Dishwashing liquid	Molasses	Rubbing alcohol	Vegetable oil	Water

d. Analyze your predictions, as they relate to the actual masses.

e. Now you are ready to add your liquids to the graduated cylinder! Pour the most dense first (largest density value), avoiding the sides of the graduated cylinder. The remaining liquids are to be poured along the sides to avoid mixing. You should have a colorful band of liquids!

f. Draw and color your density column. (Label your liquids)

Post-lab Questions (COMPLETE SENTENCES or SHOW YOUR WORK):

1. What is the relationship between mass and density when the volume of each liquid is constant?

2. A block of aluminum occupies a volume of 15.0 cm^3 and has a mass 40.5 grams. What is the density?

3. What is the mass of ethanol that exactly fills a 200.0 cm^3 container?

4. Silver has a density of 10.5 g/cm^3 and gold has a density of 19.3 g/cm^3. Which would have a greater mass, 5.0 cm^3 of silver or 5.0 cm^3 of gold?

5. 28.5 grams of iron is added to a graduated cylinder containing 45.50 mL of water. The water level rises to 49.10 mL. Calculate the density of this iron sample. Is this pure iron? *Use your reference table*