Density Lab

Pre lab:

Density is defined as the mass of something per unit volume. Another way to think of density is how closely packed together the matter is in a substance. Substances that have their atoms or molecules farther apart are said to be less dense. Substances that have their atoms or molecules very close together are said to be more dense. *Density is a physical (not chemical) characteristic property that is often used to identify a pure substance. Gold for example has a density of 19.3 g/cm$^3$. It doesn't matter the size of a piece of pure gold, it will always have a density of 19.3 g/cm$^3$. Whether you have a pure gold ring or a pure gold crown, they will both have a density of 19.3 g/cm$^3$. (Gold is one of the more dense metals.)

Whenever you measure anything you need to have units. Units are a way of labeling something so everyone understands exactly what the measurement is. If you don't use units, the measurement or numbers mean nothing!! When calculating density of an object you must find its mass and its volume. The formula for density is, mass divided by volume. Density = mass ÷ volume or, $D = \frac{m}{v}$. Density of a solid is given the units g/cm$^3$ (grams
per centimeter cubed) and density of a **liquid** is given the units g/mL (grams per milliliter.) **It should be noted that one cm³ is equal to one mL in the amount of space that is taken up.** So, if you were to give the units for the density of a liquid as g/cm³ it wouldn’t necessarily be wrong.

Whenever you measure something, there is what is called a **standard** that is used as a comparison. The **standard** for density is pure water, which has a density of exactly one g/cm³ or one g/mL. (For every cubic centimeter of water, or 1 mL, it has a mass of exactly one gram.) Something that is more dense than water will sink. Something that is less dense than water will float.

**Volume is how much space matter takes up.** (Units for the volume of a solid are cm³ and for a liquid they are mL.) There are two kinds of objects when considering the volume of a **solid** object. There are **regular shaped objects** and **irregular shaped objects.** With a **regular shaped** object you can find the volume by measuring the **length, width, and height.** These are then multiplied to get the volume. \( V = LXWXH \) and given the units cm³ (cmxcmxcm = cm³) An example of a regular shaped object would be a rectangular or square wood block. With an **irregular shaped** object the volume is found by displacement. A graduated cylinder (this is what we will be using) is filled with water to a given volume. This volume is recorded. The irregular object
is then placed in the graduated cylinder. Now a second volume is recorded.

**The volume of the object is the amount of water that was displaced** or, the amount that the water rises. The object's volume equals the volume after the object was placed in minus the volume before object was placed in.

\( \text{(Object's Volume} = V_2 - V_1) \) Another way to measure volume by displacement is to place a smaller beaker inside a larger beaker. The smaller beaker is then filled to the very top with water without spilling any over. The irregular shaped object is then placed into the water filled beaker. The amount of water that spills over, or is displaced, is equal to the volume of the object. The displaced water would then be measured in a graduated cylinder. An example of an irregular shaped object might be a marble. One last note on volume; **volume of a liquid is measured in ml**. Remember, 1 ml = 1 cm\(^3\).

The mass of an object is measured by using a balance. You will use a triple beam balance. The units for mass are given in grams.

**Units for volume and for mass will be measured to the nearest tenth** during our density lab because the accuracy of the instruments we have, only measure to the nearest tenth.