

Inquiry-Based Chemistry Lab Exercise:

Lab 5 Density of Solids

Introduction

Density is a fundamental property of physical objects. Chemists sometimes use it to help in the identification of materials. The effects of density are often demonstrated by considering whether an object will float in water. Water has a density very close to exactly 1 g/cm^3 . When an object has a density greater than 1 g/cm^3 then it will not float in water. When its density is less than 1 g/cm^3 then it floats. For example, common vegetable oil has a density of around 0.92 g/cm^3 , which is why Italian salad dressing looks the way it does. Density is defined as the amount of mass per unit volume and mathematically by the equation $D = m/V$. The letter D stands for density, m for mass, and V for volume. The SI unit of density is kg/m^3 but it will suffice in the lab for us to use g/cm^3 (remember, $1 \text{ cm}^3 = 1 \text{ mL}$). The measurement of density requires two pieces of data and therefore requires great care in the making of both measurements so as not to lose precision.

Density is often confused with weight. We often say that lead is heavy. But which is heavier, one pound of lead or one pound of feathers? ... So weight is not the difference between them. Try another question: which is heavier, 1 liter of lead or 1 liter of feathers? Clearly, even if you compressed the feathers to the maximum degree possible, they would probably never weigh as much as the lead, assuming you have the same volume of each. So the substance lead is not heavy (an extensive property), it is dense (an intensive property).

Objective

The idea for students is to come up with your own procedure. You must decide what and how to make your measurements. The notion is to have students learn science by doing science the way scientists do it.

Materials: Make a list of what you need to do the experiment

Procedure

You must find the density 3 samples solid objects (PVC, Glass, and a block). The procedure for this lab is completely up to you. Some things to think about ahead of time:

- What experiments are you going to perform?
- Before you set up the experiments try to decide what you *think* is going to happen. Write this down and refer back to it once you are done.
- In your experiments, what are you going to hold constant in each trial? What are you going to change in each trial?

Analysis Questions

1. Calculate the Density of your objects.
2. Calculate % Error =
$$\frac{\text{Measured value} - \text{Accepted value}}{\text{Accepted Value}} \times 100$$
 Measured value: your calculated density
3. What do you think would happen to the density if one blocks were cut in half? (hint: consider what would happen to its volume and mass.)
4. Does the size (or amount) of a material affect its density? Explain.