Experiment 1: Density of Metals

This experiment was adapted from Colby College, CHE141,
Experiment 1: Scientific Measurements and Introduction to Excel

Purpose: To determine the density of metals and practice pipetting, as a means to become familiar with the lab equipment.

Background: The determination of density for any sample is a good introduction of basic laboratory techniques. For the determination of the density of various metals, one would have to use a laboratory balance and graduated cylinder. The proper use of each of these is expected of all STEM students.

This lab involves the density determination of copper, nickel, and brass. The percent composition of the brass will be calculated. Each of these samples are supplied by RCBC. Please return all samples, clean and dry.

The mass of each sample will be determined with the lab balance. The volume of each sample will be determined by the volume by difference approach. Please make sure to look over the video in Blackboard regarding the proper use of a laboratory balance, and the video regarding the volume by difference approach.

Chemicals:

Copper metal
Zinc metal
Brass alloy
Deionized water

Equipment:

10 mL graduated cylinder and (25 mL or 50 mL) graduated cylinder
Pipet, 10 mL, & pipettor
Lab balance
Beakers (50 mL, 100 mL)

Procedure:

Part A Density of Metals

1. Obtain your samples.

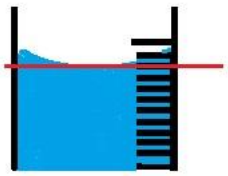
   a) *You will need enough of each metal to give a large enough volume change. So, what is large enough? To get a good number of significant figures, without having to use an excessive amount of sample, make sure the volume change is over 1 mL. For copper, zinc, and brass, that would be approximately 10 grams of each.*
   b) *You will need to transport your samples in some type of container. A clean, dry, beaker for each metal will work well. Record information about your sample in your notebook. There is useful information on the sample bottle.*

2. Determine the mass of your first sample. (Work with one sample at a time.)

   a) *Use a clean, dry 50 mL beaker.*
   b) *Tare the beaker on a lab balance so the mass reads 0.000 g.*
   c) *Remove the beaker from the balance, and add your metal sample.*
   d) *Place the beaker with the metal sample on the balance and record the mass of the metal sample. Record the mass directly in your lab notebook, not on a piece of scrap paper. Mention in your notebook that the balance was tared.*
   e) *Return to your lab bench so other students can use the balance.*

3. Determine the volume of your first sample.

   a) *Use a 25 mL or 50 mL graduated cylinder.*
   b) *Add approximately 15 mL of DI water to the cylinder. Record the <u>volume of water</u> with the correct number of significant figures.*



   c) *Add the metal sample to the graduated cylinder, gently. Use all of your sample that gave the recorded mass.*
   d) *Record the <u>volume of water and metal</u> now in the graduated cylinder. Just like in step 3b, use the correct number of significant figures in your volume reading.*

4. Pour the water and metal from the graduated cylinder, then repeat steps 2 and 3 for your other metal samples.

5. Please return your metal samples to the designated area, clean and dry. Be careful not to let the metal go down the sink drain.

Part B Practice Pipetting

1. Obtain approximately 20 mL of deionized water in a small beaker.
2. Use the 10 mL pipet and pipettor to pipet the water into a 10 mL graduated cylinder.
3. Practice pipetting 5.0 mL of water into the graduated cylinder. Do this 6 times; reuse your water for each trial. Each person in the group should do the pipetting six times. Read the volume of water in the graduated cylinder for each trial.
4. Organize your data in a table in your data section. You do not need your lab partners data. In the conclusion section of your notebook, comment on the agreement in volume for the pipet volume and the volume you read from the graduated cylinder.

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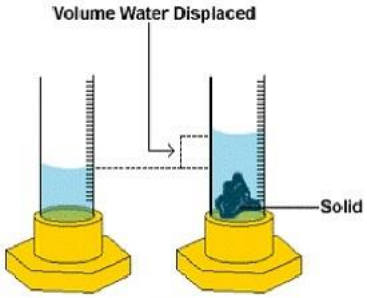
Calculations:



Santa Monica College
1 Measurements in the Laboratory
(Experiment)

1. Calculate the volume and density for each sample.

$$\text{density} = \frac{\text{mass}}{\text{volume}} \qquad \boxed{d = \frac{m}{v}}$$

   a) Report each density with the correct number of significant figures, and organized in a table.
   b) Show your calculations below the table.

2. Calculate the percent composition of the brass as % Cu and % Zn.

   a) Copper and zinc are the only elements in brass. So, the % Cu and % Zn will add to 100%.
   b) Use the density you calculated for your sample of brass.
   c) Follow the the math equations below, so you are solving for only one unknown at a time.

$$\text{density}_{Brass} = \frac{p\, d_{Cu} + q\, d_{Zn}}{100}$$

p = the % Cu by mass and q = the % Zn by mass

You need to solve for p and q.

Rearrange to solve for one unknown at a time.

$$p + q = 100\ \%$$

$$q = (100 - p)$$

rewrite as

$$\text{density}_{Brass} = \frac{p\, d_{Cu} + (100 - p)\, d_{Zn}}{100} \qquad \text{Solve for p}$$

$$q = (100 - p) \qquad \text{Solve for q}$$