**Lab** Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**The Thickness of Aluminum Foil**

Introduction

In science we often use of one known set of measurements and properties to indirectly determine other quantities. One example of this will be illustrated in this experiment. Directly measuring the thickness of a piece of aluminum foil would not be possible with the tools normally available in a high school laboratory. However, it is possible to indirectly calculate the thickness using formulas that are familiar to us.

The volume of a regular object is found by using the formula V = L x W x H, where

L = length, W = width, and H = height. Imagine that the regular object is a rectangular-shaped piece of foil. We don’t often think about foils and sheets of paper as having a “height”, we usually call this dimension “thickness”. If height, or thickness, is the value we are trying to determine, we need the length, width and volume. Getting volume of a piece of foil is tricky. Water displacement would not work well. There is another way. Remember that density is a property that is expressed as D = m/V. The density of aluminum is accepted as **2.70 g/cm3**, and the mass of a piece of aluminum foil can be measured with a balance. Do you now see a way to come up with the volume of a piece of aluminum foil?

In this experiment, the accepted values for the thickness will be available to you. The closeness of your determination to the accepted values will determine the accuracy of your measurements. If you do two or three trials with the same type of aluminum foil, you can determine the precision of your measurements.

Pre-lab Questions: Solve each problem below.

You must **SHOW YOUR WORK** and be sure to include **UNITS** on your answer.

1. What is the volume of a block that has the dimensions: L = 8.20 cm, W = 2.25 cm, H = 1.0 cm

2. If the density of a substance is 0.525 g/cm3 and the volume of a sample of this substance is

 18.25 cm3, what is the mass of this sample?

3. The volume of a rectangular box is 120 cm3 and the length is 8 cm and the width is 4 cm.

 Find the height of the box.

4. A piece of paper is known to have an area of 30.2 cm2 and has a volume of 5.2 x 10-3 cm3.

 What is the thickness of this paper?

Procedure

1. Each lab station will have 2-3 rectangular pieces of regular aluminum foil and

 2-3 rectangular pieces of heavy duty aluminum foil. Using a ruler, carefully

 measure the length and width of each piece of foil. Record the measurements

 on Data Table #1. (How exact can your measurements be using the ruler?

 Think carefully before you record your results.)

2. Using a balance, find the mass of each piece of aluminum foil. Record the masses

 on the Data Table. Again, be careful to be as exact as your instrument will allow.

 Ask your instructor if you are unsure.

3. Complete the calculations on Data Table #2.

Data

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
|  | **Type of Foil** | **Length (cm)** | **Width (cm)** | **Mass (g)** |
| 1 | Regular (R) |  |  |  |
| 2 | Regular (R) |  |  |  |
| 3 | Heavy Duty (H) |  |  |  |
| 4 | Heavy Duty (H) |  |  |  |

# Analysis/Conclusions

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | **Type of Foil** | **Area (cm2)** | **Volume (cm3)** | **Thickness (cm)** | **Avg. Thickness** |
| 1 | Regular (R) |  |  |  |  |
| 2 | Regular (R) |  |  |  |  |
| 3 | Heavy Duty (H) |  |  |  |  |
| 4 | Heavy Duty (H) |  |  |  |  |

SHOW YOUR WORK here. (One example of each type of calculation above.)

Questions

1. How do your answers compare with those of other students?
2. If your measurements are accurate, that would mean they are close to the real or correct value. Is comparing to your classmates a good indication of how accurate your measurements are? Why or why not?
3. If your measurements are precise, that would mean they are close in value to the measurements taken in separate trials or by separate scientists. Are your answers precise? Why or why not?
4. A very thin layer of gold was plated (layered) onto a metal tray that measured 25.22 cm by

 13.22 cm. The gold plating increased the mass of the plate by 0.0512 g. Calculate the

 thickness of the gold layer. The density of gold is 19.32 g/cm3.