Scientific Measurement
Density Lab

<u>Objectives</u>:

- find the volume of material samples using volume displacement
- calculate the densities of three materials by measuring the mass and volume of three samples of each material
- compare the observed densities to listed values and find percent error for each
- graph the three materials by mass vs. volume and compare the density from the graph with the average and listed densities for those materials

<u>Materials</u>:

Note: This is an <u>incomplete</u> list. Make sure you take note of <u>all</u> the equipment used in this lab in order to include a proper list in the "Materials" section for the writeup of this lab in your notebook.

- triple beam or electronic balance
- graduated cylinder
- samples of three unknown materials

<u>Methods</u>:

1. Choose three different amounts of one of the unknown materials. These could be different sized pieces, or, in the case of something like marbles or nails, different numbers of the items.
2. Put the letter of the substance you choose in the far left-hand column of the data table below.
3. For each amount of this material, find the mass of your sample and record the data in the table.
4. For each amount of the material, use a graduated cylinder to find the volume of your sample by recording the amount of water displaced. Record the data.
5. Pour off the water in the cylinder being careful not to lose any of the sample. Place the wet samples on paper towels so they can dry.
6. Repeat steps 1 through 4 for at least two other materials.
7. Clean up lab area and return equipment to the appropriate places.

Data:

Substance (ex: "A")	Sample 1 Mass (g)	Sample 1 Vol. (cm³)	Sample 2 Mass (g)	Sample 2 Vol. (cm³)	Sample 3 Mass (g)	Sample 3 Vol. (cm³)	Density (average)	Density (actual)	% Error

Discussion:

1. Using the masses and volumes you observed for each sample, calculate the average density, and enter those values in your data table.
2. Examine a table of known densities. Find the closest match for each of your average densities. What do you think your three materials were?
3. The "Density (actual)" will be given to you by your instructor when he/she tells you what materials were used in the lab. Were your determinations correct? Using this actual density of the known material, calculate your percent error for each material..
4. Plot the mass vs. volume data you obtained using volume as the independent variable (x-axis) and the value for the mass as the dependent variable (y-axis). Using a ruler, draw a "line of best fit" through the three data points you've entered on your graph for each material.
5. How does the slope of this line compare with your average density and the listed density for these three materials?.

Conclusion:

Sources of error? Were you able to determine what an unknown substance was by using its density? The substances you were given were relatively pure; what effect do you think would be seen if you had a substance that was a mixture of other substances? People have used this as one method to determine whether a sample of gold is pure or not. Describe how you think this method could help determine that fact.