CHEMISTRY I
DENSITY LAB

PURPOSE:

1. To calculate density of regular objects using the metric system.
2. To utilize significant figures in calculations.
3. To calculate percent error.

BACKROUND:

All measurements involve some degree of error or estimation. The measurements are based on the fact that the human eye can estimate to one-tenth of the smallest mark shown on a measuring instrument. Therefore, a ruler with only 1-cm increments shown can provide measurements that are estimated to 0.1 cm, while a ruler with 1-mm increments shown can provide measurements that are estimated to 0.01 cm. In this lab a metric ruler with millimeter marks will be used to measure the dimensions of three regular shaped objects with an accuracy of two places after the decimal. A measurement of 6.35 indicates reliable readings of 6 centimeters and 3 millimeters. The 5 is the estimated value based on where the object lies in between the millimeter marks.

Calculation of the volume of the objects will use the formula: **L x W x H** and have the unit of cm^3. The mass of the objects will be determined by using an electronic balance with an accuracy of two after the decimal and a triple beam balance of the same accuracy.

Each of the three objects will be measured during two trials and data will be recorded. The densities of the objects can then be calculated using the formula: **d=m/v** with the units of g/cm^3.

Success of this laboratory activity depends on the ability to take accurate and precise measurements and to apply the rules for significant figures in mass and volume calculations to determine density. Once the densities of the objects have been calculated the values can be compared to the true densities for the objects and the percent errors can be determined using the formula: $\%\text{error} = \frac{|\text{true} - \text{experimental}|}{\text{true}} \times 100$

HYPOTHESIS:
("If... then" statement)

MATERIALS:

electronic balance
triple beam balance
calculator
metric ruler
three plastic/wooden blocks

PROCEDURES:

1. Obtain block from labeled bins. Record the block letter and describe it in the data table.
2. Use the electronic balance to measure the mass of the block. Record mass and units as accurately as possible.
3. Use the triple beam balance to measure the mass of the block. Record as accurately as possible.
4. Use the metric ruler to measure the dimensions of the block. Record values and units in data table.
5. Calculate the volume of the block and record with appropriate unit.
6. Calculate the density of the block using the mass from the electronic balance and the calculated volume. Calculate density of the block using the mass from the triple beam balance and the same calculated volume. Record with appropriate unit.
7. Return block to correct bin and select a different lettered block.
8. Repeat steps 1-7 for the two additional blocks. Record all data in the table.
9. Compare your results to the true densities provided by teacher.
10. Calculate the % error for each of the three blocks and record in data table.

*Hint: label each measurement in the data table with the appropriate unit and correct sig fig for full credit.

DATA TABLE:

BLOCK LETTER			
DESCRIPTION OF BLOCK			
MASS Electronic balance			
MASS Triple beam balance			
LENGTH			
WIDTH			
HEIGHT			
VOLUME			
DENSITY Electronic balance			
DENSITY Triple beam balance			
AVERAGE DENSITY			
TRUE VALUE			
PERCENT ERROR			

CALCULATIONS: Leave ½ page blank. Calculations of volume, density, average density, and percent error for all three blocks will be placed in this location. Only the answers and units will be written in the data table.

QUESTIONS:

1. Describe the difference between accuracy and precision.
2. How does the concept of significant figures apply to accuracy?
3. Describe differences in densities calculated when using the values from the electronic balance and the triple beam balance.
4. List three units that can be used for: volume, mass, and density
5. The density of water is 1.00 g/mL. List the letters of any of the blocks that would float **and** explain how you know this without using water.

CONCLUSION: Follow guidelines for conclusion. Be sure to include actual data in the form of densities, true values, and percent errors when supporting your position on the hypothesis.