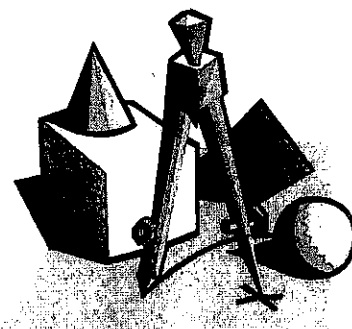## Lab 2.1- Density Challenge

Lab Preview:

1. What is density?

2. What is the equation for calculating density?

Problem: Take the measurement challenge. Accurately measure the length, width and height of a small plastic block and calculate the block's volume. Then predict the mass of the block—without a balance—by using the block's known density.

Background:

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 can provide measurements that are estimated to 0.1 cm, while a ruler with 0.1-cm increments shown can provide measurements that are estimated to 0.01 cm.

In this activity, the first goal is to determine the volume of a plastic block. The volume of any regular solid can be calculated using equation 1. The length, width, and height must be measured using a reliable instrument.

$$\text{Volume} = \text{Length} \times \text{Width} \times \text{Height} \qquad \qquad \textit{equation 1}$$

Once the solid's volume has been calculated, the mass can be predicted using the know density of the solid. To predict the mass, rearrange the density equation shown in Equation 2 to solve for mass, as shown in Equation 3.

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}} \qquad \qquad \textit{equation 2}$$

$$\text{Mass} = \text{Volume} \times \text{Density} \qquad \qquad \textit{equation 3}$$

Success of this laboratory activity depends on the ability to take accurate measurements and to apply the rules for significant figures in mass and volume calculations.

Procedure:

1. Obtain a plastic block from the teacher. Record the block number and color of the sample in the data table.
2. Measure the Length (longest side), Width (next longest side) and the Height (the shortest side) in the data table to the nearest 0.1 cm using the metric ruler.
3. Calculate the volume of the block using the appropriate number of significant figures.
4. Use the known density of the block to calculate the mass of the plastic block. The known densities for the blocks are shown in the table below.
5. Record the calculated mass of the block.

Block No.	Color of Block	Length	Width	Height	Volume	Calc. Mass	Actual Mass

Necessary Calculations:
(Show all work)

Color of Block	Density (g/cm³)
Paper-white	0.541
Black	0.967
Milky-white	0.910
Clear	1.17
Gray	1.42

Determine the accuracy of the mass calculation by comparing the calculated mass with the actual mass. Calculate the percent error in the mass calculation using the equation below:

$$\text{Percent Error} = \frac{\text{Calculated Mass} - \text{Actual Mass}}{\text{Actual Mass}} \times 100 =$$

Percent Error for Blocks: 1 _____ 2 _____ 3 _____

1	77.30	16	64.58
2	102.57	17	~~98.38~~ 97.10
3	~~104.21~~ 67.90	18	68.86
4	88.31 +	19	57.79
5	88.00	20	71.70
6	97.00	21	~~57.99~~ 83.10
7	59.97	22	51.33
8	38.32	23	68.27
9	41.43	24	42.73
10	30.47	25	79.24
11	38.46	26	66.32
12	38.31	27	100.68
13	62.83	28	82.96
14	85.61	29	110.92
15	61.49	30	82.54