Name:_____
Partner:_____
Date:_____ Pd:_____

Chemistry 11
LAB: The Density of THREE Substances

Objectives:
1. To determine the densities for THREE of the FOUR unknown substances
2. To identify sources of error.

Procedure:
1. Find the mass of a 25 mL graduated cylinder. Record
2. Add the required volume of unknown substance A to the graduated cylinder. Adjust the volume carefully using a medicine dropper. Read the bottom of the meniscus for an exact measurement. Find the mass of the unknown substance and the graduated cylinder and record.
3.Repeat step 2 for the remaining volumes of unknown substance A.
4.Repeat steps 2 and 3 using TWO of the remaining unknown substances B, C and D.

Data and Observations:
Mass of 25 mL graduated cylinder: _____g.

Volume of A (mL)	mass of graduated cylinder and A	mass of A	Volume of B (mL)	mass of graduated cylinder and B	mass of B
3.0			3.0		
5.0			5.0		
7.0			7.0		
10.0			10.0		
13.0			13.0		
15.0			15.0		
17.0			17.0		
20.0			20.0		
23.0			23.0		
25.0			25.0		

Volume of C (mL)	mass of graduated cylinder and C	mass of C	Volume of D (mL)	mass of graduated cylinder and D	mass of D
3.0			3.0		
5.0			5.0		
7.0			7.0		
10.0			10.0		
13.0			13.0		
15.0			15.0		
17.0			17.0		
20.0			20.0		
23.0			23.0		
25.0			25.0		

Analysis:

1. Calculate the mass of each unknown substance for each volume. (show one example per substance)
2. Using a single piece of graph paper, draw a f**ull page** line graph of mass (g) vs volume (mL) for the **three unknown substance** you collected data for. The independent variable (volume) will be on the x-axis while the dependent variable (mass) will be on the y-axis. Draw the "best fit" line through the points plotted for each substance.(use a legend to identify each of the three lines)
3. Title the graph: "The density of THREE SUBSTANCES"
4. From the graph, determine the SLOPE of each line using the rise/run method. Draw a vertical line and a horizontal line so the slope can be determined. Choose large values for your rise and run, as this will reduce errors.
5. The density of each substance is equal to the slope, note this.
6. Determine the mass intercept of each line (look for the place where the line crosses the y-axis!!!)
7. Write the equation for each of the three lines using the SLOPE and the MASS INTERCEPT

$$y = \mathbf{m}x + \mathbf{b}$$

where m= slope and b= mass intercept

Discussion:

1. Identify the three unknown substances you investigated using the information below:

ETHANOL = 0.79 g/mL
2% HYDROGEN PEROXIDE = 0.93 g/mL
WATER = 1.00 g/mL
3M HYDROCHLORIC ACID = 1.15g/mL

2. What is the definition of density?
3. Explain why it is not always possible to compare objects by mass. State how density could be used instead.

Sources of Error:

1. List all the equipment that you used and the specific source of error associated with each piece.
2. Is every point of your three lines exactly on the line? Suggest some reasons for this.
3. What is the advantage of using the graphical method rather than just measuring the mass and volume of one sample and calculating the result?

Conclusion:

Answer the questions implied by the objectives as stated at the top of your lab report. Then make a connection from this lab to your everyday life.