Lab 3C – Graphing as a Means of Seeking Relationships (adapted from Heath Laboratory Experiments)

Introduction:
Density is an intensive property of matter, since it does not depend on the amount of material measured. A cupful of water has the same density as a teaspoonful. Properties such as mass and volume are known as extensive properties, because they depend on the amount of material measured.
Since density is an intensive property, there is a direct relationship between the mass and volume of a specific sample of matter. In this lab, you will measure the mass and volume for a sample of water, methanol and salt solution. Then, this data can be plotted on a graph to give a linear relationship. By calculating the slope of the line of best fit, you will determine the density of each of the different solutions.

Objectives:
1. Accurately measure mass and volume for 3 different liquids
2. To plot a graph of data collected in an experiment
3. Analyze the data through graphs
4. Calculate a mathematical relationship using the mass and volume data

Procedure:
1. You will share your data with your classmates. Fill in Data Table 1 and then post your results on the board for the class. Fill in the class results in Table 2.
2. Record the mass of a 125 mL Erlenmeyer flask. **Make sure you use the same flask for the rest of the experiment.**
3. Go to one of the burets containing water, methanol, or salt water and record the current volume of the liquid (initial volume). Then dispense your assigned volume into your Erlenmeyer flask. It doesn't matter if you don't precisely get the volume assigned. What does matter is that you make your volume measurements as accurately as possible. For example, if you are assigned a volume of 3.5 mL, you might measure out 3.95 mL. That's fine, just make sure you record that value.
4. Measure the mass of the Erlenmeyer and liquid.
5. Repeat steps 2-4 for the other 2 liquids. **Do not dump out the previous liquid. Simply add the required volume and the initial mass will be equal to the previous final mass.**
6. Record your results from Table 1 on the board and copy all the results into Table 2.

Table #1

Required Volume = _____	**Water**	**Methanol**	**Salt Solution**
Initial mass of Erlenmeyer flask (g)			
Mass of Erlenmeyer flask + liquid (g)			
Total mass of liquid added to flask (g)			
Initial buret reading (mL)			
Final buret reading (mL)			
Total volume of liquid added (mL)			

Table #2

	Water		**Methanol**		**Salt Solution**	
Lab Group	**Volume (mL)**	**Mass (g)**	**Volume (mL)**	**Mass (g)**	**Volume (mL)**	**Mass (g)**
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Post-Lab Discussion and Analysis of Data:
The accepted value for the mass of one milliliter of water is one gram. In other words, the density of water is 1g/mL. It is more informative to compare the accepted value to the experimental values obtained by all class members than to any one result. If the class results are different from the accepted value, analysis of your experimental procedure may help you to decide why.

1. Use the class data to construct a graph of mass versus volume for each of the three solutions. Draw a line of best fit for each liquid and calculate the slope of each line. What relationship is represented by the slope of the line?

2. The mass of one milliliter of water is a unitary rate. What is the name given to this unitary rate?

3. What is the accepted value for the mass of one milliliter of water?

4. If your experiment gave a different value for the mass of one milliliter of water, analyze the experiment to determine three possible causes.
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Conclusions: