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Density of Water Lab

ABSTRACT:
The purpose of this lab is to ____________ by ____________________. The resulting data will be graphed by hand and using Graphical Analysis and the graph will be interpreted and compared with respect to the accepted value of the density of water.

INTRODUCTION:
Define density and show how to calculate it, using an equation with the variables defined. Include units.
Show how to find the slope of a line using an equation. Include an explanation of the variables.
Describe what the slope will mean in this lab. What information will it give you?
Define interpolation and extrapolation.
Define direct proportion and invesre proportion. (hint: your text may be helpful)

HYPOTHESIS: Possible hypotheses include predicting direct or inverse relationship and why, or what the slope might mean.
Invalid predictions include:
1. we will be able to find the density of water
2. the density of water will be xx.x g/mL

SOURCE: see footer
SAFETY: glassware will be used….. what will you wear?

MATERIALS:

Equipment
Buret
Ringstand with double buret clamp
125 mL Erlenmeyer flask
balance
150 mL and 250 mL beaker
thermometer
paper towels

Chemicals
Distilled Water

PROCEDURE:
1. Clean one 125 mL Erlenmeyer flask, and the beakers. Dry them carefully, inside and out.

2. Further dry the flask by waving it slowly above the flame of a Bunsen burner while holding it carefully by the neck with tongs. Set the hot flask on a ceramic fibered square to cool.

3. Fill the 150 mL beaker with distilled water.

4. Use the 150 mL beaker to fill the buret to above the 0.00 – mL mark. Place a small square of aluminum foil snugly over the top of the buret.

5. Using proper technique for manipulating the buret stopcock, drain water from the buret into the 250 mL beaker until the water level in it reads just below the 0.00-mL mark and stop. Set the beaker aside.

6. Record the balance number in your data table.

7. Mass the flask precisely and record the mass in your data table.

8. Record the temperature of the distilled water in the data table.

9. Place the flask beneath the buret and prepare to gather data.

10. Reading #1:
    a. record the initial reading of the buret in your data table
    b. release APPROXIMATELY 5-6 mL water from the buret into the flask
    c. record the final reading of the buret
    d. mass the flask and the water and record the mass in your data table. DO NOT EMPTY THE FLASK!

11. Reading #2:
    a. record the initial reading of the buret in your data table
    b. release an **additional** 5-6 mL water from the buret into the flask
    c. record the final reading of the buret
    d. mass the flask and the water and record the mass in your data table. DO NOT EMPTY THE FLASK!

12. Reading #3:
    a. record the initial reading of the buret in your data table
    b. release an **additional** 5-6 mL water from the buret into the flask
    c. record the final reading of the buret
    d. mass the flask and the water and record the mass in your data table. DO NOT EMPTY THE FLASK!

13. Reading #4:
    record the initial reading of the buret in your data table
    release an **additional** 5-6 mL water from the buret into the flask
    record the final reading of the buret
    mass the flask and the water and record the mass in your data table. DO NOT EMPTY THE FLASK!

14. Reading #5:
    a. record the initial reading of the buret in your data table
    b. release an **additional** 5-6 mL water from the buret into the flask
    c. record the final reading of the buret
    d. mass the flask and the water and record the mass in your data table. DO NOT EMPTY THE FLASK!
15. Check your readings. Each should inrease by approximately 5 mL or 5 grams. If they appear reasonable, clean up.
16. Do the calculations, in the **Calculations** section, in the proper format. Respond to any questions, and make the graphs as outlined in Data Analysis. HINT: There may be a very efficient yet still correct manner of displaying all your calculations as they are a bit repetitive. If you think of a good way, ask about it.

The Data Table and Calculations Tables are written next to one another in this lab as it makes your results more meaningful.

Data Table: **Calculations Table #1:**

	Balance Number			
	Water Temperature	°C		
	Mass of Empty Flask	g		
#1	Initial Reading of Buret 1	mL		
	Final Reading of Buret 1	mL	Volume of Water added 1	mL
			Total volume of Water 1	mL
	Mass of Flask and water 1	g		
			Mass of Water added 1	g
			Total Mass of Water 1	g
#2	Initial Reading of Buret 2	mL		
	Final Reading of Buret 2		Volume of Water added 2	mL
			Total Volume of Water 2	mL
	Mass of Flask and Water 2	g		
			Mass of Water added 2	g
			Total Mass of Water 2	g
#3	Initial Reading of Buret 3	mL		
	Final Reading of Buret 3	mL	Volume of Water added 3	mL
			Total Volume of Water 3	mL
	Mass of Flask and Water 3	mL		
			Mass of Water added 3	g
			Total Mass of Water 3	g
#4	Initial Reading of Buret 4	mL		
	Final Reading of Buret 4	mL	Volume of Water added 4	mL
			Total Volume of Water 4	mL
	Mass of Flask and Water 4	g		
			Mass of Water added 4	g
			Total mass of water 4	g
#5	Initial Reading of Buret 5	mL		
	Final Reading of Buret 5	mL	Volume of Water added 5	mL
			Total Volume of Water 5	mL
	Mass of Flask and Water 5	mL		
			Mass of Water added 5	g
			Total Mass of Water 5	g

Construct a table like the one below to organize your calculations as you make your graph.

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Calculations Table #2 (for making your graph)

	Column 1	Column 2	Column 3
Reading #	Total Volume of Water in Flask (mL)	Mass of Flask + Water (g)	Total Mass of Water (g)
1			
2			
3			
4			
5			

Data Analysis:

1. Use the calculations for mass and volume from Table 2 to make a graph, by hand, as follows:
    a. title the graph "Mass vs. volume of Water at ________ °C"
    b. label the y-axis "Mass of Flask/Water (g)"
    c. label the x-axis "Volume of Water (mL)"
    d. arrange the number spread from columns 1 and 2 from Table 2 on each axis to use as much of the paper as possible
    e. use a sharp pencil to place each of the 5 data points from Column 1 and Column 2 on the graph. Draw a small, neat circle around each one.
    f. Use a straight edge to draw a best-fit straight line through or near to as many of the data points as possible. Do not expect the line to touch every point and do not connect the dots. Get the line as close to as many points as possible. Label this line "flask + water"
    g. Use a sharp pencil to place each of the 5 data points from Column 1 and Column 3 on the graph. Draw a small, neat circle around each one.
    h. Use a straight edge to draw a best-fit straight line through or near to as many of the data points as possible. Do not expect the line to touch every point and do not connect the dots. Get the line as close to as many points as possible. Label this line "water"
2. Choose 2 points on the line labeled "water." These points must be exactly ON the line you drew and cannot be data points. Use a straight edge to draw a straight, dashed line from each point to each axis.
3. Use these points to calculate the slope of the line labeled "water." Show your work in 3 steps and include all units. What does the slope represent?
4. Calculate the slope of the line "flask + water" in the same manner.
5. By using your graph, estimate the mass of the flask and water if the flask had contained 18.0 mL of water. Explain in a few sentences how you did this.
6. By using your graph, estimate the mass of water if the flask had contained 18.0 mL of water. Explain in a few sentences how you did this.
7. From your graph, determine the mass of the flask, and explain how you did so.
8. Use your answer from #7 above as experimental and the mass of the flask from your data table as accepted, determine the percent error for the flask.
9. Use the known value for the density of water and the density you found experimentally to find percent error.
10. Write an equation for the "water" line in the form Y = mx + b.
11. Write an equation for the "water + flask" line in the form Y = mx + b.
12. Graph the same data using the Graphical Analysis program on the computer. Staple both graphs into your lab book after making copies to submit.

CONCLUSION: Include goal, hypothesis, error sources, and further investigations.