Name _____ Hour _____

FREEZING POINT DEPRESSION LAB

Purpose: Use the ΔT of naphthalene to determine the chemical formula of solid sulfur.

Information:

Test tube #1 contains ___10.0 g___ of naphthalene
Test tube #2 contains ___10.0____ g of naphthalene + ____1.0___ g sulfur
The K_f of naphthalene is _____-6.85_____ ºC/*m*
The chemical formula of naphthalene is __$C_{10}H_8$_____; molar mass = _____

Procedure:

1. Place your assigned test tube into a hot water bath until it is completely melted.
2. Remove your test tube from the hot water.
3. Insert a thermometer into the melted naphthalene and gently stir.
4. Record the temperature every 30 seconds. Stir each time.
5. When the freezing point is reached, the temperature will become constant and you will no longer be able to stir it. *** Take 4 more temp readings (2 min) after temp is constant!**

Pre-lab Questions:

1. What is the solute in test tube #2?
2. What is the solvent in test tube #2?
3. What is the mass of the solvent in **kg** in test tube #2?
4. What is the mass of the solute in **kg** in test tube #2?
5. What would be the molality (*m*) of naphthalene if the freezing point decreased from 78 ˚C to 75˚C?

Data:

Take temperature readings every 30 sec for both test tubes. Leave space for ≈15 min. It may not take that long.

Analysis:

1. Graph both sets of data in Excel (time on x, temp on y) and label each line.
2. Determine the average freezing point of pure naphthalene (tt #1) and of the mixture of naphthalene + sulfur. (where line appears flat)
3. Calculate the ΔT and **WRITE/PRINT** it on your graph.

Post-Lab Questions: (Show all work!)

1. What was the ΔT_f of naphthalene when the sulfur was added?
2. Using $\Delta T_f = K_f m$, calculate the molality of your solution.
3. Using the molality equation, determine the moles of sulfur in your solution.
4. Determine the experimental molar mass of sulfur using: $\text{moles} = \frac{\text{grams S}}{\text{mm S}}$
5. Divide your answer to #4 by the atomic mass of sulfur to determine the chemical formula of sulfur. (Ex: If your answer is three, than sulfur is S_3)

Conclusion: (Complete sentences, paragraph form!)

Describe how and what you found for your ΔT
Describe how and what you found for the molar mass of sulfur
Compare your values to the actual values of 2.7˚C and S_8. Use a **% error** for ΔT.
Include a possible error for the experiment

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Making a Freezing Point graph in Excel using Vista

1. In the A1 cell enter the name of the data you will be entering on the x-axis (time in minutes).
2. Enter the time values starting in the A2 cell.
3. In the B1 cell, enter the name of the data for line 1. (Test Tube #1)
4. Enter the temp values starting in the B2 cell.
5. In the C1 cell, enter the name of the data for line 2, (Test Tube #2) and enter the temp values starting in the C2 cell.
6. Click on the A1 Cell and drag your mouse to highlight all of your information. (The A1 cell will not appear highlighted)
7. Click **Insert**, **Scatter**, and pick the middle right graph choice (**Scatter with straight lines and markers**).
8. Under **Chart Tools**, click **Layout**.
9. Click **Chart Title** and title your graph.
10. Click **Axis Title** and label your axes.
11. Right click on the **y axis** and pick **Format Axis**. Change your minimum value from auto to fixed starting around 65.
12. Determine the difference in freezing point of your two lines and write it in a text box on your graph. (Click I**nsert**, **Text Box**) Also put your name in the text box.
13. Print just the graph and place it in your lab notebook or staple it to your paper.