Pre-Lab Experiment 3: Some Physical Properties of a Pure Substance and

Identification of an unknown liquid

Format & Clarity of the Report: See lab report checklist. You are graded on how you format the lab and record your data, not just data collection.

Before class starts: Read the lab for the week carefully before you start writing your pre-lab. The purpose, introduction, and procedure should be neatly written in your lab book before class starts. Keep the introduction and the purpose separate. Pre-lab questions need to be correctly answered.
Spacing: You will probably use 1 page for your purpose and introduction, 1-2 pages for the procedure, 1 page for the data table, calculations, and results table, 1 page for the questions, and 2 result statement. If you allot an appropriate amount of space, you will not have to mix labs together if you have to do more than one in a week. it makes life neater! (I have give suggestions for other allotments; look at them and use the one that makes the most sense to you.)

Purpose: Address the following in your purpose: What will you determine by comparison in this lab? What properties will you be comparing?

Introduction: Read the introduction to the lab. Pay particular attention to paragraphs 5, 6, & 7. Briefly describe how you will determine each part. For example, 'In part 2, I will take the boiling point using the micro-scale technique described in the lab manual.' Do not use exact steps mentioned in the lab manual; summarize! While writing, think about how the answers to the following questions should be worked into the introduction: What is the difference between a homogenous mixture and a heterogeneous mixture? What does "insoluble" mean? Are you determining an actual solubility (numerical value + the units g /mL water) or a relative solubility (a comparison)? If the solution is insoluble, you will be able to determine a density. Is this an actual density (units g/mL) or a relative density to water? What is the boiling point? What is the freezing point? Is this an actual freezing point or a relative freezing point to a dry ice acetone bath? I want these answered in a coherent paragraph. Don't list the answers. (In other words, yes, no, no, yes-is not appropriate; neither is treating each part as a separate question.)

Procedure:

- In Part 1, make sure you use a standard test tube.
- In Part 1: Add a few drops copper (II) sulfate solution to the water **BEFORE** you add the unknown. The copper (II) sulfate is soluble in water, so the water layer should have a blue color if it is heterogeneous. If it is homogenous, the entire solution should be BLUE.
- In part 2: the instructions say to use 0.5 mL of uk liquid. You need to add 1.5 to 2 mL of unknown. Also, the water should **NOT** boil. If the water in the beaker is boiling, you are MOST LIKELY watching an empty test tube. You need to cool down the water and start again.
- In part 2: You will measure the boiling point 3 times. Let the water in the beaker cool down to 10°C below the first measured boiling point (you can do this by removing some hot water and adding some cold water. Add more liquid to the tube and a fresh capillary tube, then re-measure the boiling point. You will report the average BOILING POINT for your Unknown
- In part 2: Boiling point, Draw or paste a picture of your apparatus in your lab book.
- In part 2: Record the atmospheric pressure for the day
- In part 3. Don't use the same tube that you used for part 1. There can be no, nil, none, zero, water in the tube.

Qualitative Observations/Data Collection: For this experiment, you should have recorded the appearance of your liquid and the unknown number of your liquid before your started the experiment. You should observe: the smell [be careful!], what happens when you first add water to your unknown, how the test tube feels before and after mixing, whether the two liquids mix, the relative density if they do not, the boiling point, and the relative melting point of your liquid when immersed in a dry ice bath. You will need to include pictures of setups, like the boiling point apparatus, for example. Also, watch your observations: in part 3, was the upper layer blue? Don't write upper-too vague.

Data Tables: For this experiment, you should have recorded the relative solubility of your liquid, the relative density of your liquid (if you can!), the boiling point of your liquid, the relative freezing point of your liquid, The unknown number.

Put the chart of unknown substances here-copy it from the lab instructions. You can Xerox it and tape it in. [Two copies, 1 for the white sheet, one for the yellow sheet)

Calculations: Calculate the average temperature for you boiling point. Put the average temperature in your combination Data/Results table.

Graph:. No graph

Results Tables: The results table has the final data, any conclusions drawn from that data.

EXAMPLE

Information for the data table: I observed My unknown was insoluble in water, the upper layer was blue, the three temperatures were 48.3°C, 48.4°C, 49.0°C, and it did not freeze in acetone bath, atmospheric pressure was 734 torr.

Information for the results table: Insoluble, Freezing point is above –78°C, denser than water, average boiling point 48.6°C. possible unknown #33 Freon–113,

Evaluation/discussion of results/error: Use the results table to write the evaluation. Describe what you observed; discuss your conclusions; verify and defend your identity of the unknown The results statement is typed, and taped into your book. You should have two copies: one for the yellow and one for the white pages.

Reviewing the questions from the Pre-lab for Experiment 2, we can apply them to the process of writing a result statement.:

1. Did the author address the purpose? What is the purpose of the lab?
    a. **WHY DID I DO THIS LAB?** "The purpose of this lab was to identify an unknown organic liquid ..... My unknown organic liquid , # 53, was _____."
2. Were there observations that were integral to the lab? What were they? How did these observations support the results?
    a. **WHAT DID I DO IN THE LAB? WHAT DID I OBSERVE IN THE LAB?** Now tell me how you reach this result. Start with your observations. What did you observe in each part?
3. What were the ultimate results for each part?
4. What did the results mean to you?
5. Did you find that the results supported the purpose?
6. Were there any conclusions that were drawn from these observations?
    a. **BASED ON YOUR PROCEDURE AND OBSERVATIONS, HOW DID YOU REACH THE CONCLUSION FOR YOUR UNKNOWN?** What compounds did you start with? Which compounds were eliminated after each part? In particular, you should describe how you eliminated other compounds in the list to arrive at your answer of one or two compounds and addressed the issue of relative boiling points and melting points in the identification of your unknown. Do not use statements like, " I knew it was benzene because it had the closest agreement to my unknown's information**. What was the part of the procedure that you felt gave you the best information about the identity of your unknown? What part of the procedure gave you the least 'sure' information about your unknown?**
7. What did you learn from doing this lab?
8. Thinking about what you learned in lecture and in the lab, do your results make sense? In other words, were there assumptions made that affected the results?

a. **WHERE DID I MAKE AN ASSUMPTION THAT COULD LEAD TO AN ERROR? " Now think of one place where an error occurred that might influence your choice of your unknown.**

9. How does the lab relate to lecture material?
10. Compare the results with theories outlined in the introduction. Do they match? Explain why they might vary.
11. Were there parts that you did not quite understand?
12. What were they? Summarize what you did not understand or had questions about.

[The above is too short to be considered an adequate evaluation].

Questions: Type the answers because they involve thought and you can edit before you place them in your lab book. Make sure you have one copy for your white sheet and one copy for the yellow sheet

QUESTION 1:
If you found that your unknown was insoluble in water, boiled between 45°C and 50°C, and froze in a dry ice ice bath, what information would clarify the elimination process to show that the unknown was not methylene chloride?" Explain thoroughly the process.

QUESTION 2:
An unknown liquid was mixed with water, and two layers formed. When a blue solution of $CuSO_4$ was added and mixed, the top layer was colored blue. A fresh sample of the same unknown froze in dry ice, and the boiling point of the unknown was measured to be 77°C. What is the identity of the unknown? Acetonitrile has similar data, the boiling point is listed as 82°C, but the thermometer was later calibrated and shown to be off by ± 3°C. What information can you use to distinguish between acetonitrile and the unknown.

QUESTION 3:
Look at the table of 'PHYSICAL PROERITES OF UNKNOWN SUBSTANCES' from the lab. Acetone, and ethanol have similar densities, but different boiling points. Both substances are soluble in water. From the concepts discussed for intermolecular forces, can you give a reason for the differences in boiling points. [Answering this question might mean a little bit of research on the internet and in your textbook]

You need to type your analysis: 12 pt font, double-spaced, in Standard English. Make sure you spell check and grammar check. (In the end, I should have a good sense of what you were looking for in this experiment, what you did and observed in the experiment, what your results were for the experiment. Think about it this way. " Oh no, I lost my report. That's okay, I can describe what I did, my results, and errors, etc., in the conclusion.")

FOR ANY STATEMENT: Submit a typed statement in 12 pt, serf font (i.e. Palatino, Garibaldi, or Times), using good grammar, syntax, and Standard English. Complete sentences are used: short well-worded sentences are better than long, poorly, worded sentences. The spelling has been checked. Questions that are presented throughout the lab can be answered in a coherent set of paragraphs, but the points must be addressed within**.** All of this was done in a manner that was well thought out, logically presented and interesting to read. The evaluation should be neatly trimmed and **GLUED OR TAPED** into your book (two copies, one original, one yellow).).