Lab
Physical Behavior of Matter (Part 2)
Hannah

Name:_____ Lab Partner:_____ Date:_____ Class:_____

A COOLING CURVE

Pre-Lab Discussion

In this lab, you will be measuring the temperature of a pure substance as it cools and solidifies. You will then plot the temperature of the substance verses time for cooling. This graph is called a cooling curve. It will enable you to see how temperature changes as substances change phase. In addition, you will be able to determine the temperatures at which the substance freezes.

Purpose

To create a cooling curve for lauric acid and to determine its freezing point.

Equipment

computer
Think Station
temperature probe
diskette with lab design
ring stand
iron ring
wire gauze
250-mL beaker
lab burner
large test tube half filled with lauric acid
stopper to fit test tube
utility clamp
400-mL beaker

Safety

Avoid breathing vapors as the lauric acid is heated. Always wear safety goggles.

Procedure

You should start steps 1 and 7 at the same time. Steps 1 through 3 may have already been done for you.

1. Connect the blue Think Station box to the computer using the black cable in the plastic bag. Plug the power transformer into the blue box and then into a power outlet.
2. Plug the temperature probe into input/output A1 in the blue box.
3. Start up the computer. If you get a windows login screen just hit “cancel”. Open “Excelerator 2002”.
4. Insert the diskette into the disk drive. Hit “Open” in Excelerator 2002. Use the drop down menu to change “My Documents” to “A:/”. Open “A Cooling Curve”.
5. On the graph, change the subtitle to the people in your group.
6. Click the button on the top left of the graph that looks like a green arrow going in a circle. This is the “preview” button. The temperature should read in the lower 20’s. If so, you are set to go.
7. Set up a water bath using a 250-mL beaker 2/3 full of tap water and ring stand.
8. Place the lauric acid sample into the beaker and begin heating. When the lauric acid begins melting, insert the temperature probe and use it to stir the melting lauric acid. When the lauric acid has completely melted, remove the test tube from the water bath.
9. Fill a 400-mL beaker 2/3 full of cold tap water.
10. Place the hot lauric acid/temperature probe assembly into the cold water bath and at the same time hit the green “go” button to begin recording temperature readings. Use the temperature probe to stir the lauric acid as it cools. When the lauric acid has cooled enough that it can no longer be stirred, stop stirring and allow the temperature probe to become embedded in the lauric acid. When the temperature reaches 35°C hit the red “stop” button. This will stop the experiment. It will automatically stop at 10 minutes regardless of the temperature. That is OK.

11. Under “Tools”, click “Rescale”.
12. ***Important***: Do not shut down the computer until you have the graph in your hand. If you do, and something goes wrong, you will need to start all over again. Under “Graph”, click “Print” to print your graph.
13. Close the software without saving and shut down the computer.
14. Remove the lauric acid/temperature probe assembly from the 400-mL beaker. Place it back in the hot water bath to melt the lauric acid and remove the temperature probe. Restopper the acid Clean off the probe by wetting a paper towel with hexane and wiping off the probe. Lauric acid is not soluble in water. Return the lauric acid.
15. Attach the graph to either your lab or your partner’s lab.

Conclusions and Questions

1. According to your graph, what is the freezing point of the lauric acid? How does this value compare to the accepted value of 44 °C?

_____

_____

_____

_____

2. For the cooling curve, describe the changes in both kinetic and potential energy during the diagonal portions of the graph. Do the same for the horizontal portion.

diagonals - _____

_____

_____

horizontal - _____

_____

_____

3. All substances have a unique melting and boiling point which can be used in identification of the substance. Make a statement that describes the melting point and boiling point of a substance in terms of the strength of its intermolecular forces of attraction.

_____

_____

4. Describe the change in phase (state) for each of the following.

fusion (melting) - _____

solidification (freezing) - _____

vaporization (boiling, evaporation) - _____

condensation - _____

sublimation - _____

deposition - _____

5. How does the freezing point of a substance compare to its melting point?

_____

_____