

## EXPERIMENT 30 COOLING CURVE OF A PURE SUBSTANCE

### I. PURPOSE

What 2 things does the flat section on the graph tell us about the pure substance?

### II. MATERIALS

Stearic acid in a test tube  
Thermometer  
400 mL beaker

### III. PROCEDURES

1. Make a data table with time in the first column, starting at 0.0 min, counting every half-minute, and temperature in  $^{\circ}\text{C}$  in the second column. Go up to about 10 minutes. You may have to expand the table and go higher if needed.
2. Get a test tube with the chemical and thermometer from the fume hood. As soon as you get it, take the first temperature measurement and start timing. Take the test tube to your lab station and put it in the utility clamp on the ring stand.
3. Let the test tube air cool. Observe and record temperature every 30 sec. until you have 6 temperatures the same.
4. Now fill a 400 mL beaker with cold tap water and immerse the test tube assembly. Continue recording temperatures until the system reaches about  $30^{\circ}\text{C}$ .
5. **Do not** remove thermometer. Return the assembly to the hot water bath in the fume hood.

### V. CALCULATIONS

1. Make a full-page graph of the data. Plot the data from this lab putting temperature on the vertical axis and time in minutes on the horizontal axis.

### VI. QUESTIONS

1. From your graph, determine the freezing point of the pure substance.
2. Explain the diagonal parts of the curves in terms of either potential or kinetic energy changes, if any.
3. Explain the horizontal parts of the curves in terms of either potential or kinetic energy changes, if any.
4. Does the curve represent an endothermic or exothermic process?
5. Draw a cooling curve for a mixture of 2 pure substances.
6. What would the curve look like if you heated the solid from  $30^{\circ}\text{C}$  to  $80^{\circ}\text{C}$ ?

### VII. DISCUSSION OF ERROR

Causes:

1. Thermometer touching the side of the test tube.
  2. Not a pure substance.
  3. Heated the test tube to  $120^{\circ}\text{C}$  rather than  $75^{\circ}\text{C}$ .
- Effect: Draw before and after curves for each.

### IX. REFLECTION

Explain why steam burns are worse than boiling water burns.