



# Heating and Cooling Curves

## Introduction

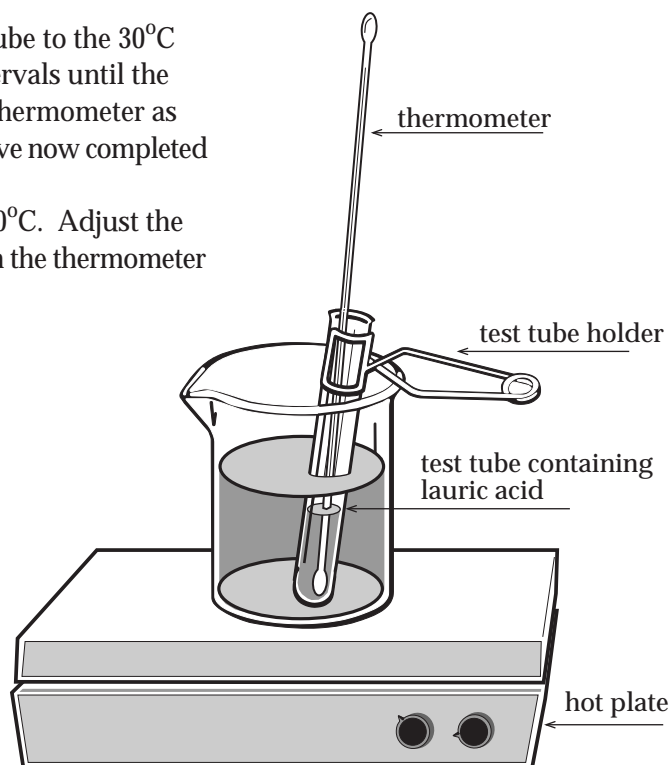
If you were to record the temperature of a pure solid substance for a period of time as you heated the substance beyond its melting point, what would the graph of temperature vs. time look like? How about a graph generated from temperatures taken during cooling? In this exercise, you will collect data on the heating and cooling of pure lauric acid.

## Procedure

1. Put on goggles. Fill one beaker about 2/3 full of warm tap water and place on hot plate. Adjust the hot plate so that you can maintain the temperature of the water at about 60°C.
2. Adjust the hot/cold water faucets so that the running water is about 30°C. Fill the other beaker about 2/3 full of 30°C water from the tap and set aside.
3. Place the test tube of lauric acid in the 60°C water on the hot plate. When the lauric acid starts to melt, carefully put a thermometer down into the melting solid. Continue to heat the lauric acid until it is about 55°C. (*see illustration to the right*)
4. Using a test tube holder, transfer the liquid lauric acid tube to the 30°C water bath and record the temperature at 30-second intervals until the temperature reaches at least 40°C. Gently stir with the thermometer as you take data until the lauric acid starts to solidify. You have now completed the cooling curve data.
5. Check your 60°C water bath to be sure that it is still at 60°C. Adjust the hot plate if necessary and transfer the lauric acid tube with the thermometer back into the warm water.
6. Record the temperature of the lauric acid at 30-second intervals until the temperature reaches about 50°C. As soon as it is melted enough to stir the lauric acid with a thermometer, carefully do so. You now have completed the heating curve data.
7. Quickly remove the thermometer from the lauric acid and thoroughly wipe the lauric acid off with a tissue (Kim-Wipe®). Return the lauric acid in the test tube to dispensing area.
8. Clean up as directed by your teacher and wash your hands.

## Materials

- large test tube containing about 15 g lauric acid
- test tube holder
- 2 large (400 or 600 mL) beakers
- hotplate
- 2 thermometers
- clock or watch with second hand
- goggles
- graph paper





## Heating and Cooling Curves

### Data Table

Time (min.)	Cooling	Heating
	Temperature (°C)	Temperature (°C)
0.5		
1.0		
1.5		
2.0		
2.5		
3.0		
3.5		
4.0		
4.5		
5.0		
5.5		
6.0		
6.5		
7.0		
7.5		
8.0		
8.5		
9.0		
9.5		
10.0		
10.5		
11.0		
11.5		
12.0		
12.5		
13.0		
13.5		
14.0		
14.5		
15.0		

### Graphing

Choose a colored pencil for your cooling data and another colored pencil to represent your heating data. Label the abscissa (X-axis) on your graph paper as “time” and ordinate (y-axis) as “temperature” and add numbers to represent the ranges for your data. Plot data in the colors you have chosen.

### Analysis and Conclusions

1. What is the freezing point for lauric acid? What is the melting point for lauric acid?
2. Explain what is happening during each section of the graph for both cooling and heating in terms of particle motion and energy.