Experiment
14

Freezing Temperature of Water

Freezing temperature is the temperature at which a substance turns from a liquid to a solid. In this experiment, you will study the freezing of water and find its freezing temperature.

OBJECTIVES

In this experiment, you will

- Observe the freezing of water.
- Use a computer to measure temperature.
- Analyze data.
- Use your data and graph to make conclusions about freezing.
- Determine the freezing temperature of water.
- Apply the concepts studied in a new situation.

MATERIALS

computer
Vernier computer interface
Logger*Pro*
Temperature Probe
ring stand
utility clamp
test tube
400 mL beaker
water
10 mL graduated cylinder
ice
salt
spoon
warm water

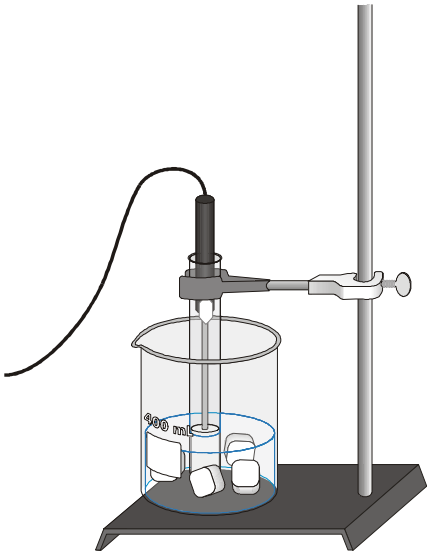


Figure 1

PROCEDURE

1. Fill a 400 mL beaker 1/3 full with ice, then add 100 mL of water as shown in Figure 1.

2. Put 5 mL of water into a test tube and use a utility clamp to fasten the test tube to a ring stand. The test tube should be clamped above the water bath. Place the Temperature Probe into the water inside the test tube.

3. Prepare the computer for data collection by opening the file "14 Freezing Temperature" from the *Middle School Science with Computers* folder.

4. When everything is ready, click Collect to begin data collection. Then lower the test tube into the ice-water bath.

5. Soon after lowering the test tube, add 5 spoons of salt to the beaker and stir with a spoon. Continue to stir the ice-water bath.

6. Slightly, but continuously, move the probe during the first 10 minutes of data collection. Be careful to keep the probe in, and not above, the ice as it forms. When 10 minutes have gone by, stop moving the probe and allow it to freeze into the ice. Continue to stir the ice-water bath. Add more ice cubes as the original ice cubes get smaller.

7. When 15 minutes have passed, data collection will stop.

8. Make and record observations as the water freezes.

9. On the displayed graph, analyze the flat part of the curve to determine the freezing temperature of water.
   a. Move the mouse pointer to the beginning of the graph's flat part. Press the mouse button and hold it down as you drag across the flat part to *select* it.
   b. Click on the Statistics button, . The mean temperature value for the selected data is listed in the statistics box on the graph. This is your value for the freezing temperature of water. Record it in your data table.

10. Sketch or print the graph as directed by your teacher. Label the freezing temperature on your graph.

11. Do not attempt to remove the Temperature Probe from the ice! Place the test tube into a beaker of warm water to melt the ice, then remove the Temperature Probe.

OBSERVATIONS

DATA

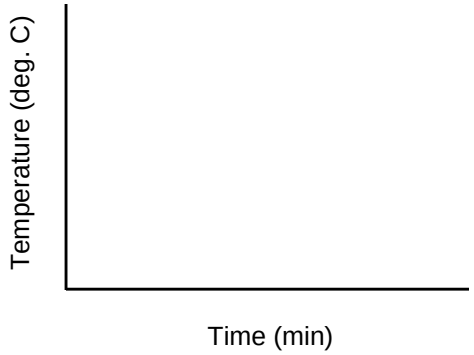
Freezing temperature of water _____°C

PROCESSING THE DATA

1. Describe your temperature *vs*. time graph.

2. What happened to the temperature of the water during freezing?

3. Phenyl salicylate has a freezing temperature of 41.5°C. In the space to the right, sketch and label a freezing curve for phenyl salicylate. Be sure to indicate the freezing temperature on the graph.



EXTENSION

1. Modify the procedure to study the freezing of another substance suggested by your teacher.