

Name: _____ Class: _____ Date: _____

Plateau Problem

Learner Outcomes:

- distinguish between heat and temperature; and explain temperature using the concept of kinetic energy and the particle model of matter.

Key Terms:

Heat

Temperature

Particle model

Melting

Freezing

Evaporation

Condensation

Sublimation

Boiling

Background Information: When a material warms up, its temperature increases and there is an increase in the kinetic energy or speed of the particles. Eventually when more heat is added, the particles will be moving with so much energy, that they cannot stay as close to one another any more and they change their position or distance from each other, rather than their speed. When this happens, there is a change in state, such as melting or evaporation.

Investigation Question: What happens to the temperature of water when it changes state?

Hypothesis: Underline the appropriate temperature change in brackets and complete the sentences)

While solid ice changes to liquid water, the temperature will (drop/stay the same/increase), because.....

While liquid water boils into gas, the temperature will (drop/stay the same/increase), because.....

Materials:

Thermometer

Stirring rod

Hot plate

Kettle

250 mL beakers

crushed ice

water

This investigation / activity has been adapted from:

Bullard J, Krupa G, Krupa M, et al. *Science Focus 7*. Toronto, ON: McGraw-Hill Ryerson.

Procedure:

1. Fill one beaker with crushed ice and a small amount of cold water to make a slush and record the temperature.
2. Place the beaker on a hot plate and heat gradually. Record the temperature by raising the thermometer slightly every three minutes.
3. Continue heating for at least six minutes longer than it takes for all the ice to melt.
4. Repeat steps 1 - 3 using a beaker of hot water.
5. Record the initial temperature and continue recording the temperature every three minutes until the water is boiling for at least three additional minutes.

Observations:

Time (Min)	Ice Slurry		Hot Water	
	Observations	Temperature	Observations	Temperature
0				
3				
6				
9				
12				
15				
18				

Analysis:

1. In this activity, you measured time and temperature.
 - a. What was the manipulated variable?

 - b. What was the responding variable?

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2. On separate sheets of graph paper, draw two separate line graphs to show your temperature /time observations; one for the ice melting and one for the water boiling. Draw a smooth line /curve through or between the points.

3. On your graphs, use a different colored pencil to mark where your ice water was still melting and where the hot water was boiling. On the temperature scale of your graphs, mark the known melting and boiling points of water in a different color

4. What do you think was happening to the particles as the temperature increased?

5. What was happening to the particles when the temperature leveled off, or stayed the same?

6. When the temperature leveled off on your graphs, was there still an increase in the amount of energy you were adding to the water? Explain.

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Extension:

1. Imagine that you combined both parts of this investigation so that you heated a sample of ice at $-2\text{ }^{\circ}\text{C}$ to steam at 110°C . Sketch what the graph would look like and label the temperatures and phases of water at these temperatures.
2. On this graph, label where the particles were increasing in speed and where they were changing positions.

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