Laboratory Investigation Name _____

Chemistry: Form L6.2A Date _____ Period _____

Plotting a Cooling Curve

PROBLEM

What happens to the temperature of a substance as it changes phase?

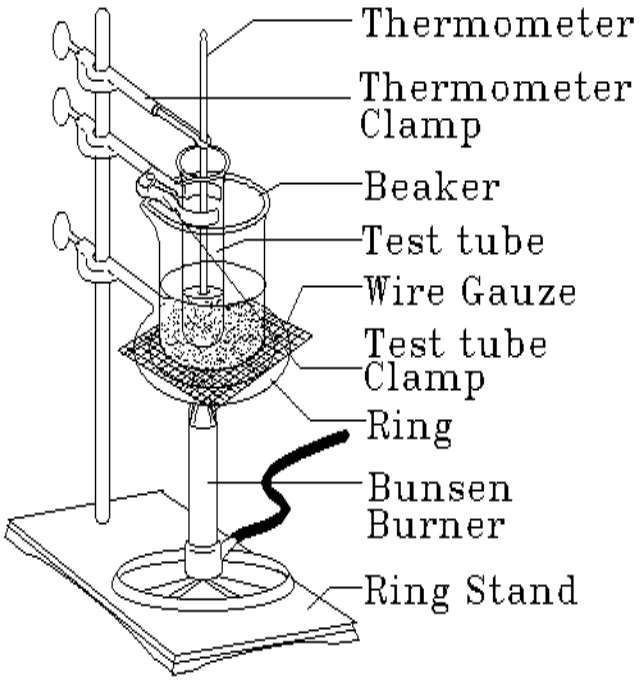
INTRODUCTION

When water is placed in the freezer, it cools and becomes ice. As they cool, other liquids turn into solids too. The particles that compose matter are always moving. As a liquid cools, the particles slow down. When the particles slow down, they collide less frequently and less energetically. As a result, the particles move closer together and the forces of attraction between them increase. When the forces of attraction become strong enough, they pull the particles very close and lock them into fixed positions. The liquid becomes a solid! As the liquid cools and the particles slow down, kinetic energy is lost. As the particles move closer together during a phase change, potential energy is lost. In this laboratory investigation, you will measure the change in temperature as a hot liquid loses energy and changes to a solid and you will plot a graph of your data.

MATERIALS (*per group*)

Beaker; Bunsen burner; ring stand and ring; safety goggles; graph paper; solid [moth flakes (paradichlorobenzene) or parafin]; striker or matches; test tube; test tube clamp; thermometer; thermometer clamp; timer

PROCEDURE



1. Fill a test tube one fifth of the way with the solid. Fill a 250 mL beaker two thirds of the way with water. Set up a hot water bath as shown in the diagram by placing the beaker on a ring stand. Then clamp the test tube in place with a test tube clamp so it stands upright in the beaker. Insert a thermometer into the the solid in the test tube and clamp it in place with a thermometer clamp so it stands upright.

2. Put on safety goggles and light your Bunsen burner. Heat the test tube in the water bath until the solid melts and the temperature climbs to at least 90°C. Make sure the bulb of the test tube is in the liquid and there is no solid remaining.

3. After the solid has melted, call your teacher to lower the iron ring and remove the hot water bath so the test tube can cool in air.

4. Record the initial temperature (time zero) in the data table on the next page. Then, with the aid of a timer, record the temperature every minute thereafter until the temperature reaches 25°C. Note the phase of the solid at each temperature in order to determine when crystallization begins.

5. Prepare a suitable graphing space with time on the *X*-axis and temperature on the *Y*-axis. Plot the points.

OBSERVATIONS

Time (Minutes)	Temperature (°C)	Time (Minutes)	Temperature (°C)	Time (Minutes)	Temperature (°C)	Time (Minutes)	Temperature (°C)
0		15		30		45	
1		16		31		46	
2		17		32		47	
3		18		33		48	
4		19		34		49	
5		20		35		50	
6		21		36		51	
7		22		37		52	
8		23		38		53	
9		24		39		54	
10		25		40		55	
11		26		41		56	
12		27		42		57	
13		28		43		58	
14		29		44		59	

CONCLUSIONS

1. What is the freezing point of the solid? _____

2. What is the melting point of the solid? _____

3. How does the graph look at the freezing point? Why? _____

_____

_____

_____

4. What type of energy change occurs while the solid is freezing, potential or kinetic? Explain? _____

_____

_____

5. Why doesn't the temperature change while the solid is freezing? _____

_____

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