Name_____ Date_____Period_____
Regents Chemistry
Long Beach High School Laboratory Experiment #_____

Heat of Fusion of Ice

Introduction

When a chemical or physical change takes place, heat is either given off or absorbed. That is, the change is either exothermic or endothermic. It is important for chemists to be able to measure this heat. Measurements of this sort are made in a device called a calorimeter. (see figure 4-1) The technique used in making these measurements is called calorimetry.

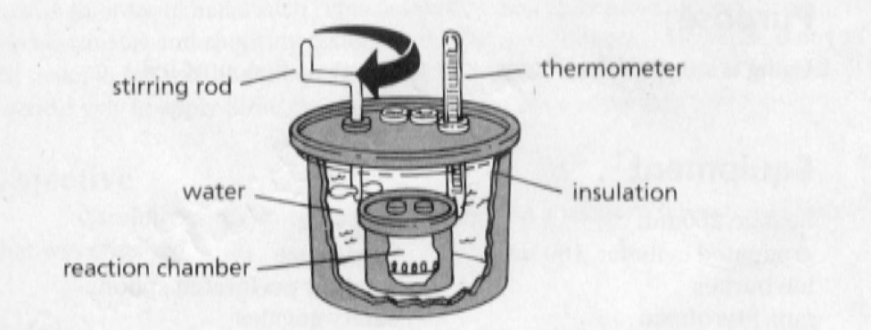

Figure 4-1

In simplest terms, a calorimeter is an insulated container made up of two chambers. The outer chambers contain a known mass of water. In the inner chamber, the experimenter places the materials that are to lose or gain heat while undergoing a physical or chemical change. The basic principle on which the calorimeter works is when two bodies at different temperatures are in contact with one another, heat will flow from the warmer body to the colder body. Thus, the heat lost by one body will be gained by the other. This exchange of heat will continue until the two bodies are at the same temperature. In a calorimeter, heat is exchanged between the water and the materials undergoing change. The experimenter takes a direct measurement of the temperature change of the water. From this information, the heat gained (or lost) by the water can be calculated. The experimenter then uses these data to determine the heat lost (or gained) by the materials undergoing change.

Unlike most calorimeters, the simple Styrofoam-cup calorimeter used in this experiment will have only one chamber. The ice will be placed directly into a measured amount of water. The heat required to melt the ice will be supplied by the water. By measuring the temperature change (ΔT) of the water, you can calculate the quantity of heat exchanged between the water and the ice. Using these experimental data, you will calculate the heat of fusion of ice.

Materials

beaker, 250mL	plastic bag	water
graduated cylinder, 100mL	safety goggles	ice
hot plate	hot hands	balance
Styrofoam cup	thermometer	

Handle the thermometer with care. It is fragile and easily broken.

Procedure

1. Measure the mass of the empty calorimeter cup accurately. **RECORD.**
2. Check the hot water tap to see how hot it is. If it is below 40°C, warm some water in a beaker to about 40°C. Add this water to the calorimeter cup until it is about half filled. Now measure the mass of the cup and this water. **RECORD.**
3. Measure the mass of an empty plastic sandwich bag. **RECORD.**
4. Add 1-2 ice cubes to the bag and measure their mass together **QUICKLY!!! RECORD!**
5. Place the cover on the calorimeter and measure the temperature of the warm water. **RECORD!**
6. Place the part of the bag with the ice into the warm water and replace the cover IMMEDIATELY. Stir gently with the thermometer until the ice has melted completely.
7. When the ice has _____ _____, remove the bag from the water immediately. Be careful not to spill any of the now melted ice into the calorimeter. Measure the final temperature of the water. **RECORD.**

Observations

Make a minimum of five observations about this experiment.
<u>These must be included in your lab report!</u>

Data - Calorimetry Data (Make sure to label with <u>UNITS!)</u>

1. Mass of the empty calorimeter cup _____
2. Mass of calorimeter cup and water _____
3. Mass of water ONLY (m_{H2O}) _____
4. Mass of empty plastic sandwich bag _____
5. Mass of 1-2 ice cubes and plastic sandwich bag _____
6. Mass of 1-2 ice cubes ONLY (m_{ice}) _____
7. Initial temperature of water in cup (T_i) _____
8. Final temperature of water in cup (T_f) _____

Calculations (This information will go under a calculations section in your lab report)

(Show ALL work with units included)

1. Show how you found the mass of the water ONLY
2. Show how you found the mass of the 1-2 ice cubes ONLY
3. Find the change in temperature of the water. ($\Delta T = T_f - T_i$)
4. Find the heat lost by the original mass of water. ($\Delta Q = m_{H2O} \times C \times \Delta T$)
5. Find the heat of fusion of ice. $\frac{\Delta Q}{m_{ice}}$ = heat of fusion of ice
7. Find your percent error. (The accepted value for the heat of fusion of ice can be found on your Reference Table B and the percent error formula on Table T)

Questions (This information will go under the questions section in your lab report)

NOTE: Make sure you are using complete sentences, restating the question in your answer!

1. List at least two possible sources of error in experiment. These must be unavoidable errors (not human error, such as misreading a thermometer or balance) How might the use of a calorimeter such as the one shown in Figure 4-1 reduce some of these errors?

2. In what way does Calorimetry make use of the law of conservation of energy

3. Define the following terms:
   a. exothermic; **b**. endothermic; **c**. heat of fusion; **d**. specific heat capacity.

4. Is the process of melting endothermic or exothermic? Provide specific evidence from this lab experiment to support your answer.

5. What is the difference between heat and temperature?

6. Some unknown solid with a mass of 200. g is at its melting point temperature in a calorimeter. As the solid melts, the 400. gram mass of water in the calorimeter drops from 80ºC to 30 ºC.
   a. How much HEAT did the water lose as the substance melted?
   b. Find the HEAT OF FUSION for unknown in CALORIES PER GRAM and JOULES per GRAM also.