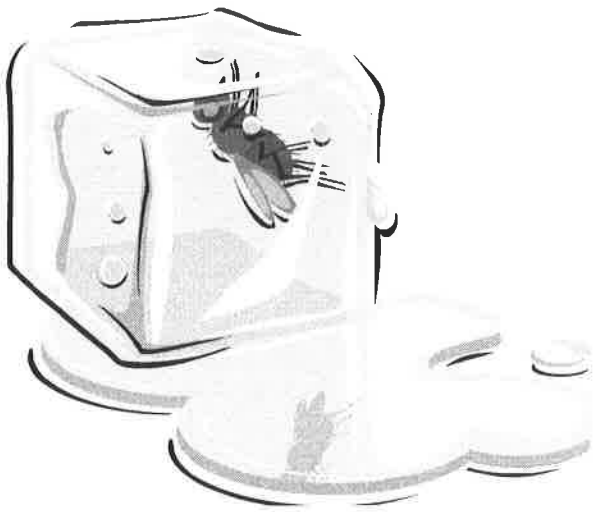
Name:_____ Date: _____

THE HEAT OF FUSION OF ICE

PURPOSE:



INTRODUCTION:

Melting and freezing are behaviors that are characteristic of pure substances and give them their identity. As energy is added, pure solid water (ice) at 0° C changes to liquid water at 0° C. To study this phase change, experimenters use a simple calorimeter, an insulated container composed of two separate chambers that can be used to measure the heat flow between two substances. When thermal heat energy is exchanged between the two chambers, heat will always from the substance with a higher temperature to the substance with a lower temperature. This exchange takes places until both chambers are at the same temperature. By measuring the temperature change and using the formula $Q=mC\Delta T$, an experimenter can calculate the amount of heat absorbed or released during this phase change from solid ice to liquid ice at 0° C.

Unlike most calorimeters that are two chambered, this experiment will use a Styrofoam cup calorimeter with only one chamber. The ice will be placed directly into a measured amount of water. By measuring the temperature change (ΔT) of the water, the quantity of heat changed between the ice and water can be calculated. Using these experimental data, the heat of fusion of ice can then be calculated.

SAFETY:

MATERIALS:

250 mL Beaker, 100 mL graduated cylinder, Hot Plate, Styrofoam cup, Thermometer, Beaker Tongs, Goggles, Water, Ice, Glass Stirring Rod and electronic balance.

PROCEDURE:

1. Place approximately 125 mL of water into a 250 mL beaker and heat it to approximately 60° C. Do not set the hot plate higher than 7. Do not leave the thermometer in the beaker on the hot plate. Periodically check the temperature of the water.
2. Measure exactly 100 mL of heated water in a graduated cylinder and pour into a Styrofoam cu. Record this volume in your data table as V_1. Make sure to record your answer to significance.
3. Measure the temperature of the water and then immediately add ice cubes. Record this data in the data table as T_1. Make sure to record your answer to significance.
4. Using the glass stirring rod, stir the ice water mixture carefully and take temperature readings every minute until the temperature reaches 5° C. The calorimeter should contain ice at all times. If the last of the ice appears to be almost gone, add one ice cube at a time. Continue to stir, adding ice as necessary until the temperature reaches 5° C. Record this final temperature as T_2.
5. Once the temperature has reached 5° C, immediately remove any un-melted ice. Allow any water removed to drain back into the cup. Measure and record the volume of the water in the calorimeter. Record this data as V_2.
6. Make sure all data collected and calculations are included in the observations section.

DATA:

V_1	
V_2	
T_1	
T_2	
M_1	
V_{ICE}	
M_2	
ΔT	
Q_1	
Q_2	
HF_{ICE}	

DATA CALCULATIONS: *SHOW ALL WORK AND UNITS!! RECORD ALL DATA!!*

1. Using the density of water (1 g/ml) find the mass (M1) of the original volume (V_1) of the water. Record in the data table above
2. Determine the volume of the water due to the melted ice (Vice= V_2-V_1. Record in the data table above.
3. Find the mass (M_2) of this volume (Vice) of water. Record in the data table above.
4. Find the change in temperature of the water ($\Delta T = T_2 - T_1$). Record in the data table above.
5. Find the heat (Q_1) lost to the original mass of the water ($Q = mC\Delta T$). Record in the data table above.
6. Find the heat (Q_2) gained by the ice. (Hint where does the heat come from?) Record in the data table above.
7. Using Q_2, determine the heat of fusion (hF ice) of ice (Q=mhf). Record in the data table above.
8. Using the known heat of fusion of ice, calculate the percent error for the experimental heat of fusion of ice (hFice) recorded above.

QUESTIONS

1. What are the possible sources of error in this experiment?
2. How might the use of a true calorimeter reduce some of these errors?
3. In what way does this experiment make use of the Law of Energy Conservation?
4. Define the following terms:
    a. Exothermic
    b. Endothermic
    c. Heat of Fusion
    d. Specific Heat Capacity
5. Is the process of melting endothermic or exothermic? Explain your answer.