Scarsdale High School

Heat of Fusion of Ice

Objective: Experimentally determine the value of the heat of fusion, ΔH_{f} , of ice.

Task: Perform the attached lab.

Materials: 1. See attached lab procedure

Lab Report:

PRESENTATION COUNTS

Lab reports must be fully integrated and in the proper order as listed below.

- 1. Introduction
- 2. Results, Observations and Calculations
- 3. Conclusion
- 4. References

Submit the lab report through Google Classroom

Due Date: One week after the completion of the lab

Scarsdale High School

Heat of Fusion of Ice

Introduction

Pure substances have characteristic melting and freezing behavior. Pure water changes from solid (ice) to liquid (water) at 0 °C as energy is added to it.

In this experiment, you will determine the energy required to melt one gram of ice by letting an excess of it interact with warm water in a Styrofoam cup (ice calorimeter). The ice will cool the water to about 0 °C. The energy given up by the water as it cools is the energy used to melt the ice. Recall that it takes 4.184 J of heat to raise the temperature of 1.00 gram of water 1.00 °C.

Reference:	Specific heat (C _p):	Water	4.18 J/g * °C
		Styrofoam	20.9 J/g * °C

Materials

- 1. Styrofoam cup
- 2. Beaker to support the cup
- 3. LabQuest and Temperature Probe
- 4. Crucible tongs
- 5. Calculator
- 6. Ice

Procedure

- 1. Weigh an empty Styrofoam cup and record its mass to the nearest 0.01g.
- 2. Place 100 mL of warm water into the Styrofoam cup and measure the mass of the cup and water together.
- 3. Place the Styrofoam cup into a beaker to support it during the data collection
- 4. Set up the LabQuest to record for at least 600 seconds. Record the temperature of the warm water to the nearest 0.1 °C for at least 60 seconds.
- 5. Place several ice cubes into the warm water and gently stir the mixture until the temperature of the mixture reaches less than 5 °C. Add more ice as needed.
- 6. Stop the LabQuest. Using the graph, determine the lowest temperature to the nearest 0.1 °C.
- 7. Quickly and carefully remove the remaining ice cubes from the Styrofoam cup without removing any of the water. Use a scoopula or tongs to assist in this task. It is very important that you not remove any liquid water from the Styrofoam cup.

Scarsdale High School

- 8. Reweigh the Styrofoam cup with the water still in it. Record the mass to the nearest 0.01g.
- 9. Repeat the experiment at least 4 more times minimum of 5 trials.

Experimental Data Table	Mass of the Styrofoam cup	Mass of the Styrofoam cup and warm water	Mass of the Styrofoam cup, warm water and melted ice	Initial temperature of the water	Final temperature of the water
Measurement Units					
Trial 1					
Trial 2					
Trial 3					
Trial 4					
Trial 5					
Trial 6					
Trial 7					
Trial 8					

Scarsdale High School

Calculations (For each calculation, show your work in your lab report.)

Record the following calculations in the table listed below:

- 1. Calculate the mass of the warm water?
- 2. Calculate the mass of the melted ice?
- 3. Determine the change in the temperature?
- 4. Determine the heat energy transferred from the warm water to the ice?

 $Q = m * C_p * \Delta T$

where m is the mass of warm water in the cup

5. Calculate the Heat of Fusion of water:

$$\label{eq:deltaH2O} \begin{split} -Q_{H2O} &= Q_{ice} \\ \Delta H_f &= Q_{ice} \; / \; m_{H2O \; (s)} \end{split}$$

Scarsdale High School

Trial	$\begin{array}{c} \text{Mass } \text{H}_2\text{O}_{(l)} \\ \text{(g)} \end{array}$	$\begin{array}{c} \text{Mass } \text{H}_2\text{O}_{(s)} \\ \text{(g)} \end{array}$	$\Delta T H_2 O_{(l)}$ (K)	Heat: Q _{ice} (J)	$\Delta H_{\rm f}$ (J/g)
1					
2					
3					
4					
5					
6					
7					
8					
				Average $\Delta H_f =$	

6. Calculate the heat (Joules) required to melt one gram of ice:

7. Determine the percent error for the average experimental value compared to the accepted value (You must find the accepted value of the Heat of Fusion of ice):

a.	Calculated value:	
b.	Accepted Heat of Fusion value:	334 J / g
c.	Percent error:	

Remember to include and show your calculations in your lab report!!!