Experiment 4: Determination of specific latent heat of fusion of ice

Introduction

Fusion of ice is the change in the physical state of water, and this change in the physical state is accompanied by the absorption of energy (heat), and this change occurs at a constant temperature.

$$H_2O_{(s)} \rightarrow H_2O_{(l)}$$

When an ice cube is removed from a freezer, the cube's temperature increases as it absorbs heat from its surroundings. But once the ice cube reaches 0°C, it begins to melt and its temperature stays at 0°C throughout the melting process, even though the ice cube continues to absorb heat. This occurs because the thermal energy absorbed by the ice cube is consumed by water molecules separating from each other during melting.

Latent heat of fusion L_f

It is the amount of thermal energy required to convert one gram of a substance from the solid state to the liquid state at a constant temperature and under constant pressure
It is given by the following equation.

$$\boldsymbol{L_{fus} = \frac{Q}{m}}$$

Where:

- **Q :** The heat energy
- **m :** Matter mass

The objective of the experiment

In this practice, the objet is to determine the latent heat of fusion of ice by calorimetry.

How to calculate

Since the system is isolated then

$\sum Q_i = 0$

$Q_{\text{gained}} + Q_{\text{lost}} = 0$

$Q_{H20} + Q_{cal} + Q_{glace} = 0$

With : $Q_{glace} = m_{glace}.L_{fus} + m_{glace}.c_{H2O}.(T_f - T_0)$

Materials and Chemicals

Materials	Chemicals
• Calorimeter with mixer • Thermometer • Becher • Analytical balance	• Distilled water • Pieces of ice

Procedure

1. We put pieces of ice in a beaker containing distilled water and wait for the thermal equilibrium, then we measure the equilibrium temperature (water + ice) with a thermometer and make sure that it is $\mathbf{T_0 = 0°C}$

2. We take a becher and ignore its weight before filling it with $\mathbf{m_1=200\ g}$ of cool water.

2. Put the cold water into the calorimeter.

3. We close the calorimeter and wait for thermal equilibrium to be achieved, and take a temperature reading of the system (cold water + calorimeter), let it be $\mathbf{T_1}$.

4. We take out pieces of ice from the beaker and wipe them quickly with a paper napkin, we weigh them and put them in the calorimeter, monitoring by means of a thermometer the drop in temperature resulting from the melting of the piece of ice.

5. We close the calorimeter and wait for thermal equilibrium to be achieved, and take a temperature reading of the system (cold water + product + calorimeter), let it be $\mathbf{T_f}$.

6. Record the obtained results in the table.

Product	Mass of Cold Water m_1(g)	Mass of ice m_2(g)	Temperature of Cold Water T_1 (K)	Equilibrium Temperature T_f (K)
Ice				

Answer the questions

1. Calculate the specific heat of fusion of ice
2. Compare the experimental and theoretical values.
3. Predict the dissolution ice reaction.
4. Justify your answer.

We give :

The theoretical specific heat values of ice $L_{fus} = 335$ J/ g

The calorimeter thermal capacity $K_{cal} = 61.51$ J/g. K

The specific heat of water $c_{H2O} = 4.185$ J / g .K