**Latent Heat of Fusion**

**Introduction**

The purpose of this lab is to determine the Latent Heat of Fusion of ice. In this experiment the heat of fusion of ice will be determined by using the method of mixtures

(Quantity of heat lost = Quantity of heat gained).

**Equipment**

Water

Digital Scale

Thermometer

Ice

Thermos flask

***Mw*** = mass of warm water initially in calorimeter

***Mice*** = mass of ice and water from melting

***Cw*** = specific heat of water = 4185.5 Jkg-1K-1

***Lf*** = heat of fusion of ice

***Tw*** = initial temperature water

***Tf*** = equilibrium temperature of mixture

**Experimental Procedure:**

1.Using the digital scale or the triple beam balance determine the mass of the empty thermos ***Mc***. Record the value in the Data Section below.

2. Fill the calorimeter cup to about half full with warm water. The water temperature

should be between 5o-10o above room temp. (Room temp ~20oC.)

3. Determine the mass of the calorimeter cup and water ***Mcw***. Record the values in the Data Section.

4. Calculate the mass of the added water, ***Mw***. Record the values in the Data Section.

5. Measure and record the initial temperature of the water, ***Tw***.

6. Dry several small pieces of ice with a paper towel to remove any adhering water. We want to add ice and not the liquid water on the ice.

7. Add the pieces of ice to the calorimeter and keep adding ice periodically until the temperature of the mixture is between 5o and 10o C below room temperature. Keep the mixture well stirred.

8. When all the ice has melted, measure and record the equilibrium temperature (***Tf***).

9. Measure and record the combined mass of the calorimeter cup and water, which now includes water from the melted ice ***Mcwi*.**

10. Calculate and record the mass of the ice, ***Mice* = *Mcwi***.***- Mcw***

**Data**

1. Mass of empty calorimeter cup (***Mc***) \_\_\_\_\_\_\_\_\_\_ kg

2. Mass of calorimeter cup and warm water (***Mcw***) \_\_\_\_\_\_\_\_\_\_ kg

3. Mass of warm water (***Mw = Mcw - Mc*** ) \_\_\_\_\_\_\_\_\_\_ kg

4. Mass of calorimeter cup and water (after ice melts) (***Mcwi***.) \_\_\_\_\_\_\_\_\_\_ kg

5. Mass of ice added (***Mice*** = ***Mcwi - Mcw***) \_\_\_\_\_\_\_\_\_\_ kg

6. Initial temperature of warm water (***Tw***) \_\_\_\_\_\_\_\_\_ oC

7. Final temperature of water and melted ice (***Tf***) \_\_\_\_\_\_\_\_\_\_ oC

8. Specific Heat of Water (***Cw***)

9. Use the word equation below to come up with an equation in terms of the symbols used to solve for the latent heat of fusion **Lf.**

**Heat lost = Heat gained**

**Heat lost by warm water = Heat needed to melt ice + Heat needed to warm the water which was once ice**

10. Latent Heat of Fusion of ice, Lf \_\_\_\_\_\_\_\_\_\_ Jkg-1

**Common Errors**

1. STIRRING: It is important to stir the water and ice mixture to ensure that the temperature throughout the water is uniform. Not stirring the ice and water mixture causes the final temperature to be too warm and gives an experimental value of the Latent Heat of Fusion that is too low.

2. THERMOMETER: The SS thermometer should not come into contact with the styrofoam calorimeter. This contact causes the final temperature to be too warm and gives an experimental value of the Latent Heat of Fusion that is too low.

3. DRYING THE ICE: If the ice is not dried there will be water at 0oC on the ice. The added water will contribute to the final mass of liquid but it will not gain the amount of heat that an equivalent amount of ice would gain. The initial temperature of the water in the calorimeter will not have to drop as far. Hence the final temperature will be too high. The result will be an experimental value of the Latent Heat of Fusion that is too low.

**Evaluation**

1. Calculate the percentage uncertainty in your answer. The real value is 3.3x105 Jkg-1.
2. Estimate any errors in your measurements and calculate the total percentage error.
3. Compare your answers to question 1 and 2.
4. Explain how you could improve this experiment.