Measuring the Latent Heat of Fusion

The "calorimeter" is an insulated container which (hopefully) does not allow heat to enter or escape. It therefore allows us to measure the latent heat of ice by determining the amount of energy gained by ice when it is immersed in a bath of water. The heat gained by the ice will equal the heat lost by water and the calorimeter.

We will use a calorimeter, a balance, a beaker, a thermometer, water and ice.

Name:

Lab Partners:

Procedure

1. Measure the mass of the inner calorimeter cup (without the ring) and the stirrer:

   \[ m_{\text{cup \& stirrer}} = \underline{\text{g}} \]

2. Measure the internal temperature of the freezer:

   \[ T_{\text{freezer}} = \underline{\text{C}} \]

3. Heat water to about 15 degrees (Celsius) above the room temperature.
4. Add about 200 ml of water to the calorimeter cup.
5. Determine the mass of the calorimeter cup (without the ring), the stirrer and the water:

   \[ m_{\text{cup \& stirrer \& water}} = \underline{\text{g}} \]

6. Determine the mass of the water:

   \[ m_{\text{water}} = (m_{\text{cup \& stirrer \& water}} - m_{\text{cup \& stirrer}}) = \underline{\text{g}} \]
Place the cup and stirrer into the calorimeter jacket. Stir the water gently and measure the temperature of the water (ideally, wait till the temperature is about 10 degrees above the room temperature):

$T_i = \underline{\hphantom{0}}$ C

7. Add ice to the calorimeter, being careful not to spill any water. Gently stir the water.

8. Keep adding ice to the water until the equilibrium temperature is approximately as much below room temperature as the temperature was just before the ice was added. Read the temperature of the water:

$T_f = \underline{\hphantom{0}}$ C

9. Determine the mass of the calorimeter cup (without the ring), the stirrer, the water and the added ice.

$m_{\text{cup & stirrer & water & ice}} = \underline{\hphantom{0}}$ g

10. Determine the mass of the ice:

$m_{\text{ice}} = (m_{\text{cup & stirrer & water & ice}} - m_{\text{cup & stirrer & water}}) = \underline{\hphantom{0}}$ g

**Analysis**

1. The cup and stirrer are made of aluminum. Look up the specific heat of aluminum:

$c_{\text{cal}} = \underline{\hphantom{0}}$ cal / g C

2. Compute the latent heat of fusion (water):

$L_f = -\left( m_w c_w + m_{\text{cal}} c_{\text{cal}} \right) (T_f - T_i) - m_{\text{ice}} c_{\text{ice}} T_{\text{freezer}} + m_{\text{ice}} c_w T_f \over m_{\text{ice}}$

3. Calculate the error relative to the accepted value for the latent heat of fusion for water:

$\Delta c_{\text{metal}} = 100 \% \times \left| {L_{\text{experimental}} - L_{\text{accepted}}} \right| / L_{\text{accepted}}$

$= \underline{\hphantom{0}} \%$