**H9: Melting ice – latent heat of fusion**

**Materials:**
- ice, hot water, styrofoam cups, scales, temperature probes

**Initial definitions and givens:**
- **latent** = hidden or concealed
- **fusion** – the act of melting by application of heat (one of several definitions)
- **latent heat** – heat that causes a phase change but no change in temperature
- **latent heat of fusion (L_f)** - the number of calories required to change one gram of a substance from a solid to a liquid at the melting point. It’s also equal to the number of calories released when one gram of a substance changes from a liquid to a solid.
  \[ L_f = 80 \text{ cal/g} \] for water.

**Initial Instructions and questions:**
Using ice and hot water, design an experiment to determine the latent heat of fusion for water. There is more than one way. Here are two possibilities.
(1) Add enough hot water to melt a known amount of 0 °C ice. (How do you know the ice is at 0 °C?) From the mass of the ice, the mass of the hot water, the initial temperature of the hot water, and the final temperature, you can calculate \( L_f \).
(2) Another way is to only partially melt the ice and weigh it before and after. (What will the final temperature be in this case?). This is pretty difficult to do accurately.

Pick a method and give it your best shot. One major source of error occurs if some of the ice is melted before you even add hot water. Try to minimize this. Take some time to plan your experiment, so that you know exactly how you will obtain all the required values for the \( L_f \) calculation. Good planning will help you move quickly, so heat lost to or gained from the surroundings doesn’t become important. When you have your plan, call over a teacher and explain it to them.

**Guide to notes in your lab notebook:**

1. How did your value of \( L_f \) compare with the accepted value?
2. Discuss possible sources of error?
3. How would you change your experiment to obtain a more reliable result?

**Practice problems:**

1. How much heat does it take to melt 10 g of ice at 0°C?
2. How much heat does it take to raise the temperature of 10 g of 0°C water to 10 °C?
3. How much heat is required to turn 10 g of ice at -10 °C into 10 g of water at +10 °C?
4. What temperature must 10 g of water be to just barely melt 10 g of 0°C ice?
5. How much water at room temperature (22 °C) is needed to melt 10 g of 0°C ice?