

## 4D – HEAT OF FUSION

## Analysis

Table 1 – Melting ice

Mass of ice (g)	Temperature of ice before mixing (°C)	Mass of hot water (g)	Temp. of hot water before mixing (°C)	Temp. of mixture after ice melted (°C)

1. Using 0 °C as a reference point, we have assumed that a temperature of 0 °C represents a *relative* thermal energy of zero joules. How many joules of thermal energy did the solid ice initially contribute?
2. Use the thermal energy equation (below) to calculate the amount of joules that the hot water initially contributed to the system.  
$$\text{Thermal energy}_{\text{hot}} (\text{J}) = \text{mass}_{\text{hot}} (\text{g}) \times \text{specific heat capacity}_{\text{water}} (\text{J/g} \cdot ^\circ\text{C}) \times \text{temperature}_{\text{before}} (^\circ\text{C})$$
$$E_{\text{Th}} = m \times C_p \times T$$
3. Let's define the system as the ice and the hot water. Calculate the total amount of thermal energy in the system before the ice melted.
4. After the ice melts, the entire system is made of liquid water. What is the total mass of the water in the system?
5. Use the thermal energy equation to determine the total thermal energy in the system as soon as all the ice had melted based on the total mass of water and new system temperature.

**Questions**

- ❓ 1. Does the amount of thermal energy in the system before melting equal the amount of thermal energy in the system after melting? Use energy data from your experiment to support your answer.
- ❓ 2. The difference in thermal energy before and after did not go to changing the temperature, but was used to melt the ice. The energy absorbed by ice goes towards moving particles apart instead of increasing average kinetic energy. How much energy was used to melt the ice?
- ❓ 3. The amount of energy needed to melt a certain mass of a substance is called the heat of fusion. One way to express the heat of fusion is in J/g. What is your experimental heat of fusion of ice in J/g?
- ❓ 4. How does your answer compare to the actual value for the heat of fusion of water, which is 334 J/g? What is your percent error for your experiment? The equation for percent error is:

$$\text{Percent Error} = \left| \frac{\text{accepted value} - \text{experimental value}}{\text{accepted value}} \right| \times 100$$

- ❓ 5. If energy must be added to melt ice, what must occur with energy when water freezes?