

# Phase Changes of water

ice  $\rightarrow$  liquid water (melting) <sup>(fusion)</sup> } energy is absorbed ( $333 \frac{J}{g}$ )  
 liquid water  $\rightarrow$  ice (freezing) } The same amount of energy is involved

$\Delta H_{fus}^{\circ} = 333 \frac{J}{g}$

energy is released  $333 \frac{J}{g}$

$$Q = m \Delta H_{fus}^{\circ}$$

+ if melting  
- if freezing

liquid water  $\xrightarrow{\text{evaporation (absorbing heat energy)}}$  steam (water vapor)  
 $\xleftarrow{\text{condensation (releasing heat energy)}}$

$$Q = m \Delta H_{vap}^{\circ}$$

$\Delta H_{vap}^{\circ} = 2260 \frac{J}{g}$

Example

How much heat is released when 525g of steam condenses?

$$\Delta H_{\text{vap}}^{\circ} = 2260 \frac{\text{J}}{\text{g}}$$

$$m = 525 \text{g}$$

$$Q = ?$$

$$Q = m \Delta H_{\text{vap}}^{\circ} \quad \text{--- since condensing}$$

$$Q = (525 \text{g}) (-2260 \frac{\text{J}}{\text{g}})$$

$$Q = -1186500 \text{ J}$$

$$Q = -1.19 \times 10^6 \text{ J}$$

$$-1.19 \text{ MJ}$$

There will be 1.19 MJ released (-)

Example

What is the heat of fusion for a substance if 25g takes 581J to melt?

$$m = 25 \text{g}$$

$$Q = 581 \text{ J}$$

$$\Delta H_{\text{fus}}^{\circ} = ?$$

$$Q = m \Delta H_{\text{fus}}^{\circ}$$

$$\Delta H_{\text{fus}}^{\circ} = \frac{Q}{m}$$

$$\Delta H_{\text{fus}}^{\circ} = \frac{581 \text{ J}}{25 \text{ g}}$$

$$\Delta H_{\text{fus}}^{\circ} = 23 \frac{\text{J}}{\text{g}}$$