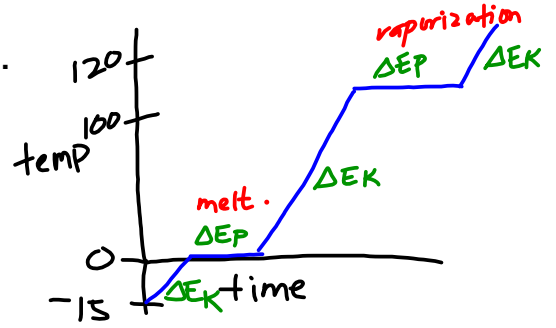
Total Energy Changes in a System

A system may undergo a series of temperature and phase changes. Ex: boiling a kettle.

We can calculate the total energy change involved in heating the water, and the phase change.

Calculate the total energy when 30.0g of ice at -15 °C is converted to steam at 120 °C.



① $mc\Delta t$ $-15 \rightarrow 0$

$= 30.0g \cdot 2.01 \frac{J}{g \cdot °C} \cdot 15°C = 904.5J$

$\hookrightarrow 0.9045KJ$

② melting $\Delta H_{fus} = n H_{fus}$

$n = \frac{m}{M} = \frac{30.0g}{18.02g/mol} = 1.665mol$

$\Delta H_{fus} = 1.665mol \cdot 6.03KJ/mol = 10.0388KJ$

③ $mc\Delta t$ $(0 \rightarrow 100)$

$= 30.0g \cdot 4.19J/g \cdot °C \cdot 100°C = 12570J$

$\hookrightarrow 12.570KJ$

④ $\Delta H_{vap} = n H_{vap}$

$= 1.665mol \cdot 40.8KJ/mol = 67.9245KJ$

⑤ $mc\Delta t$ $(100 \rightarrow 120°C)$

$= 30.0g \cdot 2.01J/g \cdot °C \cdot 20°C = 1206J$

$\hookrightarrow 1.206KJ$

$E_{total} = 0.9045KJ + 10.0388KJ + 12.570KJ + 67.9245KJ + 1.206KJ$

$= 92.6KJ$

$\hookrightarrow 93KJ$