Changes of State

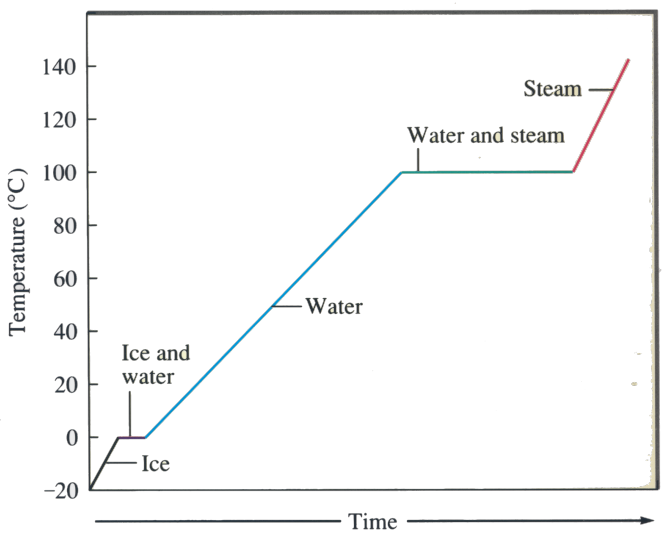
We want to be able to look at a substance and model how it will behave as it is heated or cooled. To do this we need to understand how phase changes occur.

We can illustrate this by measuring the temperate of a given amount of water as a steady source of heat is applied to it. We will want to be able to calculate the energy changes involved.

If the temperature is changing we can determine the relationship between energy and temperature by using : $q = m\ \Delta T\ s$

If the temperature is constant, then the KE must be constant and we need to calculate the energy change in a different way. We need to know the enthalpy of fusion or the enthalpy of vaporization.

$$q = n\ \Delta H_f \qquad q = n\ \Delta H_v$$



For water:

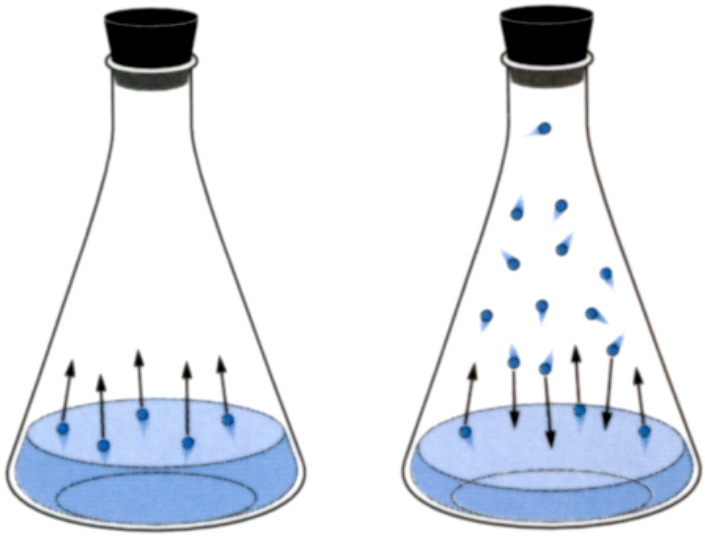
ΔH_{Vap}=40.7 kJ/mol

ΔH_{Fus}= 6.00 kJ/mol

Ex:

Vapor Pressure

A liquid at any temperature will have a certain percentage of particles that have enough energy to vaporize. Because of this liquids will produce vapors and we can measure how readily this happens by measuring the vapor pressure. That is the pressure of vapor above an enclosed liquid needed to establish equilibrium.



Phase Diagrams

We frequently want to see how the phase of a substance depends on pressure and temperature. We can represent this relationship with a phase diagram.

There are 4 important points on a phase diagram:

The triple point is the point at which all three phases are in equilibrium.

The normal boiling and melting point are the temperatures at 1 atm of pressure.

The critical point is where the sharp change between the liquid and gas phase no longer exists.