## Entropy and Enthalpy

Entropy is measured using  $\Delta S$ . It is a measure of disorder, the higher the disorder the higher the entropy and the better. Entropy has the unit of Joules per Kelvin per mole.

## 'Entropy is an isolated system not in equilibrium and will tend to increase over time'

- Gases have very high entropy values as the atoms are very disordered
- Solid however have very low entropy values as the atoms can only vibrate and remain ordered
- Liquids although tend to be closer to solids in terms of entropy values as they atoms can only slip and slide over each other

To measure the entropy change(difference in entropy values):

## $\Delta S = \Sigma S$ (products) – $\Sigma S$ (reactants)

With enthalpy changes however the reaction tends to take place spontaneously if the products are more stable than the reactants. This is because if they are at a lower energy level they tend to be more comfortable. This is why endothermic reactions do not the place spontaneously.

A spontaneous change can only take place in one direction increase we put in work. For example we cannot increase the heat energy as no ord air even although the cold air contains energy.

Both entropy and entropy balance each of e out for example an ice cube melting is spontaneous nowever it is endothermic, this is due to the entropy value.

In order to determine whether a reaction will be spontaneous we need to determine the  $\Delta$ H value and the  $\Delta$ S value to give a  $\Delta$ G. This is called the Gibbs free energy. If this value is less than 0 the reaction will happen spontaneously at that temperature. Although if the  $\Delta$ G value is greater than 0 the reaction will not happen spontaneously at that temperature.



The temperature change must be written in kelvins