KNOCKHARDY *NOTES*

A LEVEL CHEMISTRY

ENTROPY

AT A GLANCE

Free energy, enthalpy and entropy are related ...

$$\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$$

ENTROPY (S)

① A measure of the DISORDER of a system

② The more disorder, the greater the entropy

③ Disorder increases if ΔS is positive ...

$$\Delta S^\circ = S^\circ_{final} - S^\circ_{initial}$$

④ Entropy increases when

- solids melt
- liquids boil
- ionic solids dissolve in water
- the number of gas molecules increases
- the temperature of matter increases

⑤ Units of ΔS are usually $\underline{J}\,K^{-1}\,mol^{-1}$ **not** kJ

For a reversible reaction at equilibrium

$\Delta G = 0$

$\therefore$

$$\Delta S = \frac{\Delta H}{T}$$

FREE ENERGY (G)

Why should reactions with a positive ΔH value take place spontaneously ?
e.g. some salts dissolve readily in water and the temperature of the solution drops

Surely, this means that energy has to be put in for the reaction to take place. Enthalpy change ΔH **does not give the full story**. Free energy change, ΔG, give a a better picture.

Free energy change ΔG°

- A reaction is spontaneous if it can do work - *it must generate free energy*
- If ΔG is negative a reaction is capable of proceeding of its own accord

Will a reaction work ?

A reaction should be **spontaneous if ΔG is negative**, so ask ...

- Is the reaction exothermic (ΔH -ive) or endothermic (ΔH +ive) ?
- Is there an increase in disorder ? If YES then ΔS will be positive.
- Is the temperature high or low ? It affects the value of $T\Delta S^\circ$

In General

- If ΔH is -ive and ΔS is +ive then ΔG must be negative
- If ΔH is +ive and ΔS is -ive then ΔG must be positive