WJEC Chemistry A-Level

PI4.2: Entropy and Feasibility of Reactions

Detailed Notes

English Specification
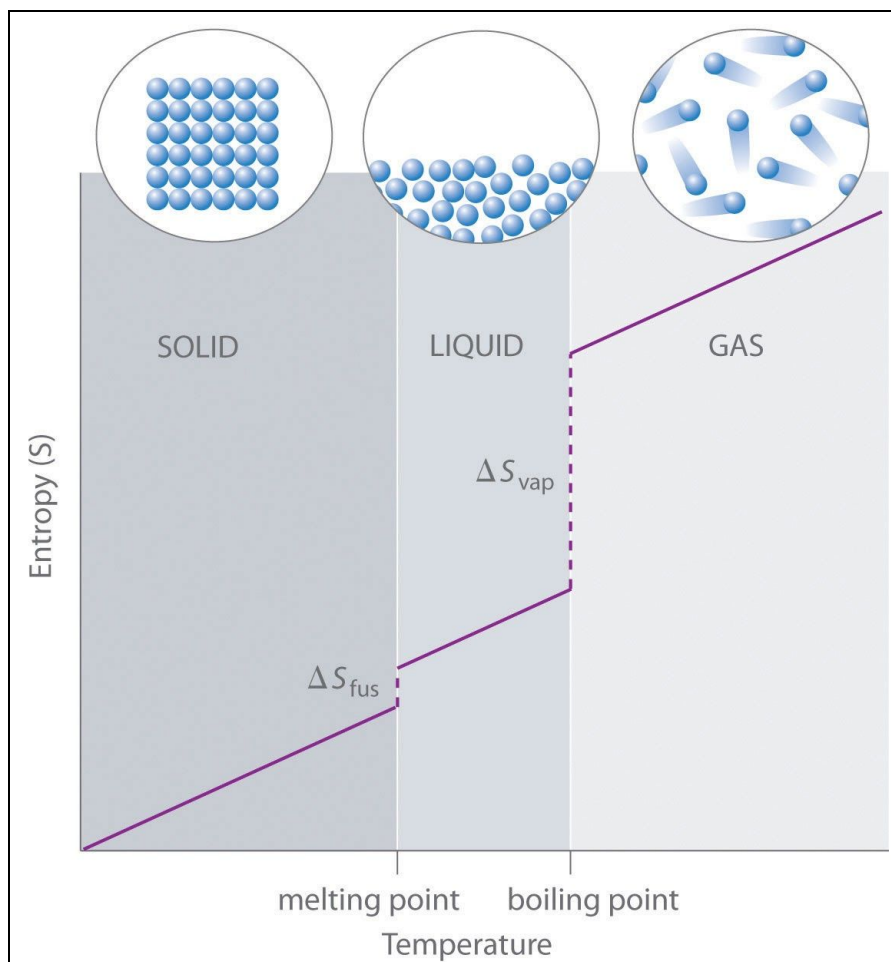
Entropy (ΔS)

In chemistry, things tend towards a **state of disorder**. Entropy is a measure of this disorder, **ΔS**.

The **more disordered** a substance, the **greater its entropy** value. Entropy increases as temperature increases because the particles **gain energy** and move **further apart**, ie. they become **less ordered**.

Gases have the **greatest entropy** compared to solids and liquids.
Example:

When a substance **melts or evaporates**, there is a **sudden increase** in entropy. The entropy change of **vaporisation** is much greater than that of **fusion** as a gas is much **more disordered** than a liquid or a solid.

The **overall entropy change** for a reaction can be calculated and is measured in **JK⁻¹mol⁻¹**:

$$\Delta S_{total} = \Delta S_{final} - \Delta S_{initial}$$

Since all things tend towards a state of disorder, all **spontaneous** reactions have a **positive entropy value**, ie. disorder increases.

Gibbs Free-Energy (ΔG)

This quantity allows the **entropy change** of a reaction to be found without needing to measure the effects on the surroundings. It uses the **reaction temperature**, **enthalpy** (ΔH) and **entropy** (ΔS) changes to determine a value for Δ**G**.

Example:

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

Free-energy is measured in **kJmol⁻¹** so it is important that ΔH and ΔS are used in the same, standard units.
This equation also takes the form **'y = mx + c'** meaning it can be represented **graphically** as a straight line graph of Δ**G against** Δ**S**.

ΔG is **negative** for all **spontaneous** reactions. This becomes true at a certain, specific temperature which can be found by putting Δ**G equal to zero**. Changing the temperature or the type of reaction occurring will change the **feasibility** and **spontaneity** of the reaction.

Δ**H**	Δ**S**	**Increasing T...**	**Feasible?**
+ve	+ve	TΔS > ΔH	Above a certain T value
-ve	+ve	ΔG gets more -ve	Always
+ve	-ve	ΔG always remains +ve	Never
-ve	-ve	Usually ΔH > TΔS	Usually