AQA Chemistry A-level

3.1.10: The Equilibrium Constant

Detailed Notes

3.1.10.1 - Kp Constant

Kp is the equilibrium constant used for **gaseous equilibria**. All reactants and products must be in a **gaseous state** in order for Kp to be calculated.

Partial Pressure

Within a gaseous system, each gas has a **partial pressure** which adds up to give the total system pressure. This partial pressure of a substance is found using the **molar fraction** of that substance and the **total pressure**.

$$\text{Partial Pressure of A} = \frac{\text{Moles of A}}{\text{Total Moles}} \times \text{Total Pressure}$$

Partial pressure of A would be shown as **(pA)**.
Example:

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A mixture of gases contains 0.51 mol N_2, 0.28 mol H_2, and 0.52 mol NH_3. If the total pressure of the mixture is 2.35 atm, what is the partial pressure of H_2?

Total moles in the system = 0.51 + 0.28 + 0.52
= 1.31 moles

Molar fraction of H_2 = 0.28 / 1.31
= 0.21

(pH_2) = 0.21 x 2.35
= 0.50 atm

Partial pressures are commonly measured in **Pascals** but can occasionally be measured in atmospheres.

Calculating Kp

Partial pressures allow the value of Kp for a gaseous equilibrium to be found. Kp is equal to the product of the **partial pressures of products** over the **partial pressure of reactants**. It is similar to Kc in that any variation in moles **raises the partial pressure to a power** of equal quantity to the number of moles.

$$2A_{(g)} + 3B_{(g)} \longrightarrow Y_{(g)} + 2Z_{(g)}$$

$$Kp = \frac{(pY)(p^2Z)}{(p^2A)(p^3B)}$$