

Edexcel Chemistry A-Level

Topic 11: Equilibrium II

Detailed Notes





Gaseous Equilibrium Constant (K_p)

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

Partial Pressure

Within a gaseous system, each gas has a **partial pressure** which add 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 ?

$$\begin{aligned} \text{Total moles in the system} &= 0.51 + 0.28 + 0.52 \\ &= 1.31 \text{ moles} \end{aligned}$$

$$\begin{aligned} \text{Molar fraction of } H_2 &= 0.28 / 1.31 \\ &= 0.21 \end{aligned}$$

$$\begin{aligned} (P_{H_2}) &= 0.21 \times 2.35 \\ &= 0.50 \text{ atm} \end{aligned}$$

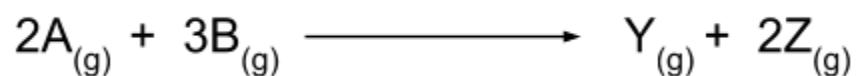
Partial pressures are commonly measured in **Pascals** but can occasionally be measured in atmospheres.





Calculating K_p

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



$$K_p = \frac{(P_Y)(P_Z^2)}{(P_A^2)(P_B^3)}$$

The value of K_p is **not affected by concentration or pressure change** or by the use of a **catalyst**, however it is affected by changing the reaction **temperature** as the equilibrium position change results in different partial pressures of reactants and products.

