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Chemical Equilibrium

7. Catalyst does not affect eqm constant eqm

8. Catalyst only change time of reach to attain eqm.

the catalyst: time ↓ to attain eqm

-ve catalyst: time ↑ to attain eqm

Active Mass:-

Concⁿ in terms of Molarity or pressure

$$\text{Active Mass} = \frac{\text{mol}}{\text{Lit}} = \frac{n}{V}$$

or []

$$\text{gases [Active Mass]} = [P_{\text{r}}]$$

Active mass of solid & Pure liq = 1 (always)

Ques 8g He, 8.4g N₂ & 128g SO₂ is present in 2L Container. Find active mass of each gas?

$$[He] = \frac{8/4}{2} = \frac{2}{2} = 1$$

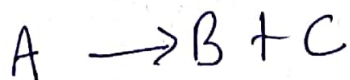
$$[N_2] = \frac{8 \cdot 4 / 28}{2} = \frac{8 \cdot 4}{28 \times 2} = \frac{84^{2+3}}{56 \times 10} = \frac{3}{20} = 0.1$$

$$[SO_2] = \frac{128/64}{2} = \frac{2}{2} = 1$$

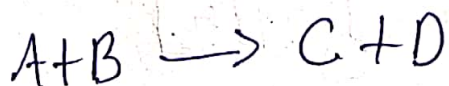
law of Mass Action: —

It states that rate of reactⁿ is directly proportional to the active mass of reactant raised to power equal stoichiometric coefficient in a balanced chemical reactⁿ

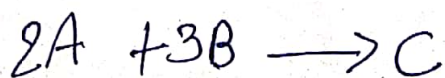
$$r \propto [\text{active mass of reacting sub}]^n$$



$$r \propto [A]$$

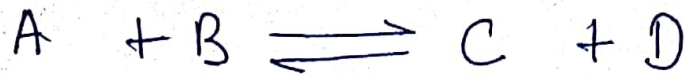


$$r \propto [A][B]$$



$$r \propto [A]^2 [B]^3$$

Application of Law of Mass Action:



$$r_f \propto [A][B] \quad r_b \propto [C][D]$$

$$r_f = k_f [A][B] \quad r_b = k_b [C][D]$$

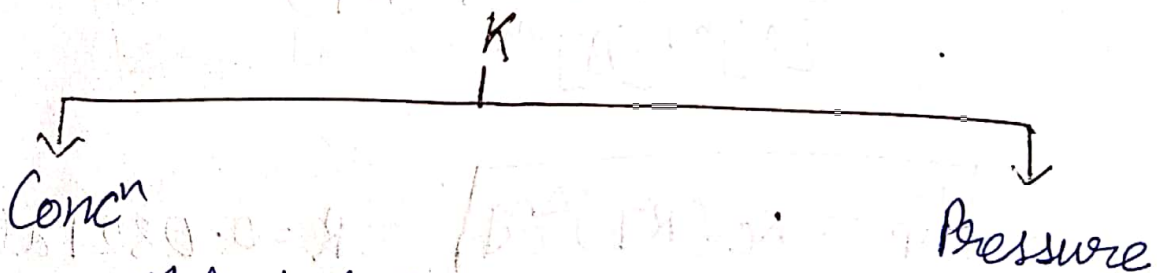
$$r_f = r_b$$

$$k_f [A][B] = k_b [C][D]$$

$$\frac{k_f}{k_b} = \frac{[C][D]}{[A][B]}$$

$$\begin{array}{l} E_{a,m} \\ \text{Const.} \end{array} \leftarrow K = \frac{[C][D]}{[A][B]}$$

$$\begin{array}{l} E_{a,m} \\ \text{Const.} \end{array} \leftarrow K = \frac{k_f}{k_b}$$



$$K_c = \frac{[C]^{n_1} [D]^{n_2}}{[A]^{m_1} [B]^{m_2}}$$

$$K_p = \frac{[P_C]^{n_1} [P_D]^{n_2}}{[P_A]^{m_1} [P_B]^{m_2}}$$

unit $(\text{mol l}^{-1})^{\Delta n_g}$ $(\text{atm})^{\Delta n_g}$

$$\Delta n_g = \text{Sum of stoichiometric Coefficient of products} - \text{Sum of stoichiometric Coefficient of reactant}$$

Relation b/w K_p & K_c

$$PV = nRT$$

$$P = \frac{n}{V} RT$$

$$P = CRT$$

$$K_p = \frac{[C]RT^{n_1} \cdot [D]RT^{n_2}}{[A]RT^{m_1} \cdot [B]RT^{m_2}}$$

$$K_p = \frac{[C]^{n_1} [D]^{n_2}}{[A]^{m_1} [B]^{m_2}} \cdot (RT)^{(n_1+n_2) - (m_1+m_2)}$$

$$K_p = K_c (RT)^{\Delta n_g}$$

$$R = 0.0821 \text{ atm l mol}^{-1} \text{ K}^{-1}$$