

D. B. College (Jaynagar) Lect-5
Chemistry Department B.Sc. (I) (Hon)
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Chemical Equilibrium

Factors affecting Equilibrium Const.

1. Representation:



$$K_c = \frac{[B]}{[A]}$$



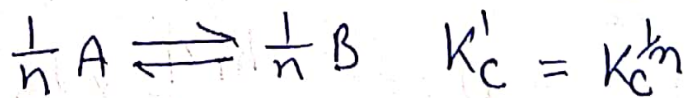
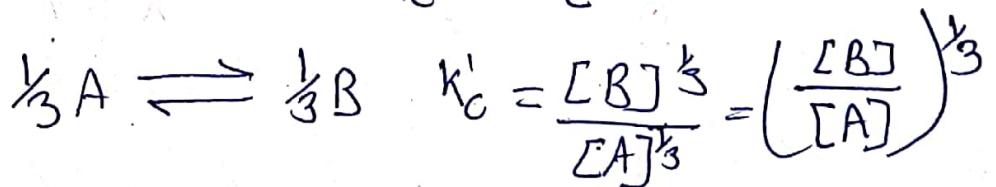
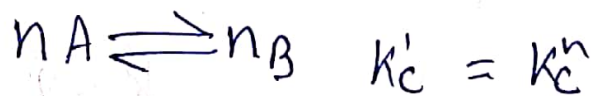
$$K_c' = \frac{[A]}{[B]}$$

$$K_c' = \frac{1}{K_c}$$

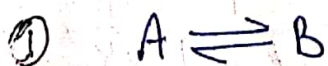
2. Stoichiometry:



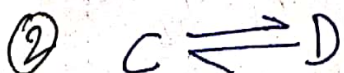
$$K_c' = \frac{[B]^3}{[A]^3} = K_c^3$$



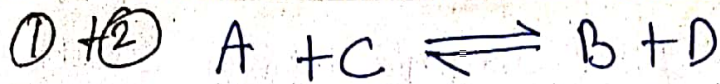
3. Multi-step reacⁿ, -



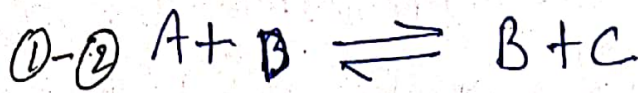
$$K_1 = \frac{[B]}{[A]}$$



$$K_2 = \frac{[D]}{[C]}$$



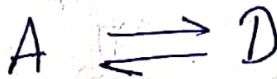
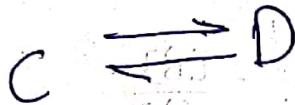
$$K = \frac{[B][D]}{[A][C]}$$



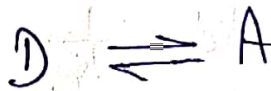
$$K = k_1 \cdot k_2$$

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

$$K = \frac{k_1}{k_2}$$



$$K = k_1 \cdot k_2 \cdot k_3$$



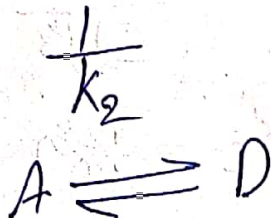
$$K = \frac{1}{k_1 \cdot k_2 \cdot k_3}$$

Ques



$$K = ?$$

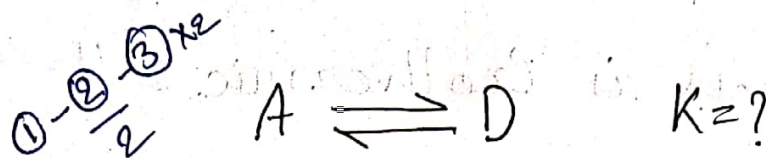
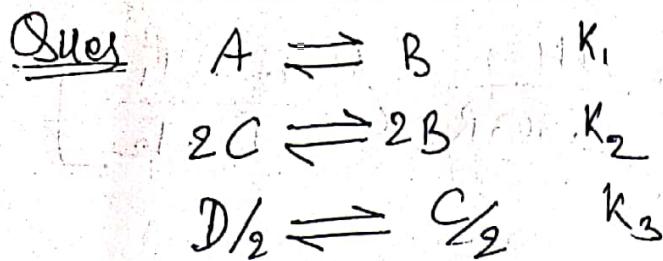
Q2



$$k_1 \times \frac{1}{k_2} \times k_3$$

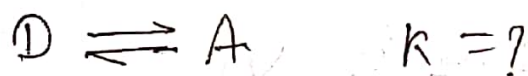
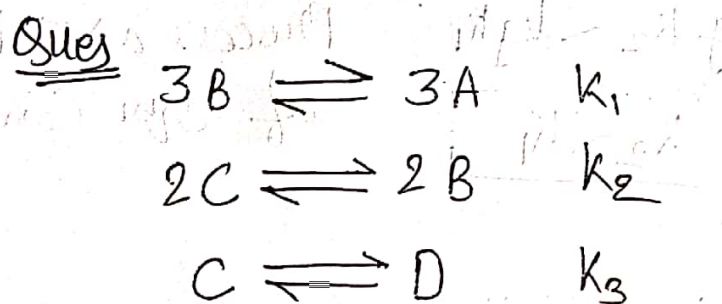


$$K = \frac{1}{k_1 \times \frac{1}{k_2} \times k_3} = \frac{k_2}{k_1 k_3}$$



① - ② - 2 × ③

$$K_1 \times \frac{1}{K_2^{1/2}} \times \frac{1}{K_3^2}$$



$\frac{1}{3} \text{①} + \frac{1}{2} \text{②} - \text{③}$

$$K = K_1^{1/3} K_2^{1/2} \frac{1}{K_3}$$

4. Temperature!

$$\log \frac{K_2}{K_1} = \frac{\Delta H}{2.303R} \left[\frac{1}{T_1} - \frac{1}{T_2} \right]$$

Vant Hoff Eqn

K_1 is eqm Const. at Temp T_1

K_2 is eqm Const. at Temp T_2

$\Delta H \rightarrow$ Heat of reaction

$$\log \frac{k_2}{k_1} = \frac{\Delta H}{2.303R} \left[\frac{T_2 - T_1}{T_1 \cdot T_2} \right]$$

Let $T_2 > T_1$

Case 1 If process is exothermic $\Delta H = -ve$

$$\log \frac{k_2}{k_1} < 0$$

$$\log k_2 - \log k_1 < 0$$

$$\log k_2 < \log k_1$$

$$\boxed{k_2 < k_1}$$

→ in an exothermic process as $T \uparrow$ value of eqm const. ↓

Case 2 If process is endothermic $\Delta H = +ve$

$$\log \frac{k_2}{k_1} > 0$$

$$\log k_2 - \log k_1 > 0$$

$$\log k_2 > \log k_1$$

$$\boxed{k_2 > k_1}$$

→ in an endothermic process as $T \uparrow$ value of eqm const. ↑

$$\Delta H = 0 \quad k_1 = k_2$$