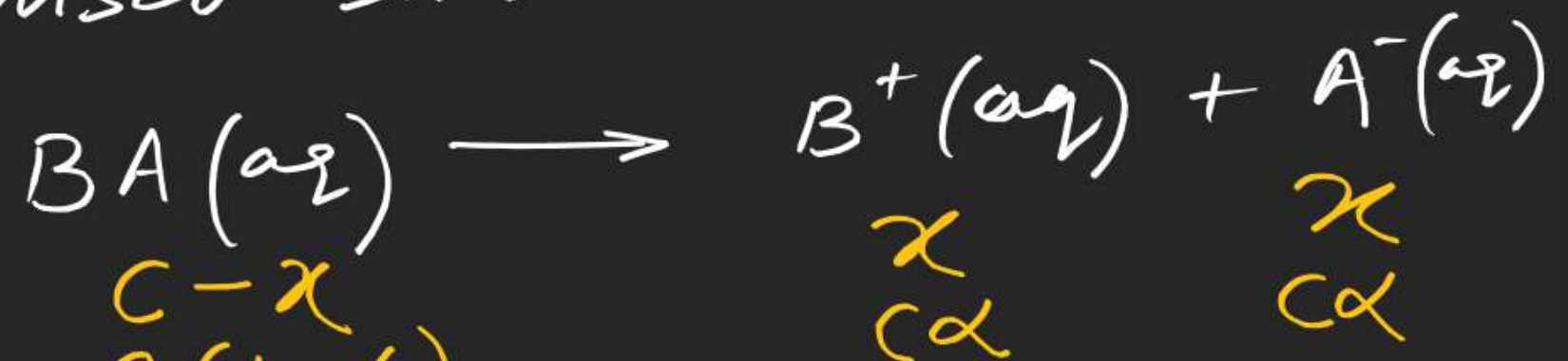


Ionic Equilibrium: →

- ① pH calculation
- ② Solubility & Solubility product
- ③ Indicators

Arrhenius theory of dissociation: →

There exist a dynamic eq^lbm betⁿ ionised and unionised substance.



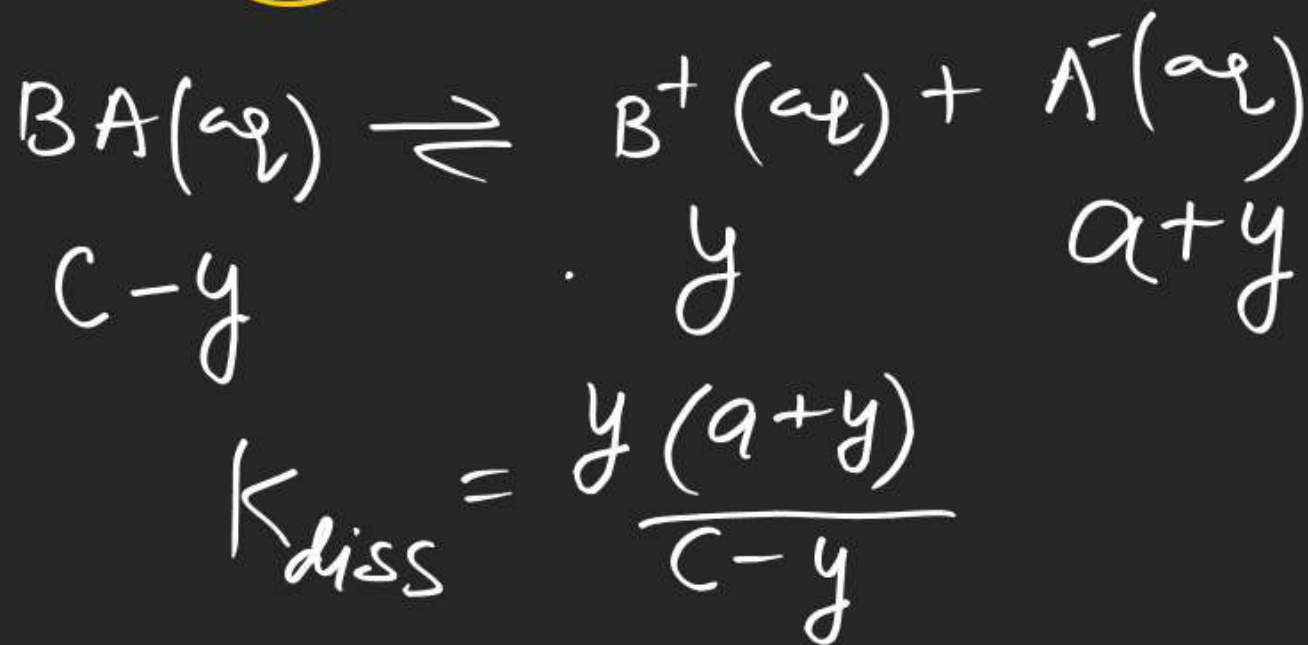
$$K_{diss} = \frac{[B^+][A^-]}{[BA]}$$

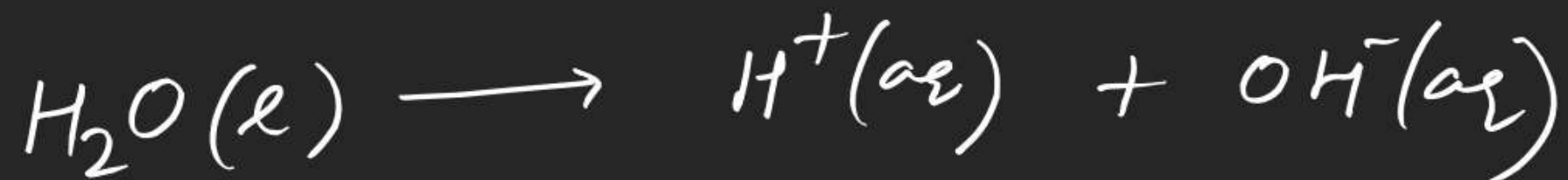
$$= \frac{x \cdot x}{C-x} = \frac{C\alpha \cdot C\alpha}{C(1-\alpha)} = \frac{C\alpha^2}{1-\alpha}$$

factors affecting α

- ① Nature of solute \rightarrow
- ② Nature of solvent \rightarrow As dielectric constant \uparrow α \uparrow
- ③ Temperature \rightarrow Since dissociation is endothermic
Therefore as T \uparrow $K_{diss} \uparrow$ $\alpha \uparrow$
- ④ Concentration $K_{diss} = \frac{C \alpha^2}{1-\alpha}$ As $C \downarrow$ $\alpha \uparrow$
This is known as Ostwald dilution law
- ⑤ Common ion effect

$$K_{diss} = \frac{\alpha^2}{C - \alpha}$$



Dissociation of H_2O : \rightarrow 

$$K_{diss} = \frac{[H^+][OH^-]}{[H_2O]}$$

$$[H_2O] = \frac{1000}{18} = 55.55$$

$$K_{diss} [H_2O] = K_w = [H^+][OH^-]$$

↑
ionic product
of $H_2O(l)$

At $25^\circ C$ $K_w = 10^{-14} \left(\frac{\text{mol}}{\text{lit}} \right)^2$

As $T \uparrow$ $K_w \uparrow$



$[H^+] > [OH^-]$ Acidic

$[H^+] < [OH^-]$ basic

$[H^+] = [OH^-]$ Neutral

At $25^\circ C$ $10^{-14} = [H^+][OH^-]$

| | | |
|-------------------|--------------------|---------|
| $[H^+] = 10^{-7}$ | $[OH^-] = 10^{-7}$ | Neutral |
| $[H^+] > 10^{-7}$ | $[OH^-] < 10^{-7}$ | Acidic |
| $[H^+] < 10^{-7}$ | $[OH^-] > 10^{-7}$ | Basic |

$$pH = -\log [H^+]$$

$$pOH = -\log [OH^-]$$

at $25^\circ C$

$[H^+] = 10^{-7}$ $pH = 7$ Neutral

$[H^+] > 10^{-7}$ $pH < 7$ Acidic

$[H^+] < 10^{-7}$ $pH > 7$ Basic

$pH = 1$ $[H^+] = 10^{-1}$

$pH = 2$ $[H^+] = 10^{-2}$

$pH = 3$ $[H^+] = 10^{-3}$

$$K_w = [H^+][OH^-]$$

$$-\log K_w = -\log [H^+] - \log [OH^-]$$

$$pK_w = pH + pOH$$

at $25^\circ C$

$$pH + pOH = 14$$

$$pH = -\log [H^+]$$

$$\text{if } [H^+] > 1 \quad pH < 0$$



Q. At 80°C , $K_w = 4 \times 10^{-12} \text{ (mol/lit)}^2$.

(a) Find pH of pure water

(b) Define a solution as acidic, basic or neutral

Acidic \rightarrow (i) 5

Basic \rightarrow (ii) 6

Basic \rightarrow (iii) 7

$$\textcircled{a} \quad [\text{H}^+][\text{OH}^-] = 4 \times 10^{-12}$$

$$[\text{H}^+]^2 = 4 \times 10^{-12}$$

$$[\text{H}^+] = 2 \times 10^{-6}$$

$$\text{pH} = 6 - \log 2 = 5.7$$

$$\log 2 = 0.3$$

$$\log 3 = 0.4771$$

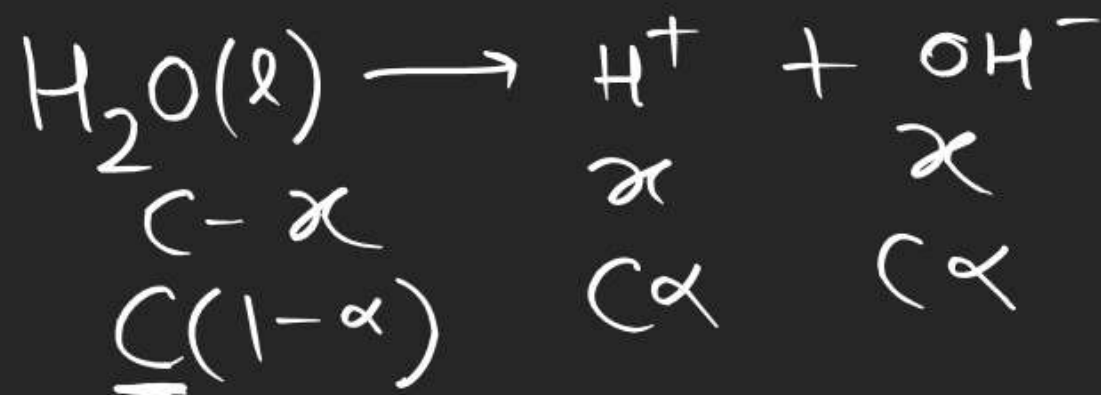
$$\log 5 = 0.7$$

(c) find α of H_2O at 80°C

$$C\alpha = [\text{H}^+] = 2 \times 10^{-6}$$

$$\frac{1000}{18} \alpha = 2 \times 10^{-6}$$

$$\alpha = \frac{18}{1000} \times 2 \times 10^{-6}$$



$$K_w = [\text{H}^+][\text{OH}^-]$$

$$4 \times 10^{-12} = (C\alpha)^2$$

$$2 \times 10^{-6} = C\alpha$$

-PH-Calculation

Solⁿ containing only acid or base

Solution containing salts

Solⁿ containing acid or base + salts (Buffer solⁿ)

only one acid or base

more than one acid or base

Monoprotic

polyprotic

strong

weak

J-Main

1-25

Kinetic

1-50