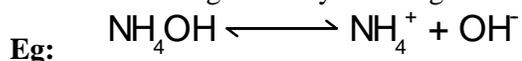


ACID BASE CONCEPTS: TITRATIONS

Q. 1. Write a note on common ion effect.

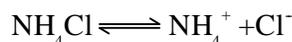
Ans. The phenomenon of lowering the degree of ionization of weak electrolyte by adding to it a solution of strong electrolyte having common ions is known ion effect.



Applying Law of mass action

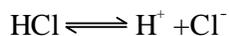
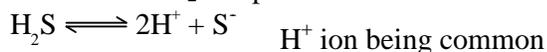
$$K = \frac{[\text{NH}_4^+][\text{OH}^-]}{[\text{NH}_4\text{OH}]}$$

On Addition of NH_4Cl , NH_4^+ are added to solution. This ion is in common in both & known as common ion effect. The value of NH_4^+ increases and because k is constant at any fixed temp. There is increase in value of $[\text{NH}_4\text{OH}]$ and decrease in value of $[\text{OH}^-]$

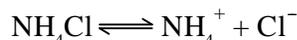


\therefore ionization of NH_4OH is decreased/suppressed by addition of NH_4Cl which gives NH_4^+ common ion.

Eg. Dissociation of H_2S in presence of HCl .



dissociation NH_4OH of in presence of NH_4Cl



Q. 2. Write a note of pH.

Ans. pH scale was given by 'sorensen'. It is used to express H^+ concentration. The term pH was originally written as pH^+ which represented H^+ potential
pH is defined as log of reciprocal of the H^+ conc.

$$\text{pH} = \log 1/\text{H}_3\text{O}^+ \quad (1)$$

According to rules of log eq (1) can be written as

$$\text{pH} = \log 1 - \log [\text{H}_3\text{O}^+] \quad (2)$$

Since log of 1 is zero

$$\therefore \text{pH} = - \log [\text{H}_3\text{O}^+] \quad (3)$$

eq. (1) and (3) are identical pH of a solution may be considered in term of numeric scale having value from 0 to 14.

Degree of acidity to 0 to 7

And degree of alkalinity 7 to 14

Value 7 at which H^+ and OH^- ion conc. are equal at room temp is referred as neutral point or neutrality. Neutral pH at 0°C is 7.47 and at 100°C is 6.15 in pure water

$$[\text{H}^+] = 10^{-7} \text{ g ion/lit}$$

$$\therefore \log [\text{H}^+] = \log [10^{-7}] = -7$$

$$\text{or } \log [\text{H}^+] = - \log [10^{-7}] = -(-7) = 7$$

- log is denoted by p

$$\therefore - \log [\text{H}^+] = \text{pH} = 7$$

Q. 3. What is POH show relation between pH and POH.

Ans. Suppose in a solution, conc. of OH^- is 10^{-5} ion/lit then it's P^{OH} Value will be

$$\text{POH} = -\log [\text{OH}^-] = -\log 10^{-5} = -(-5) = 5$$

Relation between pH and POH

We know that ionic product of H_2O , K_w at 25°C is 1×10^{-14}

\therefore PK_w will be written as

$$\text{PK}_w = -\log K_w = -\log 10^{-14} = -(-14) = 14$$

$$K_w = [\text{H}^+] [\text{OH}^-] = 10^{-14}$$

$$\therefore \log K_w = \log [\text{H}^+] + \log [\text{OH}^-] = \log 10^{-14}$$

$$\log k_w = \log [\text{H}^+] + \log [\text{OH}^-] = \log 10^{-14}$$

Multiplying above equation throughout by (-1)

$$-\log k_w = -\log [\text{H}^+] - \log [\text{OH}^-] = -\log 10^{-14}$$

$$\text{PK}_w = \text{pH} + \text{pOH} = -(-14) = 14$$

$$\therefore \text{pH} + \text{POH} = 14$$

Applicable to all dilute solutions at room temp. If pH value is known, value of POH can be calculated and vice-versa

$$\text{pH} = 14 - \text{POH}$$

$$\text{POH} = 14 - \text{pH}$$

Q. 4. In an aqueous solution $[\text{H}^+] = 10^{-3}$ g/lit; calculate pH and POH value

Ans.

$$[\text{H}^+] = 10^{-3} \text{ g ion/lit}$$

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

$$\text{or } \left\{ \text{pH} = \log \frac{1}{[\text{H}^+]} = \log \frac{1}{10^{-3}} = \log^3 = 3 \right\}$$

$$[\text{H}^+] [\text{OH}^-] = 10^{-14}$$

$$[\text{OH}^-] = \frac{10^{-14}}{[\text{H}^+]} = \frac{10^{-14}}{10^{-3}} = 10^{-14} \times 10^3 = 10^{-11}$$

\therefore POH of solution will be 11

$$\text{pH} + \text{POH} = 3 + 11 = 14$$

Q. 5. $[\text{H}_3\text{O}^+]$ conc. of a 0.05 solution of HCl is 0.05 M. What is pH of this solution.

Ans.

$$\text{pH} = -\log (5 \times 10^{-2}) = -\log 10^{-2} - \log 5$$

$$= 2 - 0.70 = 1.30$$