



01

- Which of the following statements is/are incorrect?
- Aqueous solution of sugar conducts electricity.
 - Conductance of electricity increases with an increase in concentration of common salt in aqueous glucose solution.
 - Aqueous solution of acetic acid mainly contains unionised acetic acid molecules and only some CH_3COO^- and H_3O^+ ions.
 - III only
 - II only
 - II and III only
 - I, II and III

ELECTROLYTE

Substance which allow the flow of electricity through their aqueous solution or through their molten form.

01 STRONG ELECTROLYTE
electrolyte which dissociates completely into ions.
eg : HCl , NaOH

02 WEAK ELECTROLYTE
electrolyte which dissociates partially into ions.
eg : CH_3COOH , NH_4OH

IONIC EQUILIBRIUM

Equilibrium established in between ions and unionised Salt in a weak electrolyte.

Eg. In weak electrolytes, equilibrium is established between ions and the unionized molecules. This type of equilibrium I.involves ions in aqueous solution. II.is called physical equilibrium. III.is due to complete ionization IV.is called ionic equilibrium. The correct statement(s) is/are
(A) I and IV only (B) II and III only (C) IV only (D) I, II, III and IV
ANS : (A)

02

- Which of the following is conjugate acid of SO_4^{2-} ?
- HSO_4^-
 - H^+
 - H_2SO_4
 - SO_4^{2-}

ACID-BASE CONCEPTS

01 ARRHENIUS CONCEPT

Acids are H^+ ions donors and bases are OH^- ion donors.
 $\text{HCl} \rightarrow \text{H}^+ + \text{Cl}^-$ (acid) $\text{NaOH} \rightarrow \text{Na}^+ + \text{OH}^-$ (base)

02 BRONSTED - LOWRY CONCEPT

Acids are protons (H^+ ion) donors and bases are proton acceptors.
Eg : $\text{CH}_3\text{COOH} + \text{H}_2\text{O} \rightleftharpoons \text{CH}_3\text{COO}^- + \text{H}_3\text{O}^+$
acid base Base acid

base + $\text{H}^+ \rightarrow$ Conjugate acid acid - $\text{H}^+ \rightarrow$ Conjugate base

Conjugate acid of $\text{H}_2\text{O} \rightarrow \text{H}_3\text{O}^+$ Conjugate base of $\text{H}_2\text{O} \rightarrow \text{OH}^-$

03 LEWIS CONCEPT

Bases are lone pair e^- donors & acids are lone pair e^- acceptors.

Lewis acid - Substances having Vacant space in their valence shell to accomodate lone pair of e^-
Eg : BF_3 , AlCl_3 , H^+ , Ag^+

Lewis base - Substances having lone pair of e^- in their valence shell
Eg : NH_3 , H_2O , Cl^- , OH^-

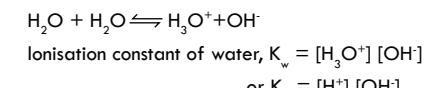
03

- Which of the following species can act both as an acid as well as a base?
- SO_4^{2-}
 - HSO_4^-
 - PO_4^{3-}
 - Cl^-

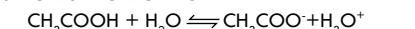
IONISATION AND IONISATION CONSTANT

In all ionisation reactions concentration of water $[\text{H}_2\text{O}]$ is taken as constant

01 IONISATION OF WATER



02 IONISATION OF ACID



$$\text{Ionisation constant, } K_a = \frac{[\text{CH}_3\text{COO}^-] [\text{H}_3\text{O}^+]}{[\text{CH}_3\text{COOH}]}$$

$$\text{or } K_a = \frac{[\text{CH}_3\text{COO}^-] [\text{H}^+]}{[\text{CH}_3\text{COOH}]}$$

03 IONISATION OF BASE



04

- What will be the pH of a soft drink if hydrogen ion concentration in sample is 3.8×10^{-3} M?
- 3.8
 - 5.04
 - 2.42
 - 9.2

VALUE OF IONIC PRODUCT

At 25°C , $K_w = [\text{H}_3\text{O}^+] [\text{OH}^-] = 1 \times 10^{-14}$

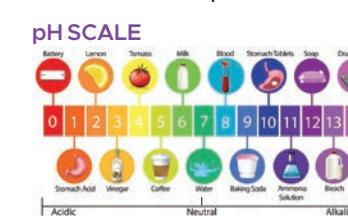
01 If $[\text{H}^+] = [\text{OH}^-] = 1 \times 10^{-7}$ mol/L : solution will be neutral

02 If $[\text{H}^+] > [\text{OH}^-]$ i.e $[\text{H}^+] > 1 \times 10^{-7}$ mol/L solution will be acidic

03 If $[\text{H}^+] < [\text{OH}^-]$ i.e $[\text{H}^+] < 1 \times 10^{-7}$ mol/L solution will be basic

pH

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



05

- What will be the ionisation constant of formic acid if its 0.01 M solution is 14.5% ionised?
- 2.1×10^{-4}
 - 14.5
 - 0.145
 - 1.45×10^{-4}

IMPORTANT EQUATIONS

$$\text{pH} = -\log [\text{H}^+] \quad \text{pKa} = -\log [K_a]$$

$$\text{pOH} = -\log [\text{OH}^-] \quad \text{pKb} = -\log [K_b]$$

$$\text{pKw} = \text{pH} + \text{pOH} = 14$$

$$K_a \cdot K_b = K_w = 1 \times 10^{-14} \text{ at } 25^\circ\text{C}$$

$$\text{pKa} + \text{pKb} = 14 \text{ at } 25^\circ\text{C}$$

DEGREE OF DISSOCIATION (α)

$$\frac{\text{Number of moles ionised}}{\text{Total no. of moles}} \quad \text{Eg : } 30\% \text{ ionisation means } \alpha = \frac{30}{100} = 0.3$$

Weak acid

$$K_a = C \alpha^2$$

$$\alpha = \sqrt{K_a/c}$$

$$[\text{H}_3\text{O}^+] = C \alpha$$

$$[\text{H}^+] = \sqrt{K_a \cdot c}$$

Weak base

$$K_b = C \alpha^2$$

$$\alpha = \sqrt{K_b/c}$$

$$[\text{OH}^-] = C \alpha$$

$$[\text{OH}^-] = \sqrt{K_b \cdot c}$$

IONIC EQUILIBRIUM

06

Equimolar solutions of HF, HCOOH and HCN at 298 K have the values of K_a as 6.8×10^{-4} , 1.8×10^{-4} and 4.8×10^{-5} respectively. What will be the order of their acidic strength?

- $\text{HF} > \text{HCN} > \text{HCOOH}$
- $\text{HF} > \text{HCOOH} > \text{HCN}$
- $\text{HCN} > \text{HF} > \text{HCOOH}$
- $\text{HCOOH} > \text{HCN} > \text{HF}$

07

For a polybasic acid, the dissociation constants have different values for each step, e.g.,
 $\text{H}_3\text{A} \rightleftharpoons \text{H}^+ + \text{H}_2\text{A}^- ; K = K_{a_1}$
 $\text{H}_2\text{A}^- \rightleftharpoons \text{H}^+ + \text{HA}^{2-} ; K = K_{a_2}$
 $\text{HA}^{2-} \rightleftharpoons \text{H}^+ + \text{A}^{3-} ; K = K_{a_3}$

What is the observed trend of dissociation constants in successive stages?

- $K_{a_1} > K_{a_2} > K_{a_3}$
- $K_{a_1} = K_{a_2} = K_{a_3}$
- $K_{a_1} < K_{a_2} < K_{a_3}$
- $K_{a_1} = K_{a_2} = K_{a_3}$

08

- Which of the following salts does not show its correct nature mentioned against it?
- NaCl solution - Neutral
 - NaCN solution - Acidic
 - NH_4NO_3 solution - Acidic
 - KF solution - Basic

09

- Which one of the following pairs of solution is not an acidic buffer?
- CH_3COOH and CH_3COONa
 - H_2CO_3 and Na_2CO_3
 - H_3PO_4 and Na_3PO_4
 - HClO_4 and NaClO_4

ACID STRENGTH

- acid strength $\propto K_a$
- acid strength $\propto \frac{1}{\text{pKa}}$

For an acid HA

As HA bond strength decreases, acid strength increases

As we move from top to bottom, size of anion increases
∴ HA bond strength decreases & acid strength increases.
eg :- Acid strength of $\text{HI} > \text{HBr} > \text{HCl} > \text{HF}$

As we move from left to right, electronegativity increases
∴ HA bond becomes more polar & acid strength increases.
eg :- Acid strength of $\text{HF} > \text{H}_2\text{O} > \text{NH}_3 > \text{CH}_4$

POLYPROTIC ACIDS & POLYHYDROXY BASES

Acids having ionisable hydrogen are known as protic acids or basic acids. eg :- HCl , H_2SO_4 , $\text{H}_2\text{C}_2\text{O}_4$, H_3PO_4 , CH_3COOH etc

Here H_2SO_4 , $\text{H}_2\text{C}_2\text{O}_4$ & H_3PO_4 are having more than one ionisable hydrogen, they are known as polyprotic acids

Polyprotic acids ionises in stepwise.

Here the removal of H^+ ion from neutral molecule is easy, but it is difficult to remove further H^+ ions from their corresponding anions
 $\therefore K_{a_1} > K_{a_2} > K_{a_3}$

In case of polyhydroxy bases or polyacidic bases like $\text{Fe}(\text{OH})_3$, $\text{Ba}(\text{OH})_2$ etc $K_{b_1} > K_{b_2} > K_{b_3}$

HYDROLYSIS OF SALTS



SALT OF STRONG ACID & STRONG BASE

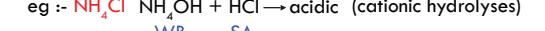
Strong acid (SA) & strong base (SB) \rightarrow Neutral, It's pH = 7



Note : Neutral salts do not undergo hydrolysis

SALT OF STRONG ACID & WEAK BASE. (SA + WB \rightarrow acidic)

It's pH < 7



Cationic hydrolyses

SALT OF WEAK ACID & STRONG BASE (WA + SB \rightarrow Basic)

It's pH > 7

