QB365 Question Bank Software Study Materials

Ionic Equilibrium Important 2 Marks Questions With Answers (Book Back and Creative)

12th Standard

Chemistry

Total Marks : 40

2 Marks

20 x 2 = 40

1) What are Lewis acids and bases? Give two example for each.

Answer : **(i) Lewis acid:** It is a species that accepts an electron pair. Eg: $Ag^{+}; BF_3; A/Cl_3$

(ii) Lewis base: It is a species that donates an electron pair. Eg: $Cl^{-}; NH_3; H_2O$

2) The concentration of hydroxide ion in a water sample is found to be 2.5×10^{-6}M. Identify the nature of the solution.

Answer : 1. If $[OH^{-}] > 1 \times 10^{-7}$M, the solution is basic. $2.5 \times 10^{-6}\text{M} > 1 \times 10^{-7}\text{M}$

2. ∴ The solution is basic.

3) A lab assistant prepared a solution by adding a calculated quantity of HCl gas 25^0C to get a solution with $[H_3O^+] = 4 \times 10^{-5}$M. Is the solution neutral (or) acidic (or) basic.

Answer : $[H_3O^+] = 4 \times 10^{-5}$M

$pH = - \log_{10}[H_3O^+]$

$pH = -\log_{10}[4 \times 10^{-5}]$

$pH = -\log_{10}[4] - \log_{10}[10^{-5}]$ $\quad \log_{10} 10 = 1$

$pH = -\log 4 + 5\log_{10}10$

$= 5 - \log 4$

$= 5 - 0.6021$

$=4.3979$

Since pH is less than 7, the solution is acidic.

4) Define solubility product.

Answer : The solubility product of a compound is defined as the product of the molar concentration of the constituent ions, each raised to the power of its stoichiometric co - efficient in a balanced equilibrium equation.

$X_mY_{n\,(s)} \rightleftharpoons mX^{n+}{}_{(aq)} + nY^{m-}{}_{(aq)}$

$K_{sp} = [X^{n+}]^m[Y^{m-}]^n$

5) Define pH.

Answer : (i) $p^H = -\log_{10}[H_3O^+]$

(ii) The pH of a solution is defined as the negative logarithm of base 10 of the molar concentration of the hydronium ions present in the solution.

6) K_{sp} of AgCl is 1.8×10^{-10}. Calculate molar solubility in 1 M $AgNO_3$

Answer : $K_{sp} = 1.8 \times 10^{-10}$, $[AgNO_3] = 1$ M

$$AgCl_{(s)} \rightleftharpoons \underset{s}{Ag^{+}_{(aq)}} + \underset{s}{Cl^{-}_{(aq)}}$$

$$AgNO_{3(aq)} \rightleftharpoons \underset{1M}{Ag^{+}_{(aq)}} + \underset{1M}{NO^{-}_{3(aq)}}$$

$[Ag^+] = (s + 1) \approx 1 \quad (\because s << 1)$

$[Cl^-] = s$

$K_{sp} = [Ag^+][Cl^-]$

$1.8 \times 10^{-10} = (1)(s)$

$\therefore s = 1.8 \times 10^{-10}\text{M}$

7) Calculate the concentration of OH^- in a fruit juice which contains 2×10^{-3} M, H_3O^+ ion. Identify the nature of the solution.

Answer : Given that $H_3O^+ = 2 \times 10^{-3} M$

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$K_w = [H_3O^+][OH^-]$

$\therefore [OH^-] = \frac{K_w}{[H_3O^+]} = \frac{1\times10^{-14}}{2\times10^{-3}} = 0.5 \times 10^{-11} M$

$2 \times 10^{-3} >> 0.5 \times 10^{-11}$

i.e., $[H_3O^+] > > [OH^-]$, hence the juice is acidic in nature

8) A solution of 0.10M of a weak electrolyte is found to be dissociated to the extent of 1.20% at 25°C. Find the dissociation constant of the acid.

Answer : Given that $\alpha = 1.20\% = \frac{1.20}{100} \times 1.2 \times 10^{-2}$

$K_a = \alpha^2 c$

$= (1.2 \times 10^{-2})^2 (0.1) = 1.44 \times 10^{-4} \times 10^{-1}$

$= 1.44 \times 10^{-5}$

9) Calculate the pH of 0.1M CH_3COOH solution. Dissociation constant of acetic acid is 1.8×10^{-5}.

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

For weak acids,

$= \sqrt{k_a \times C}$

$= \sqrt{1.8 \times 10^{-5} \times 0.1}$

$= 1.34 \times 10^{-3}$ M

$pH = -\log(1.34 \times 10^{-3})$

= 3-log1.34

= 3-0.1271

= $2.8729 \simeq 2.87$

10) Classify the following as acid (or) base using Arrhenius concept

i)HNO_3 ii) $Ba(OH)_2$ iii) H_3PO_4 iv) CH_3COOH

Answer : i) $HNO_3 \overset{H_2O}{\rightleftharpoons} H^+_{(aq)} + NO^-_{3(aq)}$ [Acid]

ii) $Ba(OH)_2 \overset{H_2O}{\rightleftharpoons} Ba^{2+}_{(aq)} + 2OH^-_{(aq)}$ [base]

iii) $H_3PO_4 \overset{H_2O}{\rightleftharpoons} 2H^+_{(aq)} + HPO_4{}^{2-}_{(aq)}$ [Acid]

iv) $CH_3COOH \overset{H_2O}{\rightleftharpoons} CH_3COO^-_{(aq)} + H^+_{(aq)}$ [Acid]

11) Write down the conjugate acid and base of the following

(i) NH_3

(ii) HSO^-_4

Answer :

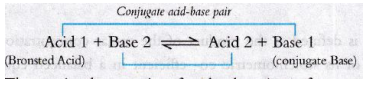
	(i)	(ii)
Conjugate Acid	NH_4^+	H_2SO_4
Conjugate Base	NH_2^-	SO_4^{2-}

12) BF_3 is termed as an acid though it does not contain H^+ ions. Explain.

Answer : According to Lewis concept of Acid and bases, any species capable of accepting an electron pair is an acid. BF_3 is electron deficient so accepts a pair of electron, Hence termed as acid

13) What is meant by conjugate base and conjugate acid?

Answer : According to Lowry Bronsted (acid - base) reaction:

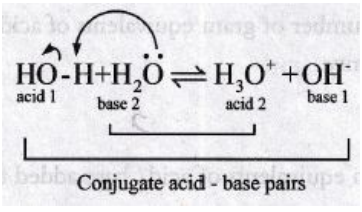


(i) The species that remains after the donation of a proton is a base (Base 1) and is called the conjugate base of the Bronsted acid (Acid 1). Acid 1 is the conjugate acid of Base 2. Base 2 accepts a proton from Acid 1 and it given Acid 2. So Acid 2 is the conjugate acid of Base 2.

(ii) In other words, chemical species that differ only by a proton are called conjugate acid - base pairs.

14) What is meant by auto ionisation of water? Explain.

Answer : When an acidic or a basic substance is dissolved in water, depending upon its nature, it can either donate (or) accept a proton. In addition to that the pure water itself has a little tendency to dissociate. i.e, one water molecule donates a proton to an another water molecule. This is known as auto ionisation of water and it is represented as



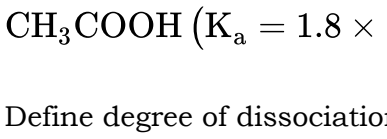
In the above ionisation, one water molecule acts as an acids while the another water molecule acts as a base.

15) What is the effect of temperature on $\left[H_3O^+\right]$, $\left[OH^-\right]$ and K_w? Why?

Answer : With the increase in temperature, the $[H_3O^+]$ and $[OH]^-$ also increases. Hence the ionic product of water also increases. This is because the dissociation of water is an endothermic reaction.

16) The pH of 10^{-8} M HCl is not 8. Why?

Answer : 1. In addition to the auto ionisation of water, the following equilibrium due to the dissociation of HCl can also exist



2. In addition to the auto ionisation of water, HCl molecules also produces H_3O^+ ion by donating a proton to water.

Hence $\left[H_3O^+\right] > \left[OH^-\right]$.

3. It means the aqueous HCl solution is acidic.

4. In such cases $\left[H_3O^+\right] = 10^{-8} + 10^{-7} = 11 \times 10^{-8}M$

$$pH = -\log_{10}\left[H_3O^+\right]$$
$$= -\log_{10}\left(11 \times 10^{-8}\right)$$
$$= -\log_{10} 11 - 8\log_{10} 10]$$
$$= 8 - \log 11 = 8 - 1.0414 = 6.9586$$

17) What are basic solution? What will be their pH?

Answer : (i) When a solution has $\left[H_3O^+\right] < 1 \times 10^{-7}M$ or $\left[OH^-\right] > 1 \times 10^{-7}M$ at 25^0C, it is called a basic solution.

(ii) Their pH will be > 7.

18) How will you identify whether an acid is strong or weak from K, value?

Answer : (i) Acids with K_a value greater than ten are strong acids and less than one are weak acids.

(ii) Eg. at 25°C

$HCl\left(K_a = 2 \times 10^6\right) \longrightarrow$ strong acid

$CH_3COOH\left(K_a = 1.8 \times 10^{-5}\right) \longrightarrow$ weak acid

19) Define degree of dissociation.

Answer : Degree of dissociation (α) is the fraction of the total number of moles of a substance that dissociates at equilibrium.

$$\alpha = \frac{\text{Number of moles dissociated}}{\text{Total number of moles}}$$

20) What is a buffer solution?

Answer : A solution which resists the drastic changes in its pH upon addition of small quantities of acids or bases is called a buffer solution.