IONIC EQUILIBRIUM
(MAINS)

SINGLE CORRECT OPTION TYPE

1. pH of $0.002\,N\,CH_3COOH$ having 2.3% dissociation and pH of $0.002N\,NH_4OH$ having 2.3% dissociation respectively.
(A) 4.33 & 9.66 (B) 4.33 & 4.33 (C) 9.66 & 9.66 (D) cannot be determined

2. Calculate the $\left[OH^-\right]$ of $\left[NH_2C_2H_4NH_3\right]^+$ and $\left[H_3N-C_2H_4NH_3\right]^{2+}$ in 0.15 M ethylene diamine (aq) if
$NH_2C_2H_4NH_2+H_2O \rightleftharpoons NH_2C_2H_4N^+H_3+OH^- \quad \left(k_1=8.5\times10^{-5}\right)$
$NH_2C_2H_4N^+H_3+H_2O \rightleftharpoons \left[NH_3C_2H_4NH_3\right]^{2+}+OH^- \quad \left(k_2=2.7\times10^{-8}\right)$ respectively
(A) 3.57×10^{-3}M & 2.7×10^{-8}M (B) 2.7×10^{-8}M & 2.7×10^{-8}M
(C) 1.3×10^{-3}M & 2.7×10^{-8}M (D) 3.57×10^{-3}M & 7.56×10^{-9}M

3. A 0.1 M solution of weak acid HA is 1% dissociated at 298 k. What will be the new degree of dissociation of HA and pH when 0.2 M of Na A is added. Find k_a.
(A) $\alpha=10^{-5}; pH=5.3010; k_a=10^{-3}$ (B) $\alpha=5\times10^{-5}; pH=7; k_a=10^{-5}$
(C) $\alpha=5\times10^{-5}; pH=5.3010; k_a=10^{-5}$ (D) $\alpha=10^{-5}; pH=7; k_a=10^{-3}$

4. k_a for the ionisation of Fe^{+3} to $\left[Fe(OH)\right]^{+2}$ and H^+ is 6.5×10^{-3}, what is the maximum pH value. Which could be used so that at least 95% of the total Fe^{+3} in a dilute solution exists as Fe^{+3}?
(A) 4.8 (B) 0.9 (C) 13.1 (D) 11.8

5. Citric acid (H_3A) is a polyprotic acid with k_1, k_2 and k_3 equals to 7.4×10^{-4}, 1.7×10^{-5} and 4.0×10^{-7} respectively. Calculate $\left[A^{-3}\right]$ in 0.01 M citric acid.
(A) 1.75×10^{-5} (B) 2.4×10^{-3} (C) 2.4×10^{-10}M (D) 2.8×10^{-9}M

6. 100 ml of a buffer solution contains 0.1 M each of weak acid HA and salt NaA. How many grams of NaOH should be added to the buffer solution so that its p^H will 6? $\left(k_a \text{ of } HA=10^{-5}\right)$
(A) 0.328 (B) 0.458 (C) 4.19 (D) none

7. The p^{kb} of CN^- is 4.7. The p^H of solution prepared by mixing 2.5 mol of KCN of 2.5 mol of HCN in water and making the total volume upto 500 ml is
(A) 10.3 (B) 9.3 (C) 8.3 (D) 4.7

8. A 0.1 molar solution of weak base BOH is 1% dissociated. If 0.2 mol of BCl is added in 1 lit solution of BOH. The degree of dissociation of BOH will become
(A) 0.02 (B) 0.005 (C) 5×10^{-5} (D) 2×10^{-3}

9. An aqueous solution of metal chloride $MCl_2\,(0.05M)$ is saturated with $H_2S(0.1M)$. The minimum p^H at which metal sulphide will be precipitated is
$\left(K_{sp}MS=5\times10^{-21}; K_1(H_2S)=10^{-7}; K_2(H_2S)=10^{-14}\right)$
(A) 3.25 (B) 2.5 (C) 1.5 (D) 1.25

10. The p^H of a solution of weak base at half neutralisation with strong acid is 8 k_b for the base is

(A) 1×10^{-4} (B) 10^{-6} (C) 10^{-8} (D) none

11. A solution of 0.1M NaZ has $p^H = 8.9$. The k_a of HZ is

(A) 6.3×10^{-11} (B) 6.3×10^{-10} (C) 1.6×10^{-5} (D) 1.6×10^{-6}

12. Some chemist at ISRO wished to prepare a saturated solution of a silver compound and they wanted it to have the highest concentration of silver ion possible. Which of the following compounds would they use?
$k_{sp}(AgCl) = 1.8\times10^{-10}$; $k_{sp}(AgBr) = 5\times10^{-13}$; $k_{sp}(Ag_2CrO_4) = 2.4\times10^{-12}$

(A) AgCl (B) AgBr (C) Ag_2CrO_4 (D) all of these

13. Let the solubilities of AgCl in H_2O and in 0.01 M $CaCl_2$, 0.01 M NaCl, 0.05 M $AgNO_3$, be S_1, S_2, S_3, S_4 respectively. What is the correct relationship between these quantities.

(A) $S_1 > S_2 > S_3 > S_4$ (B) $S_1 > S_2 = S_3 > S_4$ (C) $S_1 > S_3 > S_2 > S_4$ (D) $S_4 > S_2 > S_3 > S_1$

14. The pH of the solution obtained by mixing equal volumes of solution of pH = 5 and pH = 3 of the same electrolyte is :

(A) 3.3 (B) 4.0 (C) 5.5 (D) 6.0

15. The K_{sp} of $Mg(OH)_2$ is 1×10^{-12}; 0.01M $Mg(OH)_2$ will precipitate at the limiting pH :

(A) 3 (B) 9 (C) 5 (D) 8

16. Zn salt is mixed with $(NH_4)_2S$ of molarity 0.021M. The amount of Zn^{2+} remains unprecipitated in 12 ml of this solution $(K_{spZns} = 4.51\times10^{-24})$

(A) 1.677×10^{-22}g (B) 1.767×10^{-22}g (C) 2.01×10^{-23}g (D) None of these

17. The total number of different kind of buffers obtained during the titration of H_3PO_4 with NaOH are

(A) 3 (B) 1 (C) 2 (D) Zero

18. Buffering action of a mixture of CH_3COOH and CH_3COONa is maximum when the ratio of salt to acid is equal to

(A) 1.0 (B) 100.0 (C) 10.0 (D) 0.1

19. If the solubility of $PbBr_2$ is `s' mol per litre, then by considering 80% ionization, its ionic product is :

(A) $2s^3$ (B) $4s^2$ (C) $4s^3$ (D) $2s^4$

20. Consider the equilibrium reactions,

$H_3PO_4 \underset{}{\overset{k_1}{\rightleftharpoons}} H^+ + H_2PO_4^-$ $H_2PO_4^- \underset{}{\overset{k_2}{\rightleftharpoons}} H^+ + HPO_4^{2-}$

$HPO_4^{2-} \underset{}{\overset{k_3}{\rightleftharpoons}} H^+ + PO_4^{3-}$

The equilibrium constant, K for the following dissociation $H_3PO_4 \rightleftharpoons 3H^+ + PO_4^{3-}$ is

(A) $\frac{k_1}{k_1k_3}$ (B) $k_1k_2k_3$ (C) $\frac{k_2}{k_1k_3}$ (D) $k_1 + k_2 + k_3$

INTEGER TYPE

21. How many of the following 0.1 M solution are acidic?

(a) NH_4Cl (b) NaOH (c) $HC_2H_3O_2$ (d) NaCl

(e) $NH_3 + NH_4Cl$ (f) NH_3 (g) HCl (h) $HClO_4$

(i) $(NH_4)_2SO_4$ (j) K_2SO_4

22. The pH of blood stream is maintained by a proper balance of H_2CO_3 and $NaHCO_3$ concentrations. What volume (ml) of 5 M $NaHCO_3$ solution, should be mixed with 10 ml sample of blood, which is 2 M in H_2CO_3 in order to maintain a p^H of 7.4 k_a for H_2CO_3 in blood is 7.8×10^{-7} ?

23. Find number of mole of AgI which many be dissolved in 1 lit of 1M CN^- solution.
Given $k_{sp}(AgI) = 1.2\times10^{-17}$ and $k_c\left[Ag(CN)_2\right]^- = 7.1\times10^{19}M^{-2}$

24. 0.2 M solution of $Ba(OH)_2$ is found to be 90% ionised at $25^\circ C$. Find the pH of the solution at that temperature.

25. 20ml of 0.2m NaoH is added to 50ml of 0.2m acetic acid. What is the P^H of the resulting solution ?

KEY

1.	A	**2.**	A	**3.**	C	**4.**	B	**5.**	D
6.	A	**7.**	B	**8.**	C	**9.**	C	**10.**	B
11.	C	**12.**	C	**13.**	C	**14.**	A	**15.**	B
16.	A	**17.**	A	**18.**	A	**19.**	A	**20.**	B
21.	5	**22.**	78.37	**23.**	0.49	**24.**	13.56	**25.**	4.56

✻ *Wish You all the Best* ✻