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: 99672 40893
83696 11389
99671 69853
Shop No. 1,2,3,4 Ayodhya Nagari, Hendre Pada, Badlapur (West), Thane, Maharashtra - 421503

Practice Paper

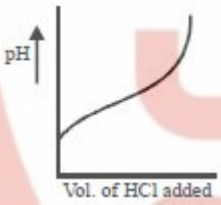
Time : 2 Hour | 11th standard (JEE BASED) IONIC EQUILIBRIUM | Total Marks : 200

Chemistry

*** SECTION - A** [160]

1. When $100\,mL$ of $0.1\,M\,NaCN$ solution is titrated with $0.1\,M\,HCl$ solution the variation of pH of solution with volume of HCl added will be

(A)



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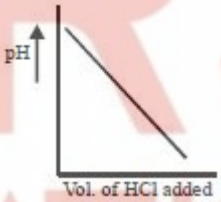

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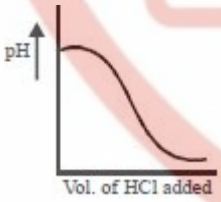

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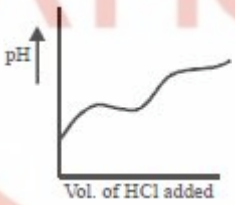


2. Find the value of $\frac{[NaCN]}{[HCN]}$ Given pH of the buffer solution of $NaCN$ and HCN is 9.3 and K_a of HCN is 5×10^{-10}

(A) 0 (B) 9.3 (C) 1 (D) 10

3. $20\,ml$ solution contains $0.1\,M, NH_4Cl$ and $0.01\,M\,NH_4OH$. By adding which one its pH will not change ?

(A) Addition of $1\,ml$ water

(B) Addition of $5\,ml$, $0.1\,M\,NH_4Cl$

(C) Addition of $5\,ml$, $0.1\,M\,NH_4OH$

(D) Addition of $10\,ml$, $0.1\,M\,NH_4Cl$

4. Which of the following is a buffer solution ?

(A) A solution of KCl and KOH

(B) A solution of CH_3COOK

(C) A solution of K_2SO_4 and NH_4OH

(D) A solution of $PhCOOK$ and $PhCOOH$

5. If $20\,ml$ of $0.1\,M\,NaOH$ is added to $30\,ml$ of $0.2\,M\,CH_3COOH (pK_a = 4.74)$. Find pH of resulting solution :-

(A) 4.44 (B) 5.48 (C) 4.74 (D) 6.44

6. A certain buffer solution contains equal concentration of X^- and HX. The K_a for HX is 10^{-8}. The pH of the buffer is

(A) 3 (B) 8 (C) 11 (D) 14

7. The required amount of KBr (molar mass $= 119$) in gram to start the precipitation of $AgBr$ in $500\,mL$ solution of $0.05\,M\,AgNO_3$ will be (K_{SP} of $AgBr = 5 \times 10^{-13}$)

(A) $1.19 \times 10^{-9}\,g$ (B) $4 \times 10^{-11}\,g$ (C) $5.95 \times 10^{-10}\,g$ (D) $2.97 \times 10^{-10}\,g$

8. If K_{sp} of CaF_2 at 25^oC is 1.7×10^{-10}, the combination amongst the following which gives a precipitate of CaF_2 is

(A) $1 \times 10^{-2}\,M\ Ca^{2+}$ and $1 \times 10^{-5}\,M\ F^-$

(B) $1 \times 10^{-4}\,M\ Ca^{2+}$ and $1 \times 10^{-4}\,M\ F^-$

(C) $1 \times 10^{-3}\,M\ Ca^{2+}$ and $1 \times 10^{-5}\,M\ F^-$

(D) $1 \times 10^{-2}\,M\ Ca^{2+}$ and $1 \times 10^{-3}\,M\ F^-$

9. The following equilibrium exists in an aqueous solution of hydrogen sulphide : $H_2S \rightleftharpoons H^+ + HS^-$

If dilute HCl is added to an aqueous solution of H_2S without any change in temperature

(A) The equilibrium constant will change

(B) The concentration of HS^- will increase

(C) The concentration of undissociated H_2S will decrease

(D) The concentration of HS^- will decrease

10. The solubility product of silver sulphide is 3.2×10^{-11}. Its solubility at the experimental temperature is

(A) 2×10^{-4} moles per litre

(B) 6×10^{-6} moles per litre

(C) 1.2×10^{-5} moles per litre

(D) 8×10^{-4} moles per litre

11. $0.1\,M$, $60\,ml\ NH_4Cl\ (K_h = 10^{-9})$ is titrated against $0.2\,M\ NaOH$, pH at $\frac{1}{3}$ equivalence point is

(A) 9.301 (B) 8.699 (C) 7.301 (D) 6.301

12. A compound whose aqueous solution will have the highest pH

(A) $NaCl$ (B) Na_2CO_3 (C) NH_4Cl (D) $NaHCO_3$

13. If two acids of equimolar concentration are taken then which option is correct

(A) $\alpha_1^2 K_{a_1} = \alpha_2^2 K_{a_2}$ (B) $\alpha_1 K_{a_1}^2 = \alpha_2 K_{a_2}^2$ (C) $\alpha_1^2 K_{a_2} = \alpha_2^2 K_{a_1}$ (D) $\alpha_1 K_{a_2}^2 = \alpha_2 K_{a_1}^2$

14. Select the pK_a value of the strongest acid from the following

(A) 1 (B) 3 (C) 2 (D) 4.5

15. Calculate the pOH of a solution at 25^oC that contains $1 \times 10^{-10}\, M$ of hydronium ions, i.e. H_3O^+

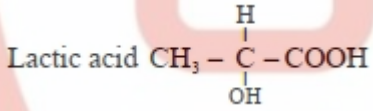
(A) 1 (B) 7 (C) 4 (D) 9

16. The conjugate base of sulphuric acid is

(A) Sodium hydroxide (B) Hydrochloric acid

(C) Bisulphate ion (D) Barium hydroxide

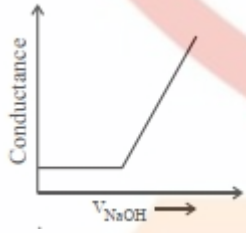
17. If the pKa of lactic acid is 5,then the pH of $0.005\ M$ calcium lactate solution at $25^\circ\, C$ is $\ldots\ldots \times 10^{-1}$ (Nearest integer)



(A) 85 (B) 84 (C) 83 (D) 82

18. Choose the correct representation of conductometric titration of benzoic acid vs sodium hydroxide.

(A)



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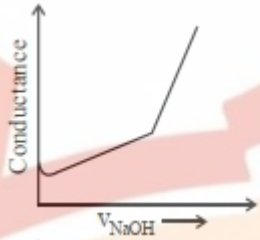

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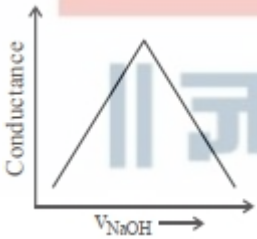

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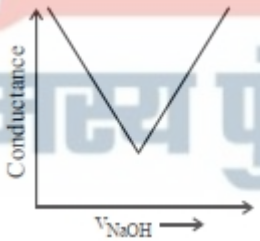
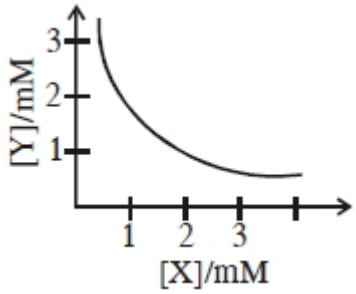


19. The stoichiometry and solubility product of a salt with the solubility curve given below is, respectively



(A) $X_2Y, 2 \times 10^{-9}\ M^3$ (B) $XY_2, 1 \times 10^{-9}\ M^3$ (C) $XY_2, 4 \times 10^{-9}\ M^3$ (D) $XY, 2 \times 10^{-6}\ M^3$

20. Addition of sodium hydroxide solution to a weak acid (HA) results in a buffer of $pH\,6$. lf ionisation constant of HA is 10^{-5} , the ratio of salt to acid concentration in the buffer solution will be

(A) $4:5$ (B) $1:10$ (C) $10:1$ (D) $5:4$

21. What is the pH of a $10^{-4}\,M\,OH^-$ solution at $330\,K$, if K_w at $330\,K$ is $10^{-13.6}$?

(A) 4 (B) 9 (C) 10 (D) 9.6

22. An acidified solution of $0.05 M Zn^{2+}$ is saturated with $0.1 M H_2S$. What is the minimum molar concentration (M) of H^+required to prevent the precipitation of ZnS ?

Use $K_{sp}(ZnS) = 1.25 \times 10^{-22}$ and

Overall dissociation constant of $H_2S, K_{NET} = K_1K_2 = 1 \times 10^{-21}$

(A) 0.10 (B) 0.15 (C) 0.20 (D) 0.25

23. When $100\,mL$ of $1.0\,M\,HCl$ was mixed with $100\,mL$ of $1.0\,M\,NaOH$ in an insulated beaker at constant pressure, a temperature increase of $5.7^\circ C$ was measured for the beaker and its contents (Expt. 1). Because the enthalpy of neutralization of a strong acid with a strong base is a constant $\left(-57.0\,kJ\,mol^{-1}\right)$, this experiment could be used to measure the calorimeter constant. In a second experiment (Expt. 2), $100\,mL$ of $2.0\,M$ acetic acid $\left(K_a = 2.0 \times 10^{-5}\right)$ was mixed with $100\,mL$ of $1.0 M\,NaOH$ (under identical conditions to Expt. 1) where a temperature rise of $5.6^\circ C$ was measured.

(Consider heat capacity of all solutions as $4.2 Jg^{-1}K^{-1}$ and density of all solutions as $1.0\ gmL^{-1}$)

1. Enthalpy of dissociation (in $kJmol^{-1}$) of acetic acid obtained from the Expt. 2 is

$(A)\ 1.0\ (B)\ 10.0\ (C)\ 24.5\ (D)\ 51.4$

2. The pH of the solution after Expt. 2 is

$(A)\ 2.8\ (B)\ 4.7\ (C)\ 5.0\ (D)\ 7.0$

Give the answer question 1 and 2.

(A) (A,B) (B) (B,D) (C) (B,C) (D) (A,C)

24. A solution which is $10^{-3}M$ each in Mn^{2+}, Fe^{2+}, Zn^{2+} and Hg^{2+} is treated with $10^{-16}M$ sulphide ion. If K_{sp} of MnS, FeS, ZnS and HgS are 10^{-15}, 10^{-23}, 10^{-20} and 10^{-54} respectively, which one will precipitate first

(A) FeS (B) MgS (C) HgS (D) ZnS

25. The compound insoluble in acetic acid is

(A) Calcium oxide

(B) Calcium carbonate

(C) Calcium oxalate

(D) Calcium hydroxide

26. By adding a strong acid to the buffer solution, the pH of the buffer solution

(A) Remains constant (B) Increases

(C) Decreases (D) Becomes zero

27. Which of the following is more soluble in ammonia

(A) $AgCl$ (B) $AgBr$ (C) Agl (D) None of these

28. Which of the following is not a Bronsted acid

(A) $CH_3NH_4^+$ (B) CH_3COO^- (C) H_2O (D) HSO_4^-

29. According to Bronsted law, water is a/an

(A) Base

(B) Acid

(C) Acid and base both

(D) Salt

30. With reference to protonic acids, which of the following statements is correct

(A) PH_3 is more basic than NH_3

(B) PH_3 is less basic than NH_3

(C) PH_3 is equally basic as NH_3

(D) PH_3 is amphoteric while NH_3 is basic

31. In the equilibrium $HClO_4 + H_2O \rightleftharpoons H_2O^+ + ClO_4^-$

(A) $HClO_4$ is the conjugate acid of H_2O

(B) H_2O is the conjugate acid of H_3O^+

(C) H_3O^+ is the conjugate base of H_2O

(D) ClO_4^- is the conjugate base of $HClO_4$

32. An example for a strong electrolyte is

(A) Urea (B) Ammonium hydroxide

(C) Sugar (D) Sodium acetate

33. An electrolyte

(A) Gives complex ions in solution

(B) Dissolves in water to give ions

(C) Is ionized in the solid state

(D) Generates ions on passing electric current

34. The pH of $0.05\,M$ solution of dibasic acid is

(A) 1 (B) 2 (C) 3 (D) 4

35. The solubility of Sb_2S_3 in water is 1.0×10^{-5} $mol/litre$ at $298\,K$. What will be its solubility product

(A) 108×10^{-25} (B) 1.0×10^{-25} (C) 144×10^{-25} (D) 126×10^{-24}

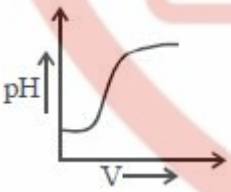
36. The solubility product of 1×10^{-5} is 1.44×10^{-4} at $100\,^oC$. The solubility of silver chloride in boiling water may be

(A) $0.72 \times 10^{-4}\,M$ (B) $1.20 \times 10^{-2}\,M$ (C) $80\,^oC$ (D) $0.5\,M\ HCOOH$,

37. What will be hydrogen ion concentration in moles $litre^{-1}$ of a solution, whose pH is 4.58

(A) 2.63×10^{-5} (B) 3.0×10^{-5} (C) 4.68 (D) None of these

38. During titration of acetic acid with aq. $NaOH$ solution, the neutralisation graph has a vertical line. This line indicates



(A) alkaline nature of equivalence

(B) acidic nature of equivalence

(C) neutral nature of equivalence

(D) depends on experimental proceeding

39. Given

(i) $HCN\,(aq) + H_2O\,(l) \rightleftharpoons H_3O^+\,(aq) + CN^-\,(aq)$
$K_a = 6.2 \times 10^{-10}$

(ii) $CN^-\,(aq) + H_2O\,(l) \rightleftharpoons HCN\,(aq) + OH^-\,(aq)$
$K_b = 1.6 \times 10^{-5}$

These equilibria show the following order of the relative base strength

(A) $OH^- > H_2O > CN^-$ (B) $OH^- > CN^- > H_2O$

(C) $H_2O > CN^- > OH^-$ (D) $CN^- > H_2O > OH^-$

40. Identify each species in the following equilibrium according to the code : . $SA=$ stronger acid ; $SB=$ stronger base ; $WA=$ weaker acid ; $WB=$ weaker base. The pK_a of $(CH_3)_2NH$ is 36 ; the pK_a of CH_3OH is 15.2

$$\underset{1}{CH_3OH} + \underset{2}{(CH_3)_2}NH \rightleftarrows CH_3 - O^- CH_3 - \underset{\underset{H}{|}}{\overset{+}{N}}H - CH_3$$

(A) $1=WA, 2=WB$ (B) $1=WB, 2=WA$ (C) $1=SA, 2=SB$ (D) $1=SB, 2=SA$

*** SECTION - B** **[40]**

41. pH of $0.1\,M$ solution of a weak acid (HA) is 4.50. It is neutralised with $NaOH$ solution to decrease the acid content to half pH of the resulting solution

42. pH of $NaCl$ solution is

43. At $25\,^oC$, the dissociation constant of CH_3COOH and NH_4OH in aqueous solution are almost the same. The pH of a solution $0.01\,N\,CH_3COOH$ is 4.0 at $25\,^oC$. The pH of $0.01\,N\,NH_4OH$ solution at the same temperature would be

44. The pH of the solution: $5\,mL$ of $\frac{M}{5}$,$HCl + 10\,mL$ of $\frac{M}{10}$ $NaOH$ is

45. If the pH of a solution is 4.0 at $25\,^oC$, its pOH would be $(K_w = 10^{-14})$

46. $20\,mL$ of $0.1\,M\,NaOH$ is added to $50\,mL$ of $0.1\,M$ acetic acid solution. The pH of the resulting solution is $\ldots\ldots \times 10^{-2}$ (Nearest integer)
$\text{Given : pKa } (CH_3COOH) = 4.76$
$\log 2 = 0.30$
$\log 3 = 0.48$

47. What is the percent ionization (α) of a $0.01\,M\,HA$ solution ? .....% $(K_a = 10^{-6})$

48. The pH of the solution containing $10\ ml$ of $0.1\,N\ NaOH$ and $10\ ml$ of $0.05\,N$ H_2SO_4 would be

49. The degree of hydrolysis of a salt of weak acid and weak base in its $0.1\,M$ solution is found to be 50%. If the molarity of the solution is $0.2\,M$, the percentage hydrolysis of the salt should be.....%

50. At $25\,^oC$, the solubility product of $Mg(OH)_2$ is 1.0×10^{-11}. At which pH, will Mg^{2+} ions start precipitating in the form of $Mg(OH)_2$ from a solution of $0.001\,M\,Mg^{2+}$ ions?