CHEMISTRY

BOOKS - P BAHADUR CHEMISTRY (HINGLISH)

IONIC EQUILIBRIUM

Exercise1

1. (a) Suggest a solvent in which aniline acts as strong base.

(b) Write equation for the auto-ionisation of (i) $HCOOH$, (ii) NH_3 .

(c) $[A]\left(H_2O\right)_6]^{3+}$ is acid or base and write its conjugate paranter and reaction.

(d) Write the order of acidic nature of HCI, $HCOOH$ and CH_3COOH in (i) H_2O, (ii) liq. NH_3.

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2. The ionization constant of propionic acid is 1.32×10^{-5}. Calculate the degree of ionization of the acid in its 0.05M solution and also its pH. What will be its degree of ionization in the solution of $0.01NHCI$?

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3. The ionisation constant of dimethylamine is 5.4×10^{-4}. Calculate its degree of ionization in its $0.02M$ solution. What percentage of dimethylamine is ionized if the solution is also $0.1M$ in $NaOH$?

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4. Calculate the degree of ionisation of $0.05M$ acetic acid if its pK_a value is 4.74. How is the degree of dissociation affected when its

solution also contains

a. $0.01M$, b. $0.1M$ in HCl?

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5. Write equilibrium constant expressions for the following reactions. Show how they are related ?

(a) $Na_2CO_3 + HCI \Leftrightarrow NaHCO_3 + NaCI$

(b) $2Na^+ + CO_3^{2-} + H^+ + CI^- \Leftrightarrow 2Na^+ + HCO_3^- + CI^-$

(c) $CO_3^{2-} + H^+ \Leftrightarrow HCO_3^-$

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6. The first ionization constant of H_2S is 9.1×10^{-8}. Calculate the concentration of HS^{Θ} ion in its $0.1M$ solution. How will this concentration be affected if the solution is $0.1M$ in HCl also? If the

second dissociation constant if H_2S is 1.2×10^{-13}, calculate the concentration of S^{2-} under both conditions.

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7. Calculate $\left[OH^-\right]$ in $0.20M$ solution of NH_3, if K_b for NH_3 is 1.8×10^{-5}.

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8. 0.00135 mole of NH_3 dissociates in 1.0 litre solution of $0.10M$. Calculate the dissociation constant of NH_3.

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9. What concentration of dichloroacetic acid gives $\left[H^+\right] = 8.5 \times 10^{-3}M$?

$\left(\text{Given}: K_a \text{of acid} = 5.0 \times 10^{-2}\right)$.

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10. Calculate K for the reaction, $A^- + H_3^+ O \Leftrightarrow HA + H_2O$

if K_a value for the acid HA is 1.0×10^{-6}.

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11. Consider a solution of monoprotic weak acid having dissociation constant K_a. What is the minimum concentration C in terms of K_a, such that the concentration of the undissociated acid that the concentration of the undissociated acid can be equated to C within a $10\,\%$ limit of error ? Assume that activity coefficient correction are negligible.

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12. Ionic product of water at $310K$ is 2.7×10^{-14}. What is the pH of netural water at this temperature?

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13. The K_w for $2H_2O \Leftrightarrow H_3O^+ \_ OH^-$ changes from 10^{-14} at $25\,^\circ C$ to 9.62×10^{-14} at $60\,^\circ C$. What is pH of water at $60\,^\circ C$? What happens to its neutrality ?

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14. The ionization constant of $HF, HCOOH$ and HCN at $298K$ are $6.8 \times 10^{-4}, 1.8 \times 10^{-4}$ and 4.8×10^{-9} respectively. Calculate the ionization constant of the corresponding conjugate base.

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15. The pH of $0.1M$ solution of cyanic acid $(HCNO)$ is 2.34. Calculate the ionization constant of the acid and its degree of ionisation in the solution.

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16. The pH of $0.005M$ codenine $\left(C_{18}H_{21}NO_3\right)$ solution is 9.95. Calculate its ionisation constant and pK_b.

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17. Detremine degree of dissociation of $0.05MNH_3$ at $25^\circ C$ in a solution of $pH = 1$.

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18. K_1 and K_2 for dissociation of H_2A are 4×10^{-3} and 1×10^{-5}. Calculate concentration of A^{2-} ion in $0.1MH_2A$ solution. Also report $\left[H^+\right]$ and pH.

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19. Calculate pH of:

(a) $10^{-3}NHNO_3$, (b) $10^{-3}MH_2SO_4$,

(c) $10^{-3}NH_2SO_4$, (d) $0.01NHCI$,

(e) $10^{-8}NHCI$, (f) 10^2MHCI.

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20. Calculate pH for:

(a) $0.001NaOH$, (b) $0.01NCa(OH)_2$,

(c) $0.01MCa(OH)_2$, (d) $10^{-8}MNaOH$,

(e) $10^2 MNaOH$, (f) $0.0008 MMg(OH)_2$

Assume complete ionisation of each.

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21. The pH of $0.05M$ aqueous solution of diethy1 amine is 12.0 . Caluclate K_b.

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22. Calculate the pH of the following solutions:

a. $2g$ of $TlOH$ dissolved in water to give 2 litre of solution.

b. $0.3g$ of $Ca(OH)_2$ dissolved in water to give $500mL$ of solution.

c. $0.3g$ of $NaOH$ dissolved in water to give $200mL$ of solution.

d. $1mL$ of $13.6MHCl$ is duluted with water to give 1 litre of solution.

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23. Calculate the hydrogen ion concentration in the following biological fluids whose pH are given below:

a. Human muscle-fluid, 6.83

b. Human stomach fluid, 1.2

c. Human blood, 7.38

d. Human saliva, 6.4.

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24. If $0.561g$ of (KOH) is dissolved in water to give. $200mL$ of solution at $298K$. Calculate the concentration of potassium, hydrogen and hydroxyl ions. What is its pH?

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25. The solubility of $Sr(OH)_2$ at $298K$ is $19.23gL^{-1}$ of solution. Calculate the concentrations cf strontium and hydroxyl ions and the pH of the solution.

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26. How many moles of $Ca(OH)_2$ must be dissolved to produce 250 mL of an aqueous solution of pH 10.65, assuming completer dissociation ?

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27. The solubility of $Mg(OH)_2$ in pure water is 9.57×10^{-3}g $litre^{-1}$. Calculate the pH of its saturated solution. (Assume $100\,\%$ ionisation)

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28. A trpical aspirin tablet constains 324 mg of aspirin (acetyl salicylic acid $C_9H_8O_4$) a monoprotic acid having $K_a = 3.0 \times 10^{-4}$. What is the degree of dissociation of salt and pH of the solution, if two aspirin tables are dissolved to prepare 300 mL solution in water ?

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29. The $\left[H^+\right]$ is $2.1 \times 10^{-3}M$ in a $0.072M$ solution of benzoic acid. Calculate K_a for benzoic acid.

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30. Calculate the pH of a solution made by mixing 50 mL of $0.01Mba(OH)_2$ with 50 mL water. (Assume complete ionisation)

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31. A solution of HCI has p$H = 5$. If $1mL$ of it is diluted to $1L$ what will be the pH of resulting solution?

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32. A solution of $0.01M$ concentration of NH_4OH is $2.6\,\%$ dissociated. Calculate $\left[H^+\right]$, $\left[OH^-\right]$, $\left[NH_4^+\right]$, $\left[NH_4OH\right]$ and pH of solution.

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33. Calculate the pH of the mixture formed by the addition of $5, 9, 9.5, 9.9, 9.95, 10, 10.05$ and 10.1 mL of $0.5MKOH$ solution to 100 mL of $0.05HBr$ solution. What will be the most suitable indicator for this titration ?

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34. Calculate the pH of the resultant mixture:

a. $10mL$ of $0.2MCa(OH)_2$ + $25mL$ of $0.1MHCl$

b. $10mL$ of $0.01MH_2SO_4$ + $10mL$ of $0.01MCa(OH)_2$.

c. $10mL$ of $0.1MH_2SO_4$ + $10mL$ of $0.1MKOH$.

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35. A $60.0mL$ solution of $0.10MNaHCO_{2(aq.)}$ is mixed with 4.0 mL of $0.070MHCI_{aq.}$. Calculate the pH and the molarity of HCOOH in the mixed solution. pK_a for $HCOOH = 3.75$

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36. Calculate the pH of resulting solution, when 50 mL of $0.20MHCI$ is mixed with 50 mL of $0.20MCH_3COOH$.

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37. Calculate the enthalpy of deprotonation of HCOOH. (Given that: K_a value for HCOOH at $20\,^\circ C$ and $30\,^\circ C$ are 1.765×10^{-4} and 1.768×10^{-4} at $30\,^\circ C$)

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38. Calculate the pH of a given mixtures.

(a) $\left(4gCH_3COOH + 6gCH_3COONa\right)$ in 100 mL of mixture, (K_a for $CH_3COOH = 1.8 \times 10^{-5}$)

(b) 5 mL of $0.1MBOH + 250$ mL of $0.1MBCI$, (K_a for

$MOH = 1.8 \times 10^{-5}$)

(c) (0.25 mole of CH_3COOH + 0.35 mole of $CH_{3COOH = 3.6 \times 10^{-4}}$

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39. How many mole of NH_4CI must be added to one liltre of $1.0MNH_4OH$ to have a buffer of $pH = 9$? $\left(K_{NH_4OH} = 1.8 \times 10^{-5}\right)$

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40. The ionization constant of formic acid is 1.8×10^{-4}. Around what pH will its mixture with sodium formed give buffer solution of higher capacity. Calculate the ratio of sodium formate and formic acid in a buffer of $pH4.25$.

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41. How much of $0.3M$ ammonium hydroxide should be mixed with 30 mL of $0.2M$ solution of ammonium chloride to give buffer solutions of $pH 8.65$ and 10 ? (Give: $pK_b of NH_4OH = 4.75$)

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42. How much volume of $0.1MHac$ should be added to $50mL$ of $0.2MNaAc$ solution to have a $pH 4.91$?

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43. The ionization constant of phenol is 1.0×10^{-10}. What is the concentration of phenolate ion in $0.05M$ solution of phenol? What will be its degree of ionization if the solution is also $0.01M$ in sodium phenolate?

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44. The ionization constant of chloroacetic acid is 1.35×10^{-3}. What will be the pH of $0.1M$ acid and its $0.1M$ sodium salt solution?

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45. What should be the concentration of NaA, if its 50 mL solution of $0.10MNH_3$ and $0.10MNH_4CI$ without changing the pH by more than 1.0 unit ? Assume no change in volume. $\left(K_af \text{ or } HA = 1.0 \times 10^{-5}\right)$

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46. How many moles of NaOH can be added to $1.0L$ solution of $0.10MNH_3$ and $0.10MN_4CI$ without changing in volume. $\left(K_bf \text{ or } NH_3 = 1.8 \times 10^{-5}\right)$

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47. Is it possible for a weak acid, say acetic acid $\left(K_a = 1.8 \times 10^{-5}\right)$ to have a pH = 7 by adding any other chemical and if so how much amount of it should be added ?

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48. In an excess of $NH_{3(aq.)}$, Cu^{2+} ion form a deep blue complex ion $\left[Cu\left(NH_3\right)_4\right]^{2+}$ having formation constant $K_f = 5.6 \times 10^{11}$. Calculate the concentration of Cu^{2+} in a solution prepared by adding 5.0×10^{-3} mole of $CuSO_4$ to 0.50 litre of $0.40 MNH_3$.

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49. Determine the solubilities of silver chromate, barium chromate, ferric hydroxide, lead chloride and mercurous iodide at 298 K form

their solubility product constants given below. Determine also the molarities of individual ions.

$K_{SP}\left(Ag_2CrO_4\right) = 1.1 \times 10^{-12}$,

$K_{SP}\left(BaCrO_4\right) = 1.2 \times 10^{-10}$,

$K_{SP}\left[Fe(OH)_3\right] = 1.0 \times 10^{-38}$,

$K_{SP}\left(PbCI_2\right) = 1.6 \times 10^{-5}$,

$K_{SP}\left(Hg_2I_2\right) = 4.5 \times 10^{-29}$.

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50. K_{SP} of $BaSO_4$ is 1.5×10^{-9} . Calculate is solubility in: (a) Pure water, , (b) $0.10MBaCI_2$.

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51. What is the maximum concentration of equimolar solutions of ferrous sulphate and sodium sulphide so that when mixed in equal

volumes, there is no precipitation of iron sulphide? (For iron sulphide, $K_{sp} = 6.3 \times 10^{-18}$).

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52. Equal volumes of 0.002 M solution of sodium iodate and cupric chlorate are mixed togather. Will it lead to precipitation of copper iodate?

$\left(\text{for cupric iodate} K = 7.4 \times 10^{-8}\right)$.

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53. What is the minimum volume of water required to dissolve $1.0g$ of calcium sulphate at $298K$?

(For calcium sulphate , $K_{sp} is 9.1 \times 10^{-6}$).

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54. 50 mL of a sample of clear saturated solution of Ag_2CrO_4 requies 20 mL of a $XMPb\left(NO_3\right)_2$ for its titration. What is the value of X ? $\left(K_{SP}f \text{ or } Ag_2CrO_4 = 1.6 \times 10^{-12}\right)$

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55. $M(OH)_x$ has $K_{SP} = 4 \times 10^{-12}$ and its solubility in water is 10^{-4} M. Calculate the value of x.

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56. The fixing of photographic film involves film involves dissolving unexposed AgBr in a thiosulphate solultion.

$$AgBr_{(s)} + 2S_2O_{3(a.)}^{2-} \Leftrightarrow \left[Ag\left(S_2O_3\right)_2\right]_{(aq.)}^{3-} + Br_{(aq.)}^{-}$$

Calculate the equilibrium constant K for the dissociation reaction of

$\left[Ag\left(S_2O_3\right)_2\right]^{3-}$.

$K_{SP}ofAgBr = 5.4 \times 10^{-13}$ and K_f or $\left[Ag\left(S_2O_3\right)_2\right]^{3-} = 4.7 \times 10^{-13}$)

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57. Determine whether Cd^{2+} can be separed form Zn^{2+} by bubbling H_2S through a $0.3M$ HCI solution that contgains $0.005MCd^{2+}$ and $0.005MZn^{2+}$. (K_{SP} for CdS and ZnS are 8×10^{-7} and 3×10^{-2}) respectively)

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58. Calculate pH of a saturated solution of $Mg(OH)_2$. ($K_{SP}f$ or $Mg(OH)_2 = 8.9 \times 10^{-12}$)

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59. A saturated solution of a salt MX exhibits an osmotic pressure of $74.4mm$ Hg at $25^{\circ}C$. Assuming 100% ionisation of MX, calculate K_{SP} of MX.

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60. The ionization constant of ammonium hydroxide is 1.77×10^{-5} at 298 K. Calculate the hydrolysis ammonium chloride and pH of $0.04M$ ammonium chloride solution.

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61. Calculate the pH of $0.05M$ sodium acetate solution, if the pK_a of acetic acid is 4.74.

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62. The pK_a of CH_3COOH and pK_a of nH_4OH is 4.76 and 4.75, respectively. Calculate the hydrolysis constant of ammonium acetate $\left(CH_3COONH_4\right)$ at $298K$ and also the drgree of hydrolysis and pH of its (a) $0.01M$ and (b) $0.04M$ solutions.

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63. The ionization constant of nitrous acid is 4.5×10^{-4}. Calculate the pH of $0.04M$ sodium nitrite solution and also its degree of hydrolysis.

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64. A $0.02M$ solution of pyridinium hydrochloride has $pH = 3.44$. Calculate the ionization constant of pyridine.

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65. Phenol $\left(C_6H_5OH, K_a = 1.3 \times 10^{-10}\right)$ is a weak acid used in mouth washes and pyridine $\left(C_5H_5N, K_b = 1.8 \times 10^{-9}\right)$ is a weak base used as a solvent. Calculate the value of K_n for neutralization of phenol by pyridine. Does the neutralization reaction proceed very far towards completion ?

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Exercise2

1. 0.16g of N_2H_4 are dissolved in water and the total volume made upto 500 mL. Calculate the percentage of N_2H_4 that has reacted with water in this solution. $\left(K_bf \text{ or } N_2H_4 = 4.0 \times 10^{-6} < \right)$

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2. An aqueous solution contains $10\,\%$ ammonia by mass and has a density of $0.09 gcm^{-3}$. Calculate hydroxyl and hydrogen ion concentration in this solution. $\left(K_a f \text{ or } NH_4^+ = 5.0 \times 10^{-10} M\right)$

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3. Nicotinic acid $\left(K_a = 1.4 \times 10^{-5}\right)$ is repersented by the formula HNiC. Calculate its per cent dissociation in a solution, which contains 0.10 mole of nicotinic acid per 2.0 litre of solution.

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4. The ionization constant of $\overset{\oplus}{NH_4}$ ion in water is 5.6×10^{-10} at $25^\circ C$. The rate constant the reaction of $\overset{\oplus}{NH_4}$ and $\overset{\ominus}{OH}$ ion to form NH_3 and H_2O at $25^\circ C$ is $3.4 \times 10^{10} Lmol^{-1} s^{-1}$. Calculate the rate constant for proton transfer form water to NH_3.

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5. K_1 and K_2 for dissociation of H_2S are 1.0×10^{-7} and 1×10^{-14}. Calculate $\left[H^+\right]$, $\left[HS^-\right]$, $\left[S^{2-}\right]$ and $\left[H_2S\right]$ in $0.1MH_2S$ solution. Also report $\left[H^+\right]$ and pH and K_a for $H_2S \Leftrightarrow 2H^+ + S^{2-}$.\

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6. Calculate pH for:

(a) $0.01NCa(OH)_2$

(b) $0.01MCa(OH)_2$

(c) $0.0008MMg(OH)_2$

Assume complete ionisation of each.

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7. Will the pH of water be same at $4^{\circ} C$ and $25^{\circ} C$? Explain.

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8. The pH of $0.05M$ aqueous solution of diethy1 amine is 12.0 . Caluclate K_b.

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9. The average concentration of SO_2 in the atmosphere over a city on a cetrain day is 10 ppm, when the average temperature is 298 K. Given that the solubility of SO_2 in water at 298 K is 1.3653 mol $litre^{-1}$ and the pK_a of H_2SO_3 is 1.92, estimate the pH of rain on that day.

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10. What is the pH of 1 M solution of acetic acid ? To what volume one litre of this solution be diluted so that pH of the resulting solution will be twice of the original value ? $\left(K_a = 1.8 \times 10^{-5}\right)$

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11. What will be the resultant pH, when 200 mL of an aqueous solution of $HCI(pH = 2.0)$ is mixed with 300 mL of an aqueous solution of $NaOH(pH = 12.0)$?

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12. A solution contains $0.1MH_2S$ and $0.3MHCI$. Calculate the conc.of S^{2-} and HS^- ions in solution. Given K_{a_1} and K_{a_2} for H_2S are 10^{-7} and 1.3×10^{-7} respectively.

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13. Saccharin $\left(K_a = 2 \times 10^{-12}\right)$ is a weak acid represented by formula HSaC. A 4×10^{-4} mole amount of saccharin is dissolved in 200 cm^3 water of pH 3. Assuming no change in volume. Calculate the soncentration of SaC^- ions in the resulting solution at equilibrium.

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14. $500mL$ of $0.2M$ aqueous solution of acetic acid is mixed with $500mL$ of $0.2HCI$ at $25^\circ C$.

a. Calculate the degree of dissociation of acetic acid in the resulting solution and pH of the folution.

b. If $6g$ of $NaOH$ is added to the above solution determine the final pH. $\left[K_a \text{ of } CH_3COOH = 2 \times 10^{-5}\right.$.

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15. 0.15 mole of pyridinium chloride has been added into $500 cm^3$ of $0.2M$ pyridine solution. Calculate pH and hydroxyl ion contration in the resulting solution, assuming no change in volume. $\left(K_b \text{for pyridine} = 1.5 \times 10^{-9} M\right)$

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16. Calculate the change in pH of 1 litre buffer solution containing 0.1 mole each of NH_3 and NH_4CI upon addition of:

(i) 0.02 mole of dissolved gasous HCI.

(ii) 0.02 mole of dissolved of NaOH.

Assume no change in volume. $K_{NH_3} = 1.8 \times 10^{-5}$

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17. What volume (inml) of $0.10M$ sodium formate solution should be added to $50ml$ of $0.05M$ formic acid to produce a buffer solution of $pH4$. $\left[pK_a\right.$ for formic acid is 3.7]

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18. How many mole of HCI will be required to prepare one litre of buffer solution (containing $NaCN + HCI$) of $pH8.5$ using 0.01g formula weight of NaCN ? $K_{HCN} = 4.1 \times 10^{-10}\Big)$

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19. The $\left[H^+\right]$ in $0.2M$ solution of formic acid is 6.4×10^{-3} mol $litre^{-1}$. To this solution formate is added so as to adjusrt the conc.of sodium formate to one mol per litre. What will be pH of this

solution ? $\left(K_a f \text{ or } HCOOH = 2.4 \times 10^{-4}\right)$ and degree of dissociation of $HCOONa = 0.75$)

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20. A 40 mL solution of weak base BOH is tritrated with $0.1NHCI$ solution. The pH of solution is found to be 10.04 and 9.14 after the addition of $5.0mL$ and 20.0 mL of acid respecctively. Find out K_b for weak base.

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21. Calculate the amount of NH_3 and NH_4CI required to prepare a buffer solution of pH 9.0 when total concentration of buffering reagents is $0.6molL^{-1}$. $\left(pK_b f \text{ or } NH_3 = 4.7, \log 2 = 0.30\right)$

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22. A cetrain buffer solution contains equal concentration of X^- and HX. Calculate pH of buffer. $\left(K_b f \text{ or } X^- is 10^{-10}\right)$

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23. Two buffer, (X) and (Y) of pH 4.0 and 6.0 respectively are prepared from acid HA and the salt NaA. Both the buffers are 0.50 M in HA. What would be the pH of the solution obtained by mixing equal volumes of the two buffers ? $\left(K_{HA} = 1.0 \times 10^{-5}\right)$

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24. A certain weak acid has a dissociation constant 1.0×10^{-4}. The equilibrium constant for its reaction with a strong base is :

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25. The pH of blood stream is maintained by a proper balance of H_2CO_3 and $NaHCO_3$ concentrations. What volume of 5 M $NaHCO_3$ solution, shnould be mixed with 10 mL sample of blood, which is 2 M in H_2CO_3 in order to maintain a pH of $7.4\left(K_af \text{ or } H_2CO_3 \text{in blood} = 7.8 \times 10^{-7}\right)$

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26. The solubility product of $AgCl$ in water is 1.5×10^{-10}. Calculate its solubility in $0.01MNaCI$.

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27. The solubility product of SrF_2 in water is 8×10^{-10}. Calculate its solubility in $0.1M$ NaF aqueous solution.

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28. What $\left(H_3O^+\right)$ must be maintained in a saturated H_2S solution to precipitate Pb^{2+}, but not Zn^{2+} from a solution in which each ion is present at a concetration of $0.01M$? $\left(K_{SP}\text{for } H_2S = 1.1 \times 10^{-22}, K_{SP}\text{for } ZnS = 1.0 \times 10^{-21}\right)$

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29. The solubility of $Pb(OH)_2$ in water is 6.7×10^{-6}M. Calculate the solubility of $Pb(OH)_2$ in a buffer solution of $pH = 8$.

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30. A sample of AgCI was treated with $5.00mL$ of $1.5M$ Na_2CO_3 solubility to give Ag_2CO_3. The remaining solution contained

$0.0026 gofCI^-$ per litre. Calculate the solubility product of AgCI. $\left(K_{SP}f \text{ or } Ag_2CO_3 = 8.2 \times 10^{-12}\right)$

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31. A solution contains a mixture of $Ag^+(0.10M)$ and $Hg_2^{2+}(0.10M)$ which are to be separated by selective precipitation. Calculate the miximum concentreation of iodide ion at which one of them gets precipitated almost completely. What % of that metal ion is precipitated ? $\left(K_{SP}ofAgI = 8.5 \times 10^{-17} \text{ and } K_{SP} \text{ of } Hg_2I_2 = 2.5 \times 10^{-26}\right)$

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32. 0.01 mole of $AgNO_3$ is added to 1 litre of a solution which is $0.1M$ in Na_2CrO_4 and $0.005M$ in $NaIO_3$. Calculate the mole of precipitate formed at equilibrium and the concentrations of Ag^+, IO_3^- and

CrO_4^{2-}. $\left(K_{sP}\right.$ values of Ag_2CrO_4 and $AgIO_3$ are 10^{-8} and 10^{-13} erspectively)

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33. The $K_{SP}ofCa(OH)_2is4.42 \times 10^{-5}at25^\circ C$. A 500 mL of saturated solution of $Ca(OH)_2$ is mixed with equal volume of $0.4MNaOH$. How much $Ca(OH)_2$ in mg is preciptated ?

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34. A sample of hard water contasins 0.005 mole of $CaCI_2$ per liter. What is the minimum concentration of Na_2SO_4 which must be added for removing Ca^{2+} ions from this water sample ? $\left(K_{SP}f \text{ or } CaSO_4 = 2.4 \times 10^{-5}at25^\circ C\right)$

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35. Determine the concentration of NH_3 solution whose one litre can dissolve 0.10 mole AgCI. K_{SP} of AgCI and K_f of $Ag\left(NH_3\right)_2^+$ are $1.0 \times 10^{-10} M^2$ and $1.6 \times 10^7 M^{-2}$ respectively.

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36. An aqueous solution of a metal bromide $MBr_2(0.05M)$ is saturated with H_2S. What is the minimum pH at which MS will precipitate ? K_{SP} for $MS = 6.0 \times 10^{-21}$. Concentration of saturqated $H_2S = 0.1M, K_1 = 10^{-7}$ and $K_2 = 1.3 \times 10^{-13}$ for H_2S .

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37. Calculate pH at which $Mg(OH)_2$ begins to precipitate from a solution containing $0.10 MMg^{2+}$ ions. $\left(K_{SP} of Mg(OH)_2 = 1 \times 10^{-11}\right)$

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38. Freshly precipiteated Al and Mg hydroxides are stirred vigorously in a buffer solution containing $0.25M$ of NH_4CI and $0.05M$ of NH_4OH. Calculate $\left[Al^{3+}\right]$ and $\left[Mg^{2+}\right]$ in solution. K_b for $NH_4OH = 1.8 \times 10^{-5}$ K_{SP} of $Al(OH)_3 = 6 \times 10^{-32}$ and K_{SP} of $Mg(OH)_2 = 8.9 \times 10^{-12}$.

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39. A solution has $0.05MMg^{2+}$ and $0.05MNH_3$. Calculate the concentration of NH_4CI required to prevent the formation of $Mg(Oh)_2$ in solution. K_{SP} for $Mg(OH)_2 = 9.0 \times 10^{-12}$ and ionisation constant of NH_3 is 1.8×10^{-5}.

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40. The solubility of $Ag_2C_2O_4$ at $25^\circ C$ is 1.20×10^{-11}. A solution of $K_2C_2O_4$ containing $0.15mol$ in $500mL$ water is mixed with excess of Ag_2CO_3 till the following equilibrium is established:

$$Ag_2CO_3 + K_2C_2O_4 \Leftrightarrow Ag_2C_2O_4 + K_2CO_3$$

At equilibrium, the solution constains $0.03mol$ of K_2CO_3. Assuming that the degree of dissociation of $K_2C_2O_4$ and K_2CO_3 to be equal, calculate the solubility product of Ag_2CO_3. [Take 100% ionisation of $K_2C_2O_4$ and K_2CO_3]

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41. Given: $Ag\left(NH_3\right)_2^+ \Leftrightarrow Ag^+ 2NH_3, K_C = 6.2 \times 10^{-8}$ and K_{SP} of $AgCI = 1.8 \times 10^{-10}$ at 298 K. Calculate the concentration of the complex in $1.0M$ aqueous ammonia.

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42. Determine the number of mole of AgI which may be dissolved in 1.0 litre of MCN^- solution. K_{SP} for AgI and K_C for $Ag(CN)_2^-$ are $1.2 \times 10^{-17} M^2$ and $7.1 \times 10^{19} M^{-2}$ respectively.

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43. What is the pH of a $0.50M$ aqueous NaCN solution ? $\left(pK_b ofCN^- = 4.70\right)$

Watch Video Solution

44. Calculate the percentage hydrolysis in $0.003M$ aqueous solution of NaOCN. $\left(K_a f \text{ or } HOCN = 3.33 \times 10^{-4}\right)$

Watch Video Solution

45. K_a for butyric acid is 2.0×10^{-5}. Calculate pH and hydroxyl ion concentration in $0.2M$ aqueous solution of sodium butyate.

Watch Video Solution

46. K_a for ascorbic acid $(Hasc) is 5 \times 10^{-5}$. Calculate the hydrogen in an aqueous solution in which the concentration of Asc^- ions in $0.02M$.

Watch Video Solution

47. Calcualte the pH at the equivalence point when a solution of $0.1M$ acetic is titrated with a solution of $0.1M NaOH$. $\left(K_a f \text{ or } acid = 1.9 \times 10^{-5}\right)$.

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48. Calcium lactate is a salt of weak acid and represented as $Ca(LaC)_2$. A saturated solution of $Ca(LaC)_2$ contains 0.13 mole of salt in 0.50 litre solution. The pOH of this is 5.60. Assuming complete dissociation os salt, calculate K_a of lactic acid.

Watch Video Solution

49. What will be the pH of an aqueous solution of 1.0 M ammonium formate?

Given :$pK_a = 3.8$ and $pK_b = 4.8$

Watch Video Solution

50. An aqueous solution of aniline of concentration 0.24 M is prepared. What concentration of sodium hydroxide is needed in this

solution so that anilinium ion concentration remains at $1 \times 10^{-8} M$?

$\left(K_a f \text{ or } C_6H_5NH_3^+ = 2.4 \times 10^{-5} M\right)$

Watch Video Solution

51. An acid type indicator, H In differs in colour from its conjugate base $\left(In^-\right)$. The human eye is sensitive to colour differences only when the ratio $\left[In^-\right]/[HIn]$ is greater than 10 or smaller than 0.1. What should to observe a complete colour change ?

$\left(K_a = 1.0 \times 10^{-5}\right)$

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52. $0.1 MNaOH$ is titrated with $0.1 MHA$ till the end point. K_a of HA is 5.6×10^{-6} and degree of hydrolysis is less compared to 1. Calculate pH of the resulting solution at the end point ?

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Exercise3A

1. The two equilibrium $AB \Leftrightarrow A^+ + B^+$ and $AB + B^- \Leftrightarrow AB_2^-$ are simultaneously maintained in a solution with equilibrium, constant K_1 and K_2 respectively, The ratio of A^+ to AB_2^- in the solution is:

A. directly prooprtional to theconcentration of B^-

B. inversely proportional to the concentration of B^-

C. directly proportional to the square of the concentration of B^-

D. inversely proprtional to the square of the concentration of B^-

Answer: D

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2. $Ca_3\left(PO_4\right)_2$ is insoluble in in water. On adding a few drops of HCI to solid $Ca_3\left(PO_4\right)_2$ in contant with water, the solid dissolves. The reason is:

A. the solvent becomes more polar on adding HCI

B. $Ca_3\left(PO_4\right)_2$ combines with HCI to form soluble $CaCI_2$

C. $Ca\left(H_2PO_4\right)_2$ is formed, which dissolves

D. H_3PO_4, a weak acid is formed and the solubility product of $Ca_3\left(PO_4\right)_2$ decrease

Answer: B

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3. Which of the following is not correct ?

A. $\left[H^+\right] = \left[OH^-\right] = \sqrt{K_w}$ for a neutral solution at temperatures

B. $\left[H^+\right] = \left[OH^-\right] = 10^{-7}$ for a neutral solution at all temperatures

C. $\left[H^+\right] < \sqrt{K_w}$ and $\left[OH^-\right] > \sqrt{K_w}$ for an acidic solution

D. $\left[H^+\right] > \sqrt{K_w}$ and $\left[OH^-\right] < \sqrt{K_w}$ for an alkaline solution

Answer: B

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4. A solution is a mixture of 0.05 M NaCl and 0.05 M AgI. The concentration of iodide in the solution when AgCl just starts precipitating is equal to:

$\left(K_{sp}AgCl = 1 \times 10^{-10}M^2, K_{sp}AgI = 4 \times 10^{-16}M^2\right)$

A. $4 \times 10^{-6}M$

B. $2 \times 10^{-8}M$

C. $2 \times 10^{-7}M$

D. $8 \times 10^{-15} M$

Answer: C

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5. Which of the following correctly explains the nature of boric acid in aqueous medium :

A. $H_3BO_3 \xrightarrow{H_2O} H_3^+O + H_2BO_3^-$

B. $H_3BO_3 \xrightarrow{2H_2O} 2H_3^+O + HBO_3^{2-}$

C. $H_3BO_2 \xrightarrow{3H_2O} 3H_3^+O + BO_2^{3-}$

D. $H_3BO_3 \xrightarrow{H_2O} B(OH)_4^- + H^+$

Answer: D

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6. For a weak electrolyte (HA) dissociation $\lim c \to 0$, then:

A. electrolyte is assumed to be $100\ \%$ ionised

B. its dissociation constant remains same

C. the interionic attraction diminishes to zero

D. all of these

Answer: D

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7. According to Bronsted Lowry concept, the correct order of strength of bases follows the order:

A. $CH_3COO^- > OH^- > CI^-$

B. $OH^- > CH_3COO^- > CI^-$

C. $CH_3COO^- > CI^- > OH^-$

D. $OH^- > CI^- > CH_3COO^-$

Answer: B

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8. Which one is more acidic in aqueous solution ?

A. $NiCI_2$

B. $FeCI_3$

C. $AICI_3$

D. $BeCI_2$

Answer: C

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9. an acid with molecular formula $C_7H_6O_3$ forms three types of sodium salt i.e., $C_7H_5O_3Na, C_7H_4O_3Na_2$ and $C_7H_3O_3Na_3$. The basicity of the acid:

A. one

B. two

C. three

D. four

Answer: C

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10. The correct order of acid strength is

A. $CI_2O_7 > SO_2 > P_4O_{10}$

B. $CO_2 > N_2O_5 > SO_3$

C. $Na_2O > MgO > AI_2O_3$

D. $K_2O > CaO > MgO$

Answer: A

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11. Which compound will not liberate CO_2 from aqueous $NaHCO_3$?

A. $RNH_3^+ CI^-$

B. $\left(CH_3\right)_4 N^+ OH^-$

C. $RCOOH$

D. $\left(CH_3\right)_4 N^+ CI^-$

Answer: B

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12. A buffer solution contains 1 mole of $\left(NH_4\right)_2SO_4$ and 1 mole of $NH_4OH\left(K_b = 10^{-5}\right)$. The pH of solution will be:

A. 5

B. 9

C. 5.3010

D. 8.6990

Answer: D

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13. The increasing order of basic strength of $CI^-, CO_3^{2-}, CH_3COO^-, OH^-$ and F^- is:

A. $CI^- < F^- < CH_3COO^- < CO_3^{2-} < OH^-$

B. $CI^- < F^- < CO_3^{2-} < CH_3COO^- < OH^-$

C. $CH_3COO^- < CI^- < F^- < CO_3^{2-} < OH^-$

D. none of these

Answer: A

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14. In water, the acid $HCIO_4, HCI, H_2SO_4$ and HNO_3 exhibit the same strength as they are completely ionised in water (a base). This is called ..... of the solvent water.

A. strength

B. capacity

C. buffer effect

D. levelling effect

Answer: D

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15. Which one is hard base ?

A. Ag^+

B. Cr^{3+}

C. I_2

D. F^-

Answer: D

Watch Video Solution

16. Arrange NH_4^+, H_2O, H_3O^+, HF and OH^- in increasing order of acidic nature:

A. $OH^- < H_2O < NH_4^+ < HF < H_3O^+$

B. $H_3O^+ < HF < H_2O < NH_4^+ < OH^-$

C. $NH_4^+ < HF < H_3O^+ < H_2O < OH^-$

D. $H_3O^+ < NH_4^+ < HF < OH^- < H_2O$

Answer: A

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17. The strongest Bronsted base in the following anion is

A. ClO^-

B. ClO_2^-

C. ClO_3^-

D. ClO_4^-

Answer: A

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18. In the following reaction $HC_2O_4^-(aq) + PO_4^{3-}(aq) \Leftrightarrow HPO_4^{-2}(aq) + C_2O_4^{2-}(aq)$, which are the two Bronsted bases?

A. $HC_2O_4^-$ and PO_4^{3-}

B. HPO_4^{2-} and $C_2O_4^{2-}$

C. PO_4^{3-} and $C_2O_4^{2-}$

D. $HC_2O_4^-$ and HPO_4^{2-}

Answer: C

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19. The conjugate base of $\left[Al\left(H_2O\right)_3(OH)_3\right]$ is:

A. $\left[AI\left(H_2O\right)_3(OH)_2\right]^+$

B. $\left[AI\left(H_2O\right)_3(OH)_2O\right]^-$

C. $\left[AI\left(H_2O\right)_3(OH)_3\right]^-$

D. $\left[AI\left(H_2O\right)_2(OH)_4\right]^-$

Answer: D

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20. 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

Answer: A

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21. Basic lead carbonate is:

A. PbS

B. $PbCO_3$

C. $PbSO_4$

D. $2PbCO_3.Pb(OH)_2$

Answer: D

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22. The anhydride of acid H_3PO_4 and HPO_3 are:

A. P_2O_5 and P_2O_3

B. P_2O_5

C. P_2O_3

D. none of these

Answer: B

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23. The decreasing trend of acidic nature of trihalides of boron is:

A. $BF_3 > BCI_3 > BBr_3 > BI_3$

B. $BI_3 > BBr_3 > BCI_3 > BF_3$

C. $BBr_3 > BCI_3 > BF_3 > BI_3$

D. $BCI_3 > BI_3 > BF_3 > BBr_3$

Answer: D

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24. The mixed salt among the following is:

A. $CHOHCOOK \mid CHOHCOONa$

B. $NaKSO_4$

C. $CaOCI_2$

D. all of these

Answer: D

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25. pH of water is 7.0 at $25^\circ C$. If water is heated to $70^\circ C$, the:

A. pH will decrease and solution becomes acidic

B. pH will increase

C. pH will remain constant as 7

D. pH will decrease but solution will be neutral

Answer: D

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26. When HCI gas is passed through a saturated solution of common salt, pure NaCI is Precipitated because:

A. the impurities dissolve in HCI

B. HCI is highly soluble in H_2O

C. the product of $\left[Na^+\right]$ and $\left[CI^-\right]$ exceeds the solubiluity product of NaCI

D. the solulbility product of NaCI is lowest by the chloride in form aqueous HCI

Answer: C

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27. The inerferring radicals interfere in the test of usal inorganic analysis after II group analysis due to:

A. their solubility in acid medium

B. their solubilty in alkaline medium

C. their insoluble nature in alkaline madium

D. none of these

Answer: C

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28. Given, $HF + H_2O \overset{K_a}{\rightarrow} H_3O^+ + F^-$

$F^- + H_2O \overset{K_b}{\rightarrow} HF + OH^-$

Which relation is correct ?

A. $K_b = K_w$

B. $K_b = 1/K_w$

C. $K_a \times K_b = K_w$

D. $K_a/K_b = K_w$

Answer: C

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29. Isoelectric point is defined as the pH at which:

A. an amino acid becomes acidic

B. an amino acid becomes basic

C. zwitterio has positive charge

D. zwitterion has zero charge

Answer: D

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30. Which may be added to one litre of water to act a buffer?

A. One mole of $HC_2H_3O_2$ and one mole of HCI

B. One mole of NH_4OH and one mole of NaOH

C. One mole of NH_4CI and mole of HCI

D. One mole of $HC_2H_3O_2$ and 0.5 mole of NaOH

Answer: D

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31. The pH of an acidic buffer mixture is:

A. > 7

B. < 7

C. $= 7$

D. depends upon K_a of acid

Answer: D

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32. The principal buffer present in human blood is

A. HCI and CI^-

B. H_2CO_3 and HCO_3^-

C. H_2CO_3 and CI^-

D. HCI and HCO_3^-

Answer: B

Watch Video Solution

33. The ratio of dissociation constant of two weak acids HA and HB is 4. At what molar concentration ratio, the two acids will have same pH ?

A. 2

B. 0.5

C. 4

D. 0.25

Answer: D

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34. The pK_a of acteylsalicylic acid (aspirin) is 3.5. The pH of gastric juice in human stomach is about $2-3$ and the pH in the small intestine is about 8. Aspirin will be:

A. unionised in the small intestine and in the stomach

B. completely ionised in the small intestine and in the stomach

C. ionised in the stomach and almost uniunised in the small intestine

D. ionised in the small intestine and almost unionised in the stomach

Answer: D

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35. The reverse procees of neutralisation is:

A. hydrolysis

B. decomposition

C. dehydration

D. synthesis

Answer: A

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36. When different types of salts have nearly same solubility product constant K_{SP} but less than one the most soluble salt is that:

A. which produces maximum number of ions

B. which produces minimum number of ions

C. which produces more charge on ion

D. none of these

Answer: A

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37. The solubility of AgI in NaI is lowest than that in pure water, because:

A. AgI forms complex with NaI

B. effect of common ion increases ionic concentration of I^-

C. solubiltiy product of AgI is less than that of NaI

D. the temperature of the solution decreases

Answer: B

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38. Which of the following is most soluble in water ?

A. $MnS\left(K_{SP} = 8 \times 10^{-37}\right)$

B. $ZnS\left(K_{SP} = 7 \times 10^{-16}\right)$

C. $Bi_2S_3\left(K_{SP} = 1 \times 10^{-70}\right)$

D. $Ag_2S\left(K_{SP} = 6 \times 10^{-51}\right)$

Answer: B

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39. The decreasing order of strength of the bases, $OH^-, NH_2^-, H - C \equiv C^-$ and $CH_3 - CH_2^-$:

A. $CH_3 - CH_2^- > NH_2^- > H - C \equiv C^- > OH^-$

B. $H - C \equiv C^- > CH_3 - CH_2^- > NH_2^- > OH^-$

C. $OH^- > NH_2^- > H - C \equiv C^- > CH_3 - CH_2^-$

D. $NH_2^- > H - C \equiv C^- > OH^- > CH_3 - CH_2^-$

Answer: A

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40. The best explanation for the solubility of MnS in dil. HCI is that:

A. solubility product of $MnCI_2$ is less than that of MnS

B. concentration of Mn^{2+} is lowered by the formation of complex ions with chloride ions

C. concentration of sulphide ions is lowered by oxidation to free sulphur

D. concentration of sulphide ions is lowered by formation of the weak acid H_2S

Answer: D

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41. pH for the solution of salt undergoing anionic hydrolysis (say CH_3COONa) is given by:

A. $pH = 1/2\left[pK_w + pK_a + \log C\right]$

B. $pH = 1/2\left[pK_w + pK_a - \log C\right]$

C. $pH = 1/2\left[pK_w + pK_b - \log C\right]$

D. none of these

Answer: A

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42. Solubility of BaF_2 in a solution of $Ba\left(NO_3\right)_2$, will be represented by the concentration term:

A. $\left[Ba^{2+}\right]$

B. $\left[F^{-}\right]$

C. $1/2\left[F^{-}\right]$

D. $2\left[NO_3^{-}\right]$

Answer: C

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43. Which statement is correct ?

A. All Bronested bases are also Lewis bases

B. All Bronsted acids are not Lewis acids

C. All cations are acids and anions are bases

D. all of these

Answer: D

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44. Fear or exitement, generally cause one to breathe rapidaly and it results in the decrease of concentration of CO_2 in blood. In what way it will change pH of blood ?

A. pH will increse

B. pH will decrease

C. No change

D. pH will be 7

Answer: C

Watch Video Solution

45. For neutralisation of $HF + NaOH \rightarrow NaF + H_2O$, heat released during neutralisation is:

A. $> 13.7kcal$

B. $< 13.7kcal$

C. $= 13.7kcal$

D. none of these

Answer: A

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46. The pH of $0.1M$ solution of the following salts increases in the order

A. $NaCI < NH_4CI < NaCN < HCI$

B. $HCI < NH_4CI < NaCI < NaCN$

C. $NaCN < NH_4CI < NaCI < HCI$

D. $HCI < NaCI < NaCN < NH_4CI$

Answer: B

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47. The pH of the solution obtained by mixing 10 mL of $10^{-1}NHCI$ and 10 mL of $10^{-1}NNaOH$ is:

A. 8

B. 2

C. 7

D. none of these

Answer: C

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48. A cetrain buffer solution contains equal concentration of X^- and HX. Calculate pH of buffer. $\left(K_b f \text{ or } X^- is 10^{-10}\right)$

A. 4

B. 7

C. 10

D. 14

Answer: A

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49. $10^{-6} MHCl$ is diluted to 100 times. Its pH is:

A. 6.0

B. 8.0

C. 6.95

D. 9.5

Answer: C

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50. 50 mL of 2N acetic acid mixed with 10 mL of 1N sodium acetate solution will have an approximate pH of $\left(K_a = 10^{-5}\right)$:

A. 4

B. 5

C. 6

D. 7

Answer: A

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51. One litre of water contains 10^{-7} mole H^{+} ions. Degree of ionisation of water is:

A. $1.8 \times 10^{-7}\%$

B. $1.8 \times 10^{-9}\%$

C. $3.6 \times 10^{-7}\%$

D. $3.6 \times 10^{-9}\%$

Answer: A

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52. Which solutionwill have pH closer to 1.0 ?

A. 100 mL of $(M/10)HCI$ + 100 of $(M/10)NaOH$

B. $55mL$ of $(M/10)HCI$ + $45mL$ of $(M/10)NaOH$

C. $10mL$ of $(M/10)HCI + 90mL$ of $(M/10)NaOH$

D. $75mL$ of $(M/5)HCI + 25mL$ of $(M/5)NaOH$

Answer: D

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53. A certain weak acid has a dissociation constant 1.0×10^{-4}. The equilibrium constant for its reaction with a strong base is :

A. 1.0×10^{-4}

B. 1.0×10^{-10}

C. 1×10^{10}

D. 1.0×10^{-14}

Answer: C

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54. At $30^\circ C$ the solubility of $Ag_2CO_3\left(K_{SP} = 8 \times 10^{-12}\right)$ would be gretest in one litre of:

A. $0.05MNa_2CO_3$

B. $0.05MAgNO_3$

C. pure water

D. $0.05MK_2CO_3$

Answer: C

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55. The solubility products of $AI(OH)_3$ and $Zn(OH)_2$ are 8.5×10^{-23} and 1.8×10^{-14} respectively. If NH_4OH is added to a solution containing AI^{3+} and Zn^{2+} ions, then substance precipitated first is:

A. $AI(OH)_3$

B. $Zn(OH)_2$

C. both together

D. none at all

Answer: A

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56. The solubilituy of $PbCI_2$ in water is $0.01M25^\circ C$. Its maximum concentration in $0.1MNaCI$ will be:

A. $2 \times 10^{-3}M$

B. $1 \times 10^{-4}M$

C. $1.6 \times 10^{-2}M$

D. $4 \times 10^{-4}M$

Answer: D

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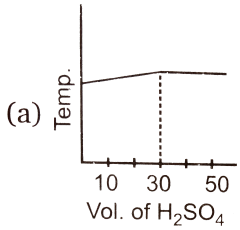
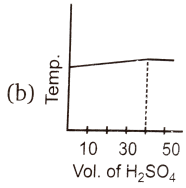
57. In an experiment to determine the enthalpy of neutralisation of sodium hydroxide with sulphuric acid, $50cm^3$ of $0.4M$ sodium hydroxide were titreated thermometrically with $0.25M$ sulphuric acid. Which of the following plots gives the correct representation ?

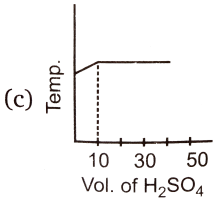
A.



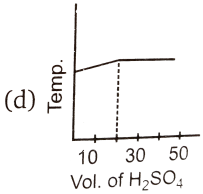
B.



C.



D.



Answer: B

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58. Calculate K for the reaction, $A^- + H_3^+O \Leftrightarrow HA + H_2O$

if K_a value for the acid HA is 1.0×10^{-6}.

A. 1×10^{-6}

B. 1×10^{12}

C. 1×10^{-12}

D. 1×10^6

Answer: D

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

A. $100\ \%$

B. $50\ \%$

C. $25\ \%$

D. none of these

Answer: B

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60. The volume of the water needed to dissolve $1g$ of $BaSO_4\left(K_{SP} = 1.1 \times 10^{-10}\right)$ at $25\,^\circ C$ is:

A. 820 litre

B. 410 litre

C. 205 litre

D. none of these

Answer: B

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61. Let the solubilities of $AgCI$ in H_2O, and in $0.01MCaCI_2$, $0.01MNaCI$, and $0.05MAgNO_3$ be S_1, S_2, S_3, S_4, respectively. What is the correct relationship between these quantites.

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. $S_4 > S_2 > S_3 > S_1$

Answer: C

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62. From separate solutions of sodium salts, NaW, NaX, NaY and NaZ have $pH 7.0$, 9.0, 10.0 and 11.0 respectively. When each solution was $0.1M$, the strongest acid is:

A. HW

B. HX

C. HY

D. HZ

Answer: A

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63. A cetrain ion B^- has an Arrhenius constant for basic character (eq. constnat 2.8×10^{-7}). The equilibrium constant for Lowry-Bronsed basic character is:

A. 2.8×10^{-7}

B. 3.57×10^{-8}

C. 3.57×10^{8}

D. 2.8×10^{7}

Answer: D

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64. Acetic acid and propionic acid have K_a values 1.75×10^{-5} and 1.3×10^{-5} respectively at a cetrain temperature. An equimolar solution of a mixture, of the two acids is partially neutralised by NaOH. How is the ratio of the contents of acetate and propionate ions related to the K_a values and the molarity ?

A. $\left(\frac{\alpha}{1-\alpha}\right) = \frac{1.75}{1.3} \times \left(\frac{\beta}{1-\beta}\right)$, where α and β are ionised fractions of these acids

B. The ratio is unrelated to the K_a values

C. The ratio is unrelated to the molarity

D. The ratio is unrelated to the pH of the solution

Answer: A

Watch Video Solution

65. The ionization constant of $\overset{\oplus}{NH_4}$ ion in water is 5.6×10^{-10} at $25^\circ C$. The rate constant the reaction of $\overset{\oplus}{NH_4}$ and $\overset{\ominus}{OH}$ ion to form NH_3 and H_2O at $25^\circ C$ is $3.4 \times 10^{10} Lmol^{-1}s^{-1}$. Calculate the rate constant for proton transfer form water to NH_3.

A. $6.07 \times 10^{5} s^{-1}$

B. $6.07 \times 10^{-10} s^{-1}$

C. $6.07 \times 10^{-5} s^{-1}$

D. $6.07 \times 10^{10} s^{-1}$

Answer: A

Watch Video Solution

66. A solution of Na_2CO_3 is added drop by drop to litre of a solution containing 10^{-4} mole of Ba^{2+} and 10^{-5} mole of Ag, if K_{SP} for $BaCO_3$

is 8.1×10^{-9} and K_{SP} for $Ag_2CO_3 is 6.9 \times 10^{-12}$, then which is not true ?

A. No precipitate of $BaCO_3$ will appear untill $\left[CO_3^{2-}\right]$ reaches 8.1×10^{-5} mole per litre

B. A precipitate of Ag_2CO_3 will appear when $\left[CO_3^{2-}\right]$ reaches 6.9×10^{-5} mol $litre^{-1}$

C. No precipitate of Ag_2CO_3 will appear until $\left[CO_3^{2-}\right]$ reaches 6.9×10^{-2} mol per litre

D. $BaCO_3$ will be precipitated first

Answer: B

Watch Video Solution

67. To separate and identify the ionis in a mixutre that may contain Pb^{2+}, Cu^{2+} and Mg^{2+} use the reagents H_2S, HCI and NaOH. They

should be added in the order:

A. $HCI, H_2S, NaOH$

B. $H_2S, HCI, NaOH$

C. $HCI, NaOH, H_2S$

D. $NaOH, H_2S, HCI$

Answer: A

Watch Video Solution

68. pH of a mixture containing $0.10MX^-$ and $0.20MHX$ is: $\left[pK_b\left(X^-\right) = 4\right]$

A. $4 + \log 20$

B. $4 - \log 2$

C. $10 + \log 2$

D. 10 - log2

Answer: D

Watch Video Solution

69. To prepare a buffer of pH 8.26, amount of $(NH_4)_2SO_4$ to be added into 500mL of $0.01MNH_4OH$ solution $\left[pK_a\left(NH_4^+\right) = 9.26\right]$ is:

A. $0.05mole$

B. $0.025mole$

C. $0.10mole$

D. $0.005mole$

Answer: B

Watch Video Solution

70. Percentange ionisation of weak acid can be calculated using the formula:

A. $100\sqrt{\frac{K_a}{C}}$

B. $\frac{100}{1+10^{\left(pK_a-pH\right)}}$

C. both (a) and (b)

D. none of these

Answer: C

Watch Video Solution

71. pH of a mixture of $1M$ benzoic acid $(pK_a = 4.20)$ and $1MC_6H_5COONa$ is 4.5. In $300ml$ buffer, benzoic acid is $[\log 2 = 0.3]$

A. 200 mL

B. 150 mL

C. 100 mL

D. 50 mL

Answer: C

Watch Video Solution

72. If the equilibrium constant for the reaction of weak acid HA with strong base is 10^9, then pH of $0.1M$ Na A is:

A. 5

B. 9

C. 7

D. 8

Answer: B

Watch Video Solution

73. For, $H_3PO_4 + H_2O \Leftrightarrow H_3O^+ + H_2PO_4^-, K_{a_1}$

$H_2PO_4 + H_2O \Leftrightarrow H_3O^+ + HPO_4^{2-}, K_{a_2}$

$HPO_4^{2-} + H_2O \Leftrightarrow H_3O^+ + PO_4^{3-}, K_{a_3}$

The correct order of K_a values is:

A. $K_{a_1} > K_{a_2} < K_{a_3}$

B. $K_{a_1} < K_{a_2} < K_{a_3}$

C. $K_{a_1} > K_{a_2} > K_{a_3}$

D. $K_{a_1} < K_{a_2} > K_{a_3}$

Answer: C

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74. pH of $0.01 MHS^-$ will be:

A. $pH = 7 + \frac{pK_a}{2} + \frac{\log C}{2}$

B. $pH = 7 - \frac{pK_a}{2} + \frac{\log C}{2}$

C. $pH = 7 + \frac{pK_1 + pK_2}{2}$

D. $pH = 7 + \left(\frac{pK_a - pK_b}{2}\right)$

Answer: A

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75. Solution of aniline hydrochloride is X due to hydrolysis of Y.X and Y are:

A. basic, $C_6H_5NH_3^+$

B. acidic, $C_6H_5NH_3^+$

C. basic, CI^-

D. acidic, CI^-

Answer: B

Watch Video Solution

76. Slaked lime, $Ca(OH)_2$ is used extensively in sewage treatment. What is themaximum pH that can be estabilished in $Ca(OH)_2(aq)$?

$Ca(OH)_{2(s)} \Leftrightarrow Ca_{(aq.)} + 2OH^-_{(aq.)}, \left(K_{SP} = 5.5 \times 10^{-6}\right)$

A. 1.66

B. 12.3471

C. 7.0

D. 14.0

Answer: B

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77. $10mL$ of $10^{-6}MHCl$ solution is mixed with $90mLH_2O$. pH will change approximately:

A. by one unit

B. by 0.3 unit

C. by 0.7 unit

D. by 0.1 unit

Answer: C

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78. $M(OH)_X$ has $K_{SP}4 \times 10^{-12}$ and solubility $10^{-4}M$. The value of x is:

A. 1

B. 2

C. 3

D. 4

Answer: B

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79. The solubility products of MA, MB, MC and MD are $1.8 \times 10^{-10}, 4 \times 10^{-3}, 4 \times 10^{-8}$ and 6×10^{-5} respectively. If a $0.01M$ solution of MX is added dropwise to a mixture containing A^-, B^-, C^- and D^- ions, then the one to be precipitated first will be:

A. MA

B. MB

C. MC

D. MD

Answer: A

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80. Which of the following statements is correct for a solution saturated with $AgCl$ and $AgBr$ if their solubilities in moles per litre in separate solutions are x and y respectively?

A. $\left[Ag^{+}\right] = \left[Br^{-}\right] \times \left[CI^{-}\right]$

B. $\left[CI^{-}\right] > \left[Br^{-}\right]$

C. $\left[Br^{-}\right] > y$

D. $\left[Ag^{+}\right] = x + y$

Answer: D

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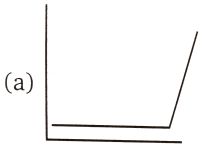
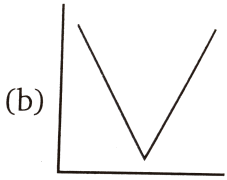
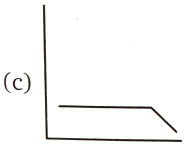
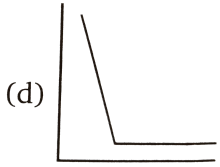
81. If NaOH is titrated HCI, variation of conductance (y-axis) with addition of HCI (x-axis) will be:

A. 

B. 

C. 

D. 

Answer: B

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82. Which of the following will not produce a precipitate with dilute silver nitrate solution ?

A. $CO_{3(aq.)}^{2-}$

B. $CrO_{4(aq.)}^{2-}$

C. $I_{(aq.)}^{-}$

D. $F_{(aq.)}^{-}$

Answer: D

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83. 10 mL of a strong acid solution of $pH = 2.000$ are mixed with 990mL of another strong acid solution of $pH = 4.000$. The pH of the resulting solution will be:

A. 4.002

B. 4.000

C. 4.200

D. 3.72

Answer: D

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84. Sulphanilic acid is a/an:

A. Arrhenius acid

B. Lewis base

C. neither (a) nor (b)

D. either (a) or (b)

Answer: D

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85. The pH of 10 M HCI solution is:

A. less than zero

B. zero

C. 2

D. 1

Answer: B

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86. At infinite dilution, the percentage dissociation of both weak acid and weak base is:

A. 1 %

B. 20 %

C. 50 %

D. 100 %

Answer: D

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87. Strong acids are generally used as standard solution in acid-base titrations because:

A. the pH at equivalence point will be 7

B. they titrate both strong and weak base

C. they form more stable solutions than weak acids

D. the salts of strong do not hydrolyse

Answer: B

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88. An acid solution with $pH = 6 at 25^{\circ} C$ is diluted by 10^2 times. The pH of solution will:

A. decrease by 2

B. increase by 2

C. decrease by 0.95 approximately

D. increase by 0.95 appromately

Answer: D

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89. Approximate pH of $0.01 M$ aqueous H_2S solution, when K_1 and K_2 for H_2S at $25^{\circ} C$ are 1×10^{-7} and 1.3×10^{-13} respectively:

A. 4

B. 5

C. 6

D. 8

Answer: A

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90. A student wants to prepared a saturated solution of Ag^+ ion. He has got only three samples $AgCI\left(K_{SP} = 1.8 \times 10^{-10}\right)$. Which compound he should use to have maximum $\left[Ag^+\right]$?

A. AgCI

B. AgBr

C. Ag_2CrO_4

D. Either of them

Answer: C

View Text Solution

91. Which of the following species is more soluble in water ?

A. $M(OH)_3$, $\left(K_{SP} = 1 \times 10^{-35}\right)$

B. $M(OH)_2$, $\left(K_{SP} = 1 \times 10^{-30}\right)$

C. MOH , $\left(K_{SP} = 1 \times 10^{-28}\right)$

D. MOH , $\left(K_{SP} = 1 \times 10^{-26}\right)$

Answer: A

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92. Number of H^+ ions present in 10 mL of solution of $pH = 3$ are:

A. 10^{13}

B. 6.02×10^{18}

C. 6.02×10^{13}

D. 6.002×10^{10}

Answer: B

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93. For pure water:

A. pH increase and pOH decreases with rise in temperature

B. pH decrease and pOH increases with rise in temperature

C. both pH and pOH increase with rise in temperature

D. both pH and pOH decrease with rise in temperature

Answer: D

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94. If $\Delta H^{\circ}_{\text{ionisation}}$ for HCN and CH_3COOH are 45.2 and $2.1KJmol^{-1}$, which one of the following is correct ?

A. $pK_{a(HCN)} < pK_a\left(CH_3COOH\right)$

B. $pK_{a(HCN)} > pK_a\left(CH_3COOH\right)$

C. $pK_{a(HCN)} = pK_a\left(CH_3COOH\right)$

D. None of these

Answer: B

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95. The self ionisation constant for pure $HCOOH, K = \left[HCOOH_2^{\oplus}\right]\left[HCOO^{\Theta}\right]$ is 10^{-6} at room temperature.

What percentage of $HCOOH$ molecules are converted to $HCOO^{\Theta}$ ions. The density of $HCOOH$ iws $1.22 gcm^{-3}$.

A. 0.002 %

B. 0.004 %

C. 0.006 %

D. 0.008 %

Answer: B

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96. Liquid NH_3 ionises to a slight extent. At $-50^{\circ}C$, its ionic product $K_{NH_3} = \left[\overset{\Theta}{Nh_4}\right]\left[\overset{\Theta}{NH_2}\right]$ is 10^{-30}. How many amide ions, $\overset{\oplus}{NH_2}$ are present per mm^3 of pure liquid NH_3?

A. $6 \times 10^6 ions$

B. $6 \times 10^{5} ions$

C. $6 \times 10^{-5} ions$

D. $6 \times 10^{-6} ions$

Answer: B

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97. The concentration of fluroacetic acid $\left(K_a of acid = 2.6 \times 10^{-3}\right)$, which is required to get $\left[H^{+}\right] = 1.50 \times 10^{-3} M$ is:

A. $0.865 M$

B. $2.37 \times 10^{-3} M$

C. $2.37 \times 10^{-4} M$

D. $2.37 \times 10^{-2} M$

Answer: B

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98. The pH of pure water at $25^\circ C$ and $35^\circ C$ are 7 and 6, respectively. Calculate the heat of formation of water from $H^{\oplus}$ and OH^{Θ}.

A. $84.55 kcal mol^{-}$

B. $-84.55 kcal mol^{-1}$

C. $74.55 kcal mol^{-1}$

D. $-74.55 kcal mol^{-1}$

Answer: B

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99. The pH of a solution obtained by mixing 10 mL of $0.1MHCI$ and 40mL of $0.2MH_2SO_4$ is:

A. 1.4865

B. 0.4865

C. 0.4685

D. 3

Answer: C

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100. The pH of a solution obtained by mixing 100mL of $0.1MHCI$ and $9.9mL$ of $0.1M$ NaOH` is:

A. 3.0409

B. 3.4049

C. 2.0409

D. None of these

Answer: A

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101. What will be the resultant pH, when 200 mL of an aqueous solution of $HCI(pH = 2.0)$ is mixed with 300 mL of an aqueous solution of $NaOH(pH = 12.0)$?

A. 11.0310

B. 11.3010

C. 10.000

D. None of these

Answer: B

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102. K_a for formic acid and acetic acid are 2.1×10^{-4} and 1.1×10^{-5} respectively. The relative strength of acids is:

A. $2:1$

B. $2.3:1$

C. $1:2.1$

D. $4.36:1$

Answer: D

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103. What volume of $0.1M$ sodium formate solution should be added to 50 mL of 0.05 M formic acid to produce a buffer solution of $pH = 4.0$? $\left(pK_a \text{ of fomic acid } = 3.80\right)$

A. $39.0mL$

B. $39.62mL$

C. $40mL$

D. $40.62mL$

Answer: B

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104. How many mole of HCI will be required to prepare one litre of buffer solution (containing $NaCN + HCI$) of $pH 8.5$ using 0.01g formula weight of NaCN ? $K_{HCN} = 4.1 \times 10^{-10}$)

A. 8.85×10^{-3}

B. 8.75×10^{-2}

C. 8.85×10^{-4}

D. 8.85×10^{-2}

Answer: A

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105. The composition of an acidic buffer mixture made up of HA and NaA of total molarity 0.29 having $pH = 4.4$ and $K_a = 1.8 \times 10^{-5}$ in terms of concentration of salt and acid respectively is:

A. $0.09M$ and $0.20M$

B. $0.20M$ and $0.09M$

C. $0.1M$ and $0.19M$

D. $0.19M$ and $0.10M$

Answer: A

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106. A weak acid HA after teratment with 12 mL of $0.1M$ strong base BOH has a pH of 5. At the end point, the volume of same base required is $26.6mL$. K_a of acid is:

A. 1.8×10^{-5}

B. 8.2×10^{-6}

C. 1.8×10^{-6}

D. 8.2×10^{-5}

Answer: B

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107. Zn salt is mixed with $\left(NH_4\right)_2 S$ of molarity $0.021M$. The amount of Zn^{2+} reamins unprecipitated in 12 mL of this solutikon : $\left(K_{SP}f \text{ or } ZnS = 4.51 \times 10^{-24}\right)$

A. $1.677 \times 10^{-22} g$

B. $1.767 \times 10^{-22} g$

C. $2.01 \times 10^{-23} g$

D. none of these

Answer: A

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108. Calculate pH at which $Mg(OH)_2$ begins to precipitate from a solution containing $0.10 M Mg^{2+}$ ions. $\left(K_{SP} of Mg(OH)_2 = 1 \times 10^{-11}\right)$

A. 5

B. 9

C. 4

D. 10

Answer: B

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109. The concentration of hydroxyl ion in a solution left after mixing 100 mL of $0.1MMgCl_2$ and 100 mL of $0.2MNaOH$ is: $\left(K_{SP}ofMg(OH)_2 = 1.2 \times 10^{-11}\right)$

A. 2.8×10^{-3}

B. 2.8×10^{-2}

C. 2.8×10^{-4}

D. 2.8×10^{-5}

Answer: C

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110. 0.1 millimole of $CdSO_4$ are present in 10 mL acid solution of $0.08NHCI$. Now H_2S is passed to precipitate all the Cd^{2+} ions. The pH of the solution after filtering off precipitate, boiling of H_2S and making the solution 100 mL by adding H_2O, is:

A. 2

B. 4

C. 6

D. 8

Answer: A

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111. An acid type indicator, H In differs in colour from its conjugate base $\left(In^-\right)$. The human eye is sensitive to colour differences only

when the ratio $\left[In^{-}\right]/[HIn]$ is greater than 10 or smaller than 0.1. What should to observe a complete colour change ? $\left(K_a = 1.0 \times 10^{-5}\right)$

A. 4

B. 2

C. 6

D. 1

Answer: B

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112. Calculate the percent error in the $\left[H_3O^{\oplus}\right]$ made by neglecting the ionisation of water in $10^{-6}MNaOH$ solution.

A. 1 %

B. 2 %

C. 3 %

D. 4 %

Answer: A

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113. The solubility of AgCI in conc. HCI is..... than in water.

A. more

B. less

C. same

D. either of these

Answer: A

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114. Which pair represents the strongest acid and strongest base that can coexist in water ?

A. NH_4^+ and NH_2^-

B. CIO_4^- and H_2F^-

C. NO_3^- and $CH \equiv C^-$

D. H_3O^+ and OH^-

Answer: D

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115. The correct order of increasing acidic strength is:

A. $\left[Fe\left(H_2O\right)_6\right]^{2+} < \left[Fe\left(H_2O\right)_6\right]^{3+} < \left[AI\left(H_2O\right)_6\right]^{3+}$

B. $\left[Fe\left(H_2O\right)_6\right]^{3+} < \left[Fe\left(H_2O\right)_6\right]^{2+} < \left[AI\left(H_2O\right)_6\right]^{3+}$

C. $\left[AI\left(H_2O\right)_6\right]^{3+} < \left[Fe\left(H_2O\right)_6\right]^{2+} < \left[AI\left(H_2O\right)_6\right]^{3+}$

D. $\left[AI\left(H_2O\right)_6\right]^{3+} < \left[Fe\left(H_2O\right)_6\right]^{3+} < \left[Fe\left(H_2O\right)_6\right]^{2+}$

Answer: A

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116. Which of the following solution can be titrated with HCI as well as NaOH using suitable acid base indicator ?

A. Glycine

B. Pyruvic acid

C. Triethylamine

D. Amine

Answer: A

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117. The K_{sp} of $Mg(OH)_2$ is 1×10^{-12}. $0.01 M Mg^{2+}$ will precipitate at the limiting pH of

A. 3

B. 9

C. 12

D. 8

Answer: B

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118. H_2S is passed through $\left(CH_3COO\right)_2$ Zn and $ZnCI_2$ solutions separately. White ppt. will be noticed in :

A. $\left(CH_3COO\right)_2Zn$ solution

B. $ZnCI_2$ solution

C. both (a) and (b)

D. none of these

Answer: A

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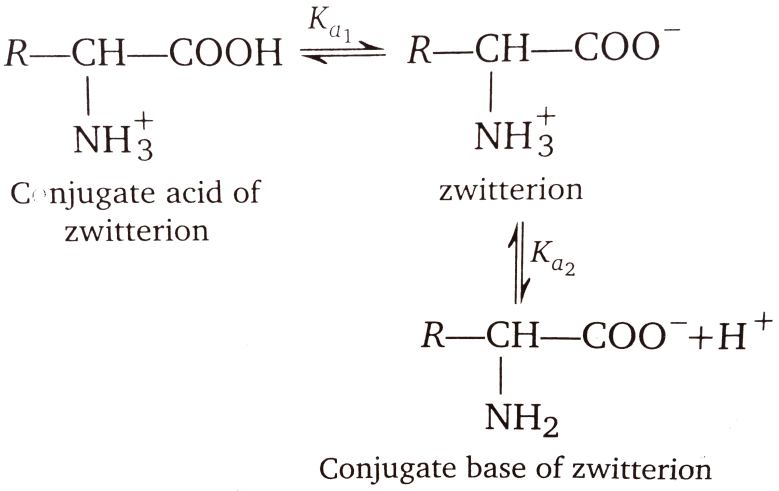
119. Select the incorrect statement about,

$R - CH \mid NH_2 - COOH$

if the following equilibrium exists :



A. $\left[H^+\right] = \sqrt{K_{a_1} \times K_{a_2}}$

B. $pH = \dfrac{pK_{a_1} + pK_{a_2}}{2}$

C. the concentration of $\left[H^+\right]$ for zwitter ion can be calculated for any amphoteric such as HCO_3^-

D. the pH of aqueous solution depends upon concentration of $R - CH(NH_2) - COOH$

Answer: D

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120. At what pH will a $1 \times 10^{-4} M$ solution of an acid base indicator H In will change its colour ?

$\left(K_b \text{for} In^- = 10^{11}\right)$

A. 7.0

B. 3.0

C. 5.5

D. 9.0

Answer: B

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121. The correct relationship between the pH of isolomar solution of $Na_2O\left(pH_1\right), Na_2S\left(pH_2\right), Na_2Se\left(pH_3\right)$ and $Na_2Te\left(pH_4\right)$ is:

A. $pH_1 > pH_2 > pH_3 > pH_4$

B. $pH_1 < pH_2 < pH_3 < pH_4$

C. $pH_1 < pH_2 < pH_3 = pH_4$

D. $pH_1 > pH_2 = pH_3 > pH_4$

Answer: A

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122. At $25^\circ C K_b$ for $BOH = 1.0 \times 10^{-12}.0.01M$ solution of BOH has $\left[OH^-\right]$:

A. $1.0 \times 10^{-6}M$

B. $1.0 \times 10^{-7}M$

C. $1.0 \times 10^{-5}M$

D. $2.0 \times 10^{-6}M$

Answer: B

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123. Silver nitrate solution is gradually added to an aqueous conjuaining $0.01M$ each of chloride, bromide and iodide ions. The correct sequence in whuich the halides will be precipitated is:

A. bromide, chloride, iodide

B. iodide, chloride, bromide

C. iodide, bromide, chloride

D. bromide, iodide, chloride

Answer: C

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124. Three sparingly soluble salts M_2X, MX and MX_3 have the same solubility product. Their solubilities will be in the order

A. $3 > 2 > 1$

B. $3 > 1 > 2$

C. $2 > 3 > 1$

D. $2 > 1 > 3$

Answer: D

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125. In which of the following combinations, is buffer action expected ?

1. $NH_3 + NH_4CI$, 2. $HCI + NaCI$

3. $NH_3 + HCIis2:1$ mole ration

Select the correct answer using the code given below:

A. 1 and 2

B. 1 and 3

C. 2 and 3

D. 1,2 and 3

Answer: B

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126. Which of the following pairs consitutes buffer?

A. $HNO_3 + NH_4NO_3$

B. $HCI + KCI$

C. $HNO_2 + NaNO_2$

D. $NaOH + NaCI$

Answer: A

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127. The hydrogen ion concentration of a $10^{-8}MHCl$ aqueous soultion at $298K\left(K_w = 10^{-14}\right)$ is

A. $9.525 \times 10^{-8}M$

B. $1.0 \times 10^{-8}M$

C. $1.0 \times 10^{-6}M$

D. $1.0525 \times 10^{-7}M$

Answer: D

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128. The hydrolysis constant for the reaction, $H_2PO_4^- + H_2 \Leftrightarrow H_3PO_4 + OH^-$ is 1.4×10^{-12}. The ionisation

constant for $H_3PO_4 + H_2O \Leftrightarrow H_2PO_4^- + H_3O^+$ is:

A. 7.14×10^{-3}

B. 1.4×10^{-12}

C. 1.4×10^{-13}

D. 7.14×10^{-12}

Answer: A

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129. pH of $0.1MNa_2HPO_4$ and $0.2MNaH_2PO_4$ are respectively: $\left(pK_a \text{for} H_3PO_4 \text{ are } 2.12, 7.21 \text{ and } 12.0 \text{ for respective dissociation to } H_2PO_4^-, HPO_4^{2-} \text{ and } PO_4^{3-}\right)$:

A. 4.665, 9.605

B. 9.605, 4.665

C. 4.665, 5.605

D. 5.605, 4.665

Answer: A

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130. C_2H_5ONa acts as ..... In C_2H_5OH.

A. stronge acid

B. weak acid

C. strong base

D. weak base

Answer: C

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131. The degree of dissociation of C_6H_5COOH is influenced by :

A. NH_4OH

B. $NaOH$

C. HCI

D. either of these

Answer: D

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132. The pH of which compound in aqueous solution depends on its concentration in solution ?

A. $RCH \mid NH_2.COOH$

B. $NaHS$

C. CH_3COONH_4

D. $\left(NH_4\right)_2SO_4$

Answer: B

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133. The pH of the mixture when 50 mL each of $0.4M$ and $0.1M$ of HCl and NaCN each are mixed not necessarily in respective order are: $\left(pK_b ofCN^- = 4.6128 \text{ and } \log 1.5 = 0.1761 \text{ and } \log 3 = 0.4771\right)$

A. 9.8239, 0.8643

B. 0.5228, 0.8643

C. 0.8643, 0.5228

D. 0.8239, 9.8643

Answer: D

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134. n moles of $N_2O_{5(s)}$ at pressure P° at 300 K are taken in a closed container of fixed volume V. N_2O_5 undergoes gas-phase decomposition at 400 K to $NO_{2(g)}$ and $O_{2(g)}$. The pressure of mixture $(Pat 400K)$ when $N_2O_{5(g)}$ has degree of decomposition $'\alpha'$ can be given by :

A. $P = P^\circ\left(1 + \frac{3}{2}\alpha\right)$

B. $P = \frac{4}{3}P^\circ\left(1 + \frac{\alpha}{2}\right)$

C. $P = n(1 - \alpha)$

D. $P = n\left(1 + \frac{3}{2}\alpha\right)$

Answer: B

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Exercise3B

1. The pH of which salt is independent of its concentration ?

A. $\left(CH_3COO\right)C_5H_5N$

B. NaH_2PO_4

C. Na_2HPO_4

D. NH_4CN

Answer: A::B::C::D

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2. Which set is not correct for the solubility product $\left(K_{SP}\right)$, solubility $(Sg/litre)$ of sparingly soluble salt $A_3B_2(mol.\,wt = M)$ in watrer ?

A. $K_{SP} = 108S^5$

B. $K_{SP} = \left[\frac{3S}{M}\right]^2 \frac{2S}{M}]^2$

C. $K_{SP} = \left[3a^{2+}\right]^3 \left[2B^{3-}\right]^2$

D. $\left[B^{3-}\right] = \frac{2S}{M}$

Answer: A::C

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3. Select the correct statements:

A. pH of $NaHCO_3$ solution can be given by $pK_{H_2CO_3} + pK_{HCO_3^-}/2$

B. AI^{3+} ion is amphoteric

C. K_{SP} values of metal nitrates are very-very high

D. Liquid SO_2 is aprotic solvent

$Na^+_{(aq.)}$ is conjugate base of $NaOH_{(aq.)}$

Answer: A::B::C::D

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4. H_2O acts as Bronsted acid in the following :

A. $H_2O + H_2O \Leftrightarrow H_3O^+ + OH^-$

B. $NH_3 + H_2O \Leftrightarrow NH_4^+ + OH^-$

C. $CaO + H_2O \Leftrightarrow Ca(OH)_2$

D. $Cu^{2+} + 4H_2O \Leftrightarrow Cu\left(H_2O\right)_4^{2+}$

Answer: A::B

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5. Which of the following is/are correct for the saturated solution of $Ca_3\left(PO_4\right)_2$ salt if its K_{SP} is 2.05×10^{-33} ?

A. Solubility of Ca_3PO_4 is $1.63 \times 10^{-6} M$

B. $\left[PO_4^{3-}\right]_{eq.} = 3.26 \times 10^{-6} M$

C. $\left[Ca^{2+}\right]_{eq.} = 4.89 \times 10^{-6} M$

D. $\left[Ca_3PO_4\right]_{eq.} = 1$

Answer: A::B::C

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6. Which of the following statement is (are) not correct ?

A. Weak electrolytes are $100\ \%$ dissociated at infinite dilution

B. $C_2H_5^-$ is conjugate base of C_2H_6

C. Boric acid although an acid but it does not donate a proton in water

D. Hydration energy is maximum for H^+ ions

Answer: A::B::C::D

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7. The pH of a buffer solution containing equimolar concentrations of solution acetate and acetric acid is equal to:

A. $K_a of CH_3COOH$

B. $pK_a of CH_3COOH$

C. 14

D. $\log\left(\frac{1}{K_a}\right) of CH_3COOH$

Answer: B::D

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8. 10 mL of $N/20 NaOH$ solution is mixed with 20 mL of $N/20 HCI$ solution. The resulting solution will :

A. turn phenolphthalein solution pink

B. turn blue litmus red

C. turn methyl orange red

D. $\left[H^{+}\right] > \left[OH^{-}\right]$

Answer: B::C::D

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9. A buffer solution can be prepared by mixing solution of:

A. sodium chloride and sodium hydroxide

B. ammonium hydroxide and ammonium chloride

C. formic acid and sodium formate

D. boric acid and borax

Answer: B::C::D

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10. Which of the following statement(s) is (are) correct in the contex of buffer mixtures ?

A. It contains a weak acid and its conjugate base

B. It contains a weak base and its conjugate acid

C. The pH of the buffer solution does not change much on the addition of a small amount acid or base

D. The pH of acidic buffer mixture is less than 7

Answer: A::B::C

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11. $CHCl_3$ does not give white ppt. with $AgNO_3$ because it:

A. is a covalent compound

B. does not give CI^- ions in solution

C. is not dissociated in water

D. None of these

Answer: A::B::C

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12. A strong electrolyte in aqueous solution exhibits:

A. almost completely dissociated

B. hydration

C. partial dissociation

D. None of these

Answer: A::B

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13. Which of the following is/are buffer solution(s) ?

A. $10mL0.1MHCI + 20mL0.1MNaCN$

B. $10mL0.1MNaOH + 20mL0.1MNH_4CN$

C. $10mL0.1MNH_4OH + 20mL0.1MCH_3COONH_4$

D. $10mL0.1MCH_3CH_3COOH + 20mL0.1MCH_3COONH_4$

Answer: A::B::C::D

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14. When equal volumes of following solution are mixed, precipitation of $AgCl$?

$\left(K_{sp} = 1.8 \times 10^{-10}\right)$ will occur only with

A. $10^{-4}M\left(Ag^{+}\right)$ and $10^{-4}M\left(Cl^{-}\right)$

B. $10^{-5}M\left(Ag^{+}\right)$ and $10^{-5}M\left(Cl^{-}\right)$

C. $10^{-6}M\left(Ag^{+}\right)$ and $10^{-6}M\left(Cl^{-}\right)$

D. $10^{-10}M\left(Ag^{+}\right)$ and $10^{-10}M\left(Cl^{-}\right)$

Answer: A::B

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15. Which of the following statement is (are) correct ?

A. A buffer solution contains a weak and its conjugate base

B. A buffer solution shows little change in pH on the addition of a small amount of acid or base

C. A buffer solution can be prepared by mixing a solution of ammonium acetate and acetic acid

D. The addition of solid potassium cyanide to water increases the pH of water

Answer: A::B::C::D

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16. Which of the following statement(s) is (are) correct ?

A. The solubility product is the product of concentration of ions of an electrolyte each raised to the power of its coefficient in the balanced chemical equation in a saturated solution

B. The solubility product of an electrolyte is a function of temperature

C. Cations of group III are precipitated as their hydroxides by NH_4OH in the presence of NH_4CI because the solubility products of these hydroxides are low

D. The ionic product with the concentration of an electrolyte

Answer: A::B::C

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17. Which of the following is/are correct order(s) in terms of increaseing pH ?

A. $NaOH > CH_3COONa > NaCl > NH_4Cl$

B. $NH_4Cl > NaCl > CH_3COONa > NaOH$

C. $NaOH > NaHCO_3 > KCl > \left(NH_4\right)_2SO_4$

D. $CH_3COOH > CH_3COONa > NH_4Cl$

Answer: A::C

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18. Which of the following statement(s) si (are) correct ?

A. The pH of $1.0 \times 10^{-8}M$ solution of HCI is 8

B. The conjugate base of $H_2PO_4^-$ is HPO_4^{2-}

C. Autoprotolysis constant of water incerses with temperature

D. When a solution of aweak monoprotic acid is titrated against a strong base, at half-neutralization point $pH = (1/2)pK_a$

Answer: B::C

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19. The phenomenon of interaction of anions and cations furnished by a electrolyte with the H^+ and OH^- ions of water to produce acidity or alkalinity is known as hydrolysis. In hydrolysis :

A. the pH may either increases or decrease

B. all the salts (except those made up with strong anion and cation) undergo hydrolysis

C. the variation of pH depends upon the nature of salt as well on the temperarature

D. none of these

Answer: A::B::C

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20. If a salt of weak acid or base is added to a solution of its acid or base respectively, then:

A. dissociation of acid or base is diminished

B. pH of the solution in case of acid increase and in case of case decreases

C. mixing of two leads for common ion effect

D. none of these

Answer: A::B::C

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21. Which of the following is (are) the example(s) of autoprotolysis ?

A. $NH_3 + NH_3 \Leftrightarrow NH_4^+ + NH_2^-$

B. $CH_3OH + CH_3OH \Leftrightarrow CH_3OH_2^+ + CH_3O^-$

C. $HCOOH + HCOOH \Leftrightarrow HCOOH_2^+ + HCOO^-$

D. $HCI + HF \Leftrightarrow H_2C^- + F^-$

Answer: A::B::C

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22. For $0.01N$ solution of sodium acetate $\left(K_a = 1.9 \times 10^{-5}\right)$. Select the correct statements.

A. Hydrolysis constant is 5.26×10^{-10}

B. Degree of hydrolysis is 2.29×10^{-4}

C. pH of solution is 8.36

D. pH of solution is 7.46

Answer: A::B::C

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23. Which of the following is (are) correct order(s) for basic strength ?

A. $NaOH > NH_4OH > H_2O$

B. $NH_3 > N_2H_4 > NH_2OH$

C. $NH_3 > H_2O > HF$

D. $OH^- < C_2H^- < NH_2^- < C_2H_3^- < C_2H_5^-$

Answer: A::B::C::D

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24. The pH of solution(s) is (are) defined as the:

A. negative logarithm of the hydrogen ion concentration

B. logarithm of reciprocal of hydrogen ion concentration

C. negative power raised on 10 in order to express $\left[H^{+}\right]$ ion conncentration

D. none of these

Answer: A::B::C

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25. Which of the following statement(s) is (are) correct regarding Lewis acids ?

A. Molecules having a central atom with an incomplete octet in it can as Lewis acids

B. Molecules in which atoms of dissimilar electronegativity are joined by multiple bonds can acts as Lewis acids

C. SiF_4, PF_5 and $FeCl_3$ are Lewis acids

D. Neutral species having at least one pair of electrons can as Lewis acids

Answer: A::B::C

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26. In $0.1M$ solution, K_a for dissociation of H_2S is 4.0×10^{-3}. Select the correct statements.

A. Concentration of H^+ is $0.018M$

B. The degree of dissociation of H_2S is $18\ \%$

C. pH of solution is 1.7447

D. Concentration of $\left[H^+\right] is 0.18M$

Answer: A::B::C

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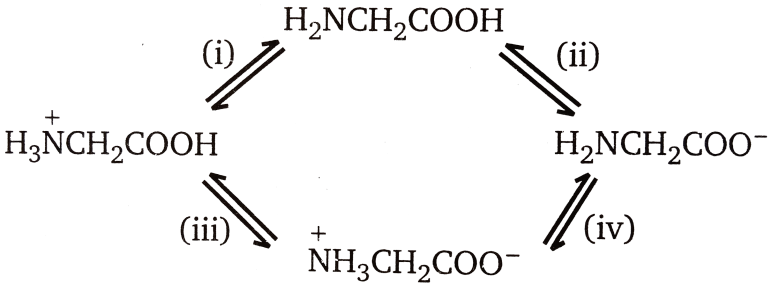
27. Which of the following indicatet proton transfer equilibrium in the glycine molecule shown below ?



A. (i)

B. (ii)

C. (iii)

D. (iv)

Answer: A::B::C::D

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28. In a solution containing $1.0 \times 10^{-3} M$ acetic acid at $25^{\circ} C$. K_a of acetic acid is 1.80×10^{-5}. Select the correct statements.

A. $\left[H^{+}\right] = 1.34 \times 10^{-4}$

B. $\left[CH_3COO^{-}\right] = 1.34 \times 10^{-4}$

C. $\left[CH_3COOH\right] = 8.66 \times 10^{-4}$

D. $\left[H^{+}\right] = 1.35 \times 10^{-6}$

Answer: A::B

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29. Which of the following mixture/solution will show pH approximately equal to 9 ?

A. $100mL$ of $3 \times 10^{-3} MHCI + 100mL$ of $4.24 \times 10^{-3} MNaCN$

B. $100mL$ of $0.01 MNH_4OH + 100mL$ of $2 \times 10^{-3} MNaOH$

C. $0.2M$ sodium butyrate, K_a for butyric acid is 2.0×10^{-5}

D. $5 \times 10^{-6} MCa(OH)_2$ solution

Answer: A::C::D

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30. Which solution will not show change in pH of dilution ?

A. $0.1MNaH_2PO_4$

B. $0.1MCH_3COONH_4$

C. $0.1MCH_3COONH_4$

D. $0.1MNH_4OH + 0.01MNH_4Cl$

Answer: A::B:C:D

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Exercise4

1. Equal volumes of $1MHCI$ and $1MH_2SO_4$ are neutralised by $1MNaOH$ solution and x and $ykJ/$ equivalent of heat are liberated, respectively. Which of the following relations is correct?

A. not a buffer solution and with $pH < 7$

B. not a buffer solution with $pH > 7$

C. a buffer solution with $pH < 7$

D. a buffer solution with $pH > 7$

Answer: A

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2. Species acting as both Bronsted acid and base is:

A. HSO_4^-

B. Na_2CO_3

C. NH_3

D. OH^-

Answer: A

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3. If the solubility of an aqueoues solution of $Mg(OH)_2$ be X mole litre, then K_{SP} of $Mg(OH)_2$ is:

A. $4X^3$

B. $108X^5$

C. $27X^4$

D. $9X$

Answer: A

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4. The solubility of a springly soluble salt AB_2 in water is $1.0 \times 10^{-5} molL^{-1}$. Its solubility product is:

A. 10^{-15}

B. 10^{-10}

C. 4×10^{-15}

D. 4×10^{-10}

Answer: C

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5. Which of the following has highest proton affinity?

A. NH_3

B. PH_3

C. H_2O

D. H_2S

Answer: A

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6. Which statement is not true?

A. pH of $1 \times 10^8 MHCl$ is 8

B. 96500 coulomb deposits 1 g equivalent of copper

C. Conjugate base of $H_2PO_4^-$ is HPO_4^{2-}

D. $pH + pOH = 14$ for all aqueous solution

Answer: A

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7. When rain is accompained by a thunderstorm, the collected rain water will have a pH:

A. influenced by occurrence of thunderstorm

B. depends upon the amount of dust in water

C. slightly lower than that of rainwater without thunderstorm

D. slightly higher than that when thunderstorm is not there

Answer: C

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8. Which one is amphoteric oxide ?

A. SO_2

B. B_2O_3

C. ZnO

D. Na_2O

Answer: C

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9. The conjugate base of $H_2PO_4^-$ is :

A. HPO_4^{2-}

B. P_2O_5

C. H_3PO_4

D. PO_4^{3-}

Answer: A

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10. K_{SP} of MX_4 and solubility of MX_4 is $Smol/L$ is related by:

A. $S = \left[K_{SP}/256\right]^{1/5}$

B. $S = \left[128K_{SP}\right]^{1/4}$

C. $S = \left[256K_{SP}\right]^{1/5}$

D. $S = \left[K_{SP}/128\right]^{1/4}$

Answer: A

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11. The solubility product of a salt having general formula MX_2 in water is 4×10^{-12}. The concentration of $M^{2+}ions$ in the aqueous solution of the salt is:

A. $2 \times 10^{-6}M$

B. $1 \times 10^{-4} M$

C. $1.6 \times 10^{-4} M$

D. $4.0 \times 10^{-6} M$

Answer: B

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12. Hydrogen ion concentration in mol/L in a solution of $pH = 5.4$ will be:

A. 3.98×10^{8}

B. 3.88×10^{6}

C. 3.68×10^{8}

D. 3.98×10^{-6}

Answer: D

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13. The conjugate base of OH^- is :

A. O_2

B. H_2O

C. O^-

D. O^{2-}

Answer: D

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14. The pK_a of a weak acid (HA) is 4.5. The pOH of an aqueous buffered solution of HA in which $50\,\%$ of the acid is ionized is:

A. 4.5

B. 2.5

C. 9.5

D. 7.0

Answer: C

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15. The first and second dissociation constant of an acid H_2A are 1.0×10^{-5} and 5.0×10^{-10} repectively. The overall dissociation constant of the acid will be

A. 5.0×10^{-5}

B. 5.0×10^{15}

C. 5.0×10^{-15}

D. 0.2×10^{5}

Answer: C

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16. Four species are listed below:

(*i*) HCO_3^-

(*ii*) H_3O^+

(*iii*) HSO_4^-

(*iv*) HSO_3F

Which one of the following is the correct sequence of their acid strength?

A. $iv < ii < iii < i$

B. $ii < iii < i < iv$

C. $i < iii < ii < iv$

D. $iii < i < iv < ii$

Answer: C

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17. The pK_a of a weak acid, HA, is 4.80. The pK_b of a weak base, BOH, is 4.78. The pH of an aqueous solution of the corresponding salt, BA, will be:

A. 8.58

B. 4.79

C. 7.01

D. 9.22

Answer: C

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18. Solid $Ba\left(NO_3\right)$ is gradually dissolved in a $1.0 \times 10^{-4} M Na_2CO_3$ solution. At what concentrations of Ba^{2+}, will a precipitate begin to form?

(K_{SP} for $BaCO_3 = 5.1 \times 10^{-9}$)

A. $4.1 \times 10^{-5} M$

B. $5.1 \times 10^{-5} M$

C. $8.1 \times 10^{-8} M$

D. $8.1 \times 10^{-7} M$

Answer: B

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19. Three reactions involving $H_2PO_4^-$ are given below

$I. H_3PO_4 + H_2O \rightarrow H_3O^+ + H_2PO_4^-$

$II. H_2PO_4^- + H_2O \rightarrow HPO_4^{2-} + H_3O^+$

III. $H_2PO_4^- + OH^- \rightarrow H_3PO_4 + O^{2+}$

In which of the above does $H_2PO_4^-$ act as an acid?

A. (ii) only

B. (i) and (ii)

C. (iii) only

D. (i) only

Answer: A

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20. In aqueous solution the ionization constants for carbonic acid are:

$K_1 = 4.2 \times 10^{-7}$ and $K_2 = 4.8 \times 10^{-11}$

Select the correct statement for a saturated $0.034M$ solution of the carbonic acid.

A. The concentration of CO_3^{2-} is $0.034M$

B. The concentration of CO_3^{2-} si greater than that of HCO_3^-

C. The concentration of H^+ and HCO_3^- are approximately equal

D. The concentratation of H^+ is double that of CO_3^{2-}

Answer: C

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21. At $25^\circ C$, 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 $0.001MMg^{2+}$ ions ?

A. 9

B. 10

C. 11

D. 8

Answer: B

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22. Solubility product of silver bromide is 5.0×10^{-13}. The quantity of potassium bromide (molar mass taken as $120 gmol^{-1}$) to be added to $1L$ of $0.05M$ solution of silver nitrate to start the precipitation of $AgBr$ is

A. $1.2 \times 10^{-10} g$

B. $1.2 \times 10^{-9} g$

C. $6.2 \times 10^{-5} g$

D. $5.0 \times 10^{-8} g$

Answer: B

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23. The pH of a 0.1 molar solution of the acid HQ is 3. The value of the ionisation constant, K_a of the acid is

A. 1×10^{-3}

B. 1×10^{-5}

C. 1×10^{-7}

D. 3×10^{-1}

Answer: B

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24. The correct order of acid strength is

A. $HClO < HClO_2 < HClO_3 < HClO_4$

B. $HClO_4 < HClO_3 < HClO_2 < HClO$

C. $HClO < HClO_4 < HClO_3 < HClO_2$

D. $HClO_4 < HClO_2 < HClO_3 < HClO$

Answer: A

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25. For a sparingly soluble salt A_pB_q, the relationship of its solubility product $\left(L_s\right)$ with its solubility (S) is

A. $L_S = S^{p+q}.\, p^p.\, q^q$

B. $L_S = S^{p+q}.\, p^q.\, q^p$

C. $L_S = S^{pq}.\, p^p.\, q^q$

D. $L_S = S^{pq}.\, (pq)^{p+q}$

Answer: A

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26. Identify the correct order of acidic strength of CO_2, CuO, CaO and H_2O.

A. $CaO < CuO < H_2O < CO_2$

B. $H_2O < CuO < CaO < CO_2$

C. $CaO < H_2O < CuO < CO_2$

D. $H_2O < CO_2 < CaO < CuO$

Answer: A

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27. H_3BO_3 is.

A. monobasic and weak Lewis acid

B. monobasic and weak Bronsted acid

C. monobasic and strong Lewis acid

D. tribasic and weak Bronsted acid

Answer: A

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28. HX is a weak acid $\left(K_a = 10^{-5}\right)$. If forms a salt $NaX(0.1M)$ on reacting with caustic soda. The degree of hydrlysis of NaX is

A. $0.0001\ \%$

B. $0.01\ \%$

C. $0.1\ \%$

D. $0.15\ \%$

Answer: B

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29. 0.1 mole of $CH_3NH_2\left(K_b = 5 \times 10^{-4}\right)$ is mixed with 0.08 mole of HCl and diluted to one litre. The $\left[H^+\right]$ in solution is

A. $8 \times 10^{-2}M$

B. $8 \times 10^{-11}M$

C. $1.6 \times 10^{-11}M$

D. $8 \times 10^{-5}M$

Answer: B

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30. The species present in solution when CO - 2 is dissolved in water are :

A. $CO_2, H_2CO_3, HCO_3^-, CO_3^{2-}$

B. H_2CO_3, CO_3^{2-}

C. CO_3^{2-}, HCO_3^-

D. CO_2, H_2CO_3

Answer: A

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31. The solubility product constant $\left(K_{sp}\right)$ of salts of types MX, MX_2, and M_3X at temperature T are $4.0 \times 10^{-8}, 3.2 \times 10^{-14}$, and 2.7×10^{-15}, respectively. The solubilities of the salts at temperature T are in the order

A. $MX > MX_2 > M_3X$

B. $M_3X > MX_2 > MX$

C. $MX_2 > M_3X > MX$

D. $MX > M_3X > MX_2$

Answer: D

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32. When $2.5mL$ of $2/5M$ weak monoacidic base $\left(K_b = 1 \times 10^{-12} at 25^\circ C\right)$ is titrated with $2/15MHCI$ in water at $25^\circ C$ the concentration of $H^\oplus$ at equivalence point is $\left(K_w = 1 \times 10^{-14} at 25^\circ C\right)$

A. $3.7 \times 10^{-13}M$

B. $3.2 \times 10^{-7}M$

C. $3.2 \times 10^{-2}M$

D. $2.7 \times 10^{-2}M$

Answer: D

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Exercise6

1. The dissociation constant of a substitude benzoic acid at $25^{\circ}C$ is 1.0×10^{-4}. The pH of a $0.01M$ solution of its sodium salt is

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2. Calculate the pH of $10^{-2}NH_2SO_4$.

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3. A certain buffer solution contains equal contration of X^- and HX. The K_b for X^- is 10^{-10}. The pH of the buffer is:

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4. In a solution containing $0.02MCH_3COOH$ and $0.01MC_6H_5COOH$. If K_{CH_3COOH} and $K_{C_6H_5COOH}$ are 1.8×10^{-5} and 6.4×10^{-5} respectively, then calculate the pH of solution.

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5. K_a for HCN is 5.0×10^{-10} at $25^\circ C$. For maintaining a constant pH of 9. Calculate the volume of $5.0MKCN$ solution required to be added to 10 mL of $2.0MHCN$ solution.

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6. A solution containing 75 mL of $0.2M$ HCl and 25 mL of $0.2M$ NaOH. Calculate the pH of solution.

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7. Calculate the change in pH of water when 0.01 mole of NaOH are added in 10 litre water.

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8. Calculate the pH at which an acid indicator with $K_a = 1.0 \times 10^{-5}$ changes colour when the indicator is $1.00 \times 10^{-3} M$.

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9. K_{SP} of $M(OH)_x$ is 27×10^{-12} and its solubility in water is 10^{-3} mol $litre^{-1}$. Find the value of X.

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10. If the equilibrium constant for the reaction of weak acid HA with strong base is 10^9, then pH of $0.1M$ Na A is:

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11. Calculate the pH of $0.01M$ solution of $AICI_3$, $\left(K_a \text{ of } \left[AI\left(H_2O\right)_6\right]^{3+} \text{ is } 1.4 \times 10^{-5}\right)$

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12. Calculate the pH of $0.2M$ sodium butyrate, $\left(K_a \text{ for butyric acid is } 2.0 \times 10^{-5}\right)$

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13. If pK_a of acetic acid and pK_b of ammonium hydroxide are 4.76 each. Find the pH of ammonium acetate.

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14. A solution with $pH2.699$ is diluted two time3s, then calculate the pH of the resulting sdolution. [Given antilog of $0.3010 = 2$]

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15. The solubility product of a sparingly soluble metal hydroxide $\left[M(OH)_2\right]$ is $5 \times 10^{-16} mol^3 dm^{-9}$ at 298 K. Find the pH of its saturated aqueous solution.

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16. Determine degree of dissociation of $0.05MNH_3$ at $25^\circ C$ in a solution of $pH = 11$.

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17. If $2H_2O_{(g)} \Leftrightarrow 2H_{2(g)} + O_{2(g)}, K_1 = 2.0 \times 10^{-13}$

$2CO_{2(g)} \Leftrightarrow 2CO_{(g)} + O_{2(g)}, K_2 = 7.2 \times 10^{-12}$

Find the equilibrium constant for the reaction

$CO_{2(g)} + H_{2(g)} \Leftrightarrow CO_{(g)} + H_2O_{(g)}$

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18. For the given reaction,

$RNH_2 + H_2O \Leftrightarrow RNH_3^+ + OH^-$. Find the pOH value for $10^{-2}NRNH_2$ solution.

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19. Ionisation constant for acids HA and BH^+ are 10^{-7} and 10^{-3} respectively. Find the pK_{eq}. for the reaction, $HA + B \Leftrightarrow BH^+ + A^-$.

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20. Find the relative strength of two weak acids HA $\left(K_a = 8.0 \times 10^{-5}\right)$ and $HB\left(K_b = 2.0 \times 10^{-5}\right)$.

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21. Find the pH at which an acid indicator having concentration $1.0 \times 10^{-4}M$, having dissociation of $1\ \%$ shows a colour change.

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22. Amonst the following, the total number of compounds whose aqueous solution turns red litmus paper blue is:

KCN K_2SO_4 $\left(NH_4\right)_2C_2O_4$ $NaCI$

$Zn\left(NO_3\right)_2$ $FeCI_3$ K_2CO_3 NH_4NO_3

$LiCN$

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23. Find the total number of diprotic acids among the following:

$H_3PO_4, H_2SO_4, H_3PO_3, H_2CO_3, H_2S_2O_7, H_3BO_3, H_3PO_2, H_2CrO_4, H_2SO_3$

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24. In 1L saturated solution of $AgCI\left[K_{sp}(AgCI) = 1.6 \times 10^{-10}\right], 0.1mol$ of

$CuCI\left[K_{sp}(CuCI) = 1.0 \times 10^{-6}\right]$ is added. The resultant concentration of Ag^{+} in the solution is 1.6×10^{-x}. The value of "x" is.

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Exercise7

1. The dissociation of weak electrolyte (a weak base or weak acid) is expressed in terms of Ostwald's dilution law. An acid is substance which furnishes a proton or accepts an electron pair, where a base is proton acceptor or electron pair donor. Stronger is acid, weaker is its conjugate base. The dissociation constants of an acid $\left(K_a\right)$ and its conjugate base $\left(K_b\right)$ are related by $K_w = K_a \times K_b$, where K_w is ionic product of water equal to $10^{-14} at 25^{\circ} C$. The numerical value of K_w however increase with temperature. In a solution of an acid or base $\left[H^{+}\right]\left[OH^{-}\right] = 10^{-14}$. Thus the $\left[H^{+}\right]$ in a solution is expressed as: $\left[H^{+}\right] = 10^{-pH}$ and $pH + pOH = 14$. Buffer solution are

the solutions which do not show appreciable change in the pH on addition of small amount of acid or base.

SO_2 contents in the atmosphere is 10 ppm and the solubility of SO_2 in water is 1.36 mol $litre^{-1}$. If pK_a of H_2SO_3 is 1.92, the pH of rainwater is:

A. 0.49

B. 0.39

C. 0.29

D. 0.19

Answer: A

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2. The dissociation of weak electrolyte (a weak base or weak acid) is expressed in terms of Ostwald's dilution law. An acid is substance

which furnishes a proton or accepts an electron pair, where a base is proton acceptor or electron pair donor. Stronger is acid, weaker is its conjugate base. The dissociation constants of an acid $\left(K_a\right)$ and its conjugate base $\left(K_b\right)$ are related by $K_w = K_a \times K_b$, where K_w is ionic product of water equal to $10^{-14} at 25^\circ C$. The numerical value of K_w however increase with temperature. In a solution of an acid or base $\left[H^+\right]\left[OH^-\right] = 10^{-14}$. Thus the $\left[H^+\right]$ in a solution is expressed as: $\left[H^+\right] = 10^{-pH}$ and $pH + pOH = 14$. Buffer solution are the solutions which do not show appreciable change in the pH on addition of small amount of acid or base.

Which of the following statements are correct ?

(1) pH of 10^{-10} M NaOH is nearly 7.

(2) The degree of dissociation of a weak acid is given by $\frac{1}{1 + 10^{\left(pK_{aq} - pH\right)}}$

(3) For weak electrolytes of polyprotic acid nature having no other electrotrolype, the anion concentration produced in II step of dissociation is always equal to K_2 at reasonable concentration of

acid.

(4) The concentration of amide ions produced during self ionisation of NH_3 is equal concentration of ammonium ions.

(5) Ostwald's dilution law is valid for strong electrolytes.

A. 1, 2, 3, 5

B. 1, 2, 3, 4

C. 1, 3, 4, 5

D. 2, 3, 4, 5

Answer: B

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3. The dissociation of weak electrolyte (a weak base or weak acid) is expressed in terms of Ostwald's dilution law. An acid is substance which furnishes a proton or accepts an electron pair, where a base is

proton acceptor or electron pair donor. Stronger is acid, weaker is its conjugate base. The dissociation constants of an acid $\left(K_a\right)$ and its conjugate base $\left(K_b\right)$ are related by $K_w = K_a \times K_b$, where K_w is ionic product of water equal to $10^{-14} at 25\,^{\circ} C$. The numerical value of K_w however increase with temperature. In a solution of an acid or base $\left[H^+\right]\left[OH^-\right] = 10^{-14}$. Thus the $\left[H^+\right]$ in a solution is expressed as: $\left[H^+\right] = 10^{-pH}$ and $pH + pOH = 14$. Buffer solution are the solutions which do not show appreciable change in the pH on addition of small amount of acid or base.

Which of the following statements are wrong ?

(1) Increase in temperature has no effect on neutral nature of water.

(2) Increase in temperature of pure water decreases its pH.

(3) Increase in temperature of pure water decreases its autoprolysis.

(4) Increase in temperature of pure increase its ionic product.

(5) Increase in temperature of pure water decreaseas degree of dissociation of water.

A. 3, 5

B. 1, 2, 4

C. 1, 5

D. 4, 5

Answer: A

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4. The dissociation of weak electrolyte (a weak base or weak acid) is expressed in terms of Ostwald's dilution law. An acid is substance which furnishes a proton or accepts an electron pair, where a base is proton acceptor or electron pair donor. Stronger is acid, weaker is its conjugate base. The dissociation constants of an acid $\left(K_a\right)$ and its conjugate base $\left(K_b\right)$ are related by $K_w = K_a \times K_b$, where K_w is ionic product of water equal to $10^{-14} at 25^\circ C$. The numerical value of K_w however increase with temperature. In a solution of an acid or base $\left[H^+\right]\left[OH^-\right] = 10^{-14}$. Thus the $\left[H^+\right]$ in a solution is

expressed as: $\left[H^{+}\right] = 10^{-pH}$ and $pH + pOH = 14$. Buffer solution are the solutions which do not show appreciable change in the pH on addition of small amount of acid or base.

Which of the following statements are true ?

(1) ClO_4^- is weak base than ClO_3^-

(2) The degree of dissociation of weak is 1.8×10^{-9}

(3) The equilibrium constant for dissociation of H_2O is 1.78×10^{-16}

(4) PO_4^{3-} is conjugate acid of HPO_4^{2-}

A. 1, 2, 3

B. 2, 3, 4

C. 1, 2, 4

D. 1, 2

Answer: A

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5. The dissociation of weak electrolyte (a weak base or weak acid) is expressed in terms of Ostwald's dilution law. An acid is substance which furnishes a proton or accepts an electron pair, where a base is proton acceptor or electron pair donor. Stronger is acid, weaker is its conjugate base. The dissociation constants of an acid $\left(K_a\right)$ and its conjugate base $\left(K_b\right)$ are related by $K_w = K_a \times K_b$, where K_w is ionic product of water equal to $10^{-14} at 25^\circ C$. The numerical value of K_w however increase with temperature. In a solution of an acid or base $\left[H^+\right]\left[OH^-\right] = 10^{-14}$. Thus the $\left[H^+\right]$ in a solution is expressed as: $\left[H^+\right] = 10^{-pH}$ and $pH + pOH = 14$. Buffer solution are the solutions which do not show appreciable change in the pH on addition of small amount of acid or base.

Which of the following solution is most important buffer for human living ?

A. HCO_3^- and CO_3^{2-}

B. CH_3COO^- and CH_3COOH

C. NH_4^+ and NH_4OH

D. None of these

Answer: A

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6. The dissociation of weak electrolyte (a weak base or weak acid) is expressed in terms of Ostwald's dilution law. An acid is substance which furnishes a proton or accepts an electron pair, where a base is proton acceptor or electron pair donor. Stronger is acid, weaker is its conjugate base. The dissociation constants of an acid $\left(K_a\right)$ and its conjugate base $\left(K_b\right)$ are related by $K_w = K_a \times K_b$, where K_w is ionic product of water equal to $10^{-14} at 25^\circ C$. The numerical value of K_w however increase with temperature. In a solution of an acid or base $\left[H^+\right]\left[OH^-\right] = 10^{-14}$. Thus the $\left[H^+\right]$ in a solution is expressed as: $\left[H^+\right] = 10^{-pH}$ and $pH + pOH = 14$. Buffer solution are

the solutions which do not show appreciable change in the pH on addition of small amount of acid or base.

The removal of PO_4^{3-} in qualitative analysis of basic radicals after II gp. is made by using a buffer solution of:

A. HCO_3^- and CO_3^{2-}

B. CH_3COO^- and CH_3COOH

C. NH_4^+ and NH_4OH

D. None of these

Answer: B

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7. The dissociation of weak electrolyte (a weak base or weak acid) is expressed in terms of Ostwald's dilution law. An acid is substance which furnishes a proton or accepts an electron pair, where a base is

proton acceptor or electron pair donor. Stronger is acid, weaker is its conjugate base. The dissociation constants of an acid $\left(K_a\right)$ and its conjugate base $\left(K_b\right)$ are related by $K_w = K_a \times K_b$, where K_w is ionic product of water equal to $10^{-14} at 25\,^{\circ} C$. The numerical value of K_w however increase with temperature. In a solution of an acid or base $\left[H^+\right]\left[OH^-\right] = 10^{-14}$. Thus the $\left[H^+\right]$ in a solution is expressed as: $\left[H^+\right] = 10^{-pH}$ and $pH + pOH = 14$. Buffer solution are the solutions which do not show appreciable change in the pH on addition of small amount of acid or base.

The pH of II gp. filtrate during III gp. basic radicals precipitation in qualitative anlysis is maintained by using a buffer solution of:

A. HCO_3^- and CO_3^{2-}

B. CH_3COO^- and CH_3COOH

C. NH_4^+ and NH_4OH

D. None of these

Answer: C

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8. The dissociation of weak electrolyte (a weak base or weak acid) is expressed in terms of Ostwald's dilution law. An acid is substance which furnishes a proton or accepts an electron pair, where a base is proton acceptor or electron pair donor. Stronger is acid, weaker is its conjugate base. The dissociation constants of an acid $\left(K_a\right)$ and its conjugate base $\left(K_b\right)$ are related by $K_w = K_a \times K_b$, where K_w is ionic product of water equal to $10^{-14} at 25^\circ C$. The numerical value of K_w however increase with temperature. In a solution of an acid or base $\left[H^+\right]\left[OH^-\right] = 10^{-14}$. Thus the $\left[H^+\right]$ in a solution is expressed as: $\left[H^+\right] = 10^{-pH}$ and $pH + pOH = 14$. Buffer solution are the solutions which do not show appreciable change in the pH on addition of small amount of acid or base.

The pK_a value of NH_4^+ is 9. The pK_b value of NH_4OH would be:

A. 9

B. 5

C. 7

D. 8

Answer: B

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9. The dissociation of weak electrolyte (a weak base or weak acid) is expressed in terms of Ostwald's dilution law. An acid is substance which furnishes a proton or accepts an electron pair, where a base is proton acceptor or electron pair donor. Stronger is acid, weaker is its conjugate base. The dissociation constants of an acid $\left(K_a\right)$ and its conjugate base $\left(K_b\right)$ are related by $K_w = K_a \times K_b$, where K_w is ionic product of water equal to $10^{-14} at 25^\circ C$. The numerical value of K_w however increase with temperature. In a solution of an acid or base $\left[H^+\right]\left[OH^-\right] = 10^{-14}$. Thus the $\left[H^+\right]$ in a solution is

expressed as: $\left[H^{+}\right] = 10^{-pH}$ and $pH + pOH = 14$. Buffer solution are the solutions which do not show appreciable change in the pH on addition of small amount of acid or base.

$0.16 gof N_2H_4 \left(K_b = 4 \times 10^{-6}\right)$ are dissolved in water and the total volume of solution is made upto 500 mL. The percentage of N_2H_4 that reacts with water is:

A. 2 %

B. 3 %

C. 1 %

D. 4 %

Answer: A

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10. The dissociation of weak electrolyte (a weak base or weak acid) is expressed in terms of Ostwald's dilution law. An acid is substance which furnishes a proton or accepts an electron pair, where a base is proton acceptor or electron pair donor. Stronger is acid, weaker is its conjugate base. The dissociation constants of an acid $\left(K_a\right)$ and its conjugate base $\left(K_b\right)$ are related by $K_w = K_a \times K_b$, where K_w is ionic product of water equal to $10^{-14} at 25\,^{\circ} C$. The numerical value of K_w however increase with temperature. In a solution of an acid or base $\left[H^+\right]\left[OH^-\right] = 10^{-14}$. Thus the $\left[H^+\right]$ in a solution is expressed as: $\left[H^+\right] = 10^{-pH}$ and $pH + pOH = 14$. Buffer solution are the solutions which do not show appreciable change in the pH on addition of small amount of acid or base.

The protonation constant for NH_3 from water is 6×10^5 . The deprotonation from NH_4^+ to H_2O has rate constant 5.6×10^{-10}. The rate constant for NH_4^+ and OH^- reaction to give NH_3 and H_2O would be:

A. 6×10^{5}

B. 5.6×10^{-10}

C. 3.4×10^{10}

D. 6×10^{-5}

Answer: C

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11. The dissociation of weak electrolyte (a weak base or weak acid) is expressed in terms of Ostwald's dilution law. An acid is substance which furnishes a proton or accepts an electron pair, where a base is proton acceptor or electron pair donor. Stronger is acid, weaker is its conjugate base. The dissociation constants of an acid $\left(K_a\right)$ and its conjugate base $\left(K_b\right)$ are related by $K_w = K_a \times K_b$, where K_w is ionic product of water equal to $10^{-14} at 25^{\circ} C$. The numerical value of K_w however increase with temperature. In a solution of an acid or

base $\left[H^{+}\right]\left[OH^{-}\right] = 10^{-14}$. Thus the $\left[H^{+}\right]$ in a solution is expressed as: $\left[H^{+}\right] = 10^{-pH}$ and $pH + pOH = 14$. Buffer solution are the solutions which do not show appreciable change in the pH on addition of small amount of acid or base.

At $50^{\circ}C$, liq. NH_3 undergoes autoprotlysis to give ammonium and azide ions having dissociation constant equal to 10^{-30}. The number of azide ions present $1cm^3$ of liq. NH_3 is:

A. 6×10^{5}

B. 6×10^{15}

C. 6×10^{8}

D. 6×10^{12}

Answer: A

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12. During neutralisation of an acid by a base, the end point refers for the completion of reaction. The detection of end point in acid - base neutralisation is usually made by an acid-base indicator. An acid-base indicator is itself a weak acid (Phenolphthlein) or a weak base (Mrthyl orange). At about $50\,\%$ ionisation which depends on the medium, the anion furnished by an indicator (acid) or cation furnished by indicator (basic) imparts its characteristic colour to solution at point. For example phenolphthalein, the dissociation is

$$HIn \Leftrightarrow H^{+}\,\text{Colourless} + In^{-}\,\text{Pink},\ K_{HIn} = \frac{\left[H^{+}\right]\left[In^{-}\right]}{[HIn]}$$

favoured in presence of alkali and pink colour of phenolphalein ion is noticed as soon as the medium changes to alkaline nature. The end point of acid-base neutralisation not necessarily coincides with equivalent point but it is closer and closer to equivalence point. Also at equivalence point of acid-base neutralisation pH is not necessarliy equal to 7.

Which among the following statements are correct ?

(1) At equivalence point of NaOH and HCI, pH = 7

(2) At equivalence point to of NaOH and $CH_3COOH, pH > 7$

(3) At equivalence point of NH_4OH and $HCI, pH < 7$

(4) an indicator shoes best results, if equivalence point is within the pH range pK_a of In $+1$

(5) At equivalence point of NH_4OH and formic acid, $pH < 7$

A. 1, 2, 3, 4

B. 1, 3, 4, 5

C. 1, 4, 5

D. 1, 2, 3, 5

Answer: A

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13. During neutralisation of an acid by a base, the end point refers for the completion of reaction. The detection of end point in acid - base neutralisation is usually made by an acid-base indicator. An acid-base indicator is itself a weak acid (Phenolphthlein) or a weak base (Mrthyl orange). At about $50\,\%$ ionisation which depends on the medium, the anion furnished by an indicator (acid) or cation furnished by indicator (basic) imparts its characteristic colour to solution at point. For example phenolphthalein, the dissociation is

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favoured in presence of alkali and pink colour of phenolphalein ion is noticed as soon as the medium changes to alkaline nature. The end point of acid-base neutralisation not necessarily coincides with equivalent point but it is closer and closer to equivalence point. Also at equivalence point of acid-base neutralisation pH is not necessarliy equal to 7.

The dissociation constant of an acid-base indicator which furnishes

coloured cation is 1×10^{-5} . The pH of solution at which indicator will furnish its colour is :

A. 5

B. 9

C. 6

D. 10

Answer: B

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14. During neutralisation of an acid by a base, the end point refers for the completion of reaction. The detection of end point in acid - base neutralisation is usually made by an acid-base indicator. An acid-base indicator is itself a weak acid (Phenolphthlein) or a weak base (Mrthyl orange). At about $50\,\%$ ionisation which depends on

the medium, the anion furnished by an indicator (acid) or cation furnished by indicator (basic) imparts its characteristic colour to solution at point. For example phenolphthalein, the dissociation is

$$HIn \Leftrightarrow H^{+}\text{Colourless} + In^{-}\text{Pink}, K_{HIn} = \frac{\left[H^{+}\right]\left[In^{-}\right]}{[HIn]}$$

favoured in presence of alkali and pink colour of phenolphalein ion is noticed as soon as the medium changes to alkaline nature. The end point of acid-base neutralisation not necessarily coincides with equivalent point but it is closer and closer to equivalence point. Also at equivalence point of acid-base neutralisation pH is not necessarliy equal to 7.

The dissociation constant of an acid-base indicator which furnished coloured anion is 1×10^{-5}. The pH of solution at which indicator is $80\ \%$ in dissociated form is:

A. 5.2310

B. 5.6020

C. 8.3980

D. 8.4820

Answer: B

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15. During neutralisation of an acid by a base, the end point refers for the completion of reaction. The detection of end point in acid - base neutralisation is usually made by an acid-base indicator. An acid-base indicator is itself a weak acid (Phenolphthlein) or a weak base (Mrthyl orange). At about $50\,\%$ ionisation which depends on the medium, the anion furnished by an indicator (acid) or cation furnished by indicator (basic) imparts its characteristic colour to solution at point. For example phenolphthalein, the dissociation is

$HIn \Leftrightarrow H^+$ Colourless $+ In^-$ Pink, $K_{HIn} = \dfrac{\left[H^+\right]\left[In^-\right]}{[HIn]}$

favoured in presence of alkali and pink colour of phenolphalein ion is noticed as soon as the medium changes to alkaline nature. The

end point of acid-base neutralisation not necessarily coincides with equivalent point but it is closer and closer to equivalence point. Also at equivalence point of acid-base neutralisation pH is not necessarliy equal to 7.

Bromophenol blue is an acid indicator having dissociation constant 5.84×10^{-5} . The percentage of coloured ion furnished at a pH of 4.84 is:

A. 80 %

B. 40 %

C. 20 %

D. 90 %

Answer: A

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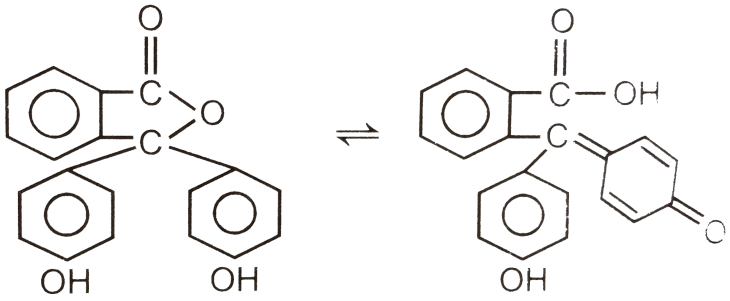
16. During neutralisation of an acid by a base, the end point refers for the completion of reaction. The detection of end point in acid - base neutralisation is usually made by an acid-base indicator. An acid-base indicator is itself a weak acid (Phenolphthlein) or a weak base (Mrthyl orange). At about $50\,\%$ ionisation which depends on the medium, the anion furnished by an indicator (acid) or cation furnished by indicator (basic) imparts its characteristic colour to solution at point. For example phenolphthalein, the dissociation is

$$HIn \Leftrightarrow H^{+}\,\text{Colourless} + In^{-}\,\text{Pink},\ K_{HIn} = \frac{\left[H^{+}\right]\left[In^{-}\right]}{[HIn]}$$

favoured in presence of alkali and pink colour of phenolphalein ion is noticed as soon as the medium changes to alkaline nature. The end point of acid-base neutralisation not necessarily coincides with equivalent point but it is closer and closer to equivalence point. Also at equivalence point of acid-base neutralisation pH is not necessarliy equal to 7.

The indicator phenolphalein is a tautomeric mixture of two forms as

given below:



I II

Which of the following statements are correct ?

(1) The form I is referred as quinonoid form and is deeper in colour

(2) The form I is referred as quinonoid form and is lighter in colour

(3) The form II is more stable in alkaline solution

(4) The change in pH form acidic to alkaline solution brings in the more and more conversion of I form to II form

(5) The form I is more stable in acidic medium

A. 1, 2, 3, 4

B. 1, 3, 4, 5

C. 3, 4, 5

D. 2, 3, 4, 5

Answer: B

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17. During neutralisation of an acid by a base, the end point refers for the completion of reaction. The detection of end point in acid - base neutralisation is usually made by an acid-base indicator. An acid-base indicator is itself a weak acid (Phenolphthlein) or a weak base (Mrthyl orange). At about $50\,\%$ ionisation which depends on the medium, the anion furnished by an indicator (acid) or cation furnished by indicator (basic) imparts its characteristic colour to solution at point. For example phenolphthalein, the dissociation is

$HIn \Leftrightarrow H^+$ Colourless $+ In^-$ Pink, $K_{HIn} = \dfrac{\left[H^+\right]\left[In^-\right]}{[HIn]}$

favoured in presence of alkali and pink colour of phenolphalein ion is noticed as soon as the medium changes to alkaline nature. The

end point of acid-base neutralisation not necessarily coincides with equivalent point but it is closer and closer to equivalence point. Also at equivalence point of acid-base neutralisation pH is not necessarliy equal to 7.

Which of the following statements are correct ?

(1) Phenolphthalein is not a good indicator for weak alkali titrations

(2) Phenolphthalein does not give pink colour with weak alkalies as NH_4OH

(3) Phenolphthalein is an acid indicator and imparts colour in basic medium

(4) Phenolphthalein is a basic indicator and imparts colour in basic medium

(5) Phenolphthalein furnishes coloured cation

A. 1, 2, 4, 5

B. 1, 2, 3, 4

C. 1, 3

D. 2, 4

Answer: C

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18. The pH of basic buffer mixtures is given by : $pH = pK_a + \log\left(\frac{[\text{Base}]}{[\text{Salt}]}\right)$, whereas pH of acidic buffer mixtures is given by: $pH = pK_a + \log\left(\frac{[\text{Salt}]}{[\text{Acid}]}\right)$. Addition of little acid or base although shows no appreciable change for all practical purpose, but since the ratio $\frac{[\text{Base}]}{[\text{Salt}]}$ or $\frac{[\text{Salt}]}{[\text{Acid}]}$ change, a slight decrease or increase in pH results in.

The amount of $\left(NH_4\right)_2SO_4$ to be added to 500 mL of $0.01MNH_4OH$ solution $\left(pK_af \text{ or } NH_4^+ is 9.26\right)$ prepare a buffer of $pH 8.26$ is:

A. 0.05 mole

B. 0.025 mole

C. 0.10 mole

D. 0.005 mole

Answer: B

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19. The pH of basic buffer mixtures is given by : $pH = pK_a + \log\left(\frac{[\text{Base}]}{[\text{Salt}]}\right)$, whereas pH of acidic buffer mixtures is given by: $pH = pK_a + \log\left(\frac{[\text{Salt}]}{[\text{Acid}]}\right)$. Addition of little acid or base although shows no appreciable change for all practical purpose, but since the ratio $\frac{[\text{Base}]}{[\text{Salt}]}$ or $\frac{[\text{Salt}]}{[\text{Acid}]}$ change, a slight decrease or increase in pH results in.

A solution containing 0.2 mole of dichloroacetic acid $\left(K_a = 5 \times 10^{-2}\right)$ and 0.1 mole sodium dichloroacetate in one litre solution has $\left[H^+\right]$:

A. $0.05M$

B. $0.025M$

C. $0.10M$

D. $0.005M$

Answer: A

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20. The pH of basic buffer mixtures is given by : $pH = pK_a + \log\left(\frac{[\text{Base}]}{[\text{Salt}]}\right)$, whereas pH of acidic buffer mixtures is given by: $pH = pK_a + \log\left(\frac{[\text{Salt}]}{[\text{Acid}]}\right)$. Addition of little acid or base although shows no appreciable change for all practical purpose, but since the ratio $\frac{[\text{Base}]}{[\text{Salt}]}$ or $\frac{[\text{Salt}]}{[\text{Acid}]}$ change, a slight decrease or increase in pH results in.

The volume of $0.2MNaOH$ needed to prepare a buffer of $pH4.74$ with 50 mL of $0.2M$ acetic acid is: $\left(pK_a ofCH_3COO^- = 9.26\right)$

A. $50mL$

B. $25mL$

C. $20mL$

D. $10mL$

Answer: B

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21. The ratio of pH of solution (1) containing 1 mole ofCH_3COONa and 1 mole of HCl and solution (II) containing 1 mole of CH_3COONa and 1 mole of acetic acid in one litre is :

A. $1:2$

B. $2:1$

C. $1:3$

D. $3:1$

Answer: A

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22. The pH of basic buffer mixtures is given by : $pH = pK_a + \log\left(\frac{[\text{Base}]}{[\text{Salt}]}\right)$, whereas pH of acidic buffer mixtures is given by: $pH = pK_a + \log\left(\frac{[\text{Salt}]}{[\text{Acid}]}\right)$. Addition of little acid or base although shows no appreciable change for all practical purpose, but since the ratio $\frac{[\text{Base}]}{[\text{Salt}]}$ or $\frac{[\text{Salt}]}{[\text{Acid}]}$ change, a slight decrease or increase in pH results in.

Mole of HCI required to prepare a buffer solution of $pH = 8.5$ with 0.1 mole of NaCN in one litre solution is: $\left(pK_af \text{ or } CN^- = 4.61\right)$

A. 8.85×10^{-2}

B. 7.85×10^{-2}

C. 9.85×10^{-2}

D. 6.85×10^{-2}

Answer: A

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23. The pH of basic buffer mixtures is given by : $pH = pK_a + \log\left(\frac{[\text{Base}]}{[\text{Salt}]}\right)$, whereas pH of acidic buffer mixtures is given by: $pH = pK_a + \log\left(\frac{[\text{Salt}]}{[\text{Acid}]}\right)$. Addition of little acid or base although shows no appreciable change for all practical purpose, but since the ratio $\frac{[\text{Base}]}{[\text{Salt}]}$ or $\frac{[\text{Salt}]}{[\text{Acid}]}$ change, a slight decrease or increase in pH results in.

A weak acid HA after treatment with $12mLof0.1M$ strong base BOH has a $pH = 5$. At end point, the volume of same base required is $26.6mLK_a$ of acid is:

A. 8.2×10^{-6}

B. 8.2×10^{-5}

C. 8.2×10^{-4}

D. 8.2×10^{-7}

Answer: A

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24. The solubility product of a soluble salt A_xB_y is given by: $K_{SP} = \left[A^{y+}\right]^x \left[B^{x-}\right]^y$. As soon as the product of concentration of A^{y+} and B^{x-} increases than its K_{SP}, the salt start precipitation. It may practically be noticed that AgCI is more soluble in water and its solublity decreases dramatically in $0.1MNaCI$ or $0.1MAgNO_3$ solution. It may therefore be conncluded that in presence of a common ion, the solubiolity of salt decreases.

The salting out action of RCOONa in presence of NaCI is based on:

A. common ion effect

B. hydrolysis of salt

C. solubility product

D. complex formation

Answer: C

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25. The solubility product of SrF_2 in water is 8×10^{-10}. Calculate its solubility in $0.1M$ NaF aqueous solution.

A. 8×10^{-10}

B. 2×10^{-3}

C. 2.71×10^{-10}

D. 8×10^{-8}

Answer: D

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26. The solubility product of a soluble salt A_xB_y is given by: $K_{SP} = \left[A^{y+}\right]^x\left[B^{x-}\right]^y$. As soon as the product of concentration of A^{y+} and B^{x-} increases than its K_{SP}, the salt start precipitation. It may practically be noticed that AgCI is more soluble in water and its solublity decreases dramatically in $0.1MNaCI$ or $0.1MAgNO_3$ solution. It may therefore be conncluded that in presence of a common ion, the solubiolity of salt decreases.

Equal volumes of two solutions are mixed. The one in which $CaSO_4\left(K_{SP} = 2.4 \times 10^{-5}\right)$ is precipitated, is :

A. $0.02MCaCI_2 + 0.0004MNa_2SO_4$

B. $0.01MCaCI_2 + 0.0004MNa_2SO_4$

C. $0.02MCaCI_2 + 0.0002MNa_2SO_4$

D. $0.03MCaCI_2 + 0.004MNa_2SO_4$

Answer: D

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27. The solubility product of a soluble salt A_xB_y is given by: $K_{SP} = \left[A^{y+}\right]^x\left[B^{x-}\right]^y$. As soon as the product of concentration of A^{y+} and B^{x-} increases than its K_{SP}, the salt start precipitation. It may practically be noticed that AgCI is more soluble in water and its solublity decreases dramatically in $0.1MNaCI$ or $0.1MAgNO_3$ solution. It may therefore be conncluded that in presence of a common ion, the solubiolity of salt decreases.

The pH of a saturated solution of $Mg(OH)_2$ is: $\left(K_{SP}ofMg(OH)_2 = 1 \times 10^{-11}\right)$

A. 9

B. 3.87

C. 10.43

D. 5

Answer: C

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28. The solubility product of a soluble salt A_xB_y is given by: $K_{SP} = \left[A^{y+}\right]^x\left[B^{x-}\right]^y$. As soon as the product of concentration of A^{y+} and B^{x-} increases than its K_{SP}, the salt start precipitation. It may practically be noticed that AgCI is more soluble in water and its solublity decreases dramatically in $0.1MNaCI$ or $0.1MAgNO_3$ solution. It may therefore be conncluded that in presence of a common ion, the solubiolity of salt decreases.

Which of the following statement is wrong ?

(1) K_{SP} of a salt depends upon temperature

(2) K_{SP} of a salt has no units

(3) The K_{SP} of salt A_xB_y can be given as: $x^x.\ y^y(S)^{x+y}$

(4) Solubility of BaF_2 in a solution of $Ba\left(NO_3\right)_2$ can be given by $\frac{1}{2}\left[F^-\right]$

A. 1

B. 2

C. 3

D. 4

Answer: B

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29. The solubility product of a soluble salt A_xB_y is given by: $K_{SP} = \left[A^{y+}\right]^x\left[B^{x-}\right]^y$. As soon as the product of concentration of A^{y+} and B^{x-} increases than its K_{SP}, the salt start precipitation. It may practically be noticed that AgCI is more soluble in water and its

solublity decreases dramatically in $0.1MNaCI$ or $0.1MAgNO_3$ solution. It may therefore be conncluded that in presence of a common ion, the solubiolity of salt decreases.

The volume of water neede to dissolve 1g $BaSO_4\left(K_{SP} = 1 \times 10^{-10}\right)$ is:

A. 230 litre

B. 429 litre

C. 500 litre

D. 320 litre

Answer: B

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30. A solubility contains one mole each of HA and HB (both are weak acids) in one litre solution. Now 1 mole of NaOH is added to this

solution so that both the acids are partly neutralised. Heat of neutralisation for HA and HB are- 11.8 and- 12.4 kcal respectively and the heat produced during partial neutralisation of HA and HB is- 12.25 kcal.

Mole ratio of neutralisation of HA and HB is:

A. 1 : 4

B. 1 : 2

C. 1 : 3

D. 1 : 5

Answer: C

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31. A solubility contains one mole each of HA and HB (both are weak acids) in one litre solution. Now 1 mole of NaOH is added to this

solution so that both the acids are partly neutralised. Heat of neutralisation for HA and HB are- 11.8 and- 12.4 kcal respectively and the heat produced during partial neutralisation of HA and HB is- 12.25 kcal.

The ratio of dissociation constant of two acids are:

A. $1:9$

B. $1:6$

C. $1:3$

D. $1:1$

Answer: A

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32. A solubility contains one mole each of HA and HB (both are weak acids) in one litre solution. Now 1 mole of NaOH is added to this

solution so that both the acids are partly neutralised. Heat of neutralisation for HA and HB are- 11.8 and- 12.4 kcal respectively and the heat produced during partial neutralisation of HA and HB is- 12.25 kcal.

The ratio of NaA and NaB in solution left after reaction is:

A. $1:9$

B. $1:3$

C. $1:6$

D. $1:4$

Answer: B

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33. A solubility contains one mole each of HA and HB (both are weak acids) in one litre solution. Now 1 mole of NaOH is added to this

solution so that both the acids are partly neutralised. Heat of neutralisation for HA and HB are- 11.8 and- 12.4 kcal respectively and the heat produced during partial neutralisation of HA and HB is- 12.25 kcal.

pH of solution, if hydrolysis constant for A^- is 10^{-9} :

A. 4.5228

B. 5.5228

C. 3.4696

D. 7.9215

Answer: A

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Exercise

1. Statement : The dissociation constants of polyrotic acid are in the order $K_1 > K_2 > K_3$.

Explanation : The $\left[H^+\right]$ furnished in first step of dissociation exerts common ion effect to reduce the secend dissociation so on.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: C

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2. Statement: All strong acids in water show almost almost same acidic nature.

Explanation: This is due to levelling effect of water on account of its high dielectric constant and strong proton accepting tendency.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: C

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3. Statement: $\mathbb{C}I_4$, C_6H_6 and liquid SO_2 are aprotic solvents.

Explanation: Aprotic solvents does not influence the aicdic or basic nature of solute.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: C

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4. Statement: The acidic nature of some cations is: $B^{3+} > Be^{2+} > Na^{+} > K^{+}$

Explanation: More is the effective nuclear charge on cation more is its acidic nature.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: C

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5. Statement: Acidic nature of boron trihalides is in the order $BF_3 < BCI_3 < BBr_3 < BI_3$.

Explanation: Basic nature of nitrogen trihalides is in the order $NF_3 > NCI_3 > NBr_3 > NI_3$.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: A

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6. Statement: $CO + NaOH \xrightarrow[\text{High}T]{\text{High}P} HCOONa$

Explanation: CO although being neutral can acts as acid in the given reaction.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: C

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7. Statement: The dissociation constant of water at $60^\circ C$ is 10^{-13}.

Explanation: The pH of water is 6.5 and that it behaves as acid at $60^\circ C$.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: A

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8. Assertion : Salting out action of sodium soap in presence of $NaCl$ is based on common ion effect.

Reason : Salting out action of soap is based on the fact that as the concentration of Na^+ increases, the $RCOONa$ shows precipitation because $\left[RCOO^-\right]\left[Na^+\right] > K_{sp}$.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: B

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9. Statement: Hydrolysis of salt is an exothermic phenomenon.

Explanation: It involves breaking up of water molecule to produce acids and base respectively.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: B

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10. Statement: The pH of an aqueous solution of acetic acid remains unchanged on the addition of sodium acetate.

Explanation: The ionisation of acetic acid is suppressed by the addition of sodium acetate.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: C

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11. Statement: In acidic medium, Zn^{2+} is not precipitated by H_2S.

Explanation: Common ion effect reduces the concentration of S^{2-} to a minimum level.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: C

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12. Statement: Sodium carbonate can be titrated against sulphuric acid by using methyl orange as indicator.

Explanation: The volume of sulphuric acid required to produce colour change for the two indicators (acid or basic) is different.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: A

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13. Statement: In an acid-basic titration involving a strong base and a weak acid, methyl orange can be used as an indicator.

Explanation: Methyl orange changes its colour in the pH range 3 to 5.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: B

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14. Assertion (A): Equivalent conductance increase with dilution for an electrolyte solution.

Reason (R): The number of ions per litre of electrolyte increases with dilution.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: A

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15. Statement: A micture of the solution of a weak acid and its conjugates base acts as a good buffer.

Explanation: The ratio of the conjugates base acid in the mixture does not change substantially when small amount of acids or alkalines are added to the buffer.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: D

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16. Statement: For a weak electrolyte, the plot of molar conductivity $\left(\Lambda_m\right)$ against $\sqrt{C}(C$ is concentration in mol $litre^{-1}\Big)$ is nearly linear.

Explanation: The molar conductivity at infinite dilution $\left(\Lambda_m\right)$ for an electrolyte can be considered equal to the sum of the limiting molar conductivities of the individual ions.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: B

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17. Statement: The addition of a small amount of a 'neutral' electrolyte (one that does not share a common ion) such as NaCI to a dilute solution of acetic acid, will cause an increase in the degree of dissociation of the acid.

Explanation: Due to the increased ionic strength, the mean ionic activity coefficient of H_3O^+ and CH_3COO^- will increase.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: C

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18. Statement: In water, orthoboric acid behaves as a weak monobasic acid.

Explanation: In water, orthoboric acid as a proton donor.

A. S is correct but E is wrong.

B. S is wrong but E is correc.

C. Both S and E are correct and E is correct explanation of S.

D. Both S and E are correct but E is correct explanation of S.

Answer: A

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19. Prove that degree of dissocation of a weak acid is given by:

$$\alpha = \frac{1}{1 + 10^{\left(pK_a - pH\right)}}$$

where K_a) si its dissociation constant.

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20. The concentration of fluroacetic acid $\left(K_a ofacid = 2.6 \times 10^{-3}\right)$, which is required to get $\left[H^+\right] = 1.50 \times 10^{-3} M$ is:

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21. Diborane, B_2H_6, reacts with water to from boric acid and hydrogen , What is the pH of the solution which results when $1.104g$ of B_2H_6 reacts with $100mL$ water ? Assume the final volume to be $100mL$.

Given : K_a of $H_3BO_3 = 8 \times 10^{-10} pK_a$, Atomic weight of $B = 10, 8g, MW$ of $B_2H_6 = 27.6gmol^{-1}$.

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22. Liquid ammonia ionises to a slight extent. At $-50^{\circ}C$, its self ionisation constant, $K_{NH_3} = \left[NH_4^+\right]\left[NH_2^-\right] = 10^{-30}$. How many amide ions are present per cm^3 of pure liquid ammonia ? $\left(\text{Assume} N = 6.0 \times 10^{23}\right)$

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23. The self ionisation constant for pure $HCOOH, K = \left[HCOOH_2^{\oplus}\right]\left[HCOO^{\Theta}\right]$ is 10^{-6} at room temperature. What percentage of $HCOOH$ molecules are converted to $HCOO^{\Theta}$ ions. The density of $HCOOH$ iws $1.22 gcm^{-3}$.

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24. Calculate the dissociation constant of NH_4OH at $25^\circ C$. If ΔH° and ΔS° for the given changes are as follows:

$NH_3 + H^+ \Leftrightarrow NH_4^+, , \Delta H^\circ = -52.2 kJ mol^{-1},$

$\Delta S^\circ = +1.67 JK^{-1} mol^{-1}$

$H_2O \Leftrightarrow H^+ + OH^-, \Delta H^\circ = 56.6 kJ mol^{-1},$

$\Delta S^\circ = -78.2 JK^{-1} mol^{-1}$

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25. Calculate the concentration of all species of significant concentrations presents in $0.1M H_3PO_4$ solution. If $K_1 = 7.5 \times 10^{-3}, K_2 = 6.2 \times 10^{-8}, K_3 = 3.6 \times 10^{-13}$

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26. If $CH_3COOH\left(K_a = 10^{-5}\right)$ reacts with NaOH at 298K, then find out the value of the maximum rate constant of the reverse reaction at 298 K at the end point of the reaction. Given that the rate constant of the forward reaction is $10^{-11} mol^{-1} L \sec^{-1}$ at 298 K. Also calculate Arrhenius parameter for backward reaction if $\Delta H_{298K} = 44 kcal$ and $E_{a(f)} = 94 kcal.$

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27. The K_w of water at two temperature $25^\circ C$ and $50^\circ C$ are $1.08 \times 10^{-14}, 5.474 \times 10^{-14}$ respectively. Assuming ΔH of any reaction is neutralisation of a strong acid with strong base.

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28. The pH of pure water at $25^{\circ}C$ and $35^{\circ}C$ are 7 and 6, respectively. Calculate the heat of formation of water from $H^{\oplus}$ and OH^{Θ}.

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29. For an organic monoprotic acid solution of concentration Co mole $litre^{-1}$, if K_a has a value comparable to K_w, show that the hydronium ion concentration is given by :

$$\left[H^{+}\right] = \left[\frac{K_w}{H(+)} + \frac{K_a . Co}{\left[K_a + H^{+}\right]}\right]$$

If $\left[H^{+}\right] = 10^{-3}M$ and $Co = 10^{-1}M$ in a solution of some organic monoprotic acid, what according to the above equation must be the order of magnitude of K_a ?

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30. The K_w for $2H_2O \Leftrightarrow H_3O^+ \_ OH^-$ changes from 10^{-14} at $25^\circ C$ to 9.62×10^{-14} at $60^\circ C$. What is pH of water at $60^\circ C$? What happens to its neutrality ?

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31. For the indicator thymol blue, pH is 2.0 when half of the indicator is in unionised form. Find the $\%$ of indicator in unionised form in a solution with $\left[H^+\right] = 4 \times 10^{-3} M$.

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32. Calculate the percent error in the $\left[H_3O^{\oplus}\right]$ made by neglecting the ionisation of water in $10^{-6} MNaOH$ solution.

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33. Calculate the pH of solution obtained by mixing $10ml$ of $0.1MHCl$ and $40ml$ of $0.2MH_2SO_4$

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34. What should be the pH at the equivalence point for the titration of $0.10MKH_2BO_3$ with $0.01MHCI$? $\left(K_a ofH_3BO_3 = 7.2 \times 10^{-10}\right)$

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35. Calculate the pH of a solution which contains 100 mL of $0.1MHCI$ and $9.9mL$ of $1.0MNaOH$.

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36. Calculate $\left[H^{\oplus}\right]$ in a soluton that is $0.1MHCOOH$ and $0.1MHOCN. K_a(HCOOH) = 1.8 \times 10^{-4}, K_a(HoCN) = 3.3 \times 10^{-4}.$

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37. Calculate the pH in a solution that is $0.1M$ in acetic acid and $0.1M$ in benozic acid. K_af or CH_3COOH and $C_6H_5COOHare1.8 \times 10^{-5}$ and 6.5×10^{-5} respectively.

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38. What are $\left[H^{\oplus}\right]$, $\left[A^{\Theta}\right.$, and $\left[B^{\Theta}\right]$ in a solution that is $0.3MHA$ and $0.1MHB? K_a$ for HA and HB are 1.38×10^{-4} and 1.05×10^{-10}, respectively.

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39. Calculate $\left[H^{\oplus}\right]$ and $\left[CHC1_2COO^{\Theta}\right]$ in a solution that is $0.01MHC1$ and $0.01MCHC1_2COOH$. K_a for $CHC1_2COOH$ is 5×10^{-3}.

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40. Calculate $\left[H^{+}\right]$, $\left[CH_3COO^{-}\right]$ and $\left[C_7H_8O_2^{-}\right]$ in a solution that is $0.02M$ in acetic acid and $0.01M$ in benzoic acid. $\left(K_{a_{AA}} = 1.8 \times 10^{-5}, K_{a_{BA}} = 6.4 \times 10^{-5}\right)$

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41. A solution contains $0.09HC1, 0.09MCHC1_2COOH$, and $0.1MCH_3COOH$. The pH of this solution is one. Calculate K_a for $CHC1_2COOH$. (Given $K_aCH_3COOH = 10^{-5}$)

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42. 100 mL of HCI gas at $25^{\circ}C$ and 740 mm pressure were dissolveed in one litre of water. Caculate the pH of a solution. Given, V.P. of H_2O at $25^{\circ}C$ is 23.7 mm.

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43. Calculate the pH of a buffer solution prepared by dissolving 30g of Na_2CO_3 in 500 mL of an aqueous solution contaning 150 mL of 1 M HCI. $\left(K_af \text{ or } HCO_3^- = 5.63 \times 10^{-11}\right)$

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44. The ratio of pH of solution (1) containing 1 mole ofCH_3COONa and 1 mole of HCl and solution (II) containing 1 mole of CH_3COONa and 1 mole of acetic acid in one litre is :

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45. a. Calculate the ratio of pH of a solution continaing $1mol$. Of $CH_3COONa + 1mol$ of $HC1$ per litre and of other solution containing $1mol$ of $CH_3COONa + 1mol$ of CH_3COOH per litre.

b. A $0.1M$solution of weak acid HA is $1\,\%$ dissociated at $298k$. what is its K_a? what will be the new degree of dissociation of HA and pH when $0.2M$ of NaA is added to it.

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46. Calculate the weight of $\left(NH_4\right)_2SO_4$ which must be added to $500mL$ of $0.2MNH_3$ to yield a solution of $pH = 9.35$. K_a for $NH_3 = 1.78 \times 10^{-5}$.

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47. 0.00050 mole of $NaHCO_3$ is added to a large volume of a solution buffer at $pH = 8.00$. How much material will exist in each of the three forms, H_2CO_3, HCO_3^- and CO_3^{2-} ? K_1 and K_2 for H_2CO_3 are 4.5×10^{-7} and 4.5×10^{-11} respectively.

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48. $0.1MCH_3COOH$ solution is titrated against $0.05MNaOH$ solution. Calculate pH at $1/4th$ and $3/4th$ stages of neutralization of acid. The pH for $0.1MCH_3COOH$ is 3.

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49. A solution of weak acid was titrated with base NaOH. The equivalence point was reached when $36.12mL$ of $0.1M$ NaOH have

been added. Now $18.06mL0.1M$ HCI were added to titrated solution, the pH was found to be 4.92. What is K_a of acid ?

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50. A weak acid HA after teratment with 12 mL of $0.1M$ strong base BOH has a pH of 5. At the end point, the volume of same base required is $26.6mL$. K_a of acid is:

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51. To a solution of acetic acid, solid sodium acetate is added greadually. When x mole of salt is added, the pH has a certain value. If y mole of salt is added, the pH is this time changes by 0.6 units to previous pH. What is the ratio of x and y ? If the solution is diluted after addition of y mole salt, what will be the change in pH ? Given that $y > x$.

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52. When 40 mL of a $0.1M$ weak monoacid base is titrated with $0.16MHCI$, the pH of solution at the end point is 5.23. Calculate K_b. What will be the pH if 15 mL of $0.12M$ NaOH is added to the resulting solution ?

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53. The $\left[Ag^{+}\right]$ ion in a saturated solution of Ag_2CrO_4 at $25^{\circ}Cis1.5 \times 10^{-4}M$. Determine K_{SP} of Ag_2CrO_4 at $25^{\circ}C$.

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54. K_{sp} of $PbBr_2$ is 8×10^{-5}. If the salt is 80% dissociated in solution, calculat the solubility of salt in gL^{-1}.

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55. K_{sp} of $PbC1_2$ is 10^{-13}. What will be $\left[Pb^{2+}\right]$ in a of solution prepared by mixing $100mL$ of $0.1MPb\left(NO_3\right)_2$ of solution $1.0mL1MHCI$?

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56. Calculate simultaneous solubility of AgCNS and AgBr in a solution of water. $\left(K_{SP}ofAgBr = 5 \times 10^{-13} \text{ and } K_{SP}ofAgCNS = 1 \times 10^{-12}\right)$

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57. $BaSO_4$ and $BaCrO_4$ have solubility product values in the ratio $1:2.5at25^\circ C$. When pure water is saturated with both solids

simultaneously, the total concentration of Ba^{2+} ion in the solution is $1.4 \times 10^{-5} M$. Calculate the solubility product of $BaCrO_4$. Calculate also the solubility of $BaSO_4$ in $0.01 M Na_2SO_4$ solution.

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58. A mixture of water and AgCI is shaken until a saturated solution is obtained. Now the solution is filtered and 100mL of clear solution of filtrate is mixed with 100 mL of $0.03 M NaBr$. Should a precipitate from ? K_{SP} of AgCI and AgBr are 1×10^{-10} and 5×10^{-13}.

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59. Zn salt is mixed with $\left(NH_4\right)_2 S$ of molarity $0.021 M$. What amount of Zn^{2+} will remain unprecipitated in 12 mL of the solution ? $\left(K_{SP} \text{of ZxnS} = 4.51 \times 10^{-24}\right)$

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60. A particular water sample has 131 ppm $CaSO_4$. What fraction of the water must be evaporated in a container before solid $CaSO_4$ begins to deposit ? $\left(K_{SP} of CaSO_4 = 9.0 \times 10^{-6}\right)$

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61. To a solution of $0.1 MMg^{2+}$ and $0.8 MNH_4CI$, and equal volume of NH_3 is added which just gives precipitates. Calculate $\left[NH_3\right]$ in solution.

$K_{sp} of Mg(OH)_2 = 1.4 \times 10^{-11}$ and $K_b of NH_4OH = 1.8 \times 10^{-5}$.

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62. What is the molar solubility of $AgCI_{(g)}$ in $0.100 MNH_{3(aq.)}$? Given K_{SP} of $AgCI = 1.8 \times 10^{-10}$, K_f of $\left[Ag\left(NH_3\right)_2\right]^+ = 1.6 \times 10^7$.

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63. $10mL$ of $0.3MNa_2SO_4$ are mixed with $20mL$ solution having initially $0.1MCa^{2+}$ and $0.1MSr^{2+}$ in it. Calculate the final $\left[Ca^{2+}\right]$, $\left[Sr^{2+}\right]$ and $\left[SO_4^{2-}\right]$ in solution? Given $K_{sp}SrSO_4 = 7.6 \times 10^{-7}$ and $K_{sp}CaSO_4 = 2.4 \times 10^{-5}$.

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64. The solubility of $CaCO_3$ is $7mg/L$. Calculate the K_{sp} of $BaCO_3$ whne Na_2CO_3 is added slowely a solution containing equimolar concentration of Ca^{2+} and Ba^{2+} and no precipitate is formed until $90\,\%$ of Ba^{2+} has beem precipitated as $BaCO_3$.

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65. Calculate the solubility of $AgCN$ in a buffer solution of $pH = 3$, Given $K_{sp} of AGCN = 1.2 \times 10^{-16}$ and K_a for $HCN = 4.8 \times 10^{-10}$.

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66. $2M$ solution of Na_2CO_3 is boiled in a closed container with excess of CaF_2. Very small amount of $CaCO_3$ and NaF are formed. If K_{sp} of $CaCO_3$ is x and molar solubility of CaF_2 is y, find the molar after cocentration of $F^{\ominus}$ in the resulting solution after equilibrium is attained.

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67. $100.0mL$ of a saturated solution of Ag_2SO_4 is added to $250.0mL$ of saturated solution of $PbCrO_4$. Will may precipitate form and if so

what? Given K_{sp} for $Ag_2SO_4, Ag_2CrO_4, PbCrO_4$,and $PbSO_4$ are 1.4×10^{-5}, 2.4×10^{-12}, 2.8×10^{-13}, and 1.6×10^{-8}, respectively.

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68. $25.0mL$ clear saturated solution of $PbI_{2(aq.)}$ requires $13.3mL of AgNO_{3(aq.)}$ solution for complete precipitation. What is molarity of $AgNO_3$ solution ? $\left(K_{SP} \text{of } PbI_2 \text{ is } 7.1 \times 10^{-9}\right)$

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69. K_{sp} of $SrF_2 = 2.8 \times 10^{-9}$ at $25^\circ C$. How much NaF should be added to $100mL$ of solution having $0.016M$ in Sr^{2+} ions to reduce its concentration to $2.5 \times 10^{-3}M$?

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70. H_2S is bubbled into a $0.2MNaCN$ solution which is $0.02M$ each in $Ag(CN)_2^{\Theta}$ and $\left(Cd(CN)_4^{2-}\right.$. If K_{sp} of Ag_2S and CdS are 10^{-50} and 7.1×10^{-28} and K instability for $\left[Ag(CN)_2^{\Theta}\right]$ and $\left[Cd(CN)^{2-}{}'_4\right]$ are 1.0×10^{-20} and 7.8×10^{-18}, which sulphide will precipitate first?

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71. What are the concentration of Ag^+, $\left[Ag\left(NH_3\right)\right]^+$ and $\left[Ag\left(NH_3\right)_2\right]^+$ in a solution prepared by adding 0.10 mole of $AgNO_3$ to 1.0 litre of $3.0MNH_3$? Given :

$Ag^+_{(aq.)} + NH_{3(aq.)} \Leftrightarrow \left[Ag\left(NH_3\right)\right]^+_{(aq.)}$,

$K_1 = 2.1 \times 10^3$ ....(1)

$\left[Ag\left(NH_3\right)\right]^+_{(aq.)} + NH_{3(aq.)} \Leftrightarrow \left[Ag\left(NH_3\right)_2\right]^+_{(aq.)}$,

$K_2 = 8.1 \times 10^3$ ....(2)

$Ag^{+}_{(aq.)} + 2NH_{3(aq.)} \Leftrightarrow \left[Ag\left(NH_3\right)_2\right]^{+}_{(aq.)}$,

$K_3 = 1.7 \times 10^7$ .....(3)

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72. 338 mL clear saturated solution of $AgBrO_3$ requires just $30.4 mL of H_2S_{(g)}$ at $23\,^{\circ}C$ and 748 mm Hg to precipitate all the Ag^{+} ions Ag_2S. What will be $K_{SP} of AgBrO_3$?

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73. 0.10 moole of $AgCI_{(s)}$ is added to 1 litre of H_2O. Next crystal of NaBr are added until $75\,\%$ of the AgCI is concerted to $AgBr_{(s)}$, the less soluble silver halide. What is Br^{-} at this point ? K_{SP} of AgCI is 1.78×10^{-10} and K_{SP} of AgBr is 5.25×10^{-13}.

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74. Calculate the pH of the following mixtures given $\left(pK_a = pK_b = 4.7447\right)$:

a. $50mL0.1MNaOH + 50mL0.1MCH_3COOH$

b. $50mL0.1mNaOH + 50mL0.05MCH_3COOH$

c. $50mL0.05MNaOH + 50mL0.1MCH_3COOH$

d. $50mL0.1MNH_4OH + 50mL0.05MHCI$

e. $50mL0.05MNH_4OH + 50mL0.1MHCI$

f. $50mL0.05MNH_4OH + 50mL0.05MCH_3COOH$

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75. A solution containing 0.2 mole of dicholoracetice acid $\left(K_a = 5 \times 10^{-2}\right)$ and0.1 mole sodium dicholoroacetate in one litre solution has $\left[H^+\right]$:

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76. 10g of $NH_4CI(mol.\,wt.\,53.5)$ when dissolved in 1000g water lowered the freezing point by $0.637\,^{\circ}C$. Calculate the degree of hydrolysis of the salt if its degree of dissociation is 0.75 . The molal depression constant of water is $1.86 Kmolality^{-1}$.

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77. At $18\,^{\circ}C$ aniline and acetic acid have dissociation constants 5×10^{-10} and 1.8×10^{-5} respectively. An aqueous solution of anilium acetate is hydrolysed to the extent of $x\,\%$ under equilibrium, what is pH of the solution ? $\left(K_w = 10^{-14}\right)$

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78. Calculate the extent of hydrolysis of $0.005 M K_2CrO_4 K_2 = 3.1 \times 10^7 f$ or H_2CrO_4. $\left(H_2CrO_4\right.$ is strong for first ionisation and $\left.K_1 = 1.6\right)$.

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79. A solution was made up by $0.01MCo\left(NO_3\right)_2$ and $.02MN_2H_4$ and was found to have at equilibrium $\left[Co^{2+}\right] = 0.0062M$. Calculate K_1 for the complex formation of $Co\left(N_2H_4\right)^{2+}$.

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80. The vapour pressur of $0.01molal$ solution of weak base BOH in water at $20^\circ C$ is $17.536mm$. Calculate K_b for base. Aqueous tension at $20^\circ C$ is $17.540mm$. Assume molatilly and molarity same.

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81. A $0.01M$ aqueous solution of weak acid HA has an osotic pressure $0.293atm$ at $25^\circ C$. Another $0.01M$ aqueous solution of

other weak acid HB has an osmotic pressure of $0.345atm$ under the same conditions. Calculate equilibrium constants of two acids for their dissociation.

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82. The freezing point of $3.75 \times 10^{-2}M$ aqueous solution of weak acid HA is $272.9K$. The molality of the solution was found to be 0.0384 molal. Find the $\left[H^{+}\right]$ of the solution on adding 3.75×10^{-2} moles of NaA to one litre of the above solution. $\left(K_f \text{of water} = 1.86 \text{molal}^{-1}\right)$

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83. Calculate the pH at which an acid indicator with $K_a = 1 \times 10^{-5}$ change colour when the indicator cincentration is $1 \times 10^{-3}M$. Also report the pH at which coloured ion is $80\ \%$ present.

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84. A solution of HCI has p$H = 5$. If $1mL$ of it is diluted to $1L$ what will be the pH of resulting solution?

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85. Calculate the pH of $0.010MNaHCO_3$ solution.

$K_1 = 4.5 \times 10^{-7}, K_2 = 4.7 \times 10^{-11}$ for carbonic acid.

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