CHEMISTRY

BOOKS - CENGAGE CHEMISTRY (HINGLISH)

IONIC EQUILIBRIUM

Solved Examples

1. Write the conjugate bases for the following Brddotonsted acids

(a) HF (b) H_2SO_4 (c) HCO_3^{Θ}

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2. Wirte the conjugate acids for the following Brdddotosted bases:

a. $\overset{\Theta}{N}H_2$ b. NH_3 c. $HCOO^{\Theta}$

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3. The species $H_2O, HCO_3^{\ominus}, HSO_4^{\ominus}, NH_3$ can act both as Brddotosted acis and bases. For each case give the corresponding conjugate acid and conjugate base.

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4. Classify the following species into Lewis acid and Lewis base and show how these act as such.

a. $\overset{\ominus}{OH}$ b. $F^{\ominus}$ c. $H^{\oplus}$ d. BCI_3

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5. In the reaction of BeF_2 with $2F^{\ominus}$ to form BeF_4^{-2}, which reactant is the Lewis acid and which is the Lewis base?

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6. Write the conjugate bases of the following acids:

a. HCN b. $\overset{\oplus}{N}_2H_5$ c. C_2H_5OH

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7. Write the conjugate acids of the following bases:

a. C_5H_5N b. $\overset{\oplus}{N}_2H_5$

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8. Liquid NH_3, like water, is an amphiprotic solvent. Write the equaiton for the auto-ionisation of NH_3.

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9. Aniline $\left(C_6H_5NH_2\right)$ is a organic base in aqueous solution. Suggest a solvent in which aniline would become a weak base.

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10. The concentration of hydrogen ion in a sample of soft drink is $3.8 \times 10^{-3} M$. What is its pH?

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11. Calculate the pH of the following solutions:

a $10^{-2} MHCI$

b $10^{-3} MH_2SO_4$

c $0.2 \times 10^{-2} MNaOH$

d $0.3 \times 10^{-3} MCa(OH)_2$

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12. Calculate the concentration of hydrogen ion in the acidic solution with pH

a. 4.3 b. 5.8239 c. 3.155

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13. Calculate the concentration of $\overset{\Theta}{OH}$ in the solution of base with pH

a. 10.4771 b. 12.301 c. 11.8451

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14. Calculate the pH of the following mixtires of strong acids, strong bases, and combination of both:

a. $500mL$ of $0.1MHCI+200mL$ of $0.1MH_2SO_4+300mL$ of $0.2MHNO_3$

b. $100mL$ of $0.1MHCI+100mL$ of $0.2MH_2SO_4+100mL$ of $0.1MHNO_3$ and $700mL$ of H_2O

c. $500mL$ of $0.1MNaOH+100mL$ of $0.1MCa(OH)_2+400mL$ of $0.2MKOH$

d. $100mL$ of $0.1MNaOH+200mL$ of $0.1NCa(OH)_2+200mL$ of $0.1MKOH$ and $500mL$ of H_2O

e. $100mL$ of $0.1MHCI+300mL$ of $0.1MH_2SO_4+100mL$ of $0.3MBa(OH)_2$ and volume was made to $1L$ by adding water

f $500mL$ of $0.1MHCI+100mL$ of $0.1NH_2SO_4+400mL$ of $0.1MCa(OH)_2$

g $8g$ of $NaOH + 680mL$ of $MHCI + 10mL$ of H_2SO_4, (specific gravity $1.2, 49\% H_2SO_4$ bu mass). The total volume of the solution was made to $1L$ with water.

h. $37.0g$ of $Ca(OH)_2 + 360mL$ of $1MHCI + 10mL$ of H_2SO_4 (density $= 1.4, 49\% H_2SO_4$ by mass). The total volume of the solution was made to $1L$ with water.

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15. a. What amount of H_2SO_4 must be dissolved in $500mL$ of solution to have a pH of 2.15?

b. What amount of KOH must be dissolved in $200mL$ of solution to have a pH of 12.3?

c. What amount of $ca(OH)_2$ must be dissolved in $100mL$ of solution to have a pH of 13.85?

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16. Calculate the pH of solution made by mixing equal volume of :

a. Two solutions having $pH = 1.5$ and 2.5.

b. Three solutions having $pH = 15, 2.5,$ and 3.5.

c. Two solutions having $pH = 8$ and 9.

d. Three solutions having $pH8, 9,$ and 10.

e. Two solutions having $pH = 2$and 4.

f. Three solutions having $pH = 2, 4,$ and 6.

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17. While calculate the pH of $10^{-7}MHCI$, the common ion effect of HCI on water is considered. Why the common ion effect of water on HCI is not considered?

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18. What is the pH of the following solutions:

a. $10^{-8}MHCI$ b. $5 \times 10^{-8}MHCI$

c. $5 \times 10^{-10} MHCI$ d. $10^{2} MHCI$

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19. What is the pH of the following solutions:

a. $10^{-7} MNaOH$ b. $10^{-8} MNaOH$

c. $10^{2} MNaOH$

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20. 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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21. The value of K_w, at the physiological temperature $37^{\circ} C$ is 2.4×10^{-14}. What is the pH at the neutral point of water at this temperature where there are equal numbers of H^{+} and OH^{-} ions?

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22. 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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23. The ionisation constant of HF is 3.2×10^{-4}.

a. Calculate the dergee of dissociation of aall species present M solution.

b. Calculate the concentration of all species present $\left(H_3O^{\oplus}, F^{\Theta}\right.$ and $HF)$ in the solution.

c. Calculate method:

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24. The pH of $0.1M$ monobasic acid is 4.50. Calculate the concentration of species, $H^{\oplus}, A^{\Theta}$, and HA at equilibrium. Also determine the value of K_a and pK_a of the monobasic acid.

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25. Calculate the pH of 0.08 solution of $HOCI$ (hydrochlorous acid). The ionisation constant of the acid is 2.5×10^{-5}. Determine the percent dissociation of $HOCI$.

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26. The pH of $0.004M$ hydrazine $\left(NH_2 . NH_2\right)$ solution is 9.7. Calculate its ionisation constant K_b and pK_b.

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27. Determine the dergee of dissociation of $0.05MNH_3$ at $25^\circ C$ in a solution of $pH = 11$.

$K_b = 1.77 \times 10^{-5}\left(pK_b = 4.75\right)$

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28. Calculate the ionic constant of the conjugate acid of NH_3.

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29. Prove that the dergee of dissociation of weak acid is given by:

$$\alpha = \frac{1}{1 + 10^{pK_a - pH}}$$

where K_a is its dissociation constant of the weak acid.

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30. 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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31. Calculate $\left[H^{\oplus}\right], \left[C_3H_5O_3^{\ominus}\right]$, and $\left[PhO^{\ominus}\right]$ in a solution that is $0.03M\left(C_2H_5\overset{\overset{O}{||}}{C}-O-O-H\right)$ and $0.1MPhOH? K_a$ values for $C_3H_5O_3H$ and $PhOH$ are 1.48×10^{-4} nad 1.05×10^{-10} respectively.

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32. What is the pH of $7.0 \times 10^{-8}M$ acetic acid. What is the concentration of un-ionsed acetic acid. K_a of $CH_3COOH = 1.8 \times 10^{-5}$.

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

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34. What is the pH of the solution when $100mL$ of $0.1MHCl$ is mixed with $100mL$ of $0.1MCH_3COOH$.

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35. Calculate $\left[H^{\oplus}\right]$ and $\left[\overset{\ominus}{O}H\right]$ in $10^{-3}M$ solution of monobasic acid which is 4.0% ionised. What is the pH, K_a and pK_b of the acid.

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36. calculate $\left[H^{\oplus}\right]$ and $\left[\overset{\ominus}{O}H\right]$ in a $0.1M$ solution of weak monoacitic base which is 2.0% ionised. What is the pH of solution.

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37. 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 $\overset{\ominus}{O}H$.

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

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39. 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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40. Calculate the pH of $0.1MNH_3$ solution.

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41. Calculate the pH after $50.0mL$ of this solution is treated with $25.0mL$ of $0.1MHCI$

K_b for $NH_3 = 1.77 \times 10^{-5}\left(pK_b \approx 4.76\right)$.

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42. What is the pH of a solution containing $0.01molHCIL^{-1}$?

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43. Calculate the change in pH if $0.02molCH_3COONa$ is added to $1.0L$ of this solution. ltbRgt K_a of $CH_3COOH = 1.8 \times 10^{-5}$.

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44. $0.1MNH_3$ solution is found to have a $\left[\overset{\Theta}{OH}\right]$ of $.133 \times 10^{-3}M.$

a. What is the pH of the solution?

b. What will be the pH of the solution after $0.1 MNaOh$ is added to it?

c. Calculate K_b and pK_b for NH_3?

d. How will $NaOh$ added to the solution affect the extent of dissociation of NH_3?

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45. The self ionisation constant for pure $HCOOH, K = \left[HCOO\overset{\oplus}{H}_2\right]\left[HCOO^{\ominus}\right]$ is 10^{-6} at room temperature. What percentage of $HCOOH$ molecules are converted to $HCOO^{\ominus}$ ions. The density of $HCOOH$ iws $1.22 gcm^{-3}$.

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46. Liquid NH_3 ionises to a slight extent. At $-50^{\circ} C$, its ionic product $K_{NH_3} = \left[\overset{\ominus}{Nh}_4\right]\left[\overset{\ominus}{NH}_2\right]$ is 10^{-30}. How many amide ions, $\overset{\oplus}{NH}_2$ are present per mm^3 of pure liquid NH_3?

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47. Find the concentration of $H^{\oplus}$, HCO_3^{Θ}, and CO_3^{-2} in a $0.01M$ solution of carbonic acid if the pH of solution is 4.18.

$K_1 = 4.45 \times 10^{-7}, K_2 = 4.69 \times 10^{-11}$

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48. 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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49. Calculate the concentration of all species of significant concentrations presents in $0.1MH_3PO_4$ solution. ltbrlt

$K_1 = 7.5 \times 10^{-3}, K_2 = 6.2 \times 10^{-8}, K_{\#} = 3.6 \times 10^{-13}$

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50. A solution contains $0.1 M H_2S$ and $0.3 M HCI$. 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^{-13} respectively.

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51. Which of the following combinations of solute would result in the formation of a buffer solution.

a. $CH_3COOH + NaOH$ in

i. $1:1$ mol ratio

ii. $2:1$ mol ratio

iii. $1:2$ mol ratio

b. $NH_4CI = NH_3$in

i. $1:1$ mol ratio

ii. $2:1$ mol ratio

iii. $1:2$mol ratio

c. $HCI + NaCI$

d. $HCI + CH_3COOH$

e. $NaH + HCI$

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52. Calculate the pH of a solution made by mixing $0.1MNH_3$ and $0.1M\left(NH_4\right)_2SO_4$. $\left(pK_b \text{ of } NH_3 = 4.76\right)$

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53. How much volume of $0.1MHac$ should be added to $50mL$ of $0.2MNaAc$ solution to have a $pH4.91$?

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54. i At what pH will the mixture of $HCOOH$ and $HCOONa$ given buffer solution of higher capacity?

ii Calculate the ratio of $\frac{[HCOONa]}{[HCOOH]}$ in a buffer of $pH4.25.$ $\left(K_a\right.$ of $\left.HCOOH = 1.8 \times 10^{-4}\right)$

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55. How much of $0.3MNH_4OH$ should be mixed with $30mL$ of $0.2M$ solution of NH_4CI to given butter solution of $pH8.65$?

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56. Calculate the pH of the following mixtures given $K_a = 1.8 \times 10^{-5}$ and $K_b = 1.8 \times 10^{-5}\left(pK_a = pK_b = 4.7447\right)$.

a. $50mL0.05MNaOH + 50mL$ of $0.1MCH_3COOH$

b. $50mL0.1MNH_4OH + 50mL$ of $0.05MHCI$

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57. What volume of strong monobasic acid of normality 10 is needed to prepare $1L$ of a butter solution of $pH9$, using $1mol$ of NH_3 and as much of strong acid needed. $\left(K_b \text{ for } NH_3 = 1.8 \times 10^{-5}\right)\left(pK_b = 4.7477\right)$

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58. $40mL$ sample of $0.1M$ solution of nitric acid is added to $20mL$ of $0.3M$ aqueous ammonia. What is the pH of the resulting solution?

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59. The base imidazole has a K_b of 8.1×10^{-8}.

a. In what amounts should $0.02MHCI$ and $0.02M$ imidazole be mixted to make $100mL$ of a buffer at $pH7$?

b. If the resulting solution is diluted to $1L$, what is the pH of the diluted solution?

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60. In the titration of a solution of a weak acid HX with $NaOH$, the pH is 5.8 after $10mL$ of $NaOH$ solution has been added and 6.40 after $20mL$ of the $NaOH$ has been affed. What is the ionisation constant of the acid HX?

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61. A definite volume of an aqueous $N/20$ acetic acid $\left(pK_a = 4.74\right)$ is titrated with a strongs base. It is found that 75 equal-sized drops of $NaOH$ added from a burette effect the complete neutralisation. Find the pH when an acid solution is neutralised to the extent of 20%, 40%, and 80%, respectively.

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62. How many moles of $NaOH$ can be added to $0.1L$ of solution of $0.1MNH_3$ and $0.1MNH_4CI$ without changing pOH by more than pne unit $\left(pK_a \text{of} NH_3 = 4.75\right)$?

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63. How many moles of HCI can be added to $1.0L$ of solution of $0.1MNH_3$ and $0.1MNH_4CI$ without changing pOH by more than one unit? $\left(pK_bofNH_3 = 4.75\right)$

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64. A buffer solution of pH value 4 is to be prepared, using CH_3COOH and CH_3COONa.How much amount of sodium acetate is to be added to $1.0L$ of $M/10$ acetic acid? $\left(K_a = 2.0 \times 10^{-5}\right)$

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65. What will be the pH if $0.01mol$ of HCI is dissolved in the above buffer solution? Find the change in pH value.

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66. How will the pH be affected if $1.5L$ of H_2O is added to the above buffer?

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67. Calculate the pH of a buffer by mixing 0.15 mole of NH_4OH and 0.25 mole of NH_4CI in a $1000mL$ solution K_b for $NH_4OH = 2.0 \times 10^{-5}$

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68. To $0.1L$ of a decimolar solution of acetic acid, how much dry sodium acetate be added (in moles) so as to decrease the concentration of $H^{\oplus}$ ion to $1/10th$ of its previous value? $K_a = 2.0 \times 10^{-5}$.

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69. The equivalent point in a titration of $40.0mL$ of a sodium of a weak monoprotic acid occurs when $35.0mL$ of a $0.10MNaOH$ solutio has been added. The pH of the solution is 5.5 after the addition of $20.0mL$ of $NaOH$ solution. What is the dissociation constant of the acid ?

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70. Consider a buffer solution containing $0.1mol$ each of acetic and sodium acetate in $1.0L$ of solution, $0.01mol$ of $NaOH$ is gradully added to this buffer solution. Calculate the average buffer capcity of the solution and as well as initial and final buffer capcity. $\left[K_a = 2 \times 10^{-5}\right]pK_a = 4.7$

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71. The ph of blood stream is maintained by a proper balance of H_2CO_3 and $NaHCO_3$ concentrations. What volume of $5MNaHCO_3$ solution, should be mixed with $10mL$ sample of blood which is $2M$ in H_2CO_3 in order to maintain a pH of 7.4. K_a for H_2CO_3 in blood is 4.0×10^{-7}?

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72. Calculate the degree of hydrolysis of a mixture of aniline and acetic acid each of them being $0.01M$. K_a of acetic acid $= 1.8 \times 10^{-5}$ and $K_a(\text{aniline}) = 4.5 \times 10^{-10}$. Also calculate pH of the mixture.

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73. $2.5mL$of $2/5M$ weak mono-acidic base $\left(K_b = 1 \times 10^{-12} \text{ at } 25^\circ C\right)$ is titrated with $2/15MHCI$ in water at $25^\circ C$. Find the concentration of $H^{\oplus}$ ions at equivalence point. $\left(K_w = 1 \times 10^{-14} at 25^\circ C\right)$

a. $3.7 \times 10^{-13}M$ b. $3.2 \times 10^{-7}M$

c. $3.2 \times 10^{-2}M$ d. $2.7 \times 10^{-2}M$

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74. 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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75. Calculate the drgee of hydrolysis and pH of $0.02M$ ammonium cyanide $\left(NH_4CN\right)$ at $298K$. $\left(K_a \text{ of } HCN = 4.99 \times 10^{-9}, K_b \text{ for } NH_4OH = 1.77 \times 10^{-5}\right)$

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76. Calculate the pH of the solutions when following conditions are provided:

a. $20mL$ of $M/10CH_3COOH$ solution is titrated with $M/10$ solution of $NaOH$.

i. No titration is carried out.

ii. When $10 mL$ of $NaOH$ is added.

iii. When $20 mL$ of $NaOH$ is added.

iv. When $30 mL$ of $NaOH$ is added. $\left(pK_a \text{ of } CH_3COOH = 4.74\right)$

b. $20 mL$ of $M/10 NaOH$ solutions sio titrated with $M/10$ solution of $CH_3COOH.$

i. No titration is carried out.

ii. When $18 mL$ of Ch_3COOH is added.

iii. When $20 mL$ of CH_3COOH is added.

iv. When $40 mL$ of CH_3COOH is added.

c. $10 mL$ of $M/10 NH_4OH$ solution is titrated with $M/10$ solution of $H_2SO_4.$

i. No titration is carried out.

ii. When $4 mL$ of H_2SO_4 is added.

iii. When $5 mL$ of H_2SO_4 is added.

iv. When $10 mL$ of H_2So_4 is added. pK_a of $NH_4OH = 4.76$

d. $10 mL$ of $M/10 H_2SO_4$ solution is titrated with $M/10$ solution of $NH_4OH.$

i. No titration is carried out.

ii. When $10 mL$ of NH_4OH is added.

iii. When $20 mL$ of NH_4OH is added.

When $40 mL$ of NH_4OH is added.

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77. 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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78. Which of the following ions or compounds in a solutions tends to produe an acidic, a basic, or a neutral solution.

a. i. $C_2H_3O_2^{\ominus}$ ii. $Na^{\oplus}$ iii. So_3^{2-} iv. $F^{\ominus}$ v. $NH_4^{\oplus}$

b. i. CH_3COONa ii. $ZnCI_2$ iii. KNO_3 iv. NH_4CI

c. i. $NaCN$ ii. K_2CO_3 iii. H_3PO_4 iv. NaF

d. i. NH_4NO_3 ii. Ba_2CO_3 iii. $NaHSO_4$ iv. $NaOCI$ v. $HOCI$ vi. $AI\left(NO_3\right)_3$

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79. Arrange the following bases in order of decreasing basicity:

$S^{2-}, CH_3COO^{\Theta}, CH^{\Theta}, NH_3, F^{\Theta}$

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80. Classify each of the folowing as a strong acid, string base, weak acid, and weak base:

i. $NaOH$ ii. HF iii. $NH_4^{\oplus}$ iv. NH_3 v. F^{Θ} vi. HI

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81. Arrange the following $0.1M$ solutions in order of icreasing pH:

$H_2CO_3, HBr, HI, NH_3, KCN, NaOH, NH_4Br$

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82. Why the following compounds will produce acidic solution in water

i. H_3PO_4

ii. CO_2

iii. HNO_2

iv. $AICI_3$

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83. Write equaitons to explain why the following species act as weak bases in water solution.

i. CH_3NH_2 ii. NO_2^{Θ} iii. HPO_4^{2-} iv. CHO_2^{Θ}

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84. Which equilibrium constant(s) or ratio of equilibrium contants should be used to calculate the pH of $1.00L$ of each of the following solutions?

a. KOH b. NH_3 c. $HC_2H_3O_2$

d. $HC_2H_3O_2 + NaC_2H_3O_2$ e. $KC_2H_3O_2$

f. $0.01 molHC_2H_3O_2 + 0.050 molNaOh$

g. H_2S h. $0.01 NH_4CI + 0.50 molNaOH$

i. $0.010 molHC_2H_3O_2 + 0.10 molNaOH$

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85. The salt of which one of the follwing five weak acid will be the most hydrolysed?

a. $HA : K_a = 1 \times 10^{-8}$ b. $HB : K_a = 2 \times 10^{-6}$

c. $HC : K_a = 3 \times 10^{-8}$ d. $HD : K_a = 4 \times 10^{-10}$

e. $HE : K_a = 1 \times 10^{-7}$

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86. $500 mL$ of $0.2 M$ aqueous solution of acetic acid is mixed with $500 mL$ of $0.2 HCI$ 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. $\left[K_a\right.$ of $CH_3COOH = 2 \times 10^{-5}$.

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87. $0.1MNaOH$ is titrated with $0.1M, 20mLHA$ till the point. $K_a(HA) = 6 \times 10^{-6}$ and degree of dissociation of HA is neglible (small) as compared to unity. Calculate the pH of the resulting solution at the end point [Use $\log 6 \approx 0.8$]

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88. A hydrogen electrode placed in a solution containing sodium acetate and acetic acid in the ratio of $x:y$ and $y:x$, ahs electrode potential values of -1.5 and $-0.5V$, respectively. What is the pK_a value of acetic acid?

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89. The *emf* of the following cell is observed to be $0.118V$ at $25\,^{\circ}C$.

$$\left[Pt, H_2(1atm)\ |\ HA\left(100mL0.1M\right|\left|H^{\oplus}(0.1M)\right|H_2(1atm)\left|Pt\right]\right.$$

a. If $30mL$ of $0.2MNaOH$ is added to the negative terminal of battery, find the emf of the cell.

b. If $50mL$ of $0.2MNaOH$ is added to the negative terminal of battery, find the emf of teh cell.

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90. The freezing point of $0.20M$ solution of weak acid HA is $272.5K$. The molality of the solution is $0.263molKg^{-1}$.

a. Find the pH of the solution on adding $0.25m$ solution of acetate of the above solution.

b. Find the pH of the solution on adding $0.20M$ solution of $NaOH$. Given: K_f of water $= 1.86Km^{-1}$

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91. Methy1 red has a $K_a = 10^{-5}$. The acid form Hin is red and its conjugate base, Ind^{Θ} is yellow. Complete the following table:

pH	3	5	7
$\left[\text{Ind}^{\Theta}\right]/[\text{HIn}]$	-	-	-
Colour	-	-	-

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92. There are three acid-base indicators: methy1 orange (end point at $pH = 4$), bromothymol blue (end point $pH = 7$), and phenolphthalein (end point at $pH = 9$). Which of the following would you select for the titrations?

a. H_2SO_4 with KOH b. KCN with HCI

c. NH_3 with HNO_3 d. HF with $NaOH$

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93. A solution gives the following colours with different indicators:

a. Methy1 orange $\Rightarrow$ Yellow

b. Methy1 red $\Rightarrow$ Yellow

c. Bromothymol blue $\Rightarrow$ Orange

What is the pH of the solution?

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94. What indicators will be suitable for the following acid-base titrations:

a. $HCOOH$ against $NaOH$

b. HBr against KOH

c. NH_4OH with HNO_3

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95. 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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96. At what pH will a $1.0 \times 10^{-3}M$ solution of an indicator with $K_b = 1.0 \times 10^{-10}$ changes colour?

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97. What indicator should be used for the titration of $1.0MKH_2BO_2$ with $1.10MHCI$?

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98. Calcualte the pH at which an indicator with $pK_b = 4$ changes colour.

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99. Bromophenol blue is an indicator with a K_a value of 5.84×10^{-5}. What is the percentage of this indicator in its basic form at a pH of 4.84?

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100. An acid-base indicator has a K_a of 3.0×10^{-5}. The acid form of the indicator is red and the basic form is blue. (a) By how much must the pH change in order to change the indicator from 75% red to 75% blue?

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101. Determine the solubility of (a) $AgCI$, (b) $Fe(OH)_3$, (c) Hg_2Br_2, and (d) Ag_2SO_4 from their solubility product constants give in table. Calculate the molarities of the individual ions and also the soubities of salts in gL^{-1}.

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102. Calcualte the solubility of M_2X_3 in pure water, assuming that neither kind of ion reacts with H_2O. The solubility product of M_2X_3, $K_{sp} = 1.1 \times 10^{-23}$.

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103. The values of Ksp of two sparingly soluble salts $Ni(OH)_2$ and $AgCN$ are 2.0×10^{-15} and 6.0×10^{-17} respectively. Which salt is more soluble. Explain

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104. a. A solution of caF_2 is found to contain $10^{-4} MF^{\Theta}$ ions. What is the K_{sp} of caF_2?

b. A solution of calcium phoshate contains $2 \times 10^{-5} MPO_4^{3-}$ ions. What is $K_{sp}$of $ca_3(PO_4)_2$?

c. A solution of $Ca_3(PO_4)_2$ contains $6 \times 10^{-5} Mca^{2+}$ ions. What is the K_{sp} of $Ca_3(PO_4)_2$?

d. A solution of $Zr_3(PO_4)_4$ constains $8x10^{-5} MPO_4^{3-}$ions. what is the K_{sp} of $Zr_3(PO_4)_4$?

e. A solution of $Zr_3(PO_4)_4$ contain $3 \times 10^{-5} MZr^{4+}$ ions. What is the K_{sp} of $Zr_3(PO_4)_4$?

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105. Let the solubilities of $Agbr$ in water and in $0.01 McaBr_2, 0.01 MKBr$, and $0.05 MAgNO_3$be S_1, S_2, S_3 and S_4, respectively. Give the decreasing order of the solubilities.

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106. The K_{sp} of $AgCI$ at $25^\circ C$ is 1.5×10^{-10}. Find the solubility (in $g^{-1}L^{-1}$) in an aqueous solution containing $0.01 MAgNO_3$.

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107. The solubility of $BaSO_4$ in water is $2.33 g 100 mL^{-1}$. Calculate the percentage loss in weight when $0.2 g$ of $BaSo_4$ is washed with

a. $1L$ of water

b. $1L$ of $0.01 NH_2SO_4$. $\left[Mw_{BaSO_4} = 233 g mol^{-1}\right]$

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108. When $15mL$ of $0.05MAgNO_3$ is mixed with $45.0mL$ of $0.03MK_2CrO_4$, predict whether precipitation of Ag_2CrO_4 occurs or not? K_{sp} of $Ag_2CrO_4 = 1.9 \times 10^{-12}$

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109. The concentration of Ni^{+2} ions in a given NiS solution is $2.0 \times 10^{-6}M$. Find the minimum S^{2-} ions necessary to cause precipitation of NiS. K_{sp} of $NiS = 1.4 \times 10^{-14}$.

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110. A solution contains $0.1M$ each of $CaCI_2$ and $SrCI_2$. $A0.005M$ solution of SO_4^{2-} is slowly added to the given solution.

a. Which substance beings to precipitate first?

b. If H_2SO_4 is continuosult added, determine when will other salt be precipitated?

c. When second salt starts to precipitate, find the concentration of cation of first salt. Assume that $CaCI_2$ and $SrCI_2$ are 100% ionised and volume of the solution remains constant.

$K_{sp} of SrSO_4 = 3.2 \times 10^{-7}$ and $K_{sp} of CaSO_4 = 1.3 \times 10^{-4}$

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111. How much the concentration of $Ag^{\oplus}$ ions in a saturted solution of $AgCI$ diminish if such an amount of HCI is added to it that the concentration of CI^{Θ} ions in the solution becomes equal to $0.03M$? Also find the amount of $AgCI$ precipitated at the given concentration. K_{sp} of $AgCI = 1.8 \times 10^{-10}$.

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112. Calculate the maximum possible concentration of Mn^{2+} in water that is saturated with H_2S (which is $0.1M$ at $300K$) and maintained at $pH = 3$ with HCI. The equilibrium constant (s) for dissociation of H_sS are:

$H_2S \Leftrightarrow H^{\oplus} + HS^{\ominus}, K_1 = 9 \times 10^{-8}$

$HS^{\ominus} \Leftrightarrow H^{\oplus} + S^{2-}, K_2 = 1 \times 10^{-12}$ and

K_{sp} of $MnS = 3 \times 10^{-22}$

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113. Two weak monobasic organic acids HA and HB have dissociation constans as 3.0×10^{-5} and 1.5×10^{-5}, respectively, at $25^{\circ}C$. If $500mL$ of $1M$ solutions of each of these two acids are mixed top product $1L$ of mixed acid solution, what iws the pH of the resulting solutions?

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114. Calculate the simultaneous solubilities of $AgSCN$ and $AgBr$.

$K_{sp}(AgSCN) = 1.0 \times 10^{-12}, K_{sp}(AgBr) = 5.0 \times 10^{-13}$

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115. How much $AgBr$ could dissolve in $1.0L$ of $0.4MNH_3$? Assume that $Ag\left(NH_3\right)_2^{\oplus}$ is the only complex formed. Given: the dissociation constant for

$Ag\left(NH_3\right)_2^{\oplus} \Leftrightarrow Ag^{\oplus} \times 2NH_3,$

$K_d = 6.0 \times 10^{-8}$ and $K_{sp}(AgBr) = 5.0 \times 10^{-13}$.

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116. The solubility of silver benozate $(PhCOOAg)$ is H_2O and in a buffer solution of $pH = 4, 5$ and 6 are S_1, S_2, S_3, and S_4, respectively. Given the decreasing order of their solubilities.

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117. The ionisation constant of benzoic acid $(PhCOOH)$ is 6.46×10^{-5} and K_{sp} for silver benzoate is 2.5×10^{-3}. How many times is silver benzoate more soluble in a buffer of $pH3.19$ compared to its solubility is pure water?

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118. Write equations showing all of the equilibrium reactions occuring in aqueous solutions containing each of the following sets of reagents:

a. $NaCI$

b. $NaOH$

c. $NaC_2H_3O_2 + HC_2H_3O_2$

d. $Na_2S + CuS$

e. $NH_4CI + NH_3 + Mg(OH)_2(s)$

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119. Calculate the solubility of CoS in $0.1MH_2S$ and $0.15MH_3O^{\oplus}\left(K_{sp}\right.$ of $\left.CoS = 3 \times 10^{-26}\right)$.

$\left(K_1 \times K_2\left(H_2S\right) = 10^{-21}\right)$

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120. Explain why CoS is more soluble than predicted by the K_{sp}.

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121. The solubility of CuS in pure water at $25^{\circ} C$ is $3.3 \times 10^{-4} gL^{-1}$. Calculate K_{sp} of CuS. The accurate value of K_{sp} of CuS was found to be 8.5×10^{-36} at $25^{\circ} C$.

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122. Explain why CuS is more soluble than predicted by the K_{sp}.

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123. The solubility of TI_2S in pure CO_2 -free water is $6.3 \times 10^{-6} M$. Assume that the dissolved S^{2-} ion hydrolyses almost completely to HS^{Θ} and that the further hydrolysis to H_2S is neglected. What is the K_{sp}. $\left(K_2\left(H_2S\right) = 10^{-14}\right)$.

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124. When solid $SrCO_3$ is equilibrated with a $pH 8.60$ buffer, the solution was found to have $\left[Sr^{2+}\right] = 2.2 \times 10^{-4}$. What is the K_{sp} of $SrCO_3$.

$\left(K_2 \text{ of } H_2CO_3 = 4.7 \times 10^{-11}\right)$

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125. Calculate the solubility at $25^{\circ}C$ of $CaCO_3$ in a closed container containing a solution of $pH 8.60$. $\left[K_{sp}\left(CaCO_3\right) = 10^{-8}\right]$

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126. For galvanic cell:

$Ag \mid AgCI(s), KCI(0.2M \mid |KBr(0.001M), AgBr(s)|Ag$ Calculate EMF generated and assign correct polarity to each electorde for spontaneous process after taking into accunt the celol reaction at $25 ^\circ C$.

$K_{sp}AgCI = 2.8 \times 10^{-10}, K_{sp}AgBr = 3.3 \times 10^{-3}$.

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127. At $25 ^\circ C$, after the addition of $110mL$ of $0.1NaCI$ solution to $100mL$ of $0.1NAgNO_3$ solution, the reduction potentila of a silver electrode placed in it is $0.36V$. Calculate the $K_{sp}$of $AgCI$. (Given: $E^{\Theta}Ag/Ag^{\oplus} = -0.799V\big)$.

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128. Calculate the entropy of $\overset{\Theta}{OH}$ ion at $298K$. Given:

a. $H_2O \Leftrightarrow H^{\oplus} + \overset{\Theta}{OH}(\Delta H = 13.4kcal)$

b. K_{eq} for the reaction $= 10^{-14}$.

c. $S^{\Theta}\left(H^{\oplus}\right) = 0.0$

d. $S^{\Theta}\left(H_2O\right) = 16.7cal/molk$.

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129. Calculate K_{sp} for $AgCI$. Given:

$\Delta_f H^\Theta Ag^\oplus = 25.3 kcal mol^{-1}$

$\Delta_f H^\Theta C1^\Theta = -40.0 kcal mol^{-1}$

$\Delta_f H^\Theta AgC1 = -30.36 kcal mol^{-1}$

$S^\Theta Ag^\oplus$, $S^\Theta C1^\Theta$, and $S^\Theta AgC1$ are $17.7, 13.2$ and $23.0 cal mol^{-1}$

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130. Calculate the minimum mass of $NaCI$ necessary to dissolve $0.01 mol AgC1$ in $100L$ solution.

(Assume no change in volume) $\left(K_f AgC1_2^\Theta = 3 \times 10^5\right)\left(K_{sp} AGC1 = 10^{-10}\right)$

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131. What is the concentration of free Cd^{2+} in $0.005 M CdC1_2 ? K_1$ for chloride complexation of Cd^{2+} is 100, K_2 need not be considered.

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132. In the equantitative estimation of $Ag^{\oplus}$ ions as $AgC1$, solution of $NaC1$ is used as the precipitating reagent. Why a large excess of $NaC1$ should be avoided?

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133. 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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134. $K_1, K_2$and k_3 for the complexation of SCN^{Θ} with Fe^{3+} are $130, 16,$ and 1.0, respectively. (i) Calculate the overall formation costant of $fe(SCN)_3$ from its constituent ions. (ii) Calculate K_d (dissociation constant) of $Fe\Big)SCN)_3$.

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135. Explain why $0.1 M NH_3$ solution:

a. Will precipitate $Fe(OH)_2$ from $0.1M$ soluton Fe^{2+}.

b. Will not precipitate $Mg(OH)_2$ from a solution which is $0.2M$ in $\overset{\oplus}{NH_4}$ and $0.01M$ in Mg^{2+}.

c. Will not precipitate $AgOH$ from a solution which is $0.01M$ in $Ag^{\oplus}$.

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136. K_a for HA is 4.9×10^{-8}. After making the necessary approximation, calculate for its decimolar solution,

a. % dissociation b. $\overset{\Theta}{OH}$ concentration

c. pH

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137. Nicotinic acid $\left(K_a = 1.4 \times 10^{-5}\right)$ si represented by the formula $HNiC$. Calculate its percent dissociation in a solution which contains 0.10 moles of nictinic acid per $2.0L$ of solution.

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138. An aqueous solution contains 10% amonia by mass and has a density of $0.99gcm^{-3}$. Calculate hydroxy1 and hydrogen ion concentration in this solution K_a for $NH_4^{\oplus} = 5.0 \times 10^{-10}M$.

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

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140. Three suggestion are made for ways to removes silver ions from solution:

a. Make the solution $0.01M$in Nal.

b. Buffer the solution at $pH = 13$.

c. Make the solution $0.01 M Na_2S$. What will be the equilibrium silver ion concentartion in each case? which course of action is most effective in removing $Ag^{\oplus}$ ions?

$K_{sp}(AgI) = 8.5 \times 10^{-17}, K_{sp}(AgOH) = 2 \times 10^{-8}$,

$K_{sp}\left(Ag_2S\right) = 5.5 \times 10^{-51}$

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141. Calculate the the ratio of conjugate base// weak acid required to prepare an aqueous solution of benzoic acid and sodium benzote with pH of 4.5. The acid dissociation constant of benzoic acid is 6.5×10^{-5}.

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142. A solution is saturated with respect to $SrF_2 K_{sp} = 7.9 \times 10^{-10}$ and $SrCO_3, K_{sp} = 7.0 \times 10^{-10}$. If the fluoride ion concentration is found to be $4.0 \times 10^{-2} M$. What is the concentration of carbonates ions.

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143. The solubility of $Mg(OH)_2$ in pure water is $9.57 \times 10^{-3} gL^{-1}$. Calculate its solubility (in gL^{-1}) in $0.02 M Mg(NO_3)_2$ solution.

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144. Compare the solubility of $Fe(OH)_3 \left(K_{sp} = 4 \times 10^{-38}\right)$ and $Ni(OH)_2. \left(K_{sp} = 2 \times 10^{-16}\right)$ at $pH = 5.0$

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145. What is the pH at which $0.01 M Co^{2+}$ ions in solution precipitate down as $Co(OH)_2 ? K_{sp}$ of $Co(OH)_2$ is 2.5×10^{-16}.

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146. Freshly prepared aluminium and magnesium hydroxides are stirred vigorously in a buffer solution containing $0.25M$ of ammonium chloride and $0.05M$ of ammonium hydroxide. Calculate the concentration of aluminium and magesium ions in solution $\left(K_bNH_4OH = 1.8 \times 10^{-5}, K_{sp}Mg(OH)_2 = 6 \times 10^{-10}, K_{sp}A1(OH)_3 = 6 \times 10^{-32}\right.$.

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147. 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 ? $\left(K_{SP} of AgI = 8.5 \times 10^{-17}\right.$ and K_{SP} of $\left.Hg_2I_2 = 2.5 \times 10^{-26}\right)$

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148. A buffer solution containing $0.25 mol/L$ of NH_4CI and $0.05 mol/L$ of NH_4OH is in equilibrium with $A1^{+3}$ and Mg^{2+} ions. Calculate $\left[A1^{3+}\right]$ and $\left[Mg^{2+}\right]$ in solution.

$K_b\left(NH_4OH\right) = 2.0 \times 10^{-5}, K_{sp}\left[Mg(OH)_2\right] = 6.0 \times 10^{-12}, K_{sp}\left(A1(OH)_3\right) = 6 \times$

.

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149. The $K_{SP} of Ca(OH)_2 is 4.42 \times 10^{-5} at 25^\circ C$. A 500 mL of saturated solution of $Ca(OH)_2$ is mixed with equal volume of $0.4 M NaOH$. How much $Ca(OH)_2$ in mg is preciptated ?

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150. Determine the mass of PbI_2 that will dissolve in (a) $500 mL$ water (b) $500 mL$ of $0.01 M KI$ solution (c) $500 mL$ of a solution containing $1.33 g Pb\left(NO_3\right)_2$, K_{sp} of $PbI = 1.4 \times 10^{-8}$.

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151. Should a precipitate of barium fluoride be obtained when $100 mL$ of $0.25 M NaF$ and $100 mL$ of $0.015 M Ba(NO_3)_2$ are mixed. K_{sp} of $BaF_2 = 1.7 \times 10^{-6}$

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152. A saturated solution of silver benzoate, $AgOCOC_6H_5$ has a pH of 8.63, K_a for benzoic acid is 6.5×10^{-5}. Estimate K_{sp} for silver benzoate.

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153. For the indicator 'Hin' the ratio $(Ind^{\Theta})/(HIn)$ is 7.0 at pH of 4.3. What is K_{eq} for the indicator.

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154. Determine $\left[\overset{\Theta}{OH}\right]$ of a $0.050M$ solution of ammonia to which sufficient NH_4CI has been added to make the total $\left[NH_4^{\oplus}\right]$ equal to $0.1M$.

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155. K_{sp} of AgC1 is 2.8×10^{-10} at $25\,^{\circ}C$. Calculate solubility of AgC1 in.

a. Pure water b. $0.1MAgNO_3$

c. $0.1MKCI$ or $0.1MNaC1$

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156. 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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157. 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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158. Equal volumes of $0.02MCaC1_2$ and $0.0004MNa_2SO_4$ are mixed. Will a precipitate from? K_{sp} for $CaSO_4 = 2.4 \times 10^{-5}$?

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159. A solution containing both Zn^{2+} and Mn^{2+} ions at a concentration of $0.01M$ is saturated with H_2S. What is pH at which MnS will form a ppt ? Under these conditions what will be the concentration of Zn^{2+} ions remaining in the solution ? Given K_{sp} of $ZnSis10^{-22}$ and K_{sp} of MnS is 5.6×10^{-16}, $K_1 \times K_2$ of $H_2S = 1.10 \times 10^{-21}$.

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160. For the reaction

$Ag(CN)_2^{\ominus} \Leftrightarrow Ag^{\oplus} + 2CN^{\ominus}$, the K_c at $25^\circ C$ is 4×10^{-19} Calculate $\left[Ag^{\oplus}\right]$ in solution which was originally $0.1M$ in KCN and $0.03M$ in $AgNO_3$.

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161. A sample of hard water contains $0.05mol$ of $CaC1_2$, per litre, What is the minimum concentration of Na_2SO_4, which must be added for removing Ca^{2+} ions from this water sample? K_{sp} for $CaSO_4$ is $2.4 \times 10^{-5} at 25^\circ C$.

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162. 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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163. Calculate pH of saturated solution $Mg(OH)_2, K_{sp}$ for $Mg(OH)_2$ is 8.9×10^{-12}.

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164. 0.1 millie moles of $CdSO_4$ are present in $10ml$ acid solution of $0.08NHCI$. Now H_2S si passed to precipitate all the Cd^{2+} ions. What would be the pH of solution after filtering off percipitate, boilling of H_2S and making the solution $100ml$ by adding H_2S?

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165. The solubility of $Mg(OH)_2$ is increased by the addition of $\overset{\oplus}{N}H_4$ ion. Calculate

a. Kc for the reaction:

$Mg(OH)_2 + 2\overset{\oplus}{N}H_4 \Leftrightarrow 2NH_3 + 2H_2O + Mg^{+2}$

$K_{sp} of Mg(OH)_{。} = 6 \times 10^{-12}, K_b of NH_3 = 1.8 \times 10^{-5}$.

b. Find the solubility of $Mg(OH)_2$ in a solution containing $0.5 M NH_4 C1$ before addition of $Mg(OH)_2$.b

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166. The solubility of $Ag_2C_2O_4$ at $25^\circ C$ is 1.20×10^{-11}. A solution of $K_2C_2O_4$ containing $0.15 mol$ in $500 mL$ 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 $0.03 mol$ 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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167. $1.0L$ of solution which was in equilibrium with solid mixture of $AgC1$ and $AgC1$ and Ag_2CrO_4 was found to contain $1 \times 10^{-4} molofAg^{\oplus}$ ions, $1.0 \times 10^{-6} mol$ of $C1^{\Theta}$ ions and 8.0×10^{-4} moles of CrO_4^{2-} ions. $Ag^{\oplus}$ ions added slowely to the above mixture (keeping volume constant) till 8.0×10^{-7} mol of $AgC1$ got precipitated. How many moles of Ag_2CrO_4 were also precipitated?

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168. 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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169. Calculate the degree of hydrolysis and pH of $0.2M$ solution of NH_4C1 Given K_b for NH_4OH is 1.8×10^{-5}.

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170. Calculate for $0.01N$ solution of sodium acetate,

a. Hydrolysis constant b. Dergee of hydrolysis

c. pH Given $K_a = 1.9 \times 10^{-5}$

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171. Calcium lactate is salt of weak acid and represented as $Ca(LaC)_2$. A saturated solution of $Ca(LaC)_2$ contains $0.13mol$ of salt in $0.50L$ solution. The pOH of this is 5.60. Assuming complete dissociation of salt, calculate K_a of lacetic acid.

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172. 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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173. Calculate the pH of $0.1 M K_3PO_4$ soln. The third dissociation constant of orthophoshoric acid is 1.3×10^{-12}. Assume that the hydrolysis proceeds only in the first step.

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174. The ionization constant of $\overset{\oplus}{N}H_4$ ion in water is 5.6×10^{-10} at $25^\circ C$. The rate constant the reaction of $\overset{\oplus}{N}H_4$ and $\overset{\ominus}{O}H$ ion to form NH_3 and H_2O at $25^\circ C$ is $3.4 \times 10^{10} L mol^{-1} s^{-1}$. Calculate the rate constant for proton transfer form water to NH_3.

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175. Calculate $\left[Ag^{\oplus}\right]$ in a solution made by dissolving both $AgCrO_4$ and AgC_2O_4 untill saturation is reached with respect to both salts. Given

$K_{sp} of Ag_2CrO_4$ and $Ag_2C_2O_4$ are 9.0×10^{-12} and 6.0×10^{-12}, respectively.

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176. Using CO_2, NH_3, NH_4NO_3, and K_2CrO_4 as the only reagents, devise a qualitative analysis scheme for separating and identifying the following ions, which might all be present in the same mixture: $Ba^{2+}, Ca^{2+}, Mg^{2+}, Na^{\oplus}, Pb^{2+}$. Assume that each cation present is $0.10M$. Sate the conditions of pH and the reagent concentration which are required in each step.

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177. Assuming that the only source of perodic group IIA metals is an equimolar mixture of $NaC1, BaC1_2$ and $mGC1_2$, suggest ways of preparing pure samples of

a. $MgSO_4$ b. Ba metal c. $Ba\left(C_2H_3O_2\right)_2$.

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178. When a solution of Zn^{2+} was added to a solution of $NaOH$, a clear solution was obtained. What NH_4C1 was added to the clear solution, $Zn(OH)_2$, precipitated. Using balanced chemical equation, explain these observations.

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179. Given reagents $NH_3, NaOH, HC1$, and H_2S which one could be used to separated the ions in each of the following mixtures?

a. Cu^{2+} and Zn^{2+} b. Cu^{2+} and $A1^{3+}$ c. Zn^{2+} and $A1^{3+}$

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180. Estimate the K_{sp} of $AgBr$. Given $\Delta_f H^{\ominus}$ of $Ag^{\oplus}, Br^{\ominus}$, and $AgBr$ are 25.31, -28.9, and $-23.8 kcal$, $\Delta S^{\ominus}$ of $Ag^{\oplus}, Br^{\ominus}$, and $AgBr$ are $17.7, 19.3$, and $-26.6 cal/K$.

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181. When $40mL$ of a $0.1MN$ weak base, BOH is titrated with $0.01MHC1$, the pH of the solution at the end point is 5.5. What will be the pH if $10mL$ of $0.10MNaOH$ is added to the resulting solution ?

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182. Malonic acid is an organic dibasic acid such as H_2S having first ionistion constant, $K_1 = 1.42 \times 10^{-3}$ and second ionisation constant, $K_2 = 2.0 \times 10^{-6}$. Compute the divalent molanate ion concentration in:

a. $0.001M$ malonic acid.

b. a solution that is $0.0001M$ in malonc acid and $0.0004MHC1$.

c. a solution that is $0.0001M$ in malonic acid and $0.1MHC1$.

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183. What mass of pb^{2+} ions is left in solution, when $50.0mL$ of $0.20MPb\left(NO_3\right)_2$ is added to $50.0mL$ of $1.5MNAC1$?

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184. It is given that $0.001 mol$ each of Cd^{2+} and Fe^{2+} ions are contained in $1.0L$ of $0.02MHC1$ solution. This solutions is now saturated with H_2S gas at $25^{\circ}C$.

a. Determine whether or not each of these ions will be precipitated as sulphide?

b. How much Cd^{2+} ions remains in the solution at equilibrium?

$K_1\left(H_2S\right) = 1.0 \times 10^{-7}, K_2\left(H_2S\right) = 1.0 \times 10^{-14}$: ltbRgt

$K_{sp}(CdS) = 8 \times 10^{-27} : K_{sp}(FeS) = 3.7 \times 10^{-19}$.

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185. Calculate the $\left[F^{\Theta}\right]$ in a solution saturated with respect ot MgF_2 and SrF_2.

$K_{sp}\left(MgF_2\right) = 6.0 \times 10^{-9}, K_{sp}\left(SrF_2\right) = 3.0 \times 10^{-9}$

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186. HN_3 (hydroazic acid) is a weak acid dissociating as: $HN_3 \Leftrightarrow H^{\oplus} + N_3^{\ominus}$.

Find the concentration of $Ag^{\ominus}$ ions, if excess of solid AgN_3 is added to a solution maintained at $pH = 4$. The ionisation constant K_a of HN_3 is 2.0×10^{-5}. The solubility of AgN_3 in pure water is found to be 5.4×10^{-3} at $25\,^{\circ} C$.

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187. Calculate the solubility of $AgCN$ in a buffer solution of $pH 3.0$. Assume that no cyano complex is formed $K_{sp} AgCN = 2.2 \times 10^{-16}, K_a HCN = 6.2 \times 10^{-10}$.

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188. Calculate $\left[\overset{\oplus}{N}H_4\right]$ (derived from NH_4C1) needed to prevent $Mg(OH)_2$ from precipitating is $1.0L$ of solution which contins $0.01 mol NH_3$ and $0.001 mol Mg^{2+}$. $K_{sp} Mg(OH)_2 = 1.2 \times 10^{-11}, K_b NH_3 = 1.8 \times 10^{-5}$.

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189. A solution containing $10^{-3} M Sr(C1O_4)_2$ and $0.05 M KNO_3$ was found to have only 75% of its strontium in the uncomplexed Sr^{2+} form, the rest being $Sr(NO_3)^{\oplus}$. Calcualate the K_1 for complexation reaction:

$Sr^{2+} + NO_3^{\Theta} \rightarrow Sr(NO_3)^{\Theta}$

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190. Glycine $[NH_2CH_2COOH)$ is basic and acidic due to presence of $-NH_2$ and $-COOH$ group. It acquires a $H^{\oplus}$ to form $\overset{\oplus}{N}H_3COOH$, which is a diprotic acid with $K_1 = 4.5510^{-3}$ and $K_2 = 1.7 \times 10^{-10}$. In a $0.01M$ solution of neutral glycine,

a. What is the pH and

b. What percent of the glycine is in the cationic form at equilibrium?

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191. 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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192. The salt $ZN(OH)_2$ is involved in the following two equilibria:

$$Zn(OH)_2(s) \Leftrightarrow Zn^{3+}(aq) + 2\overset{\Theta}{O}H(aq)K_{sp} = 1.2 \times 10^{-17}$$

$$Zn(IH)_2(s) + 2\overset{\Theta}{O}H \Leftrightarrow Zn(OH)_4^{2-}(aq)K_f = 0.12$$

Calculate $\left|\overset{\Theta}{O}H\right|$ at which solubility of $Zn(OH)_2$ be a minimum. Also find the solubility of $Zn(OH)_2$ at this pH.

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193. A $500mL$ of an equilibrium mixture of gaseous N_2O_4 and NO_2 at $25^{\circ}C$ and $753mm$ of Hg was allowed to react with enough water to make

250mL of solution at $25\,^{\circ}C$. Assume that all the dissolved N_2O_4 is converted to NO_2 which disproportionates in water yielding a solution of nitrous acid and nitric acid. aAsume further that disproportionation reaction goes to completion and that none of the nitrous acid disproportionates. The equilibrium constant $\left(K_p\right)$ for $N_2O_4(g) \Leftrightarrow 2NO_2(g)0.113$ at $25\,^{\circ}C. K_a$ for HNO_2 is $4.5 \times 10^{-4} at 25\,^{\circ}C$.

a. Write balanced equation for disproportionation.

b. What is the molar concentration of NO_2 and pH of the solution?

c. What is osmotic pressure of solution?

d. How many grams of lime (CaO) would be required to neutralise the solution?

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194. A buffer solution of $0.080 M Na_2HPO_4$ and $0.020 M Na_3PO_4$ is prepared. The electrolytic oxidation of $1.0 mmol RNHOH$ is carried out in $100 mL$ buffer to give

$RNHOH + H_2O \rightarrow RNO_2 + 4H^{\oplus} + 4e^{-}$

Calculate approximate pH of the solution after oxidation is complete

$pK_{a_2}, pK_{a_2},$ and pK_{a_3} of H_3PO_4 are $2.12, 7.20,$ and $12.0,$ respectively.

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195. Calculate the pH of $0.05 M KHC_8H_4O_4$

$H_2C_8H_4O_4 + H_2O \Leftrightarrow H_3O^{\oplus} + HC_8H_4O_4^{\oplus} \; pK_{a_1} = 2.94$

$HC_8H_4O_4^{\Theta} + H_2O \Leftrightarrow H_3O^{\oplus} + C_8H_4O_4^{2-} \; pK_{a_2} = 5.44$

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196. It is found that $0.1M$ solution of three sodium salts $NaX, NaY,$ and NaZ have Ph 7.0, 9.0 and 11.0, respectively. Arrange the acids (HX, HY, and HZ) in order of increasing acidic character. Calculate dissociation constant of acids.

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197. What is $\left[Cd^{2+}\right]$ in $1.0L$ of solution prepared by dissolving $0.001 mol Cd\left(NO_3\right)_2$ and $1.5 mmol. NH_3? K_d$ for the dissociation of $Cd\left(NH_3\right)_4^{2+}$ into Cd^{2+} and $4NH_3$ is 1.8×10^{-7}. Neglect the amount of Cd in complexes containing fewer than 4 ammonia molecules.

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198. $0.001 mol$ of solid $NaC1$ was added to $1.0L$ of $0.01 M Hg\left(NO_3\right)_2$. Calculate $\left[c1^{\Theta}\right]$ equilibrated with newly formed $HgC1^{\oplus}$. K_1 for $HgC1^{\oplus}$ formation is 5.5×10^6, neglect the K_2 equilibrium.

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199. How much NH_3should be added to a solution of $0.01 M Cu\left(NO_3\right)_2$ to reduce $\left[Cu^{2+}\right.$ to 10^{-13}. Neglect the amount of copper in complexes containing fewer than 4 ammonia molecules per copper atom. Given K_d for $Cu\left(NH_3\right)_4^{2+} = 1.0 \times 10^{-12}$

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200. Calculated the minimum amount of Nh_3 which must be added to $1.0L$ of solution in order to dissolve $0.1molAgC1$ by forming $\left[Ag\left(NH_3\right)_2\right]^{\oplus}$? K_{sp} of $AgC1 = 1 \times 10^{-10}$, $K_f\left(NH_3\right)_2^{\oplus} = 1 \times 10^8$.

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201. A certain insoluble compound of M^{2+}, when shaken with water, provides an M^{2+} concentration of $1.0 \times 10^{-4}M$. A ligand is added to the system in a quantify which forms a soluble complex with M^{2+} and leaves $1.0 \times 10^{-6}M, M^{2+}$ in solution. Will the insoluble compound tend to dissolve? Explain.

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Ex 8.1

1. $100mL$ of $HC1$ gas at $25^{\circ}C$ and $740mm$ pressure is dissolved in $1L$ of H_2O. Calculate the pH of solution. Given vapour presure of H_2O at $25^{\circ}C$ is $23.7mm$.

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2. Calculate $\left[C1^{\ominus}\right], \left[Na^{\oplus}\right], \left[H^{\oplus}\right], \left[\overset{\ominus}{OH}\right]$, and the pH of resulting solution obtained by mixting $50mL$ of $0.6MHC1$ and $50mL$ of $0.3MNaOH$.

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3. Calculate the pH of solution obtained by mixing $10ml$ of $0.1MHCl$ and $40ml$ of $0.2MH_2SO_4$

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4. Calculate the pH of a solution which contains $100mL$ of $0.1MHC1$ and $9.9mL$ of $1.0MNaOH$.

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5. Calculate the $\left[H^{\oplus}\right]$ and $\left[\overset{\Theta}{O}H\right]$ of $0.0315g$ of HNO_3 in $500mL$ of water. Calculate pH and pOH also.

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6. $25.0mL$ of $0.1MNaOh$ is titred with $0.1MHC1$. Calculate pH when:

i. $20mL$ ii. $24mL$ of acid is added.

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7. The conjugate acid of $\overset{\Theta}{N}H_2$ is

A. N_2H_4

B. NH_3

C. NH_2OH

D. $\overset{\Theta}{N}H_4$

Answer: B

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8. Which solutionwill have pH closer to 1.0 ?

A. $75mL$ of $M/5HC1 + 25mL$ of $M/5NaOh$

B. $10mL$ of $M/10HC1 + 90mL$ of $M/10NaOH$

C. $55mL$ of $M/10HC1 + 54mL$ of $M/10NaOH$

D. $100mL$ of $M/10HC1 + 100mL$ of $M/10NaOH$

Answer: A

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9. An acid solution of $pH = 6$ is diluted 100 times. The pH of solution becomes

A. 6.95

B. 6

C. 4

D. 8

Answer: A

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10. The number of $H^{\oplus}$ ions present in $1mL$ of solution having $pH = 13$ is

A. 6.023×10^{10}

B. 6.023×10^{7}

C. 6.023×10^{13}

D. 10^{13}

Answer: B

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11. Equal volumes of two solutions of $Hc1$ are mixed. One solution has a $pH = 1$, while the other has a $pH = 5$. The pH of the resulting solution is

A. < 1

B. Between 1 and 2

C. 3

D. Between 4 and 5

Answer: B

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12. For pure water,

A. Both pH and pOH decrease with increase in temperature.

B. Both pH and pOH increase with increase in temperature.

C. pH decreases and pOH increases with increase in temperature.

D. pH increase and pOHdecreases with increase in temperature.

Answer: A

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13. The pH of a solution increased from 3 to 6. Its $\left[H^{\oplus}\right]$ will be

A. Reduced by 1000 times

B. Increased to 1000 times

C. Doubled

D. Reduced to half

Answer: A

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14. The following equilibria is established when H_2SO_4 is dissolved in acetic acid:

$$H_2SO_4 + CH_3COOH \Leftrightarrow H\overset{\ominus}{S}O_4 + CH_3COO\overset{\oplus}{H}_2$$

The set that characterised the conjugate acid-base pairs is:

A. $\left(H_2SO_4, CH_3COOH\right)$ and $\left(CH_3COO\overset{\oplus}{H}_2, Hs\overset{\ominus}{O}_4\right)$

B. $\left(H_2SO_4, CH_3COO\overset{\oplus}{H}_2\right)$ and $\left(CH_3COOH, H_2SO_4\right)$

C. $\left(CH_3COO\overset{\oplus}{H}_2, H_2SO_4\right)$ and $\left(Hs\overset{\ominus}{O}_4, CH_3COOH\right)$

D. $\left(H_2SO_4, Hs\overset{\ominus}{O}_4\right)$ and $\left(CH_3COO\overset{\oplus}{H}_2, CH_3COOH\right)$

Answer: C

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15. Which of the following consitute a set of atomspheric species?

A. $H_2O, H_2PO_3^{\ominus}, HPO_4^{2-}$

B. $HC_2O_4^{\ominus}, H_2PO_4^{\ominus}, SO_4^{2-}$

C. $H_2O, HPO_4^{2-}, H_2PO_2^{\ominus}$

D. $H_3O^{\oplus}, H_2PO_4^{\ominus}, HCO_3^{\ominus}$

Answer: A

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16. One litre of $0.5 MKC1$ is electrolysed by passing 9650 coulombs of electricity. The `pH of resulting solution is

A. 1.0

B. 2.0

C. 7.0

D. 13.0

Answer: D

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17. pH of a solution made by mixing $200mL$ of $0.0657MNaOH$, $140mL$ of $0.107MHC1$ and $160mL$ of H_2O is

A. 3.04

B. 2.43

C. 2.74

D. 2.27

Answer: B

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18. When one drop of a concentrated $HC1$ is added to $1L$ of pure water at $25^{\circ} C$, the pH drops suddenly from 7 to 4. When the second drop of the same acid is added, the pH of the solution further drops to about

A. 0

B. 1.0

C. 2.0

D. 3.7

Answer: D

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Ex 8.2

1. The dissociation constant of acetic acid is 8×10^{-5} ta $25^{\circ} C$. Find the pH of

i. $M/10$ ii. $M/100$ solution of acetic acid.

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2. Calculate the amount of acetic acid presnt in $1L$ of solution having $\alpha = 1\%$ and $K_a = 1.8 \times 10^{-5}$.

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3. $0.16 g N_2H_4$ is dissoolved in H_2O and total volume is made upto $500 mL$. Calculate the percentage of N_2H_4 that has reacted with H_2O in this solution. K_b for $N_2H_4 = 4.0 \times 10^{-6} M$.

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4. If the pH of $0.26 M HNO_2$ is 2.5, what will be its dissociation constant.

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5. Find the dissocation constant K_a of HA (weak monoabsic acid) which is 3.5% dissociated in an$M/20$ solution.

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6. Ionic product of water $\left(K_w \text{ is } 10^{-14}\right)$ at $25^\circ C$. What is the dissociation constant of water and auto protonation constatn of water?

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7. $2.0g$of dibrona $\left(B_2H_6\right)$ reacts with water to product $100mL$ solution. If K_a for H_3BO_3 is 7.3×10^{-10}, calculated the pH of solution.

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8. At $90^\circ C$, pure water has $\left[H_3O^{\oplus}\right] = 10^{-6}M$. What is the value of K_w at $90^\circ C$

A. 10^{-6}

B. 10^{-8}

C. 10^{-12}

D. 10^{-14}

Answer: C

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9. $HCOOH$ and CH_3COOH solutions have equal pH. If K_1/K_2 is 4, the ratio of their molar concentration will be

A. 0.25

B. 0.5

C. 2

D. 4

Answer: A

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10. $2H_2O \Leftrightarrow H_3O^{\oplus} + \overset{\ominus}{O}H, K_w = 10^{-14}$ at $25^{\circ}C$, hence K_a is

A. 10^{-7}

B. 5.55×10^{-13}

C. 10^{-14}

D. 18×10^{-17}

Answer: D

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11. Which of the following expression is wrong?

A. $\left[H^{\oplus}\right] = \left[\overset{\ominus}{O}H\right] = 10^{-7}$ for a neutral solution at all temperatures.

B. $\left[H^{\oplus}\right] < \sqrt{K_w}$ and $\left[\overset{\ominus}{O}H\right] > \sqrt{K_w}$ for basic solution

C. $\left[H^{\oplus}\right] = \left[\overset{\Theta}{OH}\right] = \sqrt{K_w}$ for a neutral solution

D. $\left[H^{\oplus}\right] > \sqrt{K_w}$ and $\left[\overset{\Theta}{OH}\right] < \sqrt{K_w}$ for an acidic solution

Answer: A

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12. For a 'C'M concentarted solution of a weak electrolyte $A_xB_y\alpha$(degree of dissociation) is

A. $\sqrt{K_{eq}/xyC}$

B. $\left[K_{eq}.\ C/(xy)\right]^{1/2}$

C. $\left(K_{eq}/C^{x+y-1}.\ x^x x^y\right)^{\frac{1}{x+y}}$

D. $\left[K_{eq}/C(x+y)\right]^{1/2}$

Answer: C

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13. K_b for NH_4OH is 1.8×10^{-5}. The $\left[\overset{\Theta}{OH}\right]$ of $0.1MNH_4OH$ is

A. 5.0×10^{-2}

B. 4.20×10^{-3}

C. 1.34×10^{-3}

D. 1.8×10^{-6}

Answer: C

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14. The dissociation constant of monobasic acids A, B, C and D are $6 \times 10^{-4}, 5 \times 10^{-5}, 3.6 \times 10^{-6}$, and 7×10^{-10}, respectively. The pH values of their $0.1M$ aqueous solutions are in the order.

A. $D > C > B > A$

B. $A > B > C > D$

C. $A = B = C = D$

D. None

Answer: A

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15. The molarity of $NH_3 of pH = 12 at 25^\circ C$ is $\left(K_b = 1.8 \times 10^{-5}\right)$

A. $11.7M$

B. $5.5M$

C. $0.55M$

D. $0.01M$

Answer: C

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16. K_a of HA at 25° is 10^{-5}. If $0.1 mol$ of this acid is dissolved in $1L$ of aqueous solution, the percent dissociation at equilibrium will be closer to

A. 0.1%

B. 1.0%

C. 99.0%

D. 99.9%

Answer: B

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17. For a polyprotic acid, H_3PO_4 its three dissociation constant K_1, K_2 and K_3 are in the order

A. $K_1 = K_2 > K_3$

B. $K_1 = K_2 = K_3$

C. $K_1 > K_2 > K_3$

D. $K_1 < K_2 < K_3$

Answer: C

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18. Given $HF + H_{\circ}O \overset{K_g}{\Leftrightarrow} H_3O^{\oplus} + f^{\oplus}$

$F^{\Theta} + H_2O \overset{K_b}{\Leftrightarrow} HF + \overset{\Theta}{OH}$

Which relation is correct?

A. $K_b = K_w$

B. $K_a \times K_b = K_w$

C. $K_b = \dfrac{1}{K_w}$

D. $\dfrac{K_a}{K_b} = K_w$

Answer: B

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

A. 10^{-14}

B. 10^{-9}

C. 10^{-10}

D. 10^{10}

Answer: D

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20. The percentage error in $\left[H^{\oplus}\right]$ provided by $10^{-8} MHC1$, if ionisation of water is not neglected, is

A. 2%

B. 3%

C. 4%

D. 5 %

Answer: D

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21. H_3BO_3 is :

A. Monobasic and weak Lewis acid

B. Monobasic and weak Brddotosted acid

C. Tribasic and weak Brddotosted acid

D. Monobasic and strong Lewis acid

Answer: A

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22. The enthalpy change for first proton neutralisation of H_2S is $-37.1kJmol^{-1}$. What is the enthalpy change for first ionisation of H_2S.

A. 94.2

B. -20.0

C. 20.0

D. -94.2

Answer: C

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23. The factor by which the degree of ionisation of $200mL$ of $0.1M$ benzoic acid solution $\left(K_a = 4 \times 10^{-5}\right)$ changes on addition of $100mL$ of $0.2MHC1$ is:

A. 0.02

B. 0.03

C. 33.33

D. None

Answer: B

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24. The concentration of CO_2 in atmosphere is $88p \pm$. If all of the CO_2 present in $10^5 mL$ of air is dissolved in $1dm^3$ water, then approximate pOH of solution at $27^\circ C$ will be $\left(K_{a_1} = 10^{-7}, K_{a_2} = 10^{-11}\right.$ for $\left.H_2CO_3\right]$

A. 3.2

B. 3.85

C. 10.15

D. None

Answer: C

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25. A solution of a weak monoprotic acid has dissociation constant K_a. The minimum initial concentration C such that the concentration of the undissociated acid can be equated to C within an error of 1% would be

A. $9900K_a$

B. $10000K_a$

C. $99K_a$

D. K_a

Answer: A

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26. Two weak acids HX and HY have K_a values 1.75×10^{-5} and 1.3×10^{-5}, respectively, at a certain temperature. An equimolar solution of mixture of two acids is parially neutralised by $NaOH$. How is the ratio of the contents of X^{Θ} and Y^{Θ} ions related to the K_a values and molarity?

A. $\left[\frac{\alpha}{1-\alpha}\right] = \frac{1.75}{1.3} \times \left[\frac{\alpha'}{1-\alpha'}\right], 0,$ where α and α' are ionised fractions of the acids HX and HY respectively.

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

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27. H_2S behaves as a weak diprotic acid in aqueous solution. Which of the following is the correct explanantion for pH of a solution of H_2S in terms of its $pK_1, pK_2, \left[H_2S\right]$ and $\left[S^{2-}\right]$

A. $pH = \frac{1}{2}\left(pK_1 + pK_2\right)$

B. $pH = \frac{1}{2}\left(pK_1 + pK_2 - \log\frac{\left[S^{2-}\right]}{\left[H_2S\right]}\right)$

C. $pH = \frac{1}{2}\left(pK_1 + pK_2 + \log\frac{\left[S^{2-}\right]}{\left[H_2S\right]}\right)$

D. $pH = \frac{1}{2}\left(pK_1 - pK_2 + \log\frac{\left[H_{2-}S\right]}{\left[S^{2-}\right]}\right)$

Answer: C

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Ex 8.3

1. Calculate the pH of a solution of given mixture.

a. $\left(2gCH_3COOH + 3gCH_3COONa\right)$ in $100mL$ of mixture.

b. $5mL$ of $0.1MNH_4OH + 250mLof0.1MNH_4C1$.

c. $\left(0.25\text{mol of}CH_3COOH + 0.35\text{mol of}CH_3COONa\right)$ in $500mL$ mixture.

$K_a\text{of}CH_3COOH = 1.8 \times 10^{-5}\left(pK_a = 4.7447\right)$

$K_b\text{of}NH_4OH = 1.8 \times 10^{-5}\left(pK_b = 4.7447\right)$

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2. How many moles of NH_4C1 should be added to $200mL$ solution of $1.18MNH_4OH$ to have a pH of 9.60. K_b of $NH_4OH = 2 \times 10^{-5}$

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3. A buffer solution was made by adding $15.0g$ of CH_3COOH and $20.5gCH_3COONa$. The buffer is diluted to $1.0L$.

a. Calculate the pH of solution.

b. What will be the change in pH if $10.0mL$ of $1.0MHC1$ is added to it.

Given: $pK_aofCH_3COOH = 4.74, \log\left(\frac{13}{12}\right) = 0.035$

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4. A buffer solution contains $0.25MNH_4OH$ and $0.3NH_4C1$.

a. Calculate the pH of the solution.

b. How much $NaOH$ should be added to $1L$ of the solution to change pH by 0.6. $K_b = 2 \times 10^{-5}$.

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5. Calculate the hydrolysis constant $\left(K_h\right)$ and degree of hydrloysis (h) of NH_4C1 in $0.1M$ solution.

$K_b = 2.0 \times 10^{-5}$. Calculate the $\left[\overset{\Theta}{O}H\right]$ ions in the solution.

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6. Calcualte the percentage hydrolysis of $10^{-3}MN_2^{\oplus}H_5C1^{\Theta}$ (hydrazinium chloride), salt contining acid ion conjugate to hydrazine base $\left(NH_2NH_2\right)$. K_b for $N_2H_4 = 1.0 \times 10^{-6}$.

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7. Calculate the amount of NH_4C1 required to dissolve in $500mL$ of water to have a $pH = 4.5, K_b = 2.0 \times 10^{-5}$.

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8. A $0.25M$ solution of pyridinium chloride $\left(C_5H_5\overset{\oplus}{N}HC1^{\Theta}\right)$ has pH of 2.89. Calculate pK_b for pyridine $\left(C_5H_5N\right)$.

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9. Which of the following is a buffer solution?

A. A solution of $KC1$ and KOH

B. A solution of CH_3COONH_4

C. A solution of K_2SO_4 and NH_4OH

D. A solution of $PhCOOK$ nad $PhCOOH$

Answer: D

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10. Which of the following is not a buffer?

A. $NH_4OH + C_6H_5COOH$

B. $HCOOH + HCOONa$

C. $H_2CO_3 + HCOOK$

D. $NH_4OH + (NH_4)_2SO_4$

Answer: A

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11. In an acidic buffer solution, if some H_2So_4 is added, its pH will

A. Remain constant

B. Change but cannot be predicted

C. Decrease

D. Increase

Answer: C

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12. Which of the following solutions containing weak acid and salt of its conjugate base has maximum buffer capaity?

A. $[\text{Salt}] < [\text{Acid}]$

B. $[\text{Salt}] = [\text{Acid}]$

C. $[\text{Salt}] > [\text{Acid}]$

D. $[\text{Salt}] + [\text{Acid}]$ is minimum

Answer: B

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13. A weak acid HA has $K_a = 10^{-6}$. What would be the molar ratio of this acid and its salt with strong base so that pH of the buffer solution is 5?

A. $1/10$

B. 10

C. 1

D. 2

Answer: B

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14. The addition of NaH_2PO_4 to $0.1MH_3PO_4$ will cuase

A. No change in pH value

B. Increases in its pH value

C. Decrease in its pH value

D. Change in pH but cannot be predicted

Answer: B

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15. On diluting a buffer solution, its pH

A. Increases

B. Decreases

C. Remains same

D. Cannot be predicted

Answer: C

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16. The pH of a solution containing $0.1 mol$ of CH_3COOH, $0.2 mol$ of CH_3COONa,and $0.05 mol$ of $NaOH$ in $1L$. $\left(pK_a of CH_3COOH = 4.74\right)$ is:

A. 5.44

B. 5.20

C. 5.04

D. 4.74

Answer: A

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17. A weak base BOH is titrated with strong acid HA. When $10mL$ of HA is added, the pH is 9.0 and when $25mL$ is added, pH is 8.0. The volume of acid required to reach the equivalence point is

A. $50mL$

B. $40mL$

C. $35mL$

D. $30mL$

Answer: D

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18. To $1.0L$ solution containing $0.1 mol$ each of NH_3 and NH_4C1, $0.05 mol NaOH$ is added. The change in pH will be $(pK_a$ for $CH_3COOH = 4.74)$

A. 0.30

B. -0.30

C. 0.48

D. -0.48

Answer: C

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19. The pH of blood is $7, 4$. If the buffer in blood constitute CO_2 and HCO_3^{Θ} ions, calculate the ratio of conjugate base of acid (H_2CO_3) to maintain the pH of blood. Given K_1 of $H_2CO_3 = 4.5 \times 10^{-7}$.

A. 11.25

B. 10.0

C. 8.5

D. None

Answer: A

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20. The pH of blood is

A. > 10

B. Between 8 and 0

C. Between 7 and 8

D. < 6

Answer: C

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21. Buffer in blood consists of

A. H_2CO_3 and $C1^{\Theta}$

B. $HC1$ and HCO_3^{Θ}

C. $HC1$ and $C1^{\Theta}$

D. $H_2CO_3$and HCO_3^{Θ}

Answer: D

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22. K_a for HCN is $5 \times 10 \wedge (-10)$ at $25\,^{\circ}C$. For maintaining a constant pH of 9.0, the volume of $5MKCN$ solution required to be added to $10mL$ of $2MHCN$ solution is

A. $9.3mL$

B. $7.95mL$

C. $4mL$

D. $2mL$

Answer: D

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23. $18mL$ of mixture of CH_3COOH and CH_3COONa required $6mL$ of $0.1MNaOH$ for neutralisation of the acid $12mL$ of $0.1MHC1$ for reaction with salt, separately. If pK_a of the acid is 4.75, what is the pH of the mixture

A. 4.5

B. 4.6

C. 4.75

D. 5.05

Answer: D

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24. The pH of blood is maintained by the balance between H_2CO_3 and $NaHCO_3$. If the amount of CO_2 in the blood is increased, how will it effect the pH of blood`?

A. pH will remain same.

B. pH wil be 7

C. pH will increases.

D. pH will decrease.

Answer: A

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25. Fixed volume of $0.1M$ benzoic acid $(pK_a = 4.2)$ solution is added into $0.2M$ sodium benzote solution and formed a $300mL$, resulting acidic buffer solution. If pH of the resulting solution is 3.9, then added volume of banzoic acid is

A. $240mL$

B. $150mL$

C. $100mL$

D. None

Answer: A

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26. $0.1mol$ of $RNH_2\left(K_b = 5 \times 10^{-5}\right)$ is mixed with $0.08mol$ of $HC1$ and diluted to $1L$. Calculate the $\left[H^{\oplus}\right]$ in the solution.

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

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

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

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

Answer: A

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27. A weak acid $HX\left(K_a = 10^{-5}\right)$ on reaction with $NaOH$ gives NaX. For $0.1M$ aqueous solution of NaX, the $\%$ hydrolysis is

A. 1%

B. 0.01%

C. 0.001%

D. 0.15%

Answer: B

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28. The pH of $0.1M$ solution of the following salts decreases in the order

A. $HCl > NaCl > NH_4Cl > NaCN$

B. $HCl > NaCN > NH_4Cl > NaCl$

C. $NaCN > NaCl > NH_4Cl > HCl$

D. $NH_4Cl > NaCN > NaCl > HCl$

Answer: C

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29. The degree of hydrolysis of a salt of W_A and W_B in its $0.1M$ solution is 50%. If the molarity of the solution is $0.2M$, the percentage hydrolysis of the salt woukd be

A. 25%

B. 50%

C. 75%

D. 100%

Answer: B

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30. pH of separate solution of four potassium salts, KW, KX, KY and KZ are $7.0, 9.0, 10.0,$ and $10.5,$ respectively. If each solution is $0.2M$, the strongst acid would be

A. HW

B. HX

C. HY

D. HZ

Answer: A

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31. Which of the following solutions have $pH < 7$.

A. BaI_2

B. $AI(NO_3)_3$

C. CH_3COONH_4

D. CsI

Answer: B

Watch Video Solution

32. Which of the following solution have $pH > 7$.

I. BaF_2 II. RbI

III. C_6H_5COONa

IV. $\left(CH_3COO\right)_2Ba$

A. I

B. I, II, III

C. I, III

D. I, III, IV

Answer: D

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33. The expression to calculate pH of sodium acetate solution at $25\,^{\circ}C$ is

A. $pH = 7 + \frac{1}{2}pK_b\left(CH_3COOH\right) - \frac{1}{2}\log[\text{salt}]$

B. $pH = 7 + \frac{1}{2}pK_a\left(CH_3COOH\right) - \frac{1}{2}\log[\text{salt}]$

C. $pH = 7 + \frac{1}{2}pK_b\left(CH_3COOH\right) + \frac{1}{2}\log[\text{salt}]$

D. $pH = 7 + \frac{1}{2}pK_a\left(CH_3COOH\right) + \frac{1}{2}\log[\text{salt}]$

Answer: D

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34. The correct order of increasing $\left[H_3O^{\oplus}\right]$ in the following aqueous solution is

A. $0.01MH_2S < 0.01MH_2SO_4 < 0.01MNaC1 < 0.01MNaNO_3$

B. $0.01MNaC1 = 0.01MNaNO_3 < 0.01MH_2S < 0.01MH_2SO_4$

C. $0.01MH_2S < 0.01MNaNO_3 = 0.01MNaC1 < 0.01MH_2SO_4$

D. $0.01MH_2S < 0.01MNaNO_3 < 0.01MNaC1 < 0.01MH_2SO_4$

Answer: B

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35. pH of water is 7. When a substance Y is dissolved in water, the pH becomes 13. The substance Y is a salt of

A. Weak acid and weak base

B. Strong acid and strong base

C. Strong acid and weak base

D. Weak acid and strong base

Answer: D

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36. The hydrolysis constang of $0.1M$ aqueous solution of sodium acetate if K_a of $CH_3COOH = 1.8 \times 10^{-5}$ is

A. 5.5×10^{-10}

B. 4.5×10^{-8}

C. 5.5×10^{-12}

D. None of these

Answer: A

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37. The compound whose $0.1M$ solution is basic is

A. CH_3COONH_4

B. NH_4C1

C. $(NH_4)_2SO_4$

D. CH_3COONa

Answer: D

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38. K_a for ascorbic acid $(HASc)$ is 5×10^{-5}. Calculate the $\left[H^{\oplus}\right]$ in an aqueous solution in which the concentration of Asc^{Θ} ions is $0.02M$.

A. 2×10^{-6}

B. 2×10^{-7}

C. 5×10^{-9}

D. 5×10^{-10}

Answer: C

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Ex 8.4

1. a. At what pH does indicator change colour if the indicator is a weak acid with $K_{Ind} = 4.0 \times 10^{-4}$.

b. For which of the following neutralisation would the indicator be useful?

i. $HCl + NaOH$

ii. $CH_3COOH + NaOH$

iii. $HCl + NH_3$

c. Name the indicators which can be used for such titration.

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2. The acid from of an acid base indicator is yellow in acid and red in basic from. What is the change in pH in order to change the indicator form 80% yellow to 80% red.

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3. Given that solubility product of $BaSO_4$ is 1×10^{-10} will be precipiate from when

a. Equal volumes of $2 \times 10^{-3} MBaC1_2$ solution and $2 \times 10^{-4} MNa_2SO_4$ solution, are mixed?

b. Equal volumes of $2 \times 10^{-8} MBaC1_2$ solution and $2 \times 10^{-3} MNa_2SO_4$ solution, are mixed?

c. $100mL$ of $10^{-3} MBaC1_2$and $400mL$ of $10^{-6} MNa_2SO_4$ are mixed.

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4. The K_{sp} of $AgC1$ at $25\,^\circ C$ is 1.6×10^{-9}, find the solubility of salt in gL^{-1} in water.

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5. If solutbility of $Ca\left(IO_3\right)_2$ in water at $20\,^\circ C$ is $3.9gL^{-1}$. Calculate the K_{sp}. Given $MwCa\left(IO_3\right)_2 = 390$.

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6. Find the solubility of $Ca(IO_3)_2$ is $molL^{-1}$ in a solution containing $0.1MCaC1$ at $25^\circ C. K_{sp}$ of $Ca(IO_3)_2 = 6.3 \times 10^{-7}$

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7. The K_{sp} of $BaSO_4$ is 1.6×10^{-9}. Find the solubility of $BaSO_4$ in gL^{-1} in

a. Pure water

b. $0.1MBa(NO_3)_2$

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8. A solution contains $1.4 \times 10^{-3}MAgNO_3$. What concentration of $KC1$ will be required to initiate the precipitation of $AgC1$? $K_{sp}AgC1 = 2.8 \times 10^{-10}$

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9. If the solubility of $CaSO_4$ in H_2O is $10^{-5}M$, Calculate the solubility in $0.005M$ solution of H_2SO_4.

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10. The concentration of $Ag^{\oplus}$ ions in a saturated solution of $Ag_2C_2O_4$ is $2.0 \times 10^{-4}M$. Calculate the solubility of $Ag_2C_2O_4$ in a solution which is $0.01M$ in $H_2C_2O_4$.

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11. $500mL$ of $2 \times 10^{-3}MA1C1_3$ and $500mol$ of $4 \times 10^{-2}M$ solution of $NaOH$ are mixed and solution is diluted to $10^{-2}L$ with water at room temperature wil a precipiate exist? Given:

$K_{sp}$of $A1(OH)_3 = 5 \times 10^{-33}$.

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12. You are provided with $500mL$ of hard water, containing $0.005mol$ of $CaC1_2$ and two H_2SO_4 samples of $0.001M$ and $0.02M$ concentration. Which one or both or none can be used for precipitating Ca^{2+} ions.

K_{sp} of $CaSO_4 = 2.4 \times 10^{-4}$.

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13. A lead salts is dissolved in $HC1$ which si 95% ionised. It is found to have $0.1MPb^{2+}$ and $0.28MH^{\oplus}$ ions. The solution is satured with $H_2S(g)$. Calculate the amount of Pb^{2+} ions that remains unprecipitated.

K_{sp} of $PbS = 4 \times 10^{-29}$,

K_{sp} of $H_2S = 1.1 \times 10^{-22}$

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14. A solution constains Zn^{2+} ions and Cu^{2+} ions each of $0.02M$. If the solution is made $1M$ in $H^{\oplus}$, and H_2S is passed untill the solution is satured, should a precipitate be formed? Given: $K_{sp}ZnS = 10^{-22}$,

$K_{sp}Cus = 8 \times 10^{-37}$.

In satured solution, $K_{sp}\left(H_2S\right) = 10^{-22}$

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15. The following pH range where the indicator shows change in colour are given

i. 4 - 9.7 ii. 7.46 - 10.0 iii. 6.5 - 4

Which of the above pH range represent titration of

I. Strong acid/strong base $\left(S_A/S_B\right)$,

II. Weak acid/strong base $\left(W_A/S_B\right)$,

III. Weak base/strong acid $\left(W_B/S_A\right)$

A. $(i) \rightarrow I, (ii) \rightarrow II, (iii) \rightarrow III$

B. $(iii) \rightarrow I, (ii) \rightarrow II, (i) \rightarrow III$

C. $(i) \rightarrow I, (iii) \rightarrow II, (i) \rightarrow III$

D. $(i) \rightarrow I, (iii) \rightarrow II, (ii) \rightarrow III$

Answer: A

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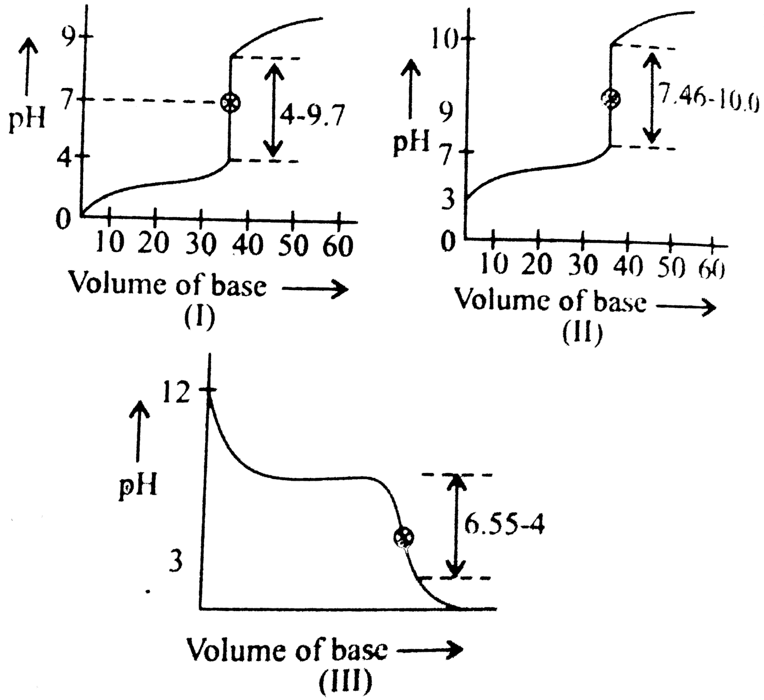
16. The following acid base titration graphs are given:



(I)

Which of the following graph represents titration of

i. $NH_4OH/HC1\left(W_A/S_A\right)$

ii. $HNO_3/KOH\left(S_A/S_B\right)$

iii. $C_6H_5COOH/KOH\left(W_A/S_B\right)$

A. $\begin{array}{ll} Graph & Titration \\ I.\ II.\ III & i.\ ii.\ iii \end{array}$

B. $\begin{matrix} Graph & Titration \\ I. II. III & ii. iii. i \end{matrix}$

C. $\begin{matrix} Graph & Titration \\ I. II. III & iii. ii. i \end{matrix}$

D. $\begin{matrix} Graph & Titration \\ I. II. III & iii. i. ii \end{matrix}$

Answer: B

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17. Which indicator is suitable for the titrations:

Titration	Indicator
$i. HCOOH/NaOH$	(A)Bromothymol blue or phenolphtalein or methy1 orange o
$ii. HBr/KOH$	(B)Methy1 orange or methy1 red or bromocresol green
$ii. NH_4OH/NHO_3$	(C)Phenolphthalein or thymolphtalein

A. $(i) \rightarrow A, (ii) \rightarrow B, (iii) \rightarrow C$

B. $(i) \rightarrow A, (ii) \rightarrow C, (iii) \rightarrow B$

C. $(i) \rightarrow B, (ii) \rightarrow C, (iii) \rightarrow A$

D. $(i) \rightarrow C, (iii) \rightarrow A, (iii) \rightarrow B$

Answer: D

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18. A solution gives the following colours with different indicators:

a. Methy1 orange $\Rightarrow$ Yellow

b. Methy1 red $\Rightarrow$ Yellow

c. Bromothymol blue $\Rightarrow$ Orange

What is the pH of the solution?

A. > 4.5

B. > 6.0

C. 6.0 to 6.3

D. 4.5 to 6

Answer: C

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19. In the titration of NH_4OH versus $HC1$, the pH of the solution at equivalence point is about:

A. 5.5

B. 7

C. 8.5

D. 9.5

Answer: A

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20. The pH indicators are

A. Salts of strong acids and strong bases

B. Salts of weak acids and weak bases

C. Either weak acids or weak bases

D. Either strong acids or strong base

Answer: C

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21. In which of the following acid-base titration, the pH is greater than 8 at the equivalence point ?

A. Aceitic acid vs ammonia

B. Acetic acid vs sodium hydroxide

C. Hydrochloric acid vs ammonia

D. Hydrochloric acid vs sodium hydroxide

Answer: B

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

A. The pH at the equivalent point will always be 7.

B. They can be used to titrate both strong and weak bases.

C. Strong acids from more stable soluitons than weak acids.

D. The salts of strong acids do not hydrolyse.

Answer: C

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23. The best indicator for detection of end point in titration of a weak acid and a strong base is

A. Methy1 orange (3 to 4)

B. Methy1 red (5 to 6)

C. Bromotymol blue (6 to 7.5)

D. Phenolphthalein (8 to 9.6)

Answer: D

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24. The precipitate of $CaF_2\left(K_{sp} = 1.7 \times 10^{-10}\right)$ is obtained when equal volumes of the following are mixed

A. $10^{-2}MCa^{2+} + 10^{-3}MF^{\Theta}$

B. $10^{-4}MCa^{2+} + 10^{-4}MF^{\Theta}$

C. $10^{-3}MCa^{2+} + 10^{-5}MF^{\Theta}$

D. $10^{-5}MCa^{2+} + 10^{-3}MF^{\Theta}$

Answer: A

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25. The solubility of A_2B_3 is "x mol dm"^(-3). ItsK_(sp)` is

A. $6x^4$

B. $64x^4$

C. $36x^5$

D. $108x^5$

Answer: D

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26. The pH of $Ca(OH)_2$ is 10.6 at $25^{\circ}C$. K_{sp} of $Ca(OH)_2$ is

A. $3.2 \times 10^{-12}M^3$

B. $3.2 \times 10^{-11}M^3$

C. $1.6 \times 10^{-12}M^3$

D. $1.6 \times 10^{-11}M^3$

Answer: B

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27. Solubility of AgI in $0.05 M BaI_2$ solution is $10^{-15} M$. The solubility of AgI in water is

A. 25×10^{-7}

B. $10^{-7} M$

C. 5×10^{-8}

D. $10^{-8} M.$

Answer: D

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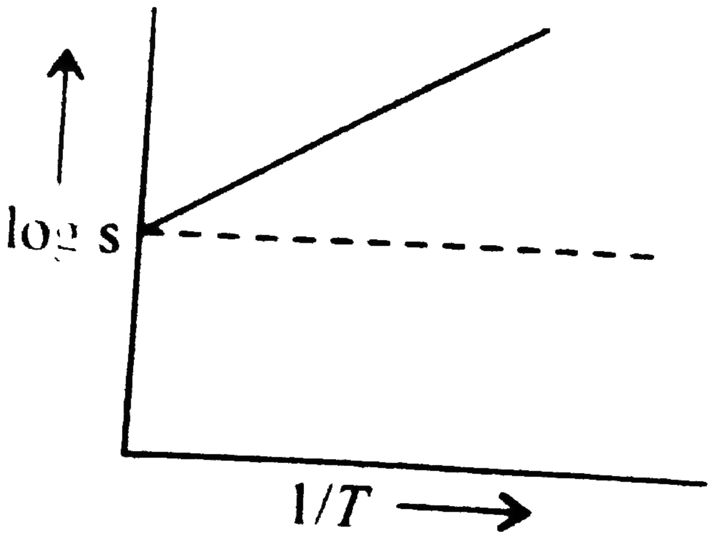
28. Solubility of a solute in water is dependent on temperature as given by

$S = Ae^{-\Delta H / RT}$, where ΔH=heat of solution

$\text{Solute} + H_2O(l) \Leftrightarrow \text{Solution}, \Delta H = \pm x$

For given solution, variation of log S with temperature is shown graphically. Hence, solution is



A. CaO

B. $MgSO_4$

C. $CuSO_4$

D. $CuSO_4.5H_2O$

Answer: D

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29. The solubility of CaF_2 in a solution of $0.1 M Ca(NO_3)_2$ is

A. $[Ca^{2+}]$

B. $2[F^{\ominus}]$

C. $\frac{[F^{\ominus}]}{2}$

D. $2[NO_3^{\ominus}]$

Answer: C

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30. The volume of water needed to dissolve $1mg$ of $PbSO_4 (K_{sp} = 1.44 \times 10^{-8}, Mw of PbSO_4 = 303 g)$ at $25^{\circ} C$ is

A. $80 mL$

B. $43mL$

C. $27.5mL$

D. 10mL`

Answer: C

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31. The volume of water needed to prepare a satured solution of $Ag^{\oplus}$ having maximum $\left[Ag^{\oplus}\right]$ ion by selecting one out of three slats form: $AgC1\left(K_{sp}=2.0\times10^{-10}\right)$, $AgBr\left(K_{sp}=5\times10^{-13}\right)$, and $Ag_2CrO_4\left(K_{sp}=2.4\times10^{-12}\right)$. whcih compound should be used to have maximum $\left[Ag^{\oplus}\right]$?

A. $AgC1$

B. $AgBr$

C. Ag_2CrO_4

D. Any one of them

Answer: C

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32. How many grams of KBr can be added to $1L$ of $0.12M$ solution of $AgNO_3$ just to start the precipitation of $AgBr$. $\left(Mw\text{of}KBr = 120, K_{sp}ofAgBr = 10^{-13}\right)$

A. $10^{-10}g$

B. $10^{-9}g$

C. $0.5 \times 10^{-10}g$

D. $0.5 \times 10^{-9}g$

Answer: A

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33. The solubility of silver benzoate $\left(C_6H_5COOAg\right)$ in H_2O and in a buffer solution of $pH = 2, 3,$ and 4 are S_1, S_2, S_3 and S_4 respectively. The decreasing order of solubility is

A. $S_1 > S_2 > S_3 > S_4$

B. $S_4 > S_3 > S_2 > S_1$

C. $S_2 > S_3 > S_4 > S_1$

D. $S_3 > S_2 > S_4 > S_1$

Answer: C

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34. The solubility of CH_3COOAg in a buffer solution with $pH = 4$, whose $K_{sp} = 10^{-12}$ and $K_a = \frac{10^{-4}}{3}$ is

A. 10^{-6}

B. 0.5×10^{-6}

C. 5×10^{-6}

D. 2×10^{-6}

Answer: D

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35. Refer to above, the ratio of solubility of CH_3COOAg in a buffer solution with $pH = 4$ and in H_2O is

A. $1/2$

B. 2

C. $1/3$

D. 3

Answer: B

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36. What is the maximum molarity of Co^{+2} ions in $0.1MHC1$ saturated with $0.1MH_2S$. $\left(K_a = 4 \times 10^{-21}\right)$. Given: K_{sp} of $CoS = 2 \times 10^{-21}$.

A. $0.10M$

B. $1.00M$

C. $4.48 \times 10^{-11}M$

D. $0.50M$

Answer: D

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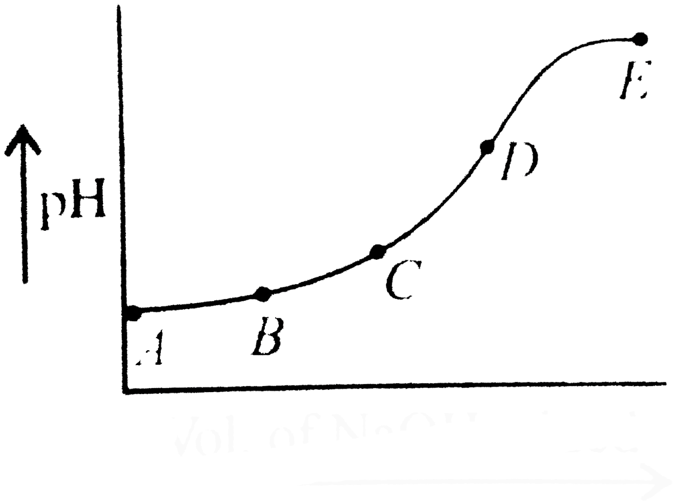
37. The following curve shows the change of pH during the course of titration of weak acid HA with a strong base. At which point in the titration curve is the concentration of acid equal to that of its conjugate

base.



A. Point B

B. Point C

C. Point D

D. Point E

Answer: C

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38. If the salts M_2X, QY_2, and PZ_3 have the same solubilities $\left(<\frac{4}{27}\right)$, their K_{sp} values are related

A. $K_{sp}(M_2X)=K_{sp}(QY_2)>K_{sp}(PZ_3)$

B. $K_{sp}(M_2X)>K_{sp}(QY_2)=K_{sp}(PZ_3)$

C. $K_{sp}(M_2X)=K_{sp}(QY_2)=K_{sp}(PZ_3)$

D. $K_{sp}(M_2X)>K_{sp}(QY_2)>K_{sp}(PZ_3)$

Answer: A

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39. Arrange the following solutions in decreasing order of $\left[Ag^{\oplus}\right]$ ion:

I. $1M\left[Ag(CN)_2\right]^{\Theta}$

II. Saturated $AgC1$

III. $1M\left[Ag\left(NH_3\right)_2\right]^{\oplus} \in 0.1MNH_3$

IV. Saturated AgI

$\left(K_{sp} of AgC1 = 10^{-10}, K_{sp} of AgI = 8.3 \times 10^{-17} K_f\right.$ (formation constant) $\left[Ag\left(CN_2\right)\right]^{\Theta} = 10^{21}, K_f\left[Ag\left(NH_3\right)_2\right]^{\oplus} = 10^8$

A. $I > II > III > IV$

B. $II > III > I > IV$

C. $IV > II > II > I$

D. I gt IV gt III gt II`

Answer: B

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Ex 8.5

1. How many moles of NH_3 must be added to $1.0L$ of $0.75 M AgNO_3$ in order to reduce the $\left[Ag^{\oplus}\right]$ to $5.0 \times 10^{-8} M. K_f Ag\left(NH_3\right)_2^{\oplus} = 1 \times 10^8$.

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2. Calculate the $\left[Fe^{2}\right]$ in a solution prepared by mixting $75.0mL$ of $0.03MFeSO_4$ with $125.0mL$ of $0.2\text{M KCN}K_fFe(CN)_6^{4-} = 1 \times 10^{24}$.

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3. a. Calculate $\left[Ag^{\oplus}\right]$ in a solution of $\left[Ag^{\oplus}\right]$ in a solution of $\left[Ag(NH_3)_2^{\oplus}\right]$ prepared by adding $1.0 \times 10^{-3} molAgNO_3$ to $1.0Lof1.0MNH_3$ solution $K_fAg(NH_3)_2^{\oplus} = 10^8$.

b. Calculate $\left[Ag^{\oplus}\right]$ which is in equilibrium with $0.15M\left[Ag(NH_3)_2\right]^{\oplus}$ and $1.5NH_3$.

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4. Calculate the $\left[Fe^{2+}\right]$ in a solution containing $0.2M\left[Fe(CN)_6\right]^{4-}$ and $0.1MCN^{\ominus}. K_fFe(CN)_6^{4-} = 1 \times 10^{24}$.

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5. Calculate how much $AgBR$ could dissolves in $1.0 L of 0.4 M NH_3. K_f Ag(NH_3)_2^{\oplus} = 1.0 \times 10^8$.

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6. Calculate K_f for the reaction:

$M^{3+} + SCN^{\ominus} \Leftrightarrow MSCN^{2+}$,

The $[M^{3+}]$ in the solution is $2.0 \times 10^{-3} M$, $[SCN^{\ominus}] = 1.5 \times 10^{-3} M$ and Free $[SCN^{\ominus}] = 1.0 \times 10^{-5} M$.

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Exercises Subjective (Weak Acid And Weak Bases)

1. a. Distinguish between acid strength and acid concentration.

b. Distinuish between weak base and an isoluble base.

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2. a. Write an equilibriu equation for a solution containing CH_3COOH and CH_3COONa. What effect does CH_3COONa have on a solution of CH_3COOH?

b. What reagents should be added to a solution to increase

i. $\left[CH_3COO^{\ominus}\right]$ ii. $\left[\overset{\oplus}{NH_4}\right]$

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3. Which of the reagents listed below could be added to water to make $0.1M$ solutions of each of the following ions?

a. $\overset{\oplus}{NH_4}$

b. $CH_3COO^{\ominus}$

c. $C1^{\ominus}$

i. NH_3 ii. NH_4C1

iii. CH_3COOH

iv. CH_3COONa

v. $HC1$

vi. $NaC1$.

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4. 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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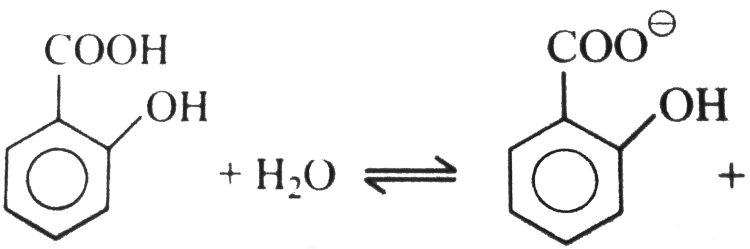
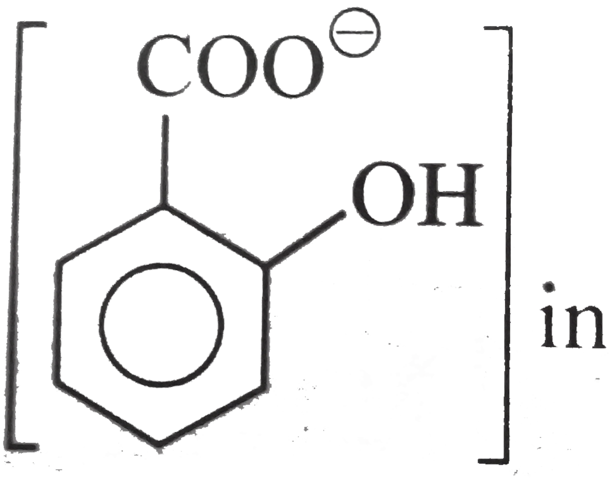
5. Accety1 salocylic acid (aspirin) ionises in water as:



$\left(K_a = 2.75 \times 10^{-9}\right)$

If two tablets of aspirin each of $0.32g$ is dissolved in water to produce

250mL solution, calculate



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6. Calculate the $\left[CH_2FCOOH\right]$ (fluoroacetic acid) which is required to get $\left[H^{\oplus}\right] = 1.5 \times 10^{-3}M$. K_a of acid $= 2.6 \times 10^{-3}$.

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7. Calculate the dissociation constant of NH_4OH at 298k, if $\Delta H^{\ominus}$ and $\Delta S^{\ominus}$ for the given changes are as follows:-

$NH_3 + H^{\oplus} \Leftrightarrow \overset{\oplus}{N}H_4,$

$\Delta H^{\Theta} = -52.2 KJmol^{-1}, \Delta S^{\Theta} = 1.67 JK^{-1}mol^{-1}$

$H_2O \Leftrightarrow H^{\oplus} + \overset{\Theta}{O}H, \Delta H^{\Theta} = 56.6 kJmol^{-1}.$

$\Delta S^{\Theta} = -76.53 JK^{-1}mol^{-1}$

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8. Determine the dergee of dissociation of $0.05 MNH_3$ at $25^{\circ} C$ in a solution of $pH = 11$.

$K_b = 1.77 \times 10^{-5} \left(pK_b = 4.75\right)$

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9. In the eqantitative analysis Bi^{3+} is detected precipitation of $[BiO(OH)(s)]$ [bismuthy1 hydroxide). Calculate the pH when the following equilibria exists:

$BiO(OH)(s) \Leftrightarrow BiO^{\oplus}(aq) + \overset{\Theta}{O}H(aq) \left(K = 4 \times 10^{-10}\right)$

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10. Calculate the $\left[\overset{\ominus}{OH}\right]$ of $\left[NH_2C_2H_4NH_3\right]^{\oplus}$ and $\left[H_3N - C_2H_4NH_3\right]^{2+}$ in $0.15M$ ethylene diamine (aq) if

$$NH_2C_2H_4NH_2 + H_2O \Leftrightarrow NH_2C_2H_4\overset{\oplus}{N}H_3 + \overset{\ominus}{OH}\left(K_1 = 8.5 \times 10^{-5}\right)$$

$$NH_2C_2H_4\overset{\oplus}{N}H_3 + H_2O \Leftrightarrow \left[NH_3C_2H_4NH_3\right]^{2+} + \overset{\ominus}{OH}\left(K_2 = 2.7 \times 10^{-8}\right)$$

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11. Calculate pH of

a. $0.002NCH_3COOH$ having 2.3% dissociation.

b. $0.002NNH_4OH$ having 2.3% dissociation.

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12. Calculate $\left[H^{\oplus}\right]$ and $\left[CHC1_2COO^{\ominus}\right]$ in a solution that is $0.01MHC1$ and $0.01MCHC1_2COOH$. K_a for $CHC1_2COOH$ is 5×10^{-3}.

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13. 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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14. What is the concentration of CH_3COOH which can be added to $0.5MHCOOH$ solution so that dissociation of both is same.

$K_{CH_3COOH} = 1.8 \times 10^{-5}, K_{HCOOH} = 2.4 \times 10^{-4}$

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15. 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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Exercises Subjective (Buffer Solutions)

1. Calculate the weight of $(NH_4)_2SO_4$ 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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2. 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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Exercises Subjective (Hydrolysis Of Salt)

1. a. Calculate the percentage hydrolysis of $0.003M$ aqueous solution of $NaOH$. K_a for $HOCN = 3.3 \times 10^{-4}$.

b. What is the pH and $\left[\overset{\Theta}{OH}\right]$ of $0.02M$ aqueous solution of sodium butyrate. $\left(K_a = 2.0 \times 10^{-5}\right)$.

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2. K_a for the ionisation of Fe^{3+} to $Fe(OH)^{2+}$ and $H^{\oplus}$ is 6.5×10^{-3}, what is the maximum pH value which could be used so that at least 95% of the total Fe^{3+} in a dilute solution exists as Fe^{3+}?

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Exercises Subjective (Polyprotic Acid)

1. Calculate the equilibrium constants for the reactions with water of $H_2PO_4^{\Theta}$, HPO_4^{2-}, and PO_4^{3-} as ase. Comparing the relative values of two equilibrium constants of $H_2PO_4^{\ominus}$ with water, deduce whether solutions of this ion in water are acidic or base, Deduce whether solutions of HPO_4^{2-} are acidic or bases. Given K_1, K_2,and K_3 for H_3PO_4 are $7.1 \times 10^{-3}, 6.3 \times 10^{-8}$, and 4.5×10^{-13} respectively.

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2. Citric acid $\left(H_3A\right)$ is a polyprotic acid with K_1, K_2, and K_3 equals to $7.4 \times 10^{-4}, 1.7 \times 10^{-5}$, and 4.0×10^{-7}, respectively. Calculate the $\left[H^{\oplus}\right], \left[H_2A^{\ominus}\right], \left[HA^{2-}\right]$, and $\left[A^{3-}\right]$ in $0.01M$ citric acid.

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Exercises Subjective (Solubility And K_{Sp})

1. a. $25mL$ of sample of saturated solution of PbI_2 requires $10mL$ of a certain $AgNO_3(aq)$ for its titration. What is the molarity of this $AgNO_3(aq)$? K_{sp} of $PbI_2 = 4 \times 10^{-9}$.

b. $M(OH)x$ has $K_{sp} = 27 \times 10^{-12}$ and solubility in water is $10^{-3}M$. Calculate the value of x.

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2. a. Equal volumes of $0.02MCaC1_2$ and $0.04MNa_2SO_4$ are mixed. Will a precipitate form? K_{sp} of $CaSO_4 = 2.4 \times 10^{-5}$

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3. 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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4. Calculate the solubility of CaF_2 in a solution buffered at $pH = 3.0. K_a$ for $HF = 6.3 \times 10^{-4}$ and K_{sp} of $CaF_2 = 3.45 \times 10^{-11}$.

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5. a. Will a precipitate of$Mg(OH)_2$ be formed in a $0.001M$ solution of $Mg\left(NO_3\right)_2$ if the pH of solution is adjusted to $9. K_{sp}$ of $Mg(OH)_2 = 8.9 \times 10^{-12}$.

b. Calculate pH at which $Mg(OH)_2$ begin to precipitae form a solution containing $0.1MMg^{2+}$ ions. $K_{sp} of Mg(OH)_2 = 1 \times 10^{-11}$.

c. Calculate $\left[\overset{\Theta}{OH}\right]$ of a solution after $100mL$ of $0.1MMgC1_2$ is added to $100mL$ of $0.2MNaOH. K_{sp}Mg(OH)_2 = 1.2 \times 10^{-11}$.

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6. 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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7. $1.75g$ of solid $NaOH$ is added to $0.25dm^3$ of $0.1MNiCI_2$ solution. Calculate:

a. Mass of $Ni(OH)_2$ forms

b. pH if final solution Given K_{sp} of $Ni(OH)_2 = 1.6 \times 10^{-14}$

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8. Zn salt is mixed with $\left(NH_4\right)_2S$ of $0.021M$. What amount of Zn^{2+} will remain uprecipitated in $12mL$ of the solution? K_{sp} of $ZnS = 4.51 \times 10^{-24}$.

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9. 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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10. A hard water sample has $131p \pm CaSO_4$. What fraction of the water must be evporated in a container before solid $CaSO_4$ begins to deposit. $K_{sp}ofCaSO_4 = 9.0 \times 10^{-6}$.

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11. To a solution of $0.01MMg^{2+}$ and $0.8MNH_4CI$, and equal volume of NH_3 is added which just gives precipitates. Calculate $\left[NH_3\right]$ in solution. $K_{sp}ofMg(OH)_2 = 1.4 \times 10^{-11}$ and $K_bofNH_4OH = 1.8 \times 10^{-5}$.

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12. $10mL$ 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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13. 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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14. Calculate the solubility of $AgCN$ in a buffer solution of $pH = 3$, Given $K_{sp}ofAgCN = 1.2 \times 10^{-16}$ and K_a for $HCN = 4.8 \times 10^{-10}$.

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15. Equal volumes of $0.02 MAgNO_3$ and $0.01 MHCN$ are mixed. Calculate $\left[Ag^{\oplus}\right]$ in solution after attaining equilibrium. $K_a HCN = 6.2 \times 10^{-10}$ and K_{sp} of $AgCN = 2.2 \times 10^{-16}$.

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16. Determine the number of mole of AgI which may be dissolved in 1.0 litre of $1MCN^-$ 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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17. $100.0 mL$ of a saturated solution of Ag_2SO_4 is added to $250.0 mL$ 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 $1.4 \times 10^{-5}, 2.4 \times 10^{-12}, 2.8 \times 10^{-13}$, and 1.6×10^{-8}, respectively.

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18. $2M$ 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^{Θ} in the resulting solution after equilibrium is attained.

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19. How much NaF should be added to $100mL$ of solution having $0.016M \in Sr^{2+}$ ions to reduces its concentration to $2.5 \times 10^{-3}M? K_{sp}SrF_2 = 2.8 \times 10^{-9}at298K.$

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Exercises Subjective(Coordination Equilibria)

1. 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 $\left[Ag(CN)_2^{\ominus}\right]$ and $\left[Cd(CN)^{2-\prime}{}_4\right]$ are 1.0×10^{-20} and 7.8×10^{-18}, which sulphide will precipitate first?

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2. Calculate the equilibrium constants of each of the indicated species necessary to reduce an initial $0.2 M Zn^{2+}$ solution to $1.0 \times 10^{-4} Zn^{2+}$.

a. Nh_3 and $Zn\left(NH_3\right)_4^{2+}$ (assume no partial complexation)

b. $\overset{\ominus}{OH}$ in equilibrium with $Zn(OH)_2(s)$.

c. $\overset{\ominus}{OH}$ and $Zn(OH)_4^{2-}$.

d. Calculate $\left[\overset{\ominus}{OH}\right]$ which would be produced by each equilibrium concentration of NH_3 in part (a). Predict whether $Zn(OH)_2$ or $Zn(OH)_4^{2-}$ would form in preference to $Zn\left(NH_3\right)_4^{2+}$ upon addition of suficient NH_3 to produce the equilibrium concentration calculated in part(a).

e. Explain what would be observeed if concentrated NH_3 solution were added slowely to $0.2M$ solution of Zn^{2+}.

Given. $K_f Zn\left(NH_3\right)_4^{2+} = 5 \times 10^8$.

$K_{sp}ZN(OH)_2 = 1.8 \times 10^{-14}$.

$K_f Zn(OH)_4^{2-} = 5 \times 10^{14}$.

$K_b NH_4OH = 1.8 \times 10^{-5}$.

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Exercises Linked Comprehension

1. $Pb(IO_3)_2$ is a sparingly soluble salt $(K_{sp} = 2.6 \times 10^{-13})$. To $35mL$ of $0.15MPb(NO_3)_2$ solution, $15mL$ of $0.8MKIO_3$ solution is added, and a precipiatte of $Pb(IO_3)_2$ is formed.

Which is the limiting reactant of teh reaction that takes place in the solution?

A. $Pb(IO_3)_2$

B. $Pb(NO_3)_2$

C. KIO_3

D. Both (b) and (c).

Answer: B

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2. $Pb\left(IO_3\right)_2$ is a sparingly soluble salt $\left(K_{sp} = 2.6 \times 10^{-13}\right)$. To $35mL$ of $0.15MPb\left(NO_3\right)_2$ solution, $15mL$ of $0.8MKIO_3$ solution is added, and a precipiatte of $Pb\left(IO_3\right)_2$ is formed.

What will be the molarity of $IO_3^{\ominus}$ ions in the solution after completion of the reaction?

A. 0.152

B. 0.081

C. 0.41

D. 0.03

Answer: D

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3. $Pb(IO_3)_2$ is a sparingly soluble salt $(K_{sp} = 2.6 \times 10^{-13})$. To $35mL$ of $0.15MPb(NO_3)_2$ solution, $15mL$ of $0.8MKIO_3$ solution is added, and a precipiatte of $Pb(IO_3)_2$ is formed.

What will be molarity of Pb^{2+} ions in the solution after completion of the reactions?

A. 8.4×10^{-10}

B. 1.6×10^{-10}

C. 2.8×10^{-10}

D. 6.1×10^{-10}

Answer: C

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4. Acid-base indicator such as methy1 orange, phenolphthalein, and bromothymol blue ate substances which change colour accroding to the hydrogen ion concentration of the solution to which they are added.

Most indicators are weak acids (or more rarely weak base) in which the undissociated and dissociated forms have different and distinct colours. If methy1 orange is used as the examples and the un-dissociated forms is written as HMO, then dissociation occurs as shown below:

Reaction: $\begin{array}{lll} HMO \Leftrightarrow & H^{\oplus} + & MO^{\ominus} \\ Red & \text{Colourless} & \text{Yellow} \end{array}$

The indicator should have a sharp colour change with the equivalence point of the titration. Usually the colour change of the indicator occurs over a range of about two pH units. It should be noted that the eye cannot detect the exact end point of the tiytration. The pK_a of the indicator should be near the pH of the solution at the equivalance point.

Which of the following sitution exists at the equivalence point of titration?

A. $\left[H^{\oplus}\right] = 10^{-7}M$

B. $\left[H^{\oplus}\right] = \left[\overset{\ominus}{OH}\right]$

C. $\left[\overset{\ominus}{OH}\right] = 10^{-7}M$

D. $\frac{\left[H^{\oplus}\right]}{\left[\overset{\Theta}{OH}\right]} = 10^{-14}$

Answer: B

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5. Acid-base indicator such as methy1 orange, phenolphthalein, and bromothymol blue ate substances which change colour accroding to the hydrogen ion concentration of the solution to which they are added. Most indicators are weak acids (or more rarely weak base) in which the undissociated and dissociated forms have different and distinct colours. If methy1 orange is used as the examples and the un-dissociated forms is written as HMO, then dissociation occurs as shown below:

Reaction: $\underset{Red}{HMO} \Leftrightarrow \underset{\text{Colourless}}{H^{\oplus}} + \underset{\text{Yellow}}{MO^{\Theta}}$

The indicator should have a sharp colour change with the equivalence point of the titration. Usually the colour change of the indicator occurs over a range of about two pH units. It should be noted that the eye cannot detect the exact end point of the tiytration. The pK_a of the indicator should be near the pH of the solution at the equivalance point. Given that the K_a (methy1 orange) $= 4.0 \times 10^{-4}$, a solution at $pH = 2$ containing the indicator would be

A. Orange

B. Yellow

C. Colorless

D. Red

Answer: D

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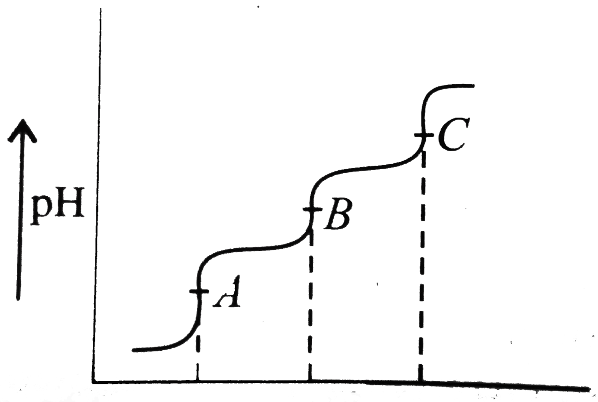
6. Acidic solution is defined as a solution whose $\left[H^{\oplus}\right] > \left[\overset{\Theta}{OH}\right]$. Base solution has $\left[\overset{\Theta}{OH}\right] > \left[H^{\oplus}\right]$. During acid-base titrations, pH of the mixture will change depending on the amount base added. This variation is shown in the form of graph by making plot as titration curves $100 mL$ of

$1.0 MH_3A\left(K_{a_1} = 10^{-3}, K_{a_2} = 10^{-5}, K_{a_3} = 10^{-7}\right)$ is titrated against

$0.1 MNaOh$. The titration curve is as follows.



What is the pH at point `A?

A. 3

B. 4

C. 5

D. 6

Answer: B

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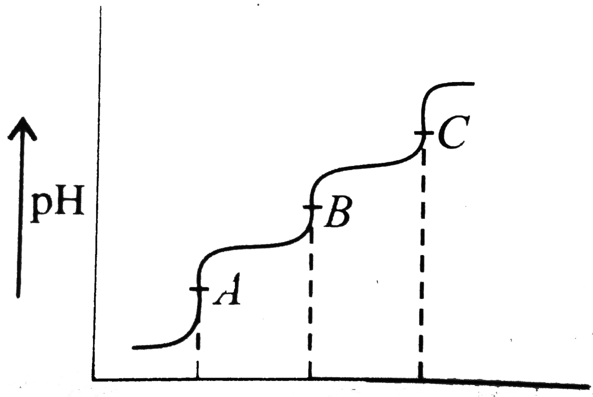
7. Acidic solution is defined as a solution whose $\left[H^{\oplus}\right] > \left[\overset{\ominus}{OH}\right]$. Base solution has $\left[\overset{\ominus}{OH}\right] > \left[H^{\oplus}\right]$. During acid-base titrations, pH of the mixture will change depending on the amount base added. This variation is shown in the form of graph by making plot as titration curves $100mL$ of $1.0MH_3A\left(K_{a_1} = 10^{-3}, K_{a_2} = 10^{-5}, K_{a_3} = 10^{-7}\right)$ is titrated against $0.1MNaOh$. The titration curve is as follows.



What would be the pH is more of NaH_2A is added to the titration mixture at point C ?

A. 11.0

B. 10.2

C. 9.7

D. 7.7

Answer: C

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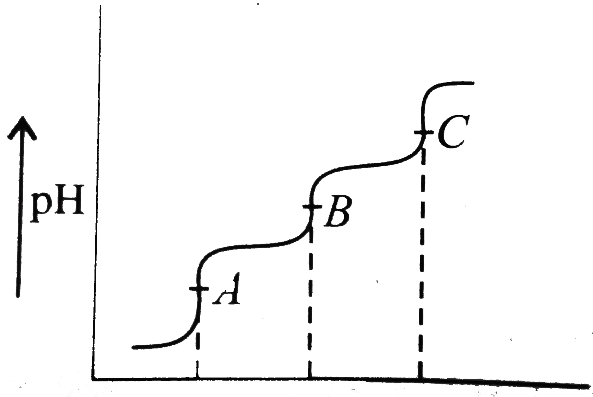
8. Acidic solution is defined as a solution whose $\left[H^{\oplus}\right] > \left[\overset{\Theta}{O}H\right]$. Base solution has $\left[\overset{\Theta}{O}H\right] > \left[H^{\oplus}\right]$. During acid-base titrations, pH of the mixture will change depending on the amount base added. This variation is shown in the form of graph by making plot as titration curves $100mL$ of $1.0MH_3A\left(K_{a_1} = 10^{-3}, K_{a_2} = 10^{-5}, K_{a_3} = 10^{-7}\right)$ is titrated against $0.1MNaOh$. The titration curve is as follows.



What will be the change in pH from point B to point C?

A. 2.8

B. 3.2

C. 4.6

D. 0.94

Answer: D

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9. In equalitative analysis, cations of graph II as well as group IV both are precipitated in the form of sulphides. Due to low value of K_{sp} of group II

sulphides, group reagent is H_2S in the presence of dil. $HC1$, and due to high value of K_{sp} of group IV sulphides, group reagent is H_2S in the presence of NH_4OH and NH_4C1. In a solution containing $0.1M$ each of Sn^{2+}, Cd^{2+}, and Ni^{2+} ions, H_2Sgas is passed.

$K_{sp} ofSnS = 8 \times 10^{-29}, K_{sp} ofCdS = 1510^{-28}, K_{sp} ofNiS - 3 \times 10^{-21}, K_1 ofH_2S = 1 \times$

If H_2S is passed into the above mixture in the presence of $HC1$, which ion will be precipitated first?

A. SnS

B. CdS

C. NiS

D. SnS and CdS (both together)

Answer: C

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10. In equalitative analysis, cations of graph II as well as group IV both are precipitated in the form of sulphides. Due to low value of K_{sp} of group II sulphides, group reagent is H_2S in the presence of dil. $HC1$, and due to high value of K_{sp} of group IV sulphides, group reagent is H_2S in the presence of NH_4OH and NH_4C1. In a solution containing $0.1M$ each of Sn^{2+}, Cd^{2+}, and Ni^{2+} ions, H_2Sgas is passed.

$K_{sp} of SnS = 8 \times 10^{-29}, K_{sp} of CdS = 1510^{-28}, K_{sp} of NiS - 3 \times 10^{-21}, K_1 of H_2S = 1 \times$

At what value of pH, NiS will start to precipitate?

A. 12.76

B. 7

C. 1.24

D. 4`

Answer: C

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$K_{sp}ofSnS = 8 \times 10^{-29}, K_{sp}ofCdS = 1510^{-28}, K_{sp}ofNiS - 3 \times 10^{-21}, K_1ofH_2S = 1 \times$

Which of the following sulphides is more soluble in pure water?

A. CdS

B. NiS

C. SnS

D. Equal solubility for all

Answer: A

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12. In equalitative analysis, cations of graph II as well as group IV both are precipitated in the form of sulphides. Due to low value of K_{sp} of group II sulphides, group reagent is H_2S in the presence of dil. $HC1$, and due to high value of K_{sp} of group IV sulphides, group reagent is H_2S in the presence of NH_4OH and NH_4C1. In a solution containing $0.1M$ each of Sn^{2+}, Cd^{2+}, and Ni^{2+} ions, H_2Sgas is passed.

$K_{sp}ofSnS = 8 \times 10^{-29}, K_{sp}ofCdS = 1510^{-28}, K_{sp}ofNiS - 3 \times 10^{-21}, K_1ofH_2S = 1 \times$

If $0.1MHC1$ is mixed in the solution containing only $0.1MCd^{2+}$ ions and saturated with H_2S, then $\left[Cd^{2+}\right]$ remaining in the solution after CdS stopes to precipitate is:

A. 10^{-8}

B. 8.2×10^{-9}

C. 5.6×10^{-6}

D. 5.6×10^{-10}

Answer: A

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13. The degree of dissociation of weak electrolyde is inversely proportional to the square root fo concentration. It is called Ostwald's dilution law.

$\alpha = \sqrt{\frac{K_a}{c}}$ As the tempertaure increases, degree of dissociation will increase.

$\frac{\alpha_1}{\alpha_2} = \sqrt{\frac{K_{a_1}}{K_{a_2}}}$ if concentration is same.

$\frac{\alpha_1}{\alpha_2} = \sqrt{\frac{c_2}{c_1}}$ if acid is same.

$0.01 M CH_3COOH$ has 4.24% degree of dissociation, the degree of dissociation of $0.1 M CH_3COOH$ will be

A. 1.33%

B. 4.24%

C. 5.24%

D. 0.33%

Answer: A

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14. The degree of dissociation of weak electrolyde is inversely proportional to the square root fo concentration. It is called Ostwald's dilution law.

$\alpha = \sqrt{\frac{K_a}{c}}$ As the tempertaure increases, degree of dissociation will increase.

$\frac{\alpha_1}{\alpha_2} = \sqrt{\frac{K_{a_1}}{K_{a_2}}}$ if concentration is same.

$\frac{\alpha_1}{\alpha_2} = \sqrt{\frac{c_2}{c_1}}$ if acid is same.

pH of $0.005 MHCOOH\left[K_a = 2 \times 10^{-4}\right]$ is equal to

A. 3

B. 2

C. 4

D. 5

Answer: A

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15. The degree of dissociation of weak electrolyde is inversely proportional to the square root fo concentration. It is called Ostwald's dilution law.

$\alpha = \sqrt{\frac{K_a}{c}}$ As the tempertaure increases, degree of dissociation will increase.

$\frac{\alpha_1}{\alpha_2} = \sqrt{\frac{K_{a_1}}{K_{a_2}}}$ if concentration is same.

$\frac{\alpha_1}{\alpha_2} = \sqrt{\frac{c_2}{c_1}}$ if acid is same.

a_1 and a_2 are in ratio of $1:2$, $K_{a_1} = 2 \times 10^{-4}$. What will be K_{a_2}?

A. 8×10^{-4}

B. 2×10^{-4}

C. 4×10^{-4}

D. 1×10^{-4}

Answer: A

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16. The following solutions are mixed: $500 mL of 0.01 M AgNO_3$ and $500 mL$ solution that was both $0.01 M$ in $NaCI$ and $0.01 M$ in $NaBr$. Given $K_{sp} AGCI = 10^{-10}, K_{sp} AgBr = 5 \times 10^{-13}$.

Calculate the $\left[CI^{\Theta}\right]$ in the equilibrium solution.

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

B. 2.5×10^{-5}

C. $5 \times 10^{-3} M$

D. $2.5 \times 10^{-3} M$

Answer: C

Watch Video Solution

17. The following solutions are mixed: $500 mL of 0.01 M AgNO_3$ and $500 mL$ solution that was both $0.01 M$ in $NaCI$ and $0.01 M$ in $NaBr$. Given

$K_{sp}AGCI = 10^{-10}, K_{sp}AgBr = 5 \times 10^{-13}$.

Calculate the $\left[Ag^{\oplus}\right]$ in the equilibrium solution.

A. $2.0 \times 10^{-8}M$

B. $2.0 \times 10^{-10}M$

C. $2.5 \times 10^{-5}M$

D. $2.5 \times 10^{-8}M$

Answer: A

Watch Video Solution

18. The following solutions are mixed: $500mLof0.01MAgNO_3$ and $500mL$ solution that was both $0.01M$ in $NaCI$ and $0.01M$ in $NaBr$. Given $K_{sp}AGCI = 10^{-10}, K_{sp}AgBr = 5 \times 10^{-13}$.

Calculate the $\left[Br^{\Theta}\right]$ in the equilibrium solution.

A. $2.0 \times 10^{-8}M$

B. $2.0 \times 10^{-10}M$

C. $2.5 \times 10^{-5}M$

D. $2.5 \times 10^{-8}M$

Answer: C

Watch Video Solution

19. When $1.5mol$ of $CuCI_2.2H_2O$ is dissolved in enough water to make $1.0L$ of solution.

Given: $K_fCuCI^{\Theta}1.0\left(K_f\right.$ is the formation constant of $\left.CuCi^{\oplus}\right)$

$\left[Cu^{2+}\right]$ in solution is

A. $1.0M$

B. $0.5M$

C. $2.0M$

D. None

Answer: A

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20. When $1.5mol$ of $CuCI_2.2H_2O$ is dissolved in enough water to make $1.0L$ of solution.

Given: $K_f CuCI^{\ominus} 1.0 \left(K_f\right.$ is the formation constant of $\left.CuCi^{\oplus}\right)$

$\left[CI^{\ominus}\right]$ in solution is

A. $2.0M$

B. $1.0M$

C. $3.0M$

D. None

Answer: A

Watch Video Solution

21. When $1.5mol$ of $CuCI_2.2H_2O$ is dissolved in enough water to make $1.0L$ of solution.

Given: $K_f CuCI^{\ominus} 1.0 \left(K_f\right.$ is the formation constant of $\left.CuCi^{\oplus}\right)$

$\left[CiCI^{\oplus}\right]$ in solution is

A. $1.0M$

B. $2.0M$

C. $3.0M$

D. $0.5M$

Answer: B

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22. Acid rain takes place dur to combination of acidic oxides with water and it is an envirronmental concern all over the world. Assuming rain water is uncontaminated with HNO_3 or H_2SO_4 and is in equilibrium with $1.25 \times 10^{-4} atm CO_2$. The Henry's law constant $\left(K_H\right)$ is 1.25×10^6torr. K_{a_1} of $H_2CO_3 = 4.3 \times 10^{-7}$

Given : $K_f CuCI^{\ominus} = 1.0\left(K_f\right.$ is formation constant of $\left.CuCI^{\oplus}\right)$

What is the pH of neturak rain water ?

A. 5.64

B. 7.00

C. 5.85

D. 7.40

Answer: C

Watch Video Solution

23. Acid rain takes place dur to combination of acidic oxides with water and it is an envirronmental concern all over the world. Assuming rain water is uncontaminated with HNO_3 or H_2SO_4 and is in equilibrium with 1.25×10^{-4} atm CO_2. The Henry's law constant $\left(K_H\right)$ is 1.25×10^6torr. K_{a_1} of $H_2CO_3 = 4.3 \times 10^{-7}$

Given : $K_f CuCI^{\ominus} = 1.0\left(K_f\right.$ is formation constant of $\left.CuCI^{\oplus}\right)$

If SO_2 content is the atomsphere is 0.64ppm by volume, pH of rain water is (assume 100% ionisation of acid rain as monobasic acid).

A. 4.0

B. 5.0

C. 6.0

D. 7.0

Answer: B

Watch Video Solution

24. In atmosphere, SO_2 and NO are oxidised to SO_3 and NO_2, respectively,w hcih react with water to given H_2SO_4 and HNO_3. The resultant solution is called acid rain. SO_2dissolves in water to form diprotic acid.

$SO_2(g) + H_2O(l) \Leftrightarrow HSO_3^{\ominus} + H^{\oplus}, K_{a_1} = 10^{-2}$.

$HSO_3^{\ominus} \Leftrightarrow SO_3^{2-} + H^{\oplus}, K_{a_2} = 10^{-7}$

and for equilibrium,

$SO_2(aq) + H_2O(l) \Leftrightarrow SO_3^{2-}(aq) + 2H^{\oplus}(aq)$

$K_a = K_{a_1} \times K_{a_2} = 10^{-9} at 300K.$

Which of the following reagnets will given white precipitate with the aqueous solution of sulphurous acid?

A. $BaCI_2$

B. HCI

C. $NaCI$

D. KCI

Answer: A

Watch Video Solution

25. In atmosphere, SO_2 and NO are oxidised to SO_3 and NO_2, respectively,w hcih react with water to given H_2SO_4 and HNO_3. The resultant solution is called acid rain. SO_2dissolves in water to form diprotic acid.

$SO_2(g) + H_2O(l) \Leftrightarrow HSO_3^{\ominus} + H^{\oplus}, K_{a_1} = 10^{-2}.$

$HSO_3^{\ominus} \Leftrightarrow SO_3^{2-} + H^{\oplus}, K_{a_2} = 10^{-7}$

and for equilibrium,

$SO_2(aq) + H_2O(l) \Leftrightarrow SO_3^{2-}(aq) + 2H^{\oplus}(aq)$

$K_a = K_{a_1} \times K_{a_2} = 10^{-9} at 300K.$

The pH of $0.01M$ aqueous solutioon of sodium sulphite (Na_2SO_3)

A. 4.5

B. 8.5

C. 9.0

D. 9.5

Answer: D

Watch Video Solution

26. In atmosphere, SO_2 and NO are oxidised to SO_3 and NO_2, respectively,w hcih react with water to given H_2SO_4 and HNO_3. The resultant solution is called acid rain. SO_2dissolves in water to form diprotic acid.

$SO_2(g) + H_2O(l) \Leftrightarrow HSO_3^{\ominus} + H^{\oplus}, K_{a_1} = 10^{-2}.$

$HSO_3^{\ominus} \Leftrightarrow SO_3^{2-} + H^{\oplus}, K_{a_2} = 10^{-7}$

and for equilibrium,

$SO_2(aq) + H_2O(l) \Leftrightarrow SO_3^{2-}(aq) + 2H^{\oplus}(aq)$

$K_a = K_{a_1} \times K_{a_2} = 10^{-9} at 300K.$

The dominant equilibrium in an aqueous solution of sodium hydrogen sulphite $(NaHSO_3)$ is

$2HSO_3^{\ominus}(aq) \Leftrightarrow SO_2(aq) + SO_3^{2-}(aq) + H_2O(l)$

The equilibrium constant for the above reaction is

A. 10^{-3}

B. 10^{-5}

C. 10^{-6}

D. 10^{-9}

Answer: B

Watch Video Solution

27. In atmosphere, SO_2 and NO are oxidised to SO_3 and NO_2, respectively,w hcih react with water to given H_2SO_4 and HNO_3. The resultant solution is called acid rain. SO_2dissolves in water to form diprotic acid.

$SO_2(g) + H_2O(l) \Leftrightarrow HSO_3^{\Theta} + H^{\oplus}, K_{a_1} = 10^{-2}$.

$HSO_3^{\Theta} \Leftrightarrow SO_3^{2-} + H^{\oplus}, K_{a_2} = 10^{-7}$

and for equilibrium,

$SO_2(aq) + H_2O(l) \Leftrightarrow SO_3^{2-}(aq) + 2H^{\oplus}(aq)$

$K_a = K_{a_1} \times K_{a_2} = 10^{-9} at 300K.$

Which of the following statement is correct?

A. H_2SO_3 is less acidic than H_2SO_4.

B. HNO_3 is less acidic than HNO_2.

C. $SO_2(g)$ is reduced in the atmosphere during thunderstron.

D. CO_2 gas develop more acidity in rain water than SO_2.

Answer: A

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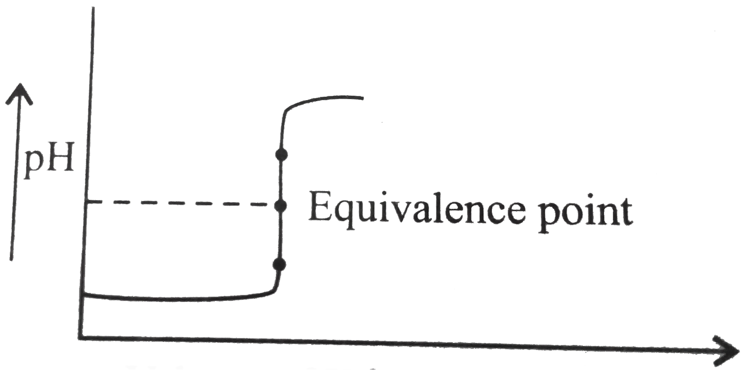
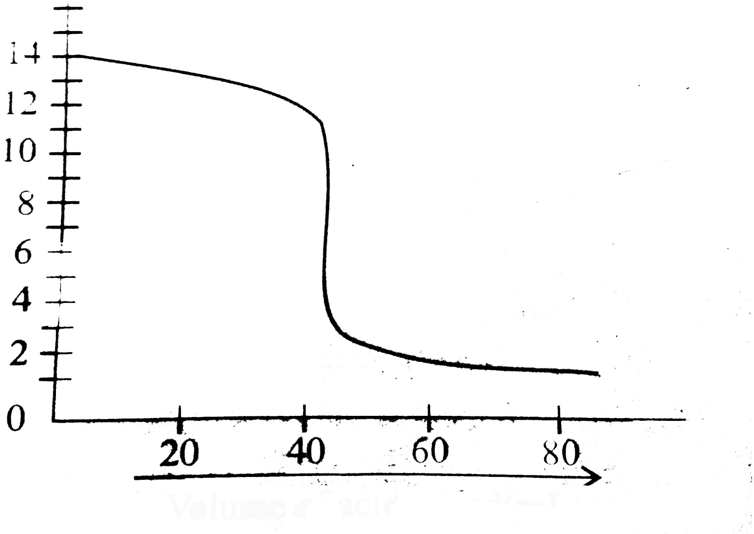
28. In acid-base titration react rapidly to neutralise each other. Equivalence point is a point at which the acid and the base (or oxidising agent and reducing agent) have beem added in equivalent quantities. The end point in the point at which the titration stops. since the purpose of the indicator is to stop the titration close to the point at which the acid and base were added in equivalent quantities, it is important that the equivalent point and the end point be as close as must change colour at a pH close to that of a solution of the salt of the acid base. Singificantly, the pH changes most rapidly near the equivalent point. The exact shape of a titration curve depends on K_a and K_b of acid and base.



The following curve represents titration curve of HCI against KOH. The pH at equivalent point is

Examine the titration curve below and answer the question.



A. 3

B. 6

C. 7

D. 8

Answer: C

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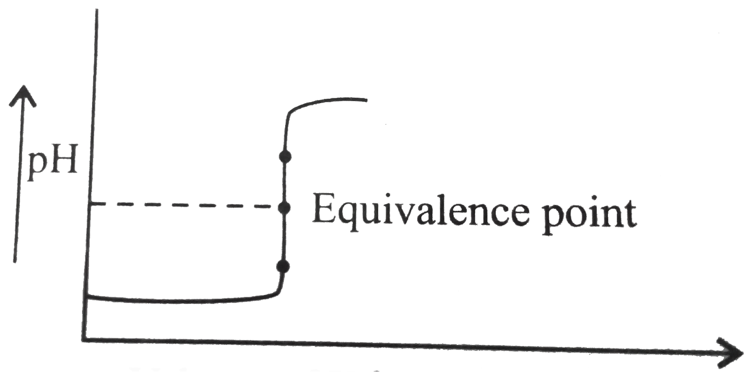
29. In acid-base titration react rapidly to neutralise each other. Equivalence point is a point at which the acid and the base (or oxidising agent and reducing agent) have beem added in equivalent quantities. The end point in the point at which the titration stops. since the purpose of the indicator is to stop the titration close to the point at which the acid and base were added in equivalent quantities, it is important that the equivalent point and the end point be as close as must change colour at a pH close to that of a solution of the salt of the acid base. Singificantly, the pH changes most rapidly near the equivalent point. The exact shape of a titration curve depends on K_a and K_b of acid and base.



The curve represents the titration of

A. $CsOHbyHBr$

B. $HClbyNaOH$

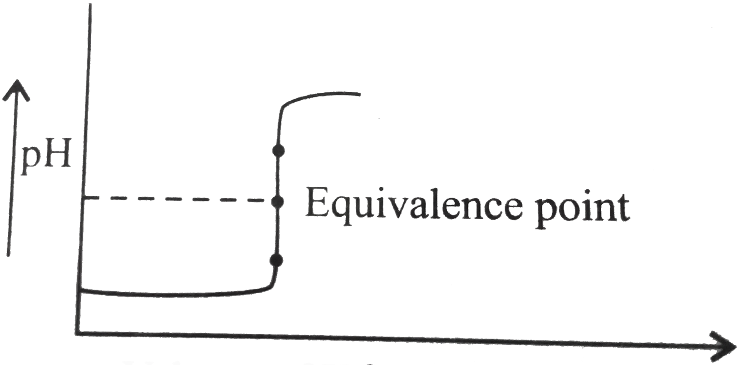
C. $HClbyKOH$

D. NH_3byHNO_3

Answer: A

Watch Video Solution

30. In acid-base titration react rapidly to neutralise each other. Equivalence point is a point at which the acid and the base (or oxidising agent and reducing agent) have beem added in equivalent quantities. The end point in the point at which the titration stops. since the purpose of the indicator is to stop the titration close to the point at which the acid and base were added in equivalent quantities, it is important that the equivalent point and the end point be as close as must change colour at a pH close to that of a solution of the salt of the acid base. Singificantly, the pH changes most rapidly near the equivalent point. The exact shape of a titration curve depends on K_a and K_b of acid and base.



The suitable indicator for the titration is

A. Methy1 orange

B. Bromothymol

C. Methy1 red

D. All of these

Answer: D

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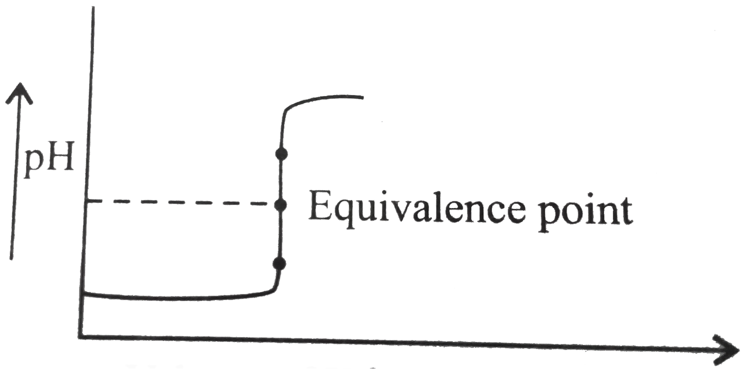
31. In acid-base titration react rapidly to neutralise each other. Equivalence point is a point at which the acid and the base (or oxidising agent and reducing agent) have beem added in equivalent quantities. The end point in the point at which the titration stops. since the purpose of the indicator is to stop the titration close to the point at which the acid and base were added in equivalent quantities, it is important that the equivalent point and the end point be as close as must change colour at a pH close to that of a solution of the salt of the acid base. Singificantly, the pH changes most rapidly near the equivalent point. The exact shape of a titration curve depends on K_a and K_b of acid and base.



The pH at equivalence point is

A. 2

B. 3

C. 7

D. 11

Answer: C

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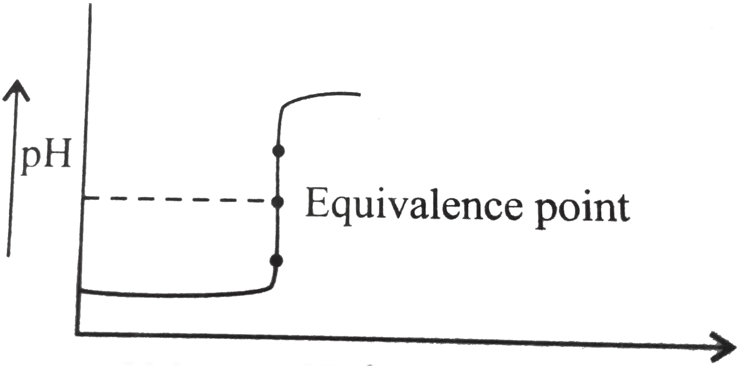
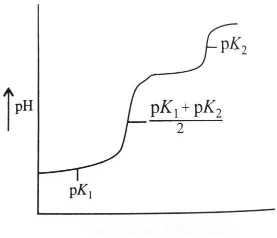
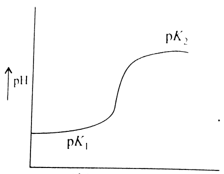
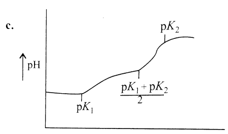
32. In acid-base titration react rapidly to neutralise each other. Equivalence point is a point at which the acid and the base (or oxidising agent and reducing agent) have beem added in equivalent quantities. The end point in the point at which the titration stops. since the purpose of the indicator is to stop the titration close to the point at which the acid and base were added in equivalent quantities, it is important that the equivalent point and the end point be as close as must change colour at a pH close to that of a solution of the salt of the acid base. Singificantly, the pH changes most rapidly near the equivalent point. The exact shape of a titration curve depends on K_a and K_b of acid and base.

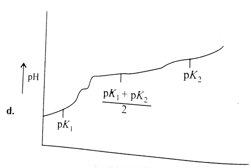


Which of the following curves indicates the titration of a weak diprotic acid by KOH of equivalent strength?

A.


B.


C.


D.


Answer: A

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33. Physical and chemical equilibrium can respond to a change in their pressure, temperature, and concentration of reactants and products. To describe the change in the equilibrium we have a principle named Le Chatelier principle. According to this principle, even if we make some changes in equilibrium, then also the system even re-establishes the equilibrium by undoing the effect.

In the reaction $N_2(g) + 3H_2(g) \Leftrightarrow 2NH_3(g)$. If we increase the pressure of the system, the equilibrium is

A. Shifts in the product side

B. Remains unchanged

C. Shifts in the reactant side

D. Cannot be predicted

Answer: A

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34. Physical and chemical equilibrium can respond to a change in their pressure, temperature, and concentration of reactants and products. To describe the change in the equilibrium we have a principle named Le Chatelier principle. According to this principle, even if we make some changes in equilibrium, then also the system even re-establishes the equilibrium by undoing the effect.

If we add SO_4^{2-} ion to a saturated solution of Ag_2SO_4, it will result in a//an

A. Result in an increase in $Ag^{\oplus}$ concentration

B. Result in a decrease in $Ag^{\oplus}$ concentration

C. Shift $Ag^{\oplus}$ ions from solid Ag_2CrO_4 into solution.

D. Result in a decrease the CrO_4^{2-} ion concentration in the solution.

Answer: B

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35. Physical and chemical equilibria can respond to a change in their pressure, temperature, and concentration of reactants and products. To describe the change in the equilibrium, we have a principle named Le Chatelier's principle. This we can define in terms of enegry, as the free energy change in equilibrium is zero means the system is stable. So if we are doing some changes in equilibrium, then the system having a tendency to reoestablish the equilibrium by undoing the effect we broughy. Consider the following equilibrium.

Three sparingly soluble salts A_2B, AB, and AB_3 are given. If all the three having the same value of solobility products $\left(K_{sp}\right)$, in the saturated solution, the correct order of their solubilites is

A. $AB_3 > AB > A_2B$

B. $AB_3 > A_2B > AB$

C. $AB > AB_3 > A_2B$

D. $AB > A_2B > AB_3$

Answer: D

Watch Video Solution

36. H_3PO_4 is a tribasic acid with pK_{a_1}, pK_{a_2} and pK_{a_3} $1.12, 7.21,$ and $12.32,$ respectively. It is used in fertiliser productions and its various salts are used in food, detrgent, toothpaste, and in metal treatment.

Small quantities of H_3PO_4 are used in inparting the sour or tart taste of soft drinkes, such as Coca Cola, and beers, in which H_3PO_4 is prese4nt 0.05% by weight (density $= 1.0 gmL^{-1}\big)$.

$10^{-3} M H_3PO_4 (pH = 7)$ is used in fertilisers as an aqueous soil digesting. Plants can absorb zinc in whater soluble from only. Zinc phosphate is the source of zinc and $PO_4^{3-})$ ions in the soil. K_{sp} of zinc phosphate $= 9.1 \times 10^{-33}$.

Calculate the pH of a Coca Cola, assuming that the acidity of the cola arises only from H_3PO_4 and K_{a_2} and K_{a_3} are no importance.

A. .18

B. 2.2

C. 3.3

D. 4.4

Answer: B

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37. H_3PO_4 is a tribasic acid with pK_{a_1}, pK_{a_2} and pK_{a_3} $1.12, 7.21$, and 12.32, respectively. It is used in fertiliser productions and its various salts are used in food, detrgent, toothpaste, and in metal treatment.

Small quantities of H_3PO_4 are used in inparting the sour or tart taste of soft drinkes, such as Coca Cola, and beers, in which H_3PO_4 is prese4nt 0.05% by weight (density $= 1.0 gmL^{-1}$).

$10^{-3} MH_3PO_4 (pH = 7)$ is used in fertilisers as an aqueous soil digesting. Plants can absorb zinc in whater soluble from only. Zinc phosphate is the source of zinc and PO_4^{3-}) ions in the soil. K_{sp} of zinc phosphate

$= 9.1 \times 10^{-33}$.

$\left[PO_4^{3-}\right]$ ion in the soil with $pH = 7$, is

A. $10^{-3}M$

B. $1.2 \times 10^{-4}m$

C. $2.2 \times 10^{-4}M$

D. $1.1 \times 10^{-10}M$

Answer: C

Watch Video Solution

38. H_3PO_4 is a tribasic acid with pK_{a_1}, pK_{a_2} and pK_{a_3} $1.12, 7.21$, and 12.32, respectively. It is used in fertiliser productions and its various salts are used in food, detrgent, toothpaste, and in metal treatment.

Small quantities of H_3PO_4 are used in inparting the sour or tart taste of soft drinkes, such as Coca Cola, and beers, in which H_3PO_4 is prese4nt 0.05% by weight (density $= 1.0gmL^{-1}$).

$10^{-3}MH_3PO_4(pH = 7)$ is used in fertilisers as an aqueous soil digesting.

Plants can absorb zinc in whater soluble from only. Zinc phosphate is the source of zinc and PO_4^{3-}) ions in the soil. K_{sp} of zinc phosphate $= 9.1 \times 10^{-33}$.

$\left[Zn^{2+}\right]$ ion in the soil is

A. $2.9 \times 10^{-11} M$

B. $4.0 \times 10^{-10} M$

C. $3.0 \times 10^{-6} M$

D. $9.1 \times 10^{-5} M$

Answer: A

Watch Video Solution

39. Aqueous solutions of $Na_2C_2O_4$ and $CaCI_2$ are mixed and precipitate of CaC_2O_4 formed is filered and dried. $250 mL$ of the saturated solution of CaC_2O_4 required $6.0 mL$ of $0.001 M KMnO_4$ solution in acidic medium for complete titration.

Number of mol of $KMnO_4$ required is this titration and number of mol of

$C_2O_4^{2-}$ ion present in the given saturated solution fo CaC_2O_4 respectively are

A. $6 \times 10^{-6}, 6 \times 10^{-6}$

B. $6 \times 10^{-6}, 1.5 \times 10^{-5}$

C. $1.5 \times 10^{-5}, 6 \times 10^{-6}$

D. $6 \times 10^{-6}, 3 \times 10^{-6}$

Answer: B

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40. Aqueous solutions of $Na_2C_2O_4$ and $CaCI_2$ are mixed and precipitate of CaC_2O_4 formed is filered and dried. $250mL$ of the saturated solution of CaC_2O_4 required $6.0mL$ of $0.001MKMnO_4$ solution in acidic medium for complete titration.

Equivalent of $KMNO_4$ required in the titration and equivalent of $C_2O_4^{2-}$ ion present in CaC_2O_4, respectively, are

A. $3 \times 10^{-5}, 3 \times 10^{-5}$

B. $1.8 \times 10^{-5}, 3 \times 10^{-6}$

C. $3 \times 10^{-6}, 6 \times 10^{-6}$

D. $6 \times 10^{-6}, 3 \times 10^{-6}$

Answer: A

Watch Video Solution

41. Aqueous solutions of $Na_2C_2O_4$ and $CaCI_2$ are mixed and precipitate of CaC_2O_4 formed is filered and dried. $250mL$ of the saturated solution of CaC_2O_4 required $6.0mL$ of $0.001MKMnO_4$ solution in acidic medium for complete titration.

K_{sp} of CaC_2O_4 is

A. 2.25×10^{-12}

B. 2.25×10^{-10}

C. 3.6×10^{-9}

D. 4.0×10^{-9}

Answer: C

Watch Video Solution

42. Aqueous solutions of $Na_2C_2O_4$ and $CaCI_2$ are mixed and precipitate of CaC_2O_4 formed is filered and dried. $250mL$ of the saturated solution of CaC_2O_4 required $6.0mL$ of $0.001MKMnO_4$ solution in acidic medium for complete titration.

Which is the indicator in the above titration?

A. Phenolphthalein

B. Methy1 ornage

C. $KMnO_4$ it self

D. None

Answer: C

Watch Video Solution

43. $H \in$ is an acidic indicator $\left(K_{Ind} = 10^{-7}\right)$ which dissociates into aqueous acidic solution of $30mL$ of $0.05MH_3PO_4\left(K_1 = 10^{-3}, K_2 = 10^{-7}, K_3 = 10^{-13}\right)$

Calculate the $\left[\frac{Ind^{\Theta}}{H \in}\right]$

A. 1.413×10^{-5}

B. 1.413×10^{-4}

C. 3.128×10^{-5}

D. 3.128×10^{-14}

Answer: A

Watch Video Solution

44. $H \in$ is an acidic indicator $\left(K_{Ind} = 10^{-7}\right)$ which dissociates into aqueous acidic solution of $30mL$ of

$0.05MH_3PO_4\left(K_1 = 10^{-3}, K_2 = 10^{-7}, K_3 = 10^{-13}\right)$

If $H \in$ and Ind^{Θ} posses colour P and Q, respectively, and concentration of HIn is 120 times than that of Ind^{Θ}. colour Q predominates over P when concnetration of Ind^{Θ} is 127 times of HIn.

What is the pH range of the indicator.

A. $4.896 \rightarrow 9.0792$

B. $4.896 \rightarrow 8.0792$

C. $4.896 \rightarrow 7.0792$

D. $4.896 \rightarrow 6.0792$

Answer: A

Watch Video Solution

45. $H \in$ is an acidic indicator $\left(K_{Ind} = 10^{-7}\right)$ which dissociates into aqueous acidic solution of $30mL$ of $0.05MH_3PO_4\left(K_1 = 10^{-3}, K_2 = 10^{-7}, K_3 = 10^{-13}\right)$

If this solution is treated with $30 mL$of $NaOH$ solution, then what molarity of $NaOH$ is needed to reach the equivalence point with indicator?

A. $0.1M$

B. $0.2M$

C. $0.3M$

D. $0.4M$

Answer: A

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Exercises Multiple Correct

1. $0.1 mol$ of $CH_3NH_2\left(K_b = 5 \times 10^{-4}\right)$ is mixed with $0.08 mol$ of HCI and diluted to $1L$. Which statement is correct?

A. The concentration of $H^{\oplus}$ ion is $8 \times 10^{-11}M$.

B. The concentration of $H^{\oplus}$ ion is $8 \times 10^{-5}M$.

C. The pH of solution is 9.8

D. The pOH of solution is 10.2.

Answer: A::C

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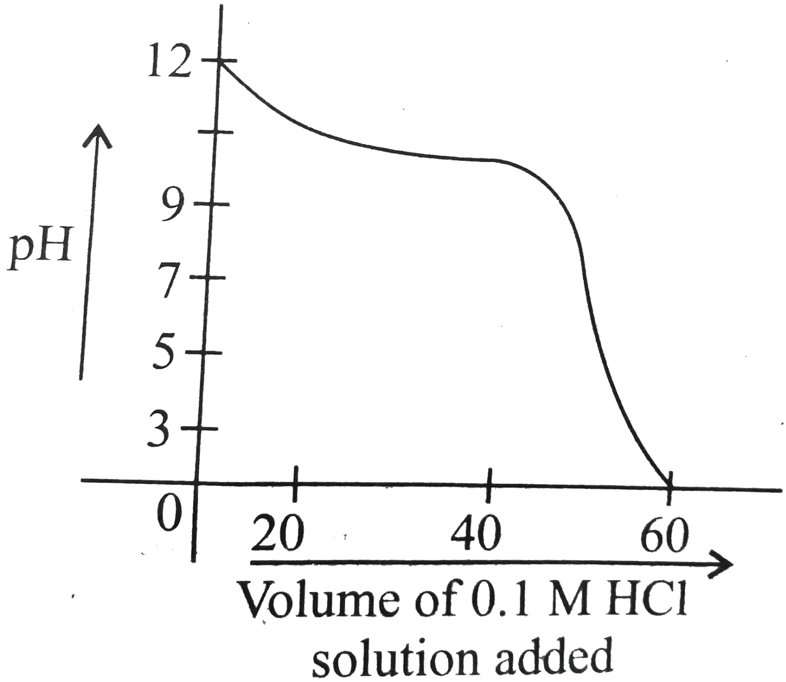
2. When weak base solution $\left(50mLof0.1NNH_4OH\right)$ is titrated with strong acid $(0.1NHCI)$, the pH of the solution initially decrease fast and then decreases slowely till near the equivalence point (as shown in figure).

Which of the following is//are correct.



A. The slow decrease of pH is due to the formation of an acidic buffer solution after the addition of some HCI.

B. The slope of shown graph will be minimum when $25mL$ of $0.1NHCI$ is added.

C. The slow decrease of pH is due to the formation of basic buffer solution.

D. The initial fast decrease in pH is due to fast consumption of $\overset{\Theta}{OH}$ ions by HCI.

Answer: B::C::D

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3. Which of the following statements about a weak acid strong base titration is//are correct?

A. The pH after the equivalence point of the weal acid string base titration is determined by using the K_b expression for the conjugate base.

B. A buffer solution of weal acid and its conjugate base is formed before the equivalence is reached.

C. The pH at the equivalence point of a weak monoprotic acid strong base titration is equal to the pH at the equivalence point of a strong acid-strong base titration.

D. The increase in pH in the region near the equivalence point of a weak acid strong base titration is grater than the pH change in the same region of a strong acid strong base titration

Answer: A::B

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4. An acid-base indicator has $K_a = 10^{-5}$. The acid form of the indicator is red and basic form is blue. Which of the following is//are correct?

A. At $pH = 4.52$, solution is red

B. At pH - 5.47, solution is blue.

C. At $pH = 6$, solution is 75% red

D. At $pH = 8$, solution is 75% blue.

Answer: A::B

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

A. HCI is higly soluble in water.

B. The ionic product $\left[Na^{\oplus}\right]\left[CI^{\Theta}\right]$ exceeds its solubility product $\left(K_{sp}\right)$.

C. The K_{sp} of $NaCI$ is lowered the presence of HCI^{Θ} ions.

D. HCI causes precipitation.

Answer: A::B::D

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6. Excess of $Ag_2SO_4(s)$, $BaSO_4(s)$, and $Ba_3\left(PO_4\right)_2(s)$ are simultaneously in euqilibrium with distilled water. Which of the following is (are) true? Assume no hydrolysis of dissolved ions.

A. $\left[Ag^{\oplus}\right]+2\left[Ba^{2+}\right]=2\left[SO_4^{2-}\right]+3\left[PO_4^{3-}\right]$

B. $2\left[Ag^{\oplus}\right]+4\left[Ba^{2+}\right]=2\left[SO_4^{2-}\right]+2\left[PO_4^{3-}\right]$

C. $2\left[Ag^{\oplus}\right]+3\left[Ba^{2+}\right]=2\left[SO_4^{2-}\right]+2\left[PO_4^{3-}\right]$

D. $\left[Ag^{\oplus}\right]+\left[Ba^{2+}\right]=\left[SO_4^{2-}\right]+\left[PO_4^{3-}\right]$

Answer: A

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7. A solution is found to contain $\left[CI^{\ominus}\right]=1.5\times10^{-1}M$, $\left[Br^{\ominus}\right]=5.0\times10^{-4}M$, $\left[CrO_4^{2-}\right]=1.9\times10^{-2}M$.

A solution of $AgNO_3$ (100 % dissociated) is added to the above solution drop by drop. Which silver salt will precipiate first ? Given:

$K_{sp}(AgCI) = 1.5 \times 10^{-10}, K_{sp}(AgBr) = 5.0 \times 10^{-13}, K_{sp}\left(Ag_2CrO_4\right) = 1.9 \times 10^{-12}$

.

A. $AgCI$

B. $AgBr$

C. Ag_2CrO_4

D. $AgCI$ and $AgBr$ togther

Answer: D

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8. $HgCrO_4$ just begins to peripitate when equal volumes of $4 \times 10^{-4} MHg_2\left(NO_3\right)_2$ and $2 \times 10^{-5} MK_2CrO_4$ are combind. What is the approximate K_{sp} value of Hg_2CrO_4?

A. $1 \times 10^{-18} molL^{-1}$

B. $8 \times 10^{-9} molL^{-1}$

C. $2 \times 10^{-9} molL^{-1}$

D. $4 \times 10^{-9} molL^{-1}$

Answer: B

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9. What is general criteria of chossing a suitable indicator for a given titration?

A. The indicator should have a broad pH range.

B. pH at the end point of titration should be close of neutral point of indicator

C. The indicator should have neutral point at $pH = 7$.

D. The indicator must show a sharp colour changes near the equivalence point of titration point.

Answer: B::D

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10. Which of the following are true for an acid- base titration?

A. Indicators catalyse the acid-base reactions by relasing or accepting $H^{\oplus}$ ions.

B. Indicators do not significantly affect the pH of the solution to which they are added

C. Acid-base reactions do not occur in the absence of indicators

D. Indicators have different colours in dissociated and undissociated forms.

Answer: B::D

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11. An acid-base indicator has $K_a = 3.0 \times 10^{-5}$. The acid form of the indicator is red and the basic form is blue. Then:

A. pH is 4.04 when indicator is 75% red.

B. pH is 5.00 when indicator is 75% blue.

C. pH is 5.00 when indicator is 75% red.

D. pH is 5.05 when indicator is 75% blue.

Answer: A::B

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12. At the end point, there is a sharp change of colour in the indicator. This happened because the

A. pH a end point changes sharply.

B. Structure of the indicator changes.

C. Colour of indicator is adsorbed by water.

D. Dissociation constant of acid and base differ by 10.

Answer: A::B

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13. For a series of indicators, the colour and pH range over which colour change takes place are as follows:

Indicator	Colour change over pH range
U	Yellow to blue pH 0.0 to 1.6
V	Red to yellow pH 2.8 to 4.1
W	Red to yellow pH 4.2 to 5.8
X	Yellow to blue pH 6.0 to 7.7
Y	Colourless to red pH 8.2 to 10.0

Which of the followinfg statements is correct ?

A. Indicator V could be used to find the equivalence point for $0.01M$ acetic and $0.1M$ ammonium hydroxide (ammonia solution) titration.

B. Indicator Y could be used to distinguish between $0.1MHCI$ and $0.01MNaOH$ solutions in water.

C. Indicator X could be used to distinguish between solution of ammonium chloride and sodium acetate.

D. Indicator W could be suitable for use in determining the concentration of acetic acid in vinegar by base titration.

Answer: C

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14. $H_3PO_4 \Leftrightarrow H^{\oplus} + H_2PO_4^{\ominus}, K_{a_1}$:

$H_2PO_4^{\ominus} \Leftrightarrow H^{\oplus} + HPO_4^{2-}, 'K_{a_2}$:

$HPO_4^{2-} \Leftrightarrow H^{\oplus} + PO_4^{3-}, K_{a_3}$:

Mark out the incorrect statements:

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

B. $pH\left(H_2PO_4^{\ominus}\right) = \dfrac{pK_{a_1} + pK_{a_2}}{2}$

C. Both H_3PO_4 and $H_2PO_4^{\ominus}$ are more acidic than HPO_4^{2-}

D. Only HPO_4^{2-} is amphiprotic anion in the solution.

Answer: B::D

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15. Aqueous solution of $HNO_3, CH_3, CH_3COOH,$ and CH_3COOK of identical concentrations are given. The pair (s) of the solution which may form a buffer upon mixing is (are):

A. $NaOH$ and CH_3COOH

B. HNO_3 and CH_3COOK

C. CH_3COOH and CH_3COOK

D. $HNO_3 + CH_3COOH$

Answer: A::B::C

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16. To which of the solution, addition of water would not effect the pH ? .

A. $100mLof0.2MCH_3COOH + 100mLof0.1MNaOH$

B. $100mLof0.2MCH_3COOH + 100mLof0.2MNaOH$

C. $200mLof0.2MCH_3COOH + 100mLof0.1MNaOH$

D. $100mLof0.2MCH_3COOH + 200mLof0.1MNaOH$

Answer: A::C

Watch Video Solution

17. Which of the following salt solutions has $pH < 7$? .

A. NH_4F

B. $Cr\left(NO_3\right)_3$

C. $\left[\left(CN_3\right)_3\overset{\oplus}{N}H\right]CI^{\Theta}$

D. CaI_2

Answer: A::B::C

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18. Which of the folowing represents hydrolysis ? .

A. $\overset{\oplus}{N}H_4 + 2H_2 \Leftrightarrow NH_4OH + H_3O^{\oplus}$

B. $\overset{\oplus}{N}H_4 + H_2O \Leftrightarrow NH_3 + H_3O^{\oplus}$

C. $HCO_3^{\ominus} + H_2OHArrH_2CO_3 + \overset{\ominus}{O}H$

D. $HCO_3^{\ominus} + H_2O \Leftrightarrow CO_3^{2-} + H_3O^{\oplus}$

Answer: A::C

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19. The pH values of aqueous solutions of which of the following compounds does not change on dilution?

A. $PhCOONH_4$

B. NH_4CN

C. $HCOONa$

D. NH_4CI

Answer: A::B

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20. In H_3PO_4 which of the following is true?

A. $K_a = K_{a_1} \times K_{a_2} \times K_{a_3}$

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: A::C

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21. The degree fo hydrolysis for a salt of strong acid and weak base

A. Is independent of dilution

B. Increases with dilution

C. Increases with decrease in K_b of the base

D. Decreases with decrease in temperature

Answer: B::C::D

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22. A solution containing a mixture of $0.05 M NaCI$ and $0.05 M$ Nal is taken. $\left(K_{sp} of AgCI = 10^{-10}\right.$ and K_{sp} of $AgI = 4 \times 10^{-16}\left.\right)$. When $AgNO_3$ is added to such a solution:

A. The concentartion fo $Ag^{\oplus}$ required to precipitate $CI^{\ominus}$ is $2 \times 10^{-9} mol L^{-1}$.

B. The concentartion of $Ag^{\oplus}$ required to precipitate $I^{\ominus}$ is $8 \times 10^{-15} mol L^{-1}$.

C. $AgCI$ and AgI will be precipitate togther.

D. First AgI will be precipitated.

Answer: A::B::D

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23. Which of the following is(are) correct when $0.1L$ of $0.0015MMgCI_2$ and $0.1L$ of $0.025MNaF$ are mixed togther? $\left(K_{sp} of MgF_2 = 3.7 \times 106(- 8)\right)$.

A. MgF_2 remains in solution

B. MgF_2 precipitates out

C. $MgCI_2$ precipitates out

D. CI^{Θ} ions remains in solution

Answer: B::D

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24. Choose the correct statement:

A. pH of acidic buffer solution decrease if more salt is added

B. pH of acidic solution increases if more salt is added.

C. pH of basic buffer increase if more salt is added.

D. pH of basic buffer increase if more salt is added.

Answer: B::C

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25. Which of the following is (are) correct for buffer solution?

A. Acidic buffer will be effective within in the pH range $\left(pK_a \pm 1\right)$.

B. Basic buffer will be effective within the pH range $\left(pK_w - pK_b \pm 1\right)$.

C. $H_3PO_4 + NaH_2PO_4$is not a buffer solution.

D. Buffers behave most effectively when the $[\text{Salt}]/[\text{Acid}]$

Answer: A::B::D

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26. A solution is prepared by dissolving $1.5g$ of a monoacidic base into $1.5kg$ of water at $300K$, which showed a depression in freezing point by $0.165\,^{\circ}C$. When $0.496g$ of the same base titrated, after dissolution, required $40mL$ of semimolar H_2SO_4 solution. If $K_f$of water is $1.86Kkgmol^{-1}$, then select the correct statements (s) out of the following(assuming molarity $=$ molarity):

A. The pH of the solution of weak base is 12.9.

B. The ionisation constant of the base is 8×10^{-3}.

C. The osmotic pressure of the aqueous solution of base is $21.67atm$

D. The base is $10\,\%$ ionized in aqueous solution.

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

Watch Video Solution

27. A solution of $0.01 M Fe^{2+}$ in a saturated H_2S solution and (i) $0.2 M of H^{\oplus}$ (ii) $0.001 M of H^{\oplus}$. $\left(K_1 \times K_2 of H_2S = 10^{-21}, K_{sp} FeS = 3.7 \times 10^{-19}\right)$. Which of the following statements is//are correct

A. FeS will precipitate in solution (i).

B. FeS will not precipitate in solution (i).

C. FeS will precipitate in solution (ii).

D. FeS will precipitate in solution (ii).

Answer: B::C

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28. Which statements is//are correct?

A. $0.1 M NH_3$ solution will precipitate $Fe(OH)_2$ from a $0.1 M$ solution Fe^{2+}.

B. $0.1 M NH_3$ solution will not precipitate $Mg(OH)_2$ from a solution which is $0.2 M$ in $\overset{\oplus}{NH_4}$ and $0.1 M$ in Mg^{2+}

C. $0.1 M NH_3$ solution will not precipitate $AgOH$ from a solution which is $0.01 M$in $Ag^{\oplus}$.

D. Will precipitate is part (c).

Answer: A::B::C

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29. Which statements is//are correct?

A. Compared to a strong acid, a weak acid titration with base starts at a higher pH.

B. Compared to a strong base, a weak base titration ends at a lower pH.

C. In both (a) and (b) titration curve is shortened at each end.

D. For titration of a weak base, the neraly vertical portion of the curve would be insufficient for an effective titration.

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

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30. Which of the following solution will have $pH = 13$?

A. $2gNaOH\text{in}500mL$ solution.

B. $100mL$ solution fo $0.05MCa(OH)_2$.

C. $100mL$ solution of $1.0NCa(OH)_2$.

D. $4gNaOH$ in $500mL$ solution.

Answer: A::B::C

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31. Which of the following statements (s) is (are) correct?

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

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

C. Autoprotoysis constant of water increases with temperature.

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

Answer: B::C

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32. The pH of $0.1M$ solution of the following salts decreases 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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33. A buffer solution can be prepared from a mixture of

A. Sodium acetate and acetic acid in water.

B. Sodium acetat and hydrochloric acid in water.

C. Ammonia and ammonia chloride in water.

D. Ammonia and sodium hydroxide in water.

Answer: A::C

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Exercises Single Correct

1. $100mL$ of a buffer solution contains $0.1M$ each of weak acid HA and salt NaA. How many gram of $NaOH$ should be added to the buffer so that it pH will be 6? $\left(K_a \text{ of } HA = 10^{-5}\right)$.

A. 0.328

B. 0458

C. 4.19

D. None

Answer: A

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2. K_a for the reaction,

$Fe^{3+}(aq) + H_2O(l) \Leftrightarrow Fe(OH)^{2+}(aq) + H_3O^{\oplus}(aq)$ is 6.5×10^{-3}, what is the maximum pH value which could be used so that at least 80% of the total iron (III) in a dilute solution exsists as Fe^{3+}?

A. 2.0

B. ~2.4

C. ~2.8

D. ~1.6

Answer: D

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3. The pK_b of CN^{Θ} is 4.7. The pH is solution prepared by mixing $2.5mol$ of $2.5mol$ of KCN of $2.5mol$ of HCN in water and making the total volume upto $500mL$ is

A. 10.3

B. 9.3

C. 8.3

D. 4.7

Answer: B

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4. A $0.1 molar$ solution of weak base BOH is 1% dissociated. If $0.2 mol$ of BCI is added in $1L$ solution of BOH. The degree of dissociation of BOH will become

A. 0.02

B. 0.005

C. 5×10^{-5}

D. 2×10^{-3}

Answer: C

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5. If the equilibrium constant of $BOH \leftrightarrow B^{\oplus} + \overset{\Theta}{OH}$ at $25^{\circ}C$ is 2.5×10^{-6}, then equilibrium constant for $BOH + H^{\oplus} \Leftrightarrow B^{\oplus} + H_2O$ at the same temperature is

A. 4.0×10^{-9}

B. 4.0×10^{-5}

C. 2.5×10^{8}

D. 2.5×10^{-6}

Answer: C

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6. An aqueous solution of metal chloride $MCI_2(0.05M)$ is saturated with $H_2S(0.1M)$. The minimum pH at which metal sulphide will be precipiated is

$\left[K_{sp}MS = 5 \times 10^{-21}, K_1\left(H_2S\right) = 10^{-7}, K_2\left(H_2S\right) = 10^{-14}.\right.$

A. 3.25

B. 2.50

C. 1.50

D. 1.25

Answer: C

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7. The pH of a solution of weak base at neutralisation with strong acid is $8.$ K_b for the base is

A. 1.0×10^{-4}

B. 1.0×10^{-6}

C. 1.0×10^{-8}

D. None of these

Answer: B

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8. The ionisation constant of an acid base indicator (a weak acid) is 1.0×10^{-6}. The ionised form of the indicator is red and unionised form is blue. The pH change required to alter the colour of indicator form 80% red is

A. 0.80

B. 1.20

C. 1.40

D. 2.00

Answer: B

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9. K_{sp} of $Mg(OH)_2$ is 4.0×10^{-6}. At what minimum pH, Mg^{2+} ions starts precipitating $0.01 MgCI$

A. $2 + \log 2$

B. $2 - \log 2$

C. $12 + \log 2$

D. $12 - \log 2$

Answer: C

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10. A solution of $0.1 M NaZ$ has $pH = 8.90$. The K_a of HZ is

A. 6.3×10^{-11}

B. 6.3×10^{-10}

C. 1.6×10^{-5}

D. 1.6×10^{-6}

Answer: C

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11. Phenolphalein does not act as an indicator for the titration between

A. HCI and NH_4OH

B. $Ca(OH)_2$ and HCI

C. $NaOH$ and H_2SO_4

D. KOH and CH_3COOH

Answer: A

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12. The pink colour of phenolphthalein in alkaline medium is due to

A. $\overset{\Theta}{OH}$ ions

B. Positive ion

C. Negative ion

D. Neutral form

Answer: C

Watch Video Solution

13. Methy1 orange gives red colour in

A. KOH solution

B. HCI solution

C. Na_2CO_3 solution

D. $NaCI$ solution

Answer: B

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14. A solution containing NH_4CI and NH_4OH has $\left[\overset{\Theta}{O}H\right] = 10^{-6} molL^{-1}$, which of the following hydroxides would be precipitated when this solution in added in equal volume to a solution containing $0.1M$ of metal ions?

A. $Mg(OH)_2, \left(K_{sp} = 3 \times 10^{-11}\right)$

B. $Fe(OH)_2\left(K_{sp} = 8 \times 10^{-16}\right)$

C. $Cd(OH)_2\left(K_{sp} = 8 \times 10^{-6}\right)$

D. $AgOH\left(K_{sp} = 5 \times 10^{-3}\right)$

Answer: B

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15. If equal volumes of $BaCI_2$ and NaF solutions are mixed, which of these combination will not give a precipitate? $\left(K_{sp} ofBaF_2 = 1.7 \times 10^{-7}\right)$.

A. $10^{-3}BaCI_2$ and $2 \times 10^{-2}MNaF$

B. $10^{-3}MBaCI$ and $1.5 \times 10^{-2}MNaF$

C. $1.5 \times 10^{-2}MBaCI_2$ and $10^{-2}MNaF$

D. $2 \times 10^{-2}MBaCI_2$ and $2 \times 10^{-2}MNaF$

Answer: C

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16. The solubility of solid silver chromate, Ag_2Cro_4, is determined in three solvents K_{sp} of $Ag_2CrO_4 = 9 \times 10^{-12}$

I. pure water II. $0.1 MgNO_3$

III. $0.1 MNa_2CrO_4$

Predict the relative solubility of Ag_2CrO_4 in the three solvents.

A. $I = II = III$

B. $I < II < III$

C. $II = III < I$

D. $II < III < I$

Answer: D

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17. 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 (a) and (b)

D. None of these

Answer: A

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18. If $K_{sp}\left(PbSO_4\right) = 1.8 \times 10^{-8}$ and $K_a\left(HSO_4^{\ominus}\right) = 1.0 \times 10^{-2}$ the equilibrium constant for the reaction.

$PbSO_4(s) + H^{\oplus}(aq) \Leftrightarrow HSO_4^{\ominus}(aq) + Pb^{2+}(aq)$ is

A. 1.8×10^{-6}

B. 1.8×10^{-10}

C. 2.8×10^{-10}

D. 1.0×10^{-2}

Answer: A

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19. Which one of the following is true for any diprotic acid, H_2X?

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

B. $K_{a_1} > K_{a_2}$

C. $K_{a_2} = \dfrac{1}{K_{a_1}}$

D. $K_{a_2} = K_{a_1}$

Answer: B

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

A. 8

B. 9

C. 10

D. 12

Answer: B

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21. 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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22. A solution is saturated with respect to $SrCO_3$ and SrF_2. The $\left[CO_3^{2-}\right]$ was found to be $1.2 \times 10^{-3}M$. The concnetration of F^{Θ} in the solution would be

Given K_{sp} of $SrCO_3 = 7.0 \times 10^{-10}M^2$,

$K_{sp} \text{of} SrF_2 = 7.9 \times 10^{-10}M^3$,

A. $1.3 \times 10^{-3}M$

B. $2.6 \times 10^{-2}M$

C. $3.7 \times 10^{-2}M$

D. $5.8 \times 10^{-7}M$

Answer: C

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23. The number of S^{2-} ions present in $1L$ of $0.1MH_2S\left[K_{a\left(H_2S\right)}=10^{-21}\right]$ solution having $\left[H^{\oplus}\right]=0.1M$ is:

A. 6.023×10^{3}

B. 6.023×10^{4}

C. 6.023×10^{5}

D. 6.023×10^{6}

Answer: A

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24. The solubility of AgI in NaI solutions is less than that in pure water because:

A. AgI forms complex with NaI

B. Of common ion effect

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

D. The temperature of the solution decreases.

Answer: B

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

A. $MX_3 > MX > M_2X$

B. $MX_3 > M_2X > MX$

C. $MX > MX_3 > M_2X$

D. $MX > M_2X > MX_3$

Answer: B

Watch Video Solution

26. When $0.2M$ solution of acetic acid is neutralised with $0.2MNaOH$ in $500mL$ of water, the pH of the resulting solution will be: $[pK_a$ of acetic acid $= 4.74]$

A. 12.67

B. 7.87

C. 8.87

D. 7

Answer: C

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27. A weak acid HX has the dissociation constant $1 \times 10^{-5}M$. It forms a salt NaX on reaction with alkali. The percentage hydrolysis of $0.1M$ solution of NaX is

A. $0.001\ \%$

B. $0.01\ \%$

C. $0.1\ \%$

D. $0.15\ \%$

Answer: B

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28. A certain buffer solution contains equal concentartion of X^{Θ} and HX. The K_b for X^{Θ} is 10^{-10}. The pH of the buffer is

A. 4

B. 7

C. 10

D. 14

Answer: A

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29. A certain weak acid has a dissocation constant of 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. 1.0×10^{10}

D. 1.0×10^{14}

Answer: C

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30. Auto-ionisation of liquid NH_3 is

$2NH_3 \Leftrightarrow NH_4^{\oplus} + NH_2^{\Theta}$

with $K_{NH_3} = \left[NH_4^{\oplus}\right]\left[NH_2^{\Theta}\right] = 10^{-30} at - 50 ^\circ C$ Number fo amide ions $\left(NH_2^{\Theta}\right)$, present per mm^3 of pure liquied NH_3 is

A. 602

B. 301

C. 200

D. 100

Answer: A

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31. A mixture of weak acid is $0.1M$ in $HCOOH\left(K_a = 1.8 \times 10^{-4}\right)$ and $0.1M$ in $HOCN\left(K_a = 3.1 \times 10^{-4}\right)$. Hence, $\left[H_3O^{\oplus}\right]$ is

A. $7.0 \times 10^{-3}M$

B. $4.1 \times 10^{-4}M$

C. $0.20M$

D. $4.1 \times 10^{-3}M$

Answer: A

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32. pH of solution made by mixing $50mL$ of $0.2MNH_4CI$ and $75mL$ of $0.1MNaOHis\left[pK_bof$NH_(3)(aq) = 4.74. log 3 = 0.47]`

A. 7.02

B. 13.0

C. 7.02

D. 9.73

Answer: D

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33. Some chemists at wished to perpare a saturated solution of a silver compound and they wanted it to have the highest concentration of silver ion possible. Which of the following compound would they use ?

$K_{sp}(AgCI) = 1.8 \times 10^{-10}, K_{sp}(AgBr) = 5.0 \times 10^{-13},$

$K_{sp}\left(Ag_2CrO_4\right) = 2.4 \times 10^{-12}\left[\text{Use}3\sqrt{0.6} = 0.84\right]$

A. $AgCI$

B. $AgBr$

C. Ag_2CrO_4

D. all of these

Answer: C

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34. An acid-base indicator has a $K_a = 3.0 \times 10^{-5}$. The acid form of the indicator is red and the basic form is blue. Then

A. pH is 4.05 when indicator is 75% red.

B. pH is 5.00 when indicator is 75% blue.

C. Both (a) and (b) are correct.

D. None of these

Answer: C

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35. The pH value of $0.001M$ aqueous solution of $NaCI$ is

A. 7

B. 4

C. 11

D. Unpredictable

Answer: A

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36. Which of the following will supress the ionisation of acetic acid in aquoeus solution ?

A. $NaCI$

B. HCI

C. KCI

D. Unpredictable

Answer: B

Watch Video Solution

37. An aqueous solution of $HCIis10^{-9}MHCI$. The pH of the solution should be

A. 9

B. Between 6 and 7

C. 7

D. Unpredictable

Answer: B

Watch Video Solution

38. Which of the following represents the conjugate pair of NH_3?

A. $NH_2^{\ominus}$

B. $NH_4^{\oplus}$

C. Both (a) and (b)

D. N^{3-}

Answer: C

Watch Video Solution

39. One of the following is a Bronsted acid but not a Bronsted base:

A. H_2S

B. H_2S

C. HCO_3^{Θ}

D. NH_3

Answer: A

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40. In the third group of qualitive analysis, the precipitating reagent is NH_4CI / NH_4OH. The function of NH_4CI is to

A. increases the ionisation of NH_4OH.

B. Supress the ionisation of NH_4OH.

C. Convert the ions of group theird into their respective chlorides.

D. Stabilise the hydroxides of group III cations.

Answer: B

Watch Video Solution

41. At a certain temperature the value of pK_w is 13.4 and the measured pH of soln is 7. The solution is

A. Acidic

B. Basic

C. Neutral

D. Unpredictable

Answer: B

Watch Video Solution

42. When $2mol$ of HCI is added to $1L$ of an acidic buffer, its pH changes from 3.4 to 2.9. The buffer capacity of the buffer solution is

A. 2

B. 0

C. 4

D. 8

Answer: C

Watch Video Solution

43. 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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44. Which of the following salts will not undergo hydrolysis in water?

A. Sodium sulphate

B. Ammonium sulphate

C. Aluminimum sulphate

D. All the salts will hydrolyse

Answer: A

Watch Video Solution

45. Which of the following salts will not change the pH of pure water on dissociation?

A. KCI

B. $AICI_3$

C. Na_2CO_3

D. $Al_2(SO_4)_3$

Answer: A

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46. A salt X is dissolved in water having $pH = 7$. The resulting solution has a pH more than 7. The salt is made by neutralisation of

A. A strong acid and strong base

B. A strong acid and strong weak base

C. A weak acid and weak base

D. A weak acid and strong base

Answer: D

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47. The pH of a solution 7.00. To this solution, sufficient base is added to increase the pH to 12.0. The increase in $\overset{\Theta}{OH}$ ion concentration is

A. $5 \times$

B. $100 \times$

C. $10^5 \times$

D. $4 \times$

Answer: C

Watch Video Solution

48. Assuming H_2SO_4 to be completely ionised the pH of a $0.05M$ aqueous of sulphuric acid is approximately

A. 0.01

B. 0.005

C. 2

D. 1

Answer: D

Watch Video Solution

49. A solution has pOH equal to 13 at $298K$. The solution will be

A. Highly acidic

B. Highly basic

C. Moderatly basic

D. Unpredictable

Answer: A

Watch Video Solution

50. If ammonia is added to pure water, the concentration of a chemical species already present will decrease. The species is

A. $O_2^{\ominus}$

B. $\overset{\ominus}{OH}$

C. $H_3O^{\oplus}$

D. H_2O

Answer: C

Watch Video Solution

51. The pH of a dilute solution of acetic acid wea found to be 4.3. The addition of a small crystal of sodium acetate will cause pH to

A. Become less than 4.3

B. Beome more than 4.3

C. Remain equal to 4.3

D. Unpredictable

Answer: B

Watch Video Solution

52. Which of the following can act both as a Bronsted acid and a Bronsted base?

A. O_2^{Θ}

B. HCI

C. HSO_4^{Θ}

D. Na_2CO_3

Answer: C

Watch Video Solution

53. Which of the following is a Lewis base?

A. H_2O

B. CI^{Θ}

C. BF_3

D. NH_3

Answer: C

Watch Video Solution

54. Which of the following is not a Lewis base?

A. CN^{Θ}

B. ROH

C. NH_3

D. $AICI_3$

Answer: D

Watch Video Solution

55. Conjugate base of $\overset{\Theta}{OH}$ is

A. H_2O

B. $H_3O^{\oplus}$

C. $H^{\oplus}$

D. O^{2-}

Answer: D

Watch Video Solution

56. Which of the following will have the largest pH?

A. $M/10HCI$

B. $M/100HCI$

C. $M/10NaOH$

D. $M/100NaOH$

Answer: C

Watch Video Solution

57. Which one of following will have the largest pH?

A. Solution containing $1 \times 10^{-2} mol of K_2SO_4 L^{-1}$.

B. Pure water.

C. Solution containing $1.0 \times 10^{-2} mol of HCIL^{-1}$.

D. Solution containing $1 \times 10^{2} mol of NH_4OHL^{-1}$.

Answer: D

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58. When $20mL$ of $M/20NaOH$ is added to $10mL$ of $M/10HCI$, the resulting solution will

A. Turn blue litmus red.

B. Turn phenolpthalein solution pink.

C. Turns methy orange red.

D. Will have no effect on either red or blue litmus

Answer: D

Watch Video Solution

59. pOH water is $7.0at298K$. If water is heated to $350K$, which of the following should be ture?

A. pOH will decrease

B. pOH will increase

C. pOH will remain seven

D. Concentration of $H^{\oplus}$ ions will increae but that of $\overset{\ominus}{OH}$ will decrease.

Answer: A

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60. Solubility of salt A_2B_3 is 1×10^{-4}, its solubility product is

A. 1.08×10^{20}

B. 1.08×10^{18}

C. 2.6×10^{-18}

D. 1.08×10^{-18}

Answer: D

Watch Video Solution

61. The value of K_{sp} is $HgCI_2$ at room temperature is 4.0×10^{-15}. The concentration of CI^{Θ} ion in its aqueous solution at saturation point is

A. 1×10^{-5}

B. 2×10^{-5}

C. 2×10^{-15}

D. 8×10^{-15}

Answer: B

Watch Video Solution

62. At $90^{\circ} C$, pure water has $\left[H_3O^{\oplus}\right] = 10^{-6.7} molL^{-1}$. What is the value of K_w at $90^{\circ} C$?

A. 10^{-6}

B. 10^{-12}

C. $10^{-13.4}$

D. $10^{-6.7}$

Answer: C

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63. What is the solubility of $PbSO_4$ in $0.01 M Na_2SO_4$ solution if K_{sp} for $PbSO_4 = 1.25 \times 10^{-9}$?

A. $1.25 \times 10^{-7} mol L^{-1}$

B. $1.25 \times 10^{-9} mol L^{-1}$

C. $1.25 \times 10^{-10} mol L^{-1}$

D. $0.10 mol L^{-1}$

Answer: A

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64. The pH of an aqueous solution of $Ba(OH)_2$ is 10. If the K_{sp} of $Ba(OH)_2$ is 1×10^{-9}, then the concentration of Ba^{2+} ions in the solution in $molL^{-1}$ is

A. 1×10^{-2}

B. 1×10^{-4}

C. 1×10^{-1}

D. 1×10^{-5}

Answer: C

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65. How many grams of $NaOH$ must be dissolved in $1L^{-1}$ of the solution to given it a pH value of 12?

A. $0.20gL^{-1}$

B. $0.40gL^{-1}$

C. $0.10 gL^{-1}$

D. $1.2 gL^{-1}$

Answer: B

Watch Video Solution

66. Which of the following solutions will have $pH = 10$ at $298K$?

A. $1 \times 10^{-10} MHCI$ solution

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

C. $1 \times 10^{-10} MNaOH$ solution

D. Both (a) and (b)

Answer: B

Watch Video Solution

67. An acid HA is 40% dissociated in an aqueous solution. The hydronium ion concentration of its $0.2M$ solution would be

A. $0.08M$

B. $0.4M$

C. $0.2M$

D. None

Answer: A

Watch Video Solution

68. $20cm^3$ of xM solution of HCI is exactly neutralised by $40cm^3$ of $0.05MNaOH$ solutions, the pH of HCI solution is

A. 1.0

B. 2

C. 1.5

D. 2.5

Answer: A

Watch Video Solution

69. A monoprotic acid (HA) is 1% ionised in its aqueous solution of $0.1M$ strength. Its pOH will be

A. 11

B. 3

C. 10

D. 2

Answer: A

Watch Video Solution

70. The pH of a solution is 5.00. To this solution, sufficient acid is added to lower the pH to 2.00. The corresponding increase in $H_3O^{\oplus}$ ion concentration is

A. 1000 times

B. 2.5 times

C. 100 times

D. 5 times

Answer: A

Watch Video Solution

71. What would be the solubility of silver chloride in $0.10MNaCI$ solution?

$K_{sp}f$ or $AgCI = 1.20 \times 10^{-10}$

A. $0.1M$

B. $1.2 \times 10^{-6}M$

C. $1.2 \times 10^{-9} M$

D. $1.2 \times 10^{-10} M$

Answer: C

Watch Video Solution

72. Which of the following metal sulphides has maximum solubility in water?

A. $CdS\left(K_{sp} = 36 \times 10^{-30}\right)$

B. $FeS\left(K_{sp} = 11 \times 10^{-20}\right)$

C. $HgS\left(K_{sp} = 32 \times 10^{-54}\right)$

D. $ZnS\left(K_{sp} = 11 \times 10^{-22}\right)$

Answer: B

Watch Video Solution

73. $M_2SO_4\left(M^{\oplus}\right.$ is a monovalent metal ion) has a K_{sp} of 3.2×10^{-6}at $298K$. The maximum concentration of SO_4^{2-} ion that could be attained in a saturated solution of this solid at $298K$ is

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

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

C. $2.89 \times 10^{-4}M$

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

Answer: D

Watch Video Solution

74. K_{sp} for lead iodate $\left[Pb\left(IO_3\right)_2 is 3.2 \times 10^{-14}\right.$ at a given temperature. The solubility in $molL^{-1}$ will be

A. 2.0×10^{-5}

B. $\left(3.2 \times 10^{-7}\right)^{1/2}$

C. $\left(3.8 \times 10^{-7}\right)$

D. 4.0×10^{-6}

Answer: A

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75. The pH of a $0.1M$ solution of NH_4Oh (having dissociation constant $K_b = 1.0 \times 10^{-5}\big)$ is equal to

A. 10

B. 6

C. 11

D. 12

Answer: C

Watch Video Solution

76. The best indicator for the detection of the end point in the titration of a weak acid and a strong base is

A. Methy1 orange (pH range $3 \rightarrow 4$)

B. Methy1 red (pH range $4 \rightarrow 6$)

C. Thymol blue (pH range $8 \rightarrow 3$)

D. Phemolphethalein (pH range $8 \rightarrow 10$)

Answer: D

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77. When a solid KCI is added to a saturated solution of $AgCI \text{in} H_2O$,

A. Nothing happens.

B. Solubility of $AgCI$ decreases.

C. Solubility of $AgCI$ increases.

D. Solubility product of $AgCI$ increases.

Answer: B

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78. Two buffer solutions, A and B, each made acetic acid and sodium acetate differ in their pH by one unit, A has satl: acid $= x : y$, has salt: acid $= y : x$. If $x > y$, then the value of $x : y$ is

A. $10,000$

B. 3.17

C. 6.61

D. 2.10

Answer: B

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79. $CaCO_3$ and $BaCO_3$ have solubility product values 1×10^{-8} and 5×10^{-9}, respectively. If water is shaken up with both solids till equilibrium is reached, the concentration of CO_3^{2-} ion is

A. 1.5×10^{-8}

B. 1.225×10^{-4}

C. 2.25×10^{-9}

D. None of these

Answer: B

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80. The pH of an acidic buffer can be raised by 2units by

A. Increasing the concentration of both weak acid and salt by two moles

B. Increasing the concentration of both the acid and salt by 10 times.

C. Diluting the solution by 10 times.

D. Increasing the concentration of the salt by 10 times by decreasing concentration of the acid by 10 times.

Answer: D

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81. Buffer solutions can be prepared form mixtures of

A. HCI and $NaCI$

B. NaH_2PO_4 and Na_2HPO_4

C. $CH_3COOH + NaCI$

D. $NH_4OH + NH_3$

Answer: B

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82. $20mol$ of $M/10CH_3COOH$ solution is titrated with $M/10NaOH$ solution. After addition of $16mL$ solution of $NaOH$. What is the pH of the solution $\left(pK_a = 4.74\right)$

A. 5.05

B. 4.15

C. 4.75

D. 5.35

Answer: D

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83. The K_a value of $CaCO_3$ and CaC_2O_4 in water are 4.7×10^{-9} and 1.3×10^{-9}, respectively, at $25\ ^\circ C$. If a miaxture of two is washed with H_2O, what is Ca^{2+} ion concentration in water?

A. 7.746×10^{-5}

B. 5.831×10^{-5}

C. 6.856×10^{-5}

D. 3.606×10^{-5}

Answer: A

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84. What are the units in which the solubility product of $Ca_3(PO_4)_2$ is expressed?

A. $moldm^{-3}$

B. mol^2dm^{-6}

C. mol^3dm^{-9}

D. mol^5dm^{-15}

Answer: D

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85. Calculate the pH of a $10^{-5} MHCl$ solution if 1mL of it is diluted to 1000mL. $K_w = 1 \times 10^{-14}$.

A. 5

B. 8

C. 7.02

D. 6.98

Answer: D

Watch Video Solution

86. Which of the following when mixed, will given a solution with $pH > 7$.

A. $0.1MHCI + 0.1MNaCI$

B. $100mLof0.1MH_2SO_4 + 100mLof0.3MNaOH$

C. $100mLof0.1MHC_2H_3O_2 + 100mLof0.1MKOH$

D. $25mLof0.1HNO_3 + 25mLof0.1MNH_3$

Answer: C

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87. A solution of CaF_2 is found to contain $4 \times 10^{-4}M$ of F^{Θ}, K_{sp} of CaF_2 is

A. 3.2×10^{-11}

B. 0.8×10^{-11}

C. 6.4×10^{-11}

D. 32×10^{-11}

Answer: A

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88. At what pH will a $10^{-3}M$ solution fo indicator with $K_b = 10^{-10}$ changes colour?

A. 10

B. 4.0

C. 3

D. 7

Answer: B

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89. If the dissociation constant of NH_4OH is 1.8×10^{-5}, the concentration of $\overset{\Theta}{OH}$ ions, in $mol^{-1} of 0.1 M NH_4OH$ is

A. 1.8×10^{-6}

B. 1.34×10^{-3}

C. 4.20×10^{-2}

D. 5.0×10^{-2}

Answer: B

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90. pH signifies:

A. Puissance de hydrogen

B. $-\log\left[H^{\oplus}\right]$

C. All the above

D. $-14 - pOH$

Answer: A

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91. A solution with $pH = 12$ is more acidic then one with a $pH = 6$ by a factor of

A. 4

B. 12

C. 400

D. 10^4

Answer: D

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92. A definite volume of an aqueous $N/20$ acetic acid $\left(pK_a = 4.74\right)$ is titrated with a strongs base. It is found that 75 equal-sized drops of $NaOH$ added from a burette effect the complete neutralisation. Find the pH when an acid solution is neutralised to the extent of $20\ \%$, $40\ \%$, and $80\ \%$, respectively.

A. 4.14

B. 9.86

C. 5.34

D. 8.68

Answer: A

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93. 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 alomost unionised in the small intestine.

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

Answer: D

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94. Which of the following salt is basic?

A. $HOCI$

B. $NaOCI$

C. $NaHSO_4$

D. NH_4NO_3

Answer: B

Watch Video Solution

95. For the indicator 'Hin' the ratio $\left(Ind^{\Theta}\right)/(HIn)$ is 7.0 at pH of 4.3. What is K_{eq} for the indicator.

A. 3.5×10^{-4}

B. 3.5×10^{-5}

C. 3.5×10^{-2}

D. 3.5×10^{-3}

Answer: A

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96. When $0.002 mol$ of acid is added to $250 mL$ of a buffer solution, pH decreases by 0.02units. The buffer capacity of the system is

A. 0.1

B. 0.2

C. 0.3

D. 0.4

Answer: D

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97. pH of an aqueous solution of $0.6MNH_3$ and $0.4MNH_4CI$ is $9.4\left(pK_b = 4.74\right)$. The new pH when $0.1MCa(OH)_2$ solution is added to it.

A. 9.86

B. 10.14

C. 10.2

D. 10.86

Answer: A

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98. Which of the following salts undergoes anionic hydrolysis?

A. $CuSO_4$

B. NH_4CI

C. $FeCI_3$

D. Na_2CO_3

Answer: D

Watch Video Solution

99. A saturated solution of $Ag_2SO_4 is 2.5 \times 10^{-2} M$. The value of its solubility product is

A. 62.5×10^{-6}

B. 6.25×10^{-4}

C. 15.625×10^{-10}

D. 3.125×10^{-6}

Answer: A

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100. Which one of the followinf is acid salt?

A. Na_2S

B. Na_2SO_3

C. $NaHSO_3$

D. Na_2SO_4

Answer: C

Watch Video Solution

101. Which one is not an acid salt?

A. NaH_2PO_4

B. NaH_2PO_2

C. NaH_2PO_3

D. All of the above are acid salts

Answer: D

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102. Which one of the following salts when dissolves in water hydrolyse?

A. $NaCI$

B. NH_4CI

C. KCI

D. Na_2SO_4

Answer: B

Watch Video Solution

103. Which of the following salt undergoes hydrolysis?

A. CH_3COOK

B. $NaNO_3$

C. KCI

D. K_2SO_4

Answer: A

Watch Video Solution

104. Out of the following the compound whose water solution has the highest pH is

A. $NaCI$

B. Na_2CO_3

C. NH_4CI

D. $NaHCO_3$

Answer: B

Watch Video Solution

105. When equal volumes of the following solutions are mixed, precipitation of $AgCI\left(K_{sp} = 1.8 \times 10^{-10}\right)$ will occur only wity

A. $10^{-4}M\left(Ag^{\oplus}\right)$ and $10^{-4}M\left(CI^{\ominus}\right)$

B. $10^{-5}M\left(Ag^{\oplus}\right)$ and $10^{-5}M\left(CI^{\ominus}\right)$

C. $10^{-5}M\left(Ag^{\oplus}\right)$ and $10^{-6}M\left(CI^{\ominus}\right)$

D. $10^{-4}M\left(Ag^{\oplus}\right)$ and $10^{-10}M\left(CI^{\ominus}\right)$

Answer: A

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106. The gatric juice in our stomach contains enough HCI to make the hydrogen ion concentration about $0.01 mol^{-1}$. The pH of gastric juice is

A. 0.01

B. 1

C. 2

D. 14

Answer: C

Watch Video Solution

107. Of the given anions, the strongest Bronsted base is

A. CIO^{Θ}

B. CIO_2^{Θ}

C. CIO_3^{Θ}

D. CIO_4^{Θ}

Answer: A

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108. In decinormal solution, CH_3COOH acid is ionised to the extent of 1.3%. If $\log 1.3 = 0.11$, what is the pH of the solution?

A. 3.89

B. 2.89

C. 4.89

D. Unpredictable

Answer: B

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109. An aqueous solution of aluminium sulphate would show

A. Acidic

B. Neutral

C. Basic

D. Both acidic and basic reaction.

Answer: A

Watch Video Solution

110. The aqueous solution of $AICI_3$ is acidic due to

A. Cation hydrolysis

B. Anion hydrolysis

C. Hydrolysis of both anion and cation

D. Dissociation

Answer: A

Watch Video Solution

111. A solution contains $10mL$ of $0.1NNaOH$ and $10mL$ of $0.05Na_2SO_4, pH$ of this solution is

A. 7

B. Less than 7

C. Greater than 7

D. Zero

Answer: C

Watch Video Solution

112. $20mL$ of $0.1NHCI$ is mixed with $20ml$ of $0.1NKOH$. The pH of the solution would be

A. 0

B. 7

C. 2

D. 9

Answer: B

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113. $0.1M$ solution of which of the substances will behave basic?

A. Sodium borate

B. Ammonium ditoride

C. Calcium nitrate

D. Sodium sulphate

Answer: A

Watch Video Solution

114. In which of the following solvents will $AgBr$ has highest solubility?

A. $10^{-3}MNaBr$

B. $10^{-3}MNH_4OH$

C. Pure water

D. $10^{-3} MHBr$

Answer: B

Watch Video Solution

115. Which of the following mixture solution has $pH \approx 1.0$?

A. $100 mLM / 10 HCI + 100 mLM / 10 NaOH$

B. $55 mLM / 10 HCI + 45 mLM / 10 NaOH$

C. $10 mLM / 10 HCI + 90 mLM / 10 NaOH$

D. $75 mLM / 5 HCI + 25 mLM / 5 NaOH$

Answer: D

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116. 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 increase

B. pH will decrease

C. No change

D. pH will adust to 7

Answer: C

Watch Video Solution

117. Which buffer solution out of the following will have $pH > 7$?

A. $CH_3COOH + CH_3COONa$

B. $HCOOH + HCOOK$

C. CH_3COONH_4

D. $NH_4OH + NH_4CI$

Answer: D

Watch Video Solution

118. Which of the following is most soluble?

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

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

C. $CuS\left(K_{sp} = 8 \times 10^{-37}\right)$

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

Answer: B

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119. If H_3O^+ ion concentration of a solution is increased by 10 times , its pH will

A. Increase by 1

B. Remains unchanged

C. Decreases by 1

D. Increase by 10

Answer: C

Watch Video Solution

120. If pK_b for fluoride ion at $25^\circ C$ is 10.83, the ionisation constant of hydrofluoric acid in water at this temperature is

A. 1.74×10^{-5}

B. 3.52×10^{-3}

C. 6.75×10^{-4}

D. 5.38×10^{-2}

Answer: C

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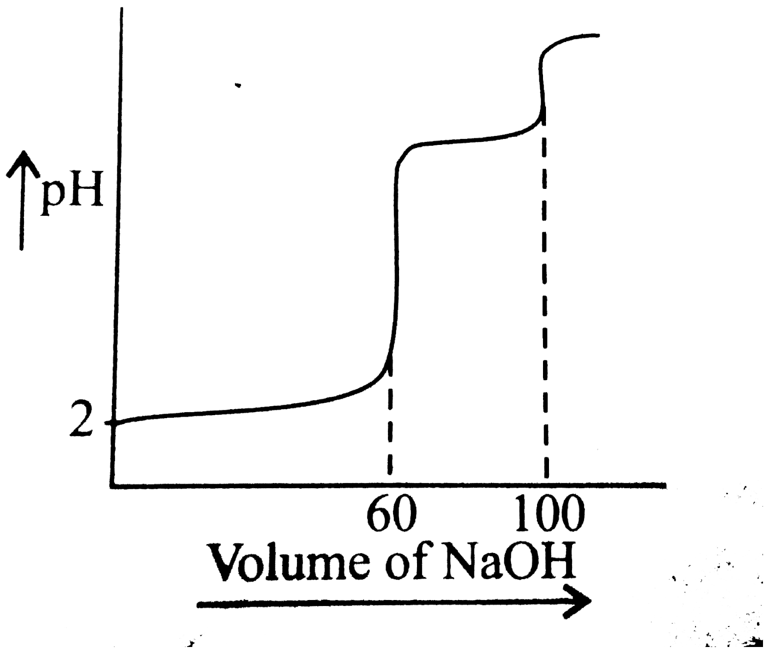
121. The following graph represents the titration of pH vs volume



A. A diprotic acid.

B. Two monoprotic acids with the same K_a but different concentrations.

C. Two monoprotic acids with different K_a but the same concentration.

D. Two monoprotic acids with differnet K_a and different concentartions.

Answer: D

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Exercises Assertion-Reasoning

1. Assertion (A): A solution contains $0.1M$ each of $pB^{2+}, Zn^{2+}, Ni^{2+}$, ions. If H_2S is passed into this solution at $25^{\circ}C$.

$Pb^{2+}, Ni^{2+}, Zn^{2+}$ will get precpitated simultanously.

Reason (R): Pb^{2+} and Zn^{2+} will get precipitated if the solution contains

$0.1 MHCI$.

$\left[K_1 H_2 S = 10^{-7}, K_2 H_2 S = 10^{-14}, K_{sp} PbS = 3 \times 10^{-29} K_{sp} NiS = 3 \times 10^{-19}. K_{sp} ZnS\right.$

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

Watch Video Solution

2. Assertion (A): Solubility of $AgCN$ in acidic solutions is greater than in pure water.

Reason (R) : Solubility equilibrium of $AgCN$ is shifted in formwed direction due to the formation of HCN.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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3. Assertion (A): Methy red has $K_a = 10^{-5}$and the acid form, "Hin" is red and its conjugate base Ind^{Θ} is yellow.

	$pH =$	3	5	7
Reason (R) :	$\frac{\left[\mathrm{Ind}^{\Theta}\right]}{[\mathrm{Hin}]} =$	10^{-2}	1	10^{2}
	Colour =	Red	Orange	Yellow

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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4. Assertion (A) : On cooling in a freezing mixture, colout of the mixture turns to pink from deep blue for a reaction.

$Co\left(H_2O\right)_6^{2+}(\text{Pink})(aq) + 4CI^{\Theta} \Leftrightarrow CoCI_4^{2-}(aq)(Blue) + 6H_2O(l)$

Reason (R) : The reaction is endothermic in formed reation, so on cooling the reaction, deep blue colour appears.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

Watch Video Solution

5. Assertion (A): Due to common ion effect, the solubility of HgI_2 is expected to be less in an aqueous solution of KI than in water. But HgI_2 dissolves in an aqueous solution of KI to form a clear solution.

Reason (R) : I^{Θ} ions is highly polarisable.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: B

Watch Video Solution

6. Assertion (A): pK_a of a weak acid become equal of the pH of the solution at the mid-point of titration.

Reason (R) : The molar concentration of the proton donor an proton acceptor beomes equal at the mid-point.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: B

Watch Video Solution

7. Assertion (A): pH of HCI solution is less than that of acetic acid of the some concentartion.

Reason (R) : In equimolar solution, the number of titrable protons present in HCI is less than that present in acetic acid.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

Watch Video Solution

8. Assertion (A): pH value of HCN solution decreases when $NaCN$ is added to it.

Reason (R) : $NaCN$ provides a common ion CN^{Θ} → HCN`.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: D

Watch Video Solution

9. Assertion (A): pH of water increases with an increase in temperature.

Reason (R) : K_w or water increases with increase in temperature.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: D

Watch Video Solution

10. Assertion (A): $Na_2S_2O_3$ is a salt of unstable acid.

Reason (R) : $H_2S_2O_3$ is a polyprotic acid.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: B

Watch Video Solution

11. Assertion (A): When a solution of CH_3COOH in water is shaken with charcoal, pH of the solution will get decreased.

Reason (R) : The degree of ionisation of CH_3COOH increase.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: D

Watch Video Solution

12. Assertion (A): There is very little difference in acid strength of H_3PO_4, H_3PO_3,and H_3PO_2.

Reason (R) : The hydrogens in these acids are not all bonded to oxygens. The electrone-grativities of P and H are almost the same.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

Watch Video Solution

13. Assertion (A): Both reactions are Lewis acid-base recations?

i. $NH_3 + BF_3 \rightarrow H_3N : BF_3$

ii. $Mg + S \rightarrow Mg^{2+} + S^{2-}$

Reason (R) : Lewis acid-base reaction involve the donation of lone pair electrons from base to acid. this donation results in a corrdinate bond.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: D

Watch Video Solution

14. Assertion (A): Solution of $AICI_3$ in water is neutral.

Reason (R) : $\left[AI\left(H_2O\right)_6\right]^{3+}$ is formed.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: D

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15. Assertion (A): In dilute benzene solutions, equimolar addition of R_3N and HCI produce a substance with a dipole moment. In the same solvent, equimolar addition of R_3N and SO_3 produce a substance having an almost identical dipole moment.

Reason (R) : Both HCI and SO_3 are Lewis acids and can react with the amine base to form polar substances which undergo ionic dissociation in a solvent sufficiently more polar than benzene.

Moreover, $(N$ - $S)$ bond is a more polar bond.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

Watch Video Solution

16. Assertion (A): A certain recation is catalysed by acids and the catalytic activity of $0.1M$ solutions of the acids in water decrease in the order, $HCl, HCOOH$, and CH_3COOH. The same reaction takes place in anhydrous NH_3, but the three acids have same catalytic effect in $0.1M$ solution.

Reason (R) : The order of catalytic activity in water is the same as the order of acidity. in anhyrous NH_3, all the three acids are strong.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

Watch Video Solution

17. Assertion (A): S reacts with SO_3^{2-} and forms $S_2O_3^{2-}$

Reason (R) : S is electorn deficient and acts and acid and SO_3^{2-} is a base in terms of Lewis acid theroy.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

Watch Video Solution

18. Assertion (A): The amino acid glycine predominatly exists in the form of ^ (⊕)$NH_3CH_2COO^{\Theta}$.

Reason (R) : The conjugate acid of glycine is $NH_2CH_2COO^{\Theta}$.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

Watch Video Solution

19. Assertion (A): Sb^{3+} is not precipitated as sulphide when $H_2S(g)$ is passed in alkaline solution.

Reason (R) : $\left[S^{2-}\right]$ ion in basic medium is inadequate for precipitation.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

Watch Video Solution

20. Assertion (A): Addition of $Ag^{\oplus}$ ions to a mixture of aqueous $NaCI$ and $NaBr$ solution will first precipitate $AgBr$ rather than $AgCI$.

Reason (R) : $K_{sp}AgCI < K_{sp}ofAgBr$.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

Watch Video Solution

21. Assertion (A): The pH of an aqueous solution of CH_3COOH remains unchanged on the addition of CH_3COONa.

Reason (R) : The pH of an aqueous solution of CH_3COOH remains unchanged on the addition of CH_3COONa.

Reason (R) : The ionisation of CH_3COOH is supressed by the addition of CH_3COONa.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: D

Watch Video Solution

22. Assertion (A): On mixing equal volumes of $1MHci$ and $2MCH_3COONa$, an acidic buffer solution is formed.

Reason (R) : The resultant mixture contains CH_3COOH and CH_3COONa which are parts of acidic buffer.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

Watch Video Solution

23. Assertion (A): On addition of NH_4CI to NH_4OH, pH decreases but remains grater than 7.

Reason (R) : Addition of $\overset{\oplus}{NH_4}$ ion decreases ionication of NH_4OH, thus $\left[\overset{\Theta}{OH}\right]$ decreases and also pH decreases.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

Watch Video Solution

24. Assertion (A): A is very dilute acidic solution of Cd^{2+} and Ni^{2+} gives yellow precipitate of CdS on passing hydrogen sulphide.

Reason (R) : Solubility product of CdS is more than that of NiS.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

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25. Assertion: In the titration of Na_2CO_3 with HCl using methyl orange indicator, the volume of acid required is twice that of the acid required using phenolphthalein as indicaton.

Reason: Two moles of HCl are required for the complete neutralisation of one mole of Na_2CO_3.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: B

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26. 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. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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27. 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. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

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28. Assertion (A): An aqueous solution of ammonium acetate acts as a buffer solution.

Reason (R) : A buffer solution reacts with small quantities of hydrogen or hydroxy ions and keps the pH almost same.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: B

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29. Assertion (A): When small amount of acid or base is added to pure water, its pH undergoes a change.

Reason (R) : Addition of an acid or a basic increases the degree of ionisation of water.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

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30. Assertion (A): ph of acidic solution is always below 7 at $25\,^{\circ}C$.

Reason (R) : At $25\,^{\circ}C$, the pH of $10^{-8}MHCI$ is 8.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

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31. Assertion (A): H_2SO_4 acts as a base in the presence of $HCIO_4$.

Reason (R) : Perchloride acid is stronger acid than H_2SO_4.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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32. Assertion (A): pH of neutral solution is always 7.

Reason (R) : pH of solution does not depend upon temperature.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

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33. Assertion (A): pH of $10^8 MHCI$ is not equal to 8.

Reason (R) : HCI does not dissociate properly in very dilute solution.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

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34. Assertion (A): If a solution with $pH = 2$ is diluted to double the volume, the pH of the solution will fall to 1.

Reason (R) : pH is inversely proportional to the volume of the solution.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If both (A) and (R) are incorrect.

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35. Assertion (A): If HCI gas is passed through satirated $NaCI$ solution, solid $NaCI$ starts separating out.

HCI decrease the solubility product of $NaCI$.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: C

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36. Assertion (A): pH of buffer chnages with temperature.

Reason (R) : Ionic of a water $\left(K_w\right)$ changes with temperature.

A. If both (A) and (R) are correc, and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct but (R) is not the correct explanation of (A).

C. If (A) is correct, but (R) is incorrect.

D. If (A) is incorrect, but (R) is correct.

Answer: A

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Exercises Integer

1. What is the sum of magic numbers of all solutions gives below :

(Interger value is between 50 and 60)

(Magic numver of a solution $= pH$ of solution $\times$ Weight factor)

	Solution	Weight factor
I	0.1M HCN $\left(K_a = 10^{-10}\right)$	2
II	$0.1MCH_3COOH + 0.1MCH_3COONa \left(K_a = 10^{-5}\right)$	1
III	$0.1MHCl$	3
IV	$0.1MNH_4OH\left(K_b = 10^{-5}\right)$	2
V	$0.01MNaOH$	0.5
VI	10mL of$0.01MCH_3COOH$ + 10ml of 0.1 MNH_4OH	1

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2. How much of the following cations belong to group IIA, III, IV, and V only in quanlitative salt analysis?

$S^{2+}, Hg_2^{2+}, Pb^{2+}, Zn^{2+}, Cu^{2+}, Cr^{3+}, Ag^{3+}, Mg^{2+}, Sb^{3+}$

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3. How much of the following are strong electorlytes?

a. NH_3 b. NH_4CI c. CH_3COOH

d. CH_3COONa e. HCI f. $NaCI$

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4. How much of the following $0.1M$ solutions are acidic?

a. NH_4CI b. $NaOH$ c. $HC_2H_3O_2$ d. $NaCI$

e. $NH_3 + NH_4CI$ f. NH_3 g. HCI

h. $HCIO_4$ i. $\left(NH_4\right)_2SO_4$ j. K_2SO_4

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5. How many in Q.(4) are basic ?

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6. How many in Q.(4) are neutral ?

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7. How many of the following salts:

i. $NH_4C_2H_3O_2$ ii. $PhCOONH_4$ iii. $NaC_2H_3O_2$

iv. NH_4CI v. MgS vi. Na_2SO_4

vii. KCI

a. Hydrolyse more in water at $25\ ^\circ C$.

b. Do not hydrolyse.

c. Both cation and anion hydrolyse to the same extent.

d. Both cation and anion hydrolyse to differnet extent.

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8. How many of the following combinations of reactants will react less than 2% of theroetically possible extent?

a. $CH_3COOH + H_2O$ b. $CH_3COO^{\ominus} + H_2O$

c. $CH_3COO^{\ominus} + H_3O^{\oplus}$ d. $CH_3COOH + KOH$

e. $CH_3COOK + HCI(aq)$ f. $HCI(g) + H_2O$

g. $CI^{\ominus} + H_3O^{\oplus}$

h. $CI^{\ominus} + H_2O$ i. $\overset{\oplus}{N}H_4 + KOH$

j. $\overset{\oplus}{N}H_4 + \overset{\ominus}{O}H$ k. $NH_3 + H_2O$

l. $NH_3 + H_3O^{\oplus}$ m. $NH_3 + HCI(aq)$

n. $K^{\oplus} + \overset{\ominus}{O}H$

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9. How many of the conbinations of reactants in above will react untill more than 98% of the limiting quantity is used up?

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10. Calculate the pH at equilibrium point when a solution of $10^{-6}MCH_3COOH$ is titrated with a solution of $10^{-6}MNaOH. K_a$ for acid $2 \times 10^{-5}\left(pK_a = 4.7\right)$ (Answer given in whole number).

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Exercises True/ False

1. Silver chloride is more soluble in very concentrated sodium chloride solution than in pure water.

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2. Any buffer solution can be used as a buffer upto two pH units only.

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3. Mg^{2+} ions is essential for selective precipitation of $Fe(OH)_3$ be aqueous NH_3.

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4. A mixture of aqueous solution of sodium acetat and sodium propanota forms a buffer solution.

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5. pH of some solution is given by $pH = \frac{pK_{a_1} + pK_{a_2}}{2}$. This formula is valid for the compound NaH_2BO_3.

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6. 0.6 mmol of NaCl and 1 mol of HCl in 1 L solution is a buffer.

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7. The K_a for CH_3COOH at 300 and $310K$ are 1.8×10^{-5} and 1.805×10^{-5}, respectively. The enthalpy of deprotonation for acetic acid is $51.6cal$.

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8. Out of the following salts:

i. NaH_2BO_3 ii. NH_2CH_2COOH

iii. CH_3COONH_4 iv. $NaHS$

Salts (i) has concentration-depends pH.

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9. Out of the following acid base-reactions, reaction (b) and (c) are possible.

a. $PH_3 + \overset{\oplus}{N}H_4 \rightarrow \overset{\oplus}{P}H_4 + NH_3$

b. $NH_3 + \overset{\oplus}{P}H_4 \rightarrow \overset{\oplus}{N}H_4 + PH_3$

c. $\left(CH_3\right)_3P + \overset{\oplus}{N}H_4 \rightarrow \left(CH_3\right)_3\overset{\oplus}{P}H + NH_3$

d. $\left(CH_3\right)_3N + PH_4^{\oplus} \rightarrow \left(CH_3\right)_2\overset{\oplus}{N}H + PH_3$

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10. The oxo-acids of P_2O_5 are H_3PO_4, $H_3P_2O_7$, HPO_3, and H_3PO_3.

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Archives Multiple Correct

1. Which of the following statements is//are correct?

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

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

C. The autoprotolysis constant of water increases with temperature.

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

Answer: B::C

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2. A buffer solution can be prepared from a mixture of

A. Sodium acetate and acetic acid in water.

B. Sodium acetat and HCI in water

C. Ammonia and ammonia chloride in water.

D. Ammonia and sodium hydroxide in water.

Answer: A::C

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3. Aqueous solutions of HNO_3, KOH, CH_3COOH,and CH_3COONa of identical concentrations are provided. The pair (s) of solution which form a buffer upon mixing is// are

A. HNO_3 and CH_3COOH

B. KOH and CH_3COONa

C. HNO_3 and CH_3COONa

D. CH_3COOH and CH_3COONa

Answer: C::D

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Archives Single Correct

1. At $90^{\circ} C$, pure water has $\left[H_3O^+\right]$ as 10^{-6} mol L^{-1}. What is the value of K_w at $90^{\circ} C$?

A. 10^{-6}

B. 10^{-12}

C. 10^{-14}

D. 10^{-8}

Answer: B

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2. The pH of $10^{-8}M$ solution of HCl in water is

A. 8

B. -8

C. Between 7 and 8

D. Between 6 and 7

Answer: D

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3. An acidic buffer solution can be prepared by mixing solution of

A. Sodium acetate and acetic acid

B. Ammonium chloride and ammonium hydroxide

C. Sulpuric acid and sodium sulphate

D. Sodium chloride and sodium hydroxide

Answer: A

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4. The strongest Bronsted base in the following anion is

A. CIO^{Θ}

B. CIO_2^{Θ}

C. CIO_3^{Θ}

D. ClO_4^{Θ}

Answer: A

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5. The precipitate of $CaF_2\left(K_{sp} = 1.7 \times 10^{-10}\right)$ is obtained when equal volumes of the following are mixed

A. $10^{-4}MCa^{2+} + 10^{-4}MF^{\Theta}$

B. $10^{-2}MCa^{2+} + 10^{-3}MF^{\Theta}$

C. $10^{-5}MCa^{2+} + 10^{-3}MF^{\Theta}$

D. $10^{-3}MCa^{2+} + 10^{-5}MF^{\Theta}$

Answer: B

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

A. 10×10^{-4}

B. 10×10^{-10}

C. 10×10^{10}

D. 1.0×10^{14}

Answer: C

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8. The conjugate acid of amide ion $\left(NH_2^-\right)$ is

A. NH_3

B. NH_2OH

C. $NH_4^{\oplus}$

D. N_2H_4

Answer: A

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9. The best indicator for the detection of the end point in the titration of a weak acid and a strong base is

A. Methy1 orange $(3 \rightarrow 4)$

B. Methy1 red $(5 \rightarrow 6)$

C. Bromothymol blue $(6 \rightarrow 7.5)$

D. Phenolphtalein $(8 \rightarrow 9.6)$

Answer: D

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10. The compound that is not a Lewis acids is

A. BF_3

B. $AICI_3$

C. $BeCI_2$

D. $SnCI_4$

Answer: D

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11. 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 alomost unionised in the small intestine.

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

Answer: D

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12. 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. $10^{-4}M\left(Ag^{\oplus}\right)$ and $10^{-4}M\left(CI^{\ominus}\right)$

B. $10^{-5}M\left(Ag^{\oplus}\right)$ and $10^{-5}M\left(CI^{\ominus}\right)$

C. $10^{-6}M\left(Ag^{\oplus}\right)$and $10^{-6}M\left(CI^{\ominus}\right)$

D. $10^{-10}M\left(Ag^{\oplus}\right)$ and $10^{-10}M\left(CI^{\ominus}\right)$

Answer: A

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13. Which of the following is the strongest acid?

A. $CIO_3(OH)$

B. $CIO_2(OH)$

C. $SO(OH)_2$

D. $SO_2(OH)_2$

Answer: A

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14. Amongst the following hydroxides, the one which has the lowest value of K_{sp} is:

A. $Mg(OH)_2$

B. $Ca(OH)_2$

C. $Ba(OH)_2$

D. $Be(OH)_2$

Answer: D

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15. Which solutionwill have pH closer to 1.0 ?

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

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

C. 75 mL of $(M/10)HCI +$ 90 mL of $(M/10)NaOH$

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

Answer: D

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

A. $L_S = S_{p+q}p_pq_q$

B. $L_S = S_{p+q}p_qq_p$

C. $L_S = S_{pq}p_qq_p$

D. $L_S = S_{pq}(pq)^{(p+q)}$

Answer: A

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18. Which of the following acids has the smallest dissociation constant?

A. $CH_3CHFCOOH$

B. FCH_2CH_2COOH

C. $B_1CH_2CH_2COOH$

D. $CH_3CHBrCOOH$

Answer: C

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

A. FeS

B. MgS

C. HgS

D. ZnS

Answer: C

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20. 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. $0.01\ \%$

B. $0.001\ \%$

C. $0.1\ \%$

D. $0.5\ \%$

Answer: A

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21. 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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22. If $Ag^{+} + NH_3 \Leftrightarrow \left[Ag\left(NH_3\right)\right]^{+}$, $K_1 = 3.5 \times 10^{-3}$ and $\left[Ag\left(NH_3\right)\right]^{+} + NH_3 \Leftrightarrow \left[Ag\left(NH_3\right)_2\right]^{+}$, $K_2 = 1.74 \times 10^{-3}$. The formation constant of $\left[Ag\left(NH_3\right)_2\right]^{+}$ is :

A. 6.08×10^{-6}

B. 6.08×10^{6}

C. 6.08×10^{-9}

D. None of these

Answer: A

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23. 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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24. When $2.5mL$ of $2/5M$ weak monoacidic base $\left(K_b = 1 \times 10^{-12} at 25^{\circ} C\right)$ is titrated with $2/15 M HCI$ 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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25. Passing H_2S gas into a mixture of Mn^{2+}, Ni^{2+}, Cu^{2+} and Hg^{2+} ions in an acidified aqueous solution precipitates

A. CuS and HgS

B. MnS and CuS

C. MnS and NiS

D. NiS and HgS

Answer: A

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Archives Integer

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

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

$KCN \quad K_2SO_4 \quad (NH_4)_2C_2O_4 \quad NaCI$

$Zn(NO_3)_2 \quad FeCI_3 \quad K_2CO_3 \quad NH_4NO_3$

$LiCN$

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3. 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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4. In 1L saturated solution of $AgCI\left[K_{SP}(AgCI) = 1.6 \times 10^{-10}\right]$, 0.1 mole of CuCI $\left[K_{SP}(CuCI) = 1.0 \times 10^{-6}\right]$ is added. The resulrant concentration of Ag^+ in the solution is 1.6×10^{-x}. The value of x is:

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Archives Fill In The Blanks

1. The conjugate base of $HSO_4^{\ominus}$ in aqueous solution is ....

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2. An element which can exist as a positive ion in acidic solution and also as a negative ion in basic solution is said to be.....

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3. Silver chloride is sparingly soluble in water because its lattice energy is greater than______

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4. $\left(CH_3(OH)_2^{\frac{1}{2}}\right)$ is..acidic than $\left(CH_3NH_3^{+}\right)$.

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5. In the reaction $I^{\Theta} + I_2 \rightarrow I_3^{\Theta}$, the Lewis acid is ....

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Archives True/False

1. Aluminium chloride $\left(AlCl_3\right)$ is a Lewis acid because it can donate electrons.

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2. The solubility of sodium hydroxide increases with increase of temperature.

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3. Give the decreasing order of the acidic properties of oxides.

a. ZnO, b. KO_2, c. P_2O_5, d. MgO

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Archives Subjective

1. How much moles of sodium propionate should be added to $1L$ of an aqueous solution containing $0.020 mol$ of propionic acid to obtain a buffer solution of $pH 4.75$? What will be the pH if $0.010 mol$ of HCI is dissolved in the above buffer solution. Compare the last pH value with the pH of $0.010 M HCI$ solution. Dissociation constant of propionic acid, K_a, at $25^{\circ} C$ is 1.34×10^{-5}.

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2. Given reason for the statement that the pH of an aqueous solution of sodium acetate is more than 7.

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3. $20mL$ of $0.2M$ sodium hydroxide is added to $50mL$ of $0.2M$acetic acid to give $70mL$ of the solution. What is the pH of this solution. Calculate the additional volume of $0.2MNaOh$ required to make the pH of the solution 4.74. (Ionisation constant of CH_3COOh is 1.8×10^{-5})

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4. The dissociation constant of a weak acid $HAsi4.9 \times 10^{-8}$. After making the necessary approximations, calculate

i. Percentage ionisation

ii. pH

iii. $\overset{\Theta}{OH}$ concentration in a decimolar solution of the acid. Water has a $pHof7$.

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5. 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 ? $\left(K_{SP} of AgI = 8.5 \times 10^{-17}\right.$ and K_{SP} of $\left.Hg_2I_2 = 2.5 \times 10^{-26}\right)$

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6. The concentration of hydrogen ions in a $0.2M$ solution of formic acid is $6.4 \times 10^{-3} molL^{-1}$. To this solution, sodium formate is added so as to adjust the concentration of sodium formate to $1 molL^{-1}$. What will be the pH of this solution? The dissociation constant of formic acid is 2.4×10^{-4} and the degree of dissociation fo sodium formate is 0.75.

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7. The solubility of $Mg(OH)_2$ in pure water is $9.57 \times 10^{-3} gL^{-1}$. Calculate its solubility (in gL^{-1}) in $0.02 M Mg\left(NO_3\right)_2$ solution.

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8. What is the pH of the solution when $0.20mol$ of HCI is added to $1L$ of a solution containing

a. $1M$ each of acetic acid and acetate ion.

b. $0.1M$each of aceta acid and acetate ion.

Assume the total volume is $1L$. K_a for acetic acid is 1.8×10^{-5}.

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9. How many gram moles of HCI will be required to prepare $1L$ of buffer solution (containing $NaCN$ and HCI) of $pH8.5$ using $0.01g$ formula weight of $NaCN > K_{HCN} = 4.1 \times 10^{-10}$.

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10. 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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11. 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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12. A 50 mL solution of weak base BOH is titrated 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 respectively. Find out K_b for weak base.

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13. The K_{SP} of $Ag_2C_2O_4$ at $25^\circ C$ is $1.29 \times 10^{-11} mol^3 L^{-3}$. A solution of $K_2C_2O_4$ containing 0.152 mole in 500 mL water is shaken at $25^\circ C$ with excess of Ag_2CO_3 till the equilbirium is reached.

$Ag_2CO_3 + K_2C_2O_4 \Leftrightarrow Ag_2C_2O_4 + K_2CO_3$

Ar equilibrium the solution contains 0.0358 mole of K_2CO_3. Assuming degree of dissociation of $K_2C_2O_4$ and K_2CO_3 to be same, calculate K_{SP} of Ag_2CO_3.

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14. The $K_{SP} of Ca(OH)_2 is 4.42 \times 10^{-5} at 25 ^\circ C$. A 500 mL of saturated solution of $Ca(OH)_2$ is mixed with equal volume of $0.4 M NaOH$. How much $Ca(OH)_2$ in mg is preciptated ?

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15. 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 $7.4\left(K_a f \text{ or } H_2CO_3\right.$in blood =$\left.7.8 \times 10^{-7}\right)$

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16. 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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17. For the reaction

$Ag(CN)_2^{\ominus} \Leftrightarrow Ag^{\oplus} + 2CN^{\ominus}$, the K_c at $25^{\circ}C$ is 4×10^{-19} Calculate $\left[Ag^{\oplus}\right]$ in solution which was originally $0.1M$ in KCN and $0.03M$ in $AgNO_3$.

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18. Calculate the pH of an aqueous solution of $1.0M$ ammonium formate assuming complete dissociation. (pK_a of formic acid $= 3.8$ and pK_b of ammonia $= 4.8$)

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

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20. 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 $3.4 \times 10^{10} L mol^{-1} s^{-1}$. Calculate the rate constant for proton transfer form water to NH_3.

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21. A sample of AgCI was treated with $5.00 mL$ of $1.5M$ Na_2CO_3 solubility to give Ag_2CO_3 . The remaining solution contained $0.0026 g of CI^-$ 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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22. 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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23. 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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24. 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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25. 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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26. 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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27. $500mL$ 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. $\left[K_a\right.$ of $CH_3COOH = 2 \times 10^{-5}$.

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28. $0.1 M NaOH$ is titrated with $0.1 M HA$ 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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