Ionic Equilibrium

Q.1. 0.16 g of N_2H_4 are dissolved in water and the total volume made up to 500 mL. The Kb for N_2H_4 is 4.0×10^{-6} M. The percentage of N_2H_4 that has reacted with water in this solution is :

(A) 2.5%

(B) 2.0%

(C) 1.9%

(D) 1.5%

Q.2. Nicotinic acid (Ka = 1.4×10^{-5}) is represented by the formula HNiC. Its per cent dissociation in a solution which contains 0.10 mole of nicotinic acid pr 2.0 litre of solution is :

(A) 1.50%

(B) 1.57%

(C) 1.60%

(D) 1.67%

Q.3. Saccharin (Ka = 2.0×10^{-12}) 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, the concentration of SaC^- ions in the resulting solution at equilibrium is :

(A) 4.0×10^{-12} M

(B) 4.0×10^{-11} M

(C) 4.0×10^{-10} M

(D) 4.0×10^{-9} M

Q.4. The ionization constant of NH^+_4 in water is 5.6×10^{-10} at 25° C. The rate constant for the reaction of NH^+_4 and OH^- to form NH_3 and H_2O at 25° C is 3.4×10^{10} litre mol^{-1} sec^{-1}. The rate constant for proton transfer from water to NH_3 is :

(A) 6.07×10^{6}

(B) 6.07×10^{4}

(C) 6.07×10^{5}

(D) 7.06×10^{5}

Q.5. An aqueous solution contains 10% ammonia by mass and has a density of 0.99 g/mL. Ka for NH_4^+ is 5.0×10^{-10}. The pH of solution is :

(A) 12.3032

(B) 12.3230

(C) 12.33203

(D) 12.0330

Q.6. The average concentration of SO_2 in the atmosphere over a city on a day is 10 ppm, when the average temperature is 298 K. The solubility of SO_2 in water at 298 K is 1.3653 mol litre $^{-1}$ and pKa of H_2SO_3 is 1.92. The pH of rain water on that day is :

(A) 0.59

(B) 0.49

(C) 0.47

(D) 0.45

Q.7. The pH of 0.05 M aqueous solution of diethyl amine is 12.0. The value of K_b is :

(A) 2.6×10^{-3}

(B) 2.5×10^{-4}

(C) 2.4×10^{-4}

(D) 2.5×10^{-3}

Q.8. The pH of water at 4° C and at 25° C are :

(A) Same

(B) more at 25° C

(C) more at 4° C

(D) none of these

Q.9. The volume of one litre of 1 M solution of acetic acid is diluted so that pH of the resulting solution becomes twice of the original value. The volum becomes :

(A) 2.77×10^{4}

(B) 3.77×10^{4}

(C) 2.77×10^{5}

(D) 3.77×10^{3}

Q.10. The resultant pH when 200 mL of an aqueous solution of HCl (pH = 2.0) is mixed with 300 mL of an aqueous solution of NaOH (pH = 12.0) is :

(A) 10.3010

(B) 10.3110

(C) 11.3110

(D) 11.3010

Q.11. 500 mL of 0.2 M aqueous solution of acetic acid is mixed with 500 mL of HCl at 25° C. Assuming no change in volume on mixing and K_a for acetic acid is 1.75×10^{-5}mol L^{-1}. The degree of dissociation of acetic acid in the resulting solution and pH of the solution are :

(A) 0.01745%; 1

(B) 0.0175%; 1

(C) 0.0176%; 1

(D) 0.0177%; 1

Q.12. 500 mL of 0.2 M aqueous solution of acetic acid is mixed with 500 mL of HCl at 25° C. Assuming no change in volume on mixing and Ka for acetic acid is 1.75×10^{-5}mol L^{-1}. If 6 g of NaOH is added the final pH is :

(A) 4.757

(B) 3.757

(C) 4.577

(D) 4.577

Q.13. An aqueous solution of aniline of concentration 0.24 M is prepared. K_a for $C_6H_5NH_3^+$ is 2.4×10^{-5} M. The concentration of sodium hydroxide needed in this solution so that aniline ion concentration should remain at 1×10^{-8} M, is :

(A) 0.020 M

(B) 0.015 M

(C) 0.010 M

(D) 0.008 M

Q.14. A solution contains 0.1 M H_2S and 0.3 M HCl. Given Ka_1 and Ka_2 for H_2S are 10^{-7} and 1.3×10^{-13} respectively. The concentration of HS^- and S^{2-} ions in solution are respectively :

(A) 3.3×10^{-7}; 1.43×10^{-20}

(B) 3.3×10^{-8}; 1.43×10^{-20}

(C) 3.3×10^{-8}; 1.43×10^{-10}

(D) 3.3×10^{-20}; 1.43×10^{-8}

Q.15. 0.15 mole of pyridinium chloride has been added into 500 cm3 of 0.2 M pyridine solution. K_b for pyridine being 1.5×10^{-9} M. The pH and hydroxyl ion concentration in the resulting solution , if there is no change in the volume, is :

(A) 5; 10^{-9}

(B) 6; 10^{-8}

(C) 6; 10^{-9}

(D) 5; 10^{-8}

Q.16. K_b for NH_3 is 1.78×10^{-5}. The amount of $(NH_4)_2SO_4$ in g which must be added to 500 mL of 0.2 M NH_3 to yield a solution of pH 9.5 is :

(A) 5.225 g

(B) 5.245

(C) 5.248

(D) 5.268

Q.17. The volume of 0.1 M sodium formate solution to be added to 50 mL of 0.05 M formic acid to produce a buffer solution of pH 4.0; pKa of formic acid being 3.80 is :

(A) 39.41 mL

(B) 39.49 mL

(C) 39.57 mL

(D) 39.62 mL

Q.18. A 40 mL solution of weak base BOH is titrated with 0.1 N HCl solution. The pH of solution is found to be 10.04 and 9.14 after the addition of 5.0 mL and 20.0 mL of acid respectively. The K_b for the weak base is :

(A) 2.81×10^{-5}

(B) 1.81×10^{-5}

(C) 1.81×10^{-4}

(D) 2.81×10^{-4}

Q.19. Assuming no change in volume and K_{NH_3} being 1.8×10^{-5}. The change in pH of 1 litre buffer solution containing 0.1 M each of NH_3 and NH_4Cl on addition of

(i) 0.02 mole of dissolved gaseous HCl and (ii) 0.02 mole of dissolved NaOH are :

(A) – 0.1761; 0.1761

(B) – 0.1671; 0.1671

(C) – 0.1716; 0.1716

(D) – 0.1167; 0.1167

Q.20. If pKb for NH3 is 4.7 and log 2 = 0.30, the amount of NH3 and NH4Cl required to prepare a buffer solution of pH 9.0 when total concentration of buffering reagents is 0.6 mol litre–1 is :

(A) [Salt] = 21.4 M; [Base] = 0.2 M

(B) [Salt] = 0.4 M; [Base] = 0.2 M

(C) [Salt] = 0.4 M; [Base] = 3.4 M

(D) [Salt] = 21.4 M; [Base] = 3.4 M

Q.21. Two buffers, X and Y of pH 4.0 and 6.0 respectively are prepared from acid HA and the salt NaA. Both the buffers are 0.50 M in HA. If KHA is 1.0×10^{-5}. The pH of the solution obtained by mixing equal volume of the two buffers is :

(A) 5.7333

(B) 5.7233

(C) 5.7133

(D) 5.7033

Q.22. A certain weak acid has $K_a = 1.0\times10^{-4}$. The equilibrium constant for its reaction with a strong base is :

(A) 10^{9}

(B) 10^{10}

(C) 10^{11}

(D) 10^{12}

Q.23. The pH of blood stream is maintained by a proper balance of H_2CO_3 and $NaHCO_3$ concentration. K_a for H_2CO_3 in blood is 7.8×10^{-7}. The volume of 5 M $NaHCO_3$ solution required to 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 is :

(A) 76.36 mL

(B) 77.36 mL

(C) 78.36 mL

(D) 79.36 mL

Q.24. Ksp of AgCl is 1.5×10^{-10} at 25° C. The solubility of AgCl in pure water is :

(A) 1.222×10^{-5} mol $litre^{-1}$

(B) 1.224×10^{-5} mol $litre^{-1}$

(C) 1.232×10^{-5} mol $litre^{-1}$

(D) 1.223×10^{-5} mol $litre^{-1}$

Q.25. The solubility of $Pb(OH)_2$ in water is 6.7×10^{-6} M. The solubility of $Pb(OH)_2$ in a buffer solution of pH 8 is :

(A) 1.203×10^{-3} mol $litre^{-1}$

(B) 1.230×10^{-3} mol $litre^{-1}$

(C) 1.302×10^{-3} mol $litre^{-1}$

(D) 1.320×10^{-3} mol $litre^{-1}$