TOPIC : REDOX REACTIONS AND ELECTROCHEMISTRY

1. Which of the following redox reaction is feasible ?
   (a) $Zn(s) + 2Ag^+(aq) \rightarrow Zn^{2+}(aq) + 2Ag(s)$
   (b) $Zn^{2+}(aq) + 2Ag(s \rightarrow 2Ag^+(aq) + Zn(s)$
   (c) $Zn(s) + 2Ag(s) \rightarrow 2Ag^+(aq) + Zn^{2+}(aq)$
   (d) $Zn^{2+}(aq) + Ag^+(aq) \rightarrow Ag(s) + Zn(s)$

2. The species undergoing reduction in the following reaction is
   $Cr + 2H_2O + OCl^- \rightarrow Cr^{3+} + 3Cl^- + 6OH^-$
   (a) Cr (b) H_2O
   (c) ClO^- (d) Cl^-

3. In the following equation :
   $ClO_3^- + 6H^+ + X \rightarrow Cl^- + 3H_2O$, X is
   (a) O (b) $6e^-$
   (c) O_2 (d) $5e^-$

4. The oxidation state of phosphorus in barium hypophosphite $[Ba(H_2PO_2)_2]$ is
   (a) + 3 (b) + 2
   (c) + 1 (d) – 1

5. In the reaction ; $I_2 + 5O_3 + H_2O \rightarrow 2HIO_3 + 5O_2$, the substance undergoing reduction is
   (a) Iodine (b) Ozone
   (c) Water (d) I_2 as well as H_2O

6. $2MnO_4^- + 6H^+ + 5SO_3^{2-} \rightarrow 5SO_4^{2-} + 3H_2O + X$. In the above equation X stands for
   (a) Mn^{2+} (b) $2Mn^{2+}$
   (c) MnO_4^{2-} (d) MnO_2

7. Which of the following reaction is not a redox reaction ?
   (a) $SO_2 + 2H_2S \rightarrow 2H_2O + S$
   (b) $Na + O_2 \rightarrow Na_2O_2$
   (c) $Na_2O + H_2SO_4 \rightarrow Na_2SO_4 + H_2O$
   (d) $4KClO_3 \rightarrow 3KClO_4 + KCl$

8. How much copper can be deposited by 2.5 Faraday of electricity ?
   (a) 2 moles (b) 2.5 moles
   (c) 1.25 moles (d) 0.125 moles

9. The conduction of electricity through the electrolyte solution is due to
   (a) Movement of molecules of electrolyte
   (b) Movement of ions of electrolyte
   (c) Movement of separate atoms
   (d) Movement of particles of the solvent

10. Two electrolytic cell contains 0.1 M ferrous sulphate and 0.2 M ferric chloride respectively are subjected to electrolysis, the ratio of iron deposited in the two cells is
    (a) 1 : 1 (b) 2 : 1
    (c) 3 : 1 (d) 3 : 2

11. The resistance of 0.0025 M solution of K_2SO_4 is 326 ohm. The specific conductance of the solution is
    (a) 4.997×10^{-4} (b) 5.997×10^{-7}
    (c) 6.997×10^{-4} (d) Unpredictable

12. The conductivity of four electrolytes P, Q, R, S in ohm^{-1} cm^{-1} are as follows P (5×10^{-5}); Q (1×10^{-10}) ; R (7×10^{-8}) ; S (9.2×10^{-3}). The one which offers highest resistance to the passage of electric current is
    (a) P (b) S
    (c) R (d) Q

13. When same quantity of electricity is passed through two electrolytic cells, the ratio of the masses of the products obtained at the cathode is the same as the ratio of their
    (a) densities
    (b) atomic masses
    (c) equivalent masses
    (d) atomic numbers

14. The standard electrode potential of four elements X, Y, Z, W are –3.05, –1.66, 0.40 and 0.76 volts respectively. The highest chemical activity will be show by
    (a) X (b) Y
    (c) Z (d) W

15. From the E^o values for the half cells

(i) $D \rightarrow D^{2+} + 2e^-$; $E^o = -1.5$ V

(ii) $B^+ + e^- \rightarrow B$; $E^o = -0.5$ V

(iii) $A^{3-} \rightarrow A^{2-} + e^-$; $E^o = 1.5$ V

(iv) $X^{2+} + e^- \rightarrow X^+$; $E^o = 0.5$ V

Which two combination would give cell with largest cell potential ?

(a) (i) and (iii) (b) (i) and (iv)

(c) (iii) and (iv) (d) (ii) and (iv)

16. The depolarizer used in dry cell batteries is

(a) NH_4Cl

(b) Manganese dioxide

(c) Potassium hydroxide

(d) Sodium triphosphide

17. On electrolysis of 10^{-6} M HCl solution

(a) Cl_2 gas is produced at the cathode

(b) Cl_2 is produced at the anode

(c) O_2 gas is produced at the cathode

(d) H_2 is produced at the cathode

18. For the cell reaction to be spontaneous

(a) $E^o_{cell} > 0$ (b) $E^o_{cell} < 0$

(c) $\Delta G > 0$ (d) $\Delta G = 0$

19. The amount of electricity that can deposit 108 g of silver from silver nitrate solution is

(a) 1 amp (b) 1 coulomb

(c) 1 Faraday (d) 2 amp

20. The brown ring complex is formulated as $[Fe(H_2O)_5NO]SO_4$. The oxidation state of iron is

(a) + 1 (b) + 2

(c) + 3 (d) 0

21. 2.5 Faradays of electricity is passed through solution of $CuSO_4$. The number of gram equivalents of copper deposited on the cathode would be

(a) 1 (b) 2

(c) 2.5 (d) 1.25

22. At STP 1.12 litre of H_2 is obtained on flowing a current for 965 seconds in a solution. The value of current is

(a) 10 amp (b) 1.0 amp

(c) 1.5 amp (d) 2.0 amp

23. Four which of the following electrolytic solution $\wedge_m$ and $\wedge_{eq}$ are equal

(a) $BaCl_2$ (b) KCl

(c) $Al_2(SO_4)_3$ (d) $CaCl_2$

24. Thermodynamic efficiency of cell is give by

(a) $\Delta H/\Delta G$ (b) $\frac{nFE}{\Delta G}$

(c) $\frac{-nEF}{\Delta H}$ (d) nFE^o

25. Red hot carbon removes oxygen from XO and YO but not form ZO. Y also removes oxygen from XO. The above information is sufficient to provide the order of activity among the metals X, Y, Z is

(a) X > Y > Z (b) Z > Y > X

(c) Y > X > Z (d) Z > X > Y

26. Zinc is generally coated over iron to prevent its corrosion because

(a) zinc is cheaper metal

(b) zinc gives a good luster to iron

(c) $E^o_{Zn^{2+}/Zn} > E^o_{Fe^{2+}Fe}$

(d) $E^o_{Zn/Zn^{2+}} > E^o_{Fe/FE^{2+}}$

27. A compound contains X, Y, Z atoms. The oxidation states of X, Y and Z are + 2, + 2, –2 respectively. The probable formula of the compound is

(a) XYZ_2 (b) $(XZ_3)_2Y_2$

(c) $X_3(Y_4Z)_2$ (d) $X_3(YZ_4)_2$

28. The equilibrium constant for a feasible cell reaction is

(a) < 1 (b) 0

(c) = 0 (d) > 1

29. In the reaction;

$$Cr_2O_7^{2-} + Fe^{2+} + H^+ \rightarrow Cr^{3+} + Fe^{3+} + H_2O$$

the coefficients of Fe^{2+} and H^+ are respectively

(a) 6, 7 (b) 6, 14

(c) 5, 7 (d) 5,14

30. The number of moles of $KMnO_4$ required to oxidize one mole of ferrous oxalate in acidic medium is

(a) 0.6 (b) 0.4

(c) 0.2 (d) 1.67

31. In order to get 9 gm of aluminium (At. mass = 27) during the electrolysis experiment, how many Faraday of electricity has to be passed ?
(a) 3 Faraday
(b) 2 Faraday
(c) 1 Faraday
(d) 1.5 Faraday

32. In SHE, the pH of the acid solution should be
(a) 7 (b) 14
(c) 0 (d) 4

33. The molar ionic conductance at infinite dilution of Ag^+ is 61.92×10^{-4} S mol^{-1} m^2 at 25°C. The ionic mobility of Ag^+ will be
(a) 6.4×10^{-8} (b) 6.192
(c) 6.192×10^{-4} (d) 3.2×10^{-4}

34. When electricity if passed to aqueous solute of aluminium chloride, 13.5 g of Al are deposited. The number of Faradays of electricity passed must be
(a) 2.0 (b) 1.5
(c) 1.0 (d) 0.5

35. The resistance of 1 N solution of acetic acid is 250 ohms when measured in a cell of cell constant 1.5 cm^{-1}. The equivalent conductance of 1 N acetic acid in ohm^{-1} cm^2 $equiv^{-1}$ is
(a) 4.6 (b) 9.2
(c) 18.4 (d) 0.023

36. In a $H_2 - O_2$ fuel cell, 6.72 L of hydrogen at NTP reacts in 15 minutes, the average current produced in ampere is
(a) 64.3 amp
(b) 643.3 amp
(c) 6.43 amp
(d) 0.643 amp

37. The passage of 25 milliampere of current through molten $CaCl_2$ for 60 seconds will cause the deposition of X calcium atoms on cathode. The value of X is
(a) 6.02×10^{19} (b) 2×10^{18}
(c) 3×10^{18} (d) 4.68×10^{18}

38. The relationship between the resistance of certain electrolytic solution 'R', its molarity M, its molar conductivity Λ_m and cell constant k_{cell} is
(a) $\Lambda_m = \frac{Rk_{cell}}{M}$ (b) $\Lambda_m = \frac{k_{cell} \times 10^3}{RM}$
(c) $\Lambda_m = RM\, k_{cell}$ (d) $\Lambda_m = \frac{Mk_{cell} \times 10^{-3}}{R}$

39. $xI_2 + ySO_2 + zH_2O \rightarrow aSO_4^{2-} + bI^- + cH^+$. The values of z, b, c are respectively
(a) 1, 1, 2 (b) 2, 2, 4
(c) 1, 2, 4 (d) 2, 4, 2

40. A cell is constituted by coupling the two electrodes Sn/Sn^{2+} and Ag/Ag^+, if $E^o_{Sn^{2+}/Sn}$, $E^o_{Ag^+/Ag}$ and E^o_{cell} are –0.14 V, 0.80 V and 0.94 V respectively. The correct representation of cell is
(a) Sn/Sn^{2+} (1 M) || Ag^+ (0.1 M)/Ag
(b) Ag/Ag^+ (1 M) || Sn^{2+} (1 M)/Sn
(c) Sn/Sn^{2+} (1 M) || Ag^+ (1 M)/Ag
(d) Sn/Sn^{2+} (0.1 M) || Ag^+ (1 M)/Ag

41. $KMnO_4$ oxdises $C_2O_4^{2-}$ to CO_2 and each two molecules of $KMnO_4$ gain $5e^-$ during the process. The number of moles of $KMnO_4$ required to oxidize 126 g of oxalic acid ($H_2C_2O_4 . 2H_2O$) is
(a) 0.2 (b) 0.4
(c) 0.6 (d) 1.0

42. A compound of xenon and fluorine is found to have 53.3% Xe. What is the oxidation number of Xe in the compound ? (At. mass F = 19)
(a) 0 (b) + 4
(c) – 4 (d) + 6

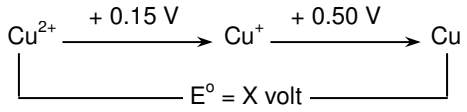
43. A certain quantity of current i amp was passed through three electrolytic cells P, Q, R connected in series and containing aqueous solutions of silver nitrate, mercuric nitrate and mercurous nitrate respectively. It resulted in the deposition of 0.216 g of Ag. The masses of Hg deposited in cell Q and R are respectively (At. mass Ag = 108; Hg = 200.6)
(a) 0.4012 g, 0.9024 g (b) 0.4012 g, 0.2006 g
(c) 0.2006 g, 0.4012 g (d) 0.1003 g, 0.2006 g

44. A current of 3 A was passed through the solution of $AuCl_4^-$ ions using gold electrodes and it caused deposition of 1.234 g of Au. The time for which the current was passed is ….. (At. mass of gold is 197)

(a) = 604 sec (b) 1208 sec

(c) 302 sec (d) 1812 sec

45. In the diagram given below the value of X is



(a) 0.325 V (b) 0.65 V

(c) –0.35 V (d) –0.65 V

46. How long will it take to remove half of silver from 200 cm^2 of 0.1 M $AgNO_3$ solution with a current of 0.1 amp. ?

(a) 40.2 min (b) 80.4 min

(c) 160.8 min (d) 120 min

47. The number of moles of electrons required for causing reduction of 0.2 moles of nitrobenzene ($C_6H_5NO_2$) to amino benzene ($C_6H_5NH_2$) is

(a) 1.2 mole (b) 0.6 mole

(c) 0.3 mole (d) 0.4 mole

48. 0.5 Faraday of electricity was passed to deposit all the copper present in 500 mL of $CuSO_4$ solution. The molarity of the solution is

(a) 0.5 M (b) 0.25 M

(c) 1.5 M (d) 1.25 M

49. One mole of N_2H_4 loses 10 moles of electrons to form a new compound Y. Assuming that all nitrogen appears in the new compound, the oxidation state of nitrogen in the new compound will be

(a) + 3 (b) + 5

(c) – 1 (d) – 3

50. E°_{cell} of $Zn/Zn^{2+} \,||\, Cu^{2+}/Cu$ is 1.10 V at 25°C. The equilibrium constant for the reaction

$$Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$$

(a) 10^{-28} (b) 10^{+37}

(c) 10^{-18} (d) 10^{17}

ANSWERS KEY

1	A	**11**	D	**21**	C	**31**	C	**41**	B
2	C	**12**	D	**22**	A	**32**	C	**42**	A
3	B	**13**	C	**23**	B	**33**	A	**43**	D
4	C	**14**	A	**24**	C	**34**	B	**44**	A
5	B	**15**	A	**25**	B	**35**	A	**45**	A
6	B	**16**	B	**26**	D	**36**	A	**46**	C
7	C	**17**	D	**27**	A	**37**	D	**47**	A
8	C	**18**	A	**28**	D	**38**	B	**48**	A
9	B	**19**	C	**29**	B	**39**	B	**49**	B
10	D	**20**	B	**30**	A	**40**	C	**50**	B