GALVANIC CELL

1. Which of the following statement is wrong about galvanic cell ?
(A) cathode is positive charged
(B) anode is negatively charged
(C) reduction takes place at the anode
(D) reduction takes place at the cathode

2. A standard hydrogen electrode has zero electrode potential because
(A) hydrogen is easier to oxidise
(B) electrode potential is assumed to be zero
(C) hydrogen atom has only one electron
(D) hydrogen is the lighest element.

3. A standard reduction electrode potentials of four metals are
A = – 0.250 V , B = – 0.140 V C = – 0.126 V , D = – 0.402 V
The metal that displaces A from its aqueous solution is :–
(A) B
(B) C
(C) D
(D) None of the above

4. The standard electrode potentials for the reactions
$Ag^+ (a) + e^- \longrightarrow Ag(s)$ $Sn^{2+} (a) + 2e^- \longrightarrow Sn (s)$
at 25 °C are 0.80 volt and –0.14 volt, respectively. The standard emf of the cell.
$Sn_{(s)}|Sn^{2+}_{(aq)} (1M)||Ag^+_{(aq)}(1M)|Ag_{(s)}$ is :
(A) 0.66 volt
(B) 0.80 volt
(C) 1.08 volt
(D) 0.94 volt

5. The thermodynamic efficiency of cell is given by-
(A) $\frac{\Delta H}{\Delta G}$
(B) $\frac{nFE_{cell}}{\Delta G}$
(C) $-\frac{nFE_{cell}}{\Delta H}$
(D) Zero

6. The standard reduction potentials for two half-cell reactions are given below,
$Cd^{2+}(aq) + 2e^- \rightarrow Cd(s)$, E° = – 0.40V
$Ag^+(aq) + e^- \rightarrow Ag(s)$, E° = 0.80V
The standard free energy change for the reaction
$2Ag^+(aq) + Cd(s) \rightarrow 2Ag(s) + Cd^{2+} (aq)$ is given by :
(A) 115.8 KJ
(B) –115.8 KJ
(C) –231.6 KJ
(D) 231.6KJ

7. The standard reduction potentials at 25°C for the following half reactions are :
$Zn^{2+} (aq) + 2e^- \rightleftharpoons Zn(s), E^\circ_{RP} = -0.762V$
$Cr^{3+} (aq) + 3e^- \rightleftharpoons Cr(s), E^\circ_{RP} = -0.740V$
$2H^+_{(aq)} + 2e^- \rightleftharpoons H_2(g), E^\circ_{RP} = 0.00 V$
$Fe^{3+}_{(aq)} + 2e^- \rightleftharpoons Fe^{2+}_{(aq)}, E^\circ_{RP} = 0.77V$
Which is the strongest reducing agent ?
(A) Zn
(B) Cr
(C) $H_2(g)$
(D) Fe^{2+} (aq)

8. Using the standard electrode potential values given below, decide which of the statements, I, II, III and IV are correct. Choose the right answer from (A), (B), (C) and (D).
$Fe^{2+}_{(aq)} + 2e^- \rightleftharpoons Fe_{(s)}$; E° = –0.44 V
$Cu^{2+}_{(aq)} + 2e^- \rightleftharpoons Cu_{(s)}$; E° = +0.34 V
$Ag^+_{(aq)} + e^- \rightleftharpoons Ag_{(s)}$; E° = +0.80 V
I. Copper can displace iron from $FeSO_4$ solution.

II. Iron can displace copper from $CuSO_4$ solution.

III. Silver can displace copper from $CuSO_4$ solution.

IV. Iron can displace silver from $AgNO_3$ solution.

(A) I and II (B) II and III (C) II and IV (D) I and IV

9. The reduction potential values are given below:

$Al^{3+} / Al = -1.67$ volt, $Mg^{2+} / Mg = -2.34$ volt

$Cu^{2+} / Cu = +0.34$ volt, $I_2 / 2I^- = +0.53$ volt

Which one is the best reducing agent ?

(A) Al (B) Mg (C) Cu (D) I_2

10. The following facts are available :–

$2X^- + Y_2 \rightarrow 2Y^- + X_2$

$2W^- + Y_2 \rightarrow$ NO reaction

$2Z^- + X_2 \rightarrow 2X^- + Z_2$

Which of the following statements is correct :–

(A) $E^\circ_{W^-/W_2} > E^\circ_{Y^-/Y_2} > E^\circ_{X^-/X_2} > E^\circ_{Z^-/Z_2}$ (B) $E^\circ_{W^-/W_2} < E^\circ_{Y^-/Y_2} < E^\circ_{X^-/X_2} < E^\circ_{Z^-/Z_2}$

(C) $E^\circ_{W^-/W_2} < E^\circ_{Y^-/Y_2} > E^\circ_{X^-/X_2} > E^\circ_{Z^-/Z_2}$ (D) $E^\circ_{W^-/W_2} > E^\circ_{Y^-/Y_2} < E^\circ_{X^-/X_2} < E^\circ_{Z^-/Z_2}$

11. $E^\circ(Ni^{2+}/Ni) = -0.25$ volt, $E^\circ(Au^{3+}/Au) = 1.50$ volt. The standard emf of the voltaic cell. $Ni_{(s)} \mid Ni^{2+}_{(aq)}$ (1.0 M) $\parallel Au^{3+}_{(aq)}$ (1.0 M) $\mid Au_{(s)}$ is :

(A) 1.25 volt (B) –1.75 volt (C) 1.75 volt (D) 4.0 volt

12. E° for $F_2 + 2e^- = 2F^-$ is 2.8 V, E° for $\frac{1}{2}F_2 + e^- = F^-$ is ?

(A) 2.8 V (B) 1.4 V (C) –2.8 V (D) –1.4 V

13. From the following E° values of half cells,

(i) $A + e \rightarrow A^-$; $E^\circ = -0.24$ V (ii) $B^- + e \rightarrow B^{2-}$; $E^\circ = +1.25$ V

(iii) $C^- + 2e \rightarrow C^{3-}$; $E^\circ = -1.25$ V (iv) $D + 2e \rightarrow D^{2-}$; $E^\circ = +0.68$ V

What combination of two half cells would result in a cell with the largest potential ?

(A) (ii) and (iii) (B) (ii) and (iv) (C) (i) and (iii) (D) (i) and (iv)

14. If ΔG° of the cell reaction, $AgCl(s) + \frac{1}{2}H_2(g) \rightarrow Ag(s) + H^+ + Cl^-$ is –21.52 KJ then ΔG° of $2AgCl(s) + H_2(g) \rightarrow 2Ag(s) + 2H^+ + 2Cl^-$ is :

(A) –21.52 KJ (B) –10.76 KJ (C) –43.04 KJ (D) 43.04 KJ

15. The reduction potential of hydrogen electrode (P_{H_2} = 1 atms; $[H^+]$ = 0.1 M) at 25°C will be -

(A) 0.00 V (B) –0.059 V (C) 0.118 V (D) 0.059 V

16. Which of the following represents the reduction potential of silver wire dipped into 0.1 M $AgNO_3$ solution at 25° C ?

(A) E°_{red} (B) $(E^\circ_{red} + 0.059)$ (C) $(E^\circ_{oxi} - 0.059)$ (D) $(E^\circ_{red} - 0.059)$

17. Which of the following will increase the voltage of the cell with following cell reaction

$Sn_{(s)} + 2Ag^+_{(aq)} \rightarrow Sn^{+2}_{(aq)} + 2Ag_{(s)}$

(A) Decrease in the concentration of Ag^+ ions

(B) Increase in the concentration of Sn^{+2} ions

(C) Increase in the concentration of Ag^+ ions

(D) (A) & (B) both

18. For a reaction - $A(s) + 2B^{+}_{(aq)} \rightarrow A^{2+}_{(aq)} + 2B_{(s)}$ K_C has been found to be 10^{12}. The E°cell is:
(A) 0.354 V (B) 0.708 V (C) 0.0098 V (D) 1.36 V

19. At 25°C the standard emf of cell having reactions involving two electrons change is found to be 0.295V. The equilibrium constant of the reaction is -
(A) 29.5×10^{-2} (B) 10 (C) 10^{10} (D) 29.5×10^{10}

20. For the cell reaction
$Mg_{(s)} + Zn^{2+}_{(aq)}(1M) \longrightarrow Zn(s) + Mg^{2+}_{(aq)}(1M)$
The emf has been found to be 1.60 V, E° of the cell is :
(A) –1.60 V (B) 1.60 V (C) 0.0 V (D) 0.16 V

21. The emf of the cell in which the following reaction,
$Zn(s) + Ni^{2+}_{(aq)}$ (a = 0.1) $\rightarrow Zn^{2+}_{(aq)}$ (a = 1.0) + Ni(s)
occurs, is found to be 0.5105 V at 298 K. The standard e.m.f. of the cell is :-
(A) –0.5105 V (B) 0.5400 V (C) 0.4810 V (D) 0.5696 V

22. The standard emf for the cell reaction,
$Zn_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Zn^{2+}_{(aq)} + Cu_{(s)}$ is 1.10 volt at 25 °C. The emf for the cell reaction when 0.1 M Cu^{2+} and 0.1 M Zn^{2+} solution are used at 25°C is :
(A) 1.10 volt (B) 0.110 volt (C) –1.10 volt (D) –0.110 volt

23. What is the potential of the cell containing two hydrogen electrodes as represented below
Pt | H_2(g) | $H^{+}_{(aq)}(10^{-8}$ M) ‖ $H^{+}_{(aq)}$(0.001 M) | H_2(g)|Pt
(A) – 0.295 V (B) – 0.0591 V (C) 0.295 V (D) 0.0591 V

24. Consider the cell, Cu|Cu^{+2}||Ag^{+}|Ag. If the concentration of Cu^{+2} and Ag^{+} ions becomes ten times the emf of the cell :–
(A) Becomes 10 times (B) Remains same
(C) Increase by 0.0295 V (D) Decrease by 0.0295 V

25. Determine the value of E° cell for the following reaction -
$Cu^{+2}_{(aq)} + Sn^{+2}_{(aq)} \longrightarrow Cu_{(s)} + Sn^{+4}_{(aq)}$ Equilibrium constant is 10^{6}
(A) 0.177 (B) 0.0177 (C) 0.215 (D) 1.77

26. The standard emf of a galvanic cell involving cell reaction with n = 4 is found to be 0.295 V at 25°C. The equilibrium constant of the reaction would be,
(A) 1.0×10^{20} (B) 2.0×10^{11} (C) 4.0×10^{12} (D) 1.0×10^{2}

27. Given electrode potentials :
$Fe^{3+}_{(aq)} + e^{-} \longrightarrow Fe^{2+}_{(aq)}$; E° = 0.771 volts $I_{2(g)} + 2e^{-} \longrightarrow 2I^{-}_{(aq)}$;E° = 0.536 volts
E°_{cell} for the cell reaction,
$2Fe^{3+}_{(aq)} + 2I^{-}_{(aq)} \longrightarrow 2Fe^{2+}_{(aq)} + I_{2(g)}$ is -
(A) (2 × 0.771 – 0.536) = 1.006 volts (B) (0.771 – 0.5 × 0.536) = 0.503 volts
(C) 0.771 – 0.536 = 0.235 volts (D) 0.536 – 0.771 = –0.235 volts

28. The equilibrium constant for the reaction
$Sr(s) + Mg^{+2}(aq) \rightleftharpoons Sr^{+2}(aq) + Mg(s)$ is 4×10^{12} at 25°C
The E° for a cell made up of the Sr/Sr^{+2} and Mg^{+2}/Mg half cells
(log 2 = 0.3)
(A) 0.3717 V (B) 0.7434 V (C) 0.1858 V (D) 0.135 V

29. By how much times will potential of half cell Cu^{+2}/Cu change if, the solution is diluted to 100 times at 298 K :–

(A) Increases by 59 mV
(B) Decrease by 59 mV
(C) Increases by 29.5 mV
(D) Decreases by 29.5 mV

ELECTROLYTIC CELL

30. When an electric current is passed through a cell containing an electrolyte, positive ions move towards the cathode and negative ions towards the anode. What will happen if the cathode is pulled out of the solution?

(A) The positive ions will start moving towards the anode and negative ions will stop moving.
(B) The negative ions will continue to move towards the anode and the positive ions will stop moving
(C) Both positive and negative ions will move towards the anode.
(D) None of these movements will take place.

31. Which of the substances Na, Hg, S, Pt and graphite can be used as electrodes in electrolytic cells having aqueous solution ?

(A) Hg and Pt
(B) Hg, Pt and graphite
(C) Na, S
(D) Na, Hg, S

32. The products formed when an aqueous solution of NaBr is electrolyzed in a cell having inert electrodes are :

(A) Na and Br_2 (B) Na and O_2 (C) H_2, Br_2 and NaOH (D) H_2 and O_2

33. Electrolysis of a $CuSO_4$ produces :–

(A) An increase in pH
(B) A decrease in pH
(C) Either decrease or increase
(D) None

34. A solution of sodium sulphate in water is electrolysed using inert electrodes. The products at the cathode and anode are respectively.

(A) H_2, O_2 (B) O_2, H_2 (C) O_2, Na (D) none

35. When an aqueous solution of lithium chloride is electrolysed using graphite electrodes

(A) Cl_2 is liberated at the anode.
(B) Li is deposited at the cathode
(C) as the current flows, pH of the solution remains constant
(D) as the current flows, pH of the solution decreases.

36. The amount of an ion discharged during electrolysis is not directly proportional to :

(A) resistance
(B) time
(C) current strength
(D) electrochemical equivalent of the element

37. Number of electrons involved in the electrodeposition of 63.5 g of Cu from a solution of $CuSO_4$ is : ($N_A = 6 \times 10^{23}$)

(A) 6×10^{23} (B) 3×10^{23} (C) 12×10^{23} (D) 6×10^{22}

38. When one coulomb of electricity is passed through an electrolytic solution the mass deposited on the electrode is equal to :

(A) equivalent weight
(B) molecular weight
(C) electrochemical equivalent
(D) one gram

39. Electro chemical equivalent of a substance is 0.0006; its e wt. is :
(A) 57.9 (B) 28.95 (C) 115.8 (D) cannot be calculated

40. W g of copper deposited in a copper voltameter when an electric current of 2 ampere is passed for 2 hours. If one ampere of electric current is passed for 4 hours in the same voltameter, copper doposited will be :
(A) W (B) W/2 (C) W/4 (D) 2W

41. When the same electric current is passed through the solution of different electrolytes in series the amounts of elements deposited on the electrodes are in the ratio of their:
(A) atomic number (B) atomic masses (C) specific gravities (D) equivalent masses

42. The amount of electricity that can deposit 108 g. of silver from silver nitrate solution is:
(A) 1 ampere (B) 1 coulomb (C) 1 Faraday (D) 2 ampere

43. The ratio of weights of hydrogen and magnesium deposited by the same amount of electricity from aqueous H_2SO_4 and fused $MgSO_4$ are :
(A) 1 : 8 (B) 1 : 12 (C) 1 : 16 (D) None of these

44. A current of 9.65 amp. flowing for 10 minute deposits 3.0 g of a metal. The equivalent wt. of the metal is :
(A) 10 (B) 30 (C) 50 (D) 96.5

45. The same amount of electricity was passed through two separate electrolytic cells containing solutions of nickel nitrate [$Ni(NO_3)_2$]and chromium nitrate [$Cr(NO_3)_3$] respectively. If 0.3 g of nickel was deposited in the first cell, the amount of chromium deposited is :
(at. wt. of Ni = 59, at. wt. of Cr = 52)
(A) 0.1 g (B) 0.17 g (C) 0.3 g (D) 0.6 g

46. The electric charge for electro deposition of 1 equivalent of a substance is :
(A) one ampere per second (B) 96500 coulomb per second
(C) one ampere for one hour (D) charge on one mole of electrons

47. 3.17 g., of a substance was deposited by the flow of 0.1 mole of electrons. The equivalent weight of the substance is :
(A) 3.17 (B) 0.317 (C) 317 (D) 31.7

48. A current of 9.65 amp. passing for 16 min. 40 sec. through a molten tin salt deposits 5.95 g. of tin The oxidation state of the tin in the salt is : (at. wt of Sn = 119)
(A) +4 (B) +3 (C) +2 (D) +1

49. The time required for a current of 3 amp. to decompose electrolytically 18 g of H_2O is:
(A) 18 hour (B) 36 hour (C) 9 hour (D) 18 seconds

50. 1 mole of Al is deposited by X coulomb of electricity passing through aluminium nitrate solution. The number of moles of silver deposited by X coulomb of electricity from silver nitrate solution is :
(A) 3 (B) 4 (C) 2 (D) 1

51. An ion is reduced to the element when it absorbs 6×10^{20} electrons. The number of gm equivalents of the ion is :
(A) 0.10 (B) 0.01 (C) 0.001 (D) 0.0001

52. When an electric current is passed through acid diluted water, 112 ml. of hydrogen gas at STP collects at the cathode in 965 second. The current passed, in ampere is :

(A) 1.0 (B) 0.5 (C) 0.1 (D) 2.0

53. How many coulombs of electric charge are required for the oxidation of 1 mole of H_2O to O_2 ?

(A) 9.65×10^4 C (B) 4.825×10^5 C (C) 1.93×10^5 C (D) 1.93×10^4 C

54. A factory produces 40 kg. of calcium in two hours by electrolysis. How much aluminium can be produced by the same current in two hours :–

(At wt. of Ca = 40, Al = 27)

(A) 22 kg. (B) 18 kg. (C) 9 kg. (D) 27 kg.

55. The cost of electricity required to deposit 1 g of Mg is Rs. 5.00. How much would it cost to deposit 9 g of Al (At wt. Al = 27, Mg = 24)

(A) Rs. 10 (B) Rs. 27 (C) Rs. 40 (D) Rs. 60

56. Calculate the volume of hydrogen at STP obtained by passing a current of 0.536 ampere through acidified water for 30 minutes.

(A) 0.112 litre (B) 0.224 litre (C) 0.056 litre (D) 0.448 litre

57. An electric current is passed through silver voltameter connected to a water voltameter in series. The cathode of the silver voltameter weighed 0.108g more at the end of the electrolysis. The volume of oxygen evolved at STP is :

(A) $56 cm^3$ (B) $550\ cm^3$ (C) $5.6\ cm^3$ (D) $11.2\ cm^3$

58. 4.5g of aluminium (at. mass 27 amu) is deposited at cathode from Al^{3+} solution by a certain quantity of electric charge. The volume of hydrogen produced at STP from H^+ ions in solution by the same quantity of electric charge will be –

(A) 44.8L (B) 11.2L (C) 22.4L (D) 5.6 L

59. The time required to coat ameter surface of 80 cm^2 with 5×10^{-3} cm thick layer of silver (density 1.08 g cm^{-3}) with the passage of 9.65A current through a silver nitrate solution is :

(A) 10 sec. (B) 40 sec. (C) 30 sec. (D) 20 sec.

60. One gm metal M^{+2} was discharged by the passage of 1.2×10^{22} electrons. What is the atomic weight of metal?

(A) 25 (B) 50 (C) 100 (D) 75

61. One mole of electron passes through each of the solution of $AgNO_3$, $CuSO_4$ and $AlCl_3$ when Ag, Cu and Al are deposited at cathode. The molar ratio of Ag, Cu and Al deposited are

(A) 1 : 1 : 1 (B) 6 : 3 : 2 (C) 6 : 3 : 1 (D) 1 : 3 : 6

62. The density of A is 10 g cm^{-3}. The quantity of electricity needed to plate an area 10 cm × 10 cm to a thickness of 10^{-2} cm using ASO_4 solution would be (Atomic mass of A = 193)

(A) 5000 C (B) 10000 C (C) 40000 C (D) 20000 C

63. During electrolysis of an aqueous solution of sodium sulphate, 2.4 L of oxygen at STP was liberated at anode. The volume of hydrogen at STP, liberated at cathode would be

(A) 1.2 L (B) 2.4 L (C) 2.6 L (D) 4.8 L

64. The charge required for the oxidation of one mole Mn_3O_4 into MnO_4^{2-} in presence of alkaline medium is

(A) 5×96500 C (B) 96500 C (C) 10×96500 C (D) 2×96500 C

65. Electrolytic conduction differs from metallic conduction from the fact that in the former
(A) The resistance increases with increasing temperature
(B) The resistance decreases with increasing temperature
(C) The resistance remains constant with increasing temperature
(D) The resistance is independent of the length of the conductor

66. Which of the following solution of KCl has the lowest value of specific conductance :
(A) 1 M (B) 0.1 M (C) 0.01 M (D) 0.001 M

67. Which of the following solutions of KCl has the lowest value of equivalent conductance ?
(A) 1 M (B) 0.1 M (C) .01 M (D) .001 M

68. The molar conductance at infinite dilution of $AgNO_3$, AgCl and NaCl are 115, 120 and 110 respectively. The molar conductance of $NaNO_3$ is :–
(A) 110 (B) 105 (C) 130 (D) 150

69. The equivalent conductivity of 0.1 N CH_3COOH at 25 °C is 80 and at infinite dilution 400. The degree of dissociation of CH_3COOH is :
(A) 1 (B) 0.2 (C) 0.1 (D) 0.5

70. The specific conductance of a 0.01 M solution of KCl is 0.0014 ohm^{-1} cm^{-1} at 25° C. Its equivalent conductance (cm^2 ohm^{-1} $equiv^{-1}$) is :–
(A) 140 (B) 14 (C) 1.4 (D) 0.14

71. The resistance of 0.01 N solution of an electrolyte was found to be 200 ohm at 298 K using a conductivity cell of cell constant 1.5 cm^{-1}. The equivalent conductance of solution is :–
(A) 750 mhocm^2 eq^{-1} (B) 75 mho cm^2 eq^{-1}
(C) 750 mho^{-1} cm^2 eq^{-1} (D) 75 mho^{-1}cm^2 eq^{-1}

72. The resistance of 0.1 N solution of a acetic acid is 250 ohm. When measured in a cell of cell constant 1.15 cm^{-1}. The equivalent conductance (in ohm^{-1} cm^2 $equiv.^{-1}$) of 0.1 N acetic acid is
(A) 46 (B) 9.2 (C) 18.4 (D) 0.023

73. If 0.01 M solution of an electrolyte has a resistance of 40 ohms in a cell having a cell constant of 0.4 cm^{-1} then its molar conductance in ohm^{-1} cm^2 mol^{-1} is :
(A) 10 (B) 10^2 (C) 10^3 (D) 10^4

74. The conductivity of a saturated solution of $BaSO_4$ is 3.06×10^{-6} ohm^{-1} cm^{-1} and its molar conductance is 1.53 ohm^{-1} cm^2 mol^{-1}. The K_{sp} of $BaSO_4$ will be :
(A) 4×10^{-12} (B) 2.5×10^{-9} (C) 2.5×10^{-13} (D) 4×10^{-6}

75. Equivalent conductances of Ba^{+2} and Cl^- ions are 127 & 76 ohm^{-1} cm^2 eq^{-1} respectively. Equivalent conductance of $BaCl_2$ at infinite dilution is -
(A) 4×10^{-12} (B) 2.5×10^{-9} (C) 2.5×10^{-13} (D) 4×10^{-6}

76. The resistance of 0.5 M solution of an electrolyte in a cell was found to be 50 Ω. If the electrodes in the cell are 2.2 cm apart and have an area of 4.4 cm^2 then the molar conductivity (in S m^2 mol^{-1}) of the solution is
(A) 0.2 (B) 0.02 (C) 0.002 (D) None of these

77. Equivalent conductance of 0.1 M HA(weak acid) solution is 10 $Scm^2equivalent^{-1}$ and that at infinite dilution is 200 $Scm^2equivalent^{-1}$ Hence pH of HA solution is

(A) 1.3 (B) 1.7 (C) 2.3 (D) 3.7

78. If x is specific resistance of the electrolyte solution and y is the molarity of the solution, then $\wedge_m$ is given by

(A) $\frac{1000x}{y}$ (B) $1000\frac{y}{x}$ (C) $\frac{1000}{xy}$ (D) $\frac{xy}{1000}$

79. The dissociation constant of n-butyric acid is 1.6×10^{-5} and the molar conductivity at infinite dilution is $380 \times 10^{-4}\ Sm^2mol^{-1}$. The specific conductance of the 0.01 M acid solution is

(A) $1.52 \times 10^{-5}\ Sm^{-1}$ (B) $1.52 \times 10^{-2}\ Sm^{-1}$

(C) $1.52 \times 10^{-3}\ Sm^{-1}$ (D) None