DPP –7 Electrolytic Cell (Quantitative)

Chapter: Electrochemistry

"You cannot control the result. But you can control whether you were honest for the next 60 minutes. Be honest. Begin."

TYPE–1 : Basic Faraday's Law Calculations

1. **When 96500 C of electricity are passed through barium chloride solution, the amount of barium deposited will be :-**
   (1) 0.5 mol (2) 1.0 mol
   (3) 1.5 mol (4) 2.0 mol
2. **A silver cup is plated with silver by passing 965 A current for one second, the mass of Ag deposited is :–(At. wt. of Ag = 107.87)**
   (1) 9.89 g. (2) 107.87 g.
   (3) 1.0787 g. (4) 100.2 g.
3. **A 5 ampere current is passed through a solution of zinc sulphate for 40 minutes. The amount of zinc deposited at the cathode is**
   (1) 0.4065 g (2) 65.04 g
   (3) 40.65 g (4) 4.065 g
4. **The amount of Cu deposited when 10 A of current is passed for 10 minute through $CuSO_4$(aq) is**
   (1) 1.97 g (2) 2.89 g
   (3) 4 g (4) 3.5 g
5. **How many grams of cobalt metal will be deposited when a solution of cobalt(II) chloride is electrolyzed with a current of 10 amperes for 109 minutes?**
   (1 Faraday = 96,500 C; Atomic mass of Co = 59 u)
   (1) 0.66 (2) 4.0
   (3) 20.0 (4) 40.0
6. **Al_2O_3 is reduced by electrolysis at low potential and high current. If 4.0×10^4 A of current is passed through molten Al_2O_3 for 6 hours, what mass of aluminium is produced ? (Assume 100% current efficiency, At. mass of Al = 27 g mol^{-1})**
   (1) 1.3×10^4 g (2) 9.0×10^3 g
   (3) 8.1×10^4 g (4) 2.4×10^5 g
7. **When during electrolysis of a solution of $AgNO_3$ 9650 C of charge pass through the electroplating bath, the mass of silver deposited on the cathode will be :**
   (1) 21.6 g (2) 108 g
   (3) 1.08 g (4) 10.8 g
8. **A current of 9.65 A is passed through an aqueous solution of NaCl using suitable electrodes for 1000 s. Given that 1 faraday equals 96500 C the amount of NaOH (mol**

wt. 40.00) formed on electrolysis is :

(1) 2.0 g (2) 8.0 g

(3) 4.0 g (4) 1.0 g.

9. A current of 9.65 A is passed through the aqueous solution of NaCl using suitable electrodes for 1000 s. The amount of NaOH formed during electrolysis is

(1) 2.0 g (2) 4.0 g

(3) 6.0 g (4) 8.0 g

10. How many atoms of calcium will be deposited from molten $CaCl_2$ by a current of 25 milliamperes flowing for 60 seconds?

(1) 4.68×10^{18} (2) 4.68×10^{15}

(3) 4.68×10^{12} (4) 4.68×10^{19}

11. A solution of concentration $CuSO_4$ is electrolysed for 965 s with a current of 20 A and 50% efficiency. The amount of Cu deposited at cathode will be [NCERT Pg. 86]

(1) 4.175 g (2) 3.175 g

(3) 5.35 g (4) 6.35 g

12. A 100 watt, 110 volt lamp is connected in series with an electrolytic cell containing $CdSO_4$ solution, the weight of Cd deposited by the current for 10 hrs is (At. wt. of Cd = 112.4)

(1) 19.06 g (2) 38.12 g

(3) 1.906 g (4) 3.812 g

TYPE–2 : Time-Based Electrolysis Problems

13. The time taken by the galvanic cell which operates almost ideally under reversible conditions at a current of 10^{-16} A to deliver 1 mole of electron is

(1) 19.30×10^{20} s (2) 4.825×10^{20} s

(3) 9.65×10^{20} s (4) 3.4×10^{11} s

14. 36 g H_2O is electrolysed by passing 3 ampere current. What will be time required for complete decomposition (in hour) :-

(1) 17.87 hour (2) 15.84 hour

(3) 35.74 hour (4) 25.35 hour

15. During the electrolysis of molten sodium chloride, the time required to produce 0.10 mol of chlorine gas using a current of 3 A is

(1) 220 minutes (2) 330 minutes

(3) 55 minutes (4) 110 minutes

TYPE–3 : Electrons, Charge & Faraday Constants

16. The coulombic charge on one mole electron is

(1) 1.6×10^{-19} C

(2) 96500 C

(3) 6.02×10^{-23} C

(4) 1.6×10^{-23} C

17. **The number of electrons delivered at the cathode during electrolysis by a current of 1 A in 60 s is (charge on electron = 1.60×10^{-19} C)**
(1) 3.75×10^{20} (2) 7.48×10^{23}
(3) 6×10^{23} (4) 6×10^{20}

18. **The number of Faradays required to deposit 1g equivalent of aluminium (At.wt 27) from a solution of $AlCl_3$ is**
(1) 1 (2) 2
(3) 3 (4) 4

19. **How many Faraday's of charge are required to reduce 1 mol of $Cr_2O_7^{2-}$ to Cr^{+3}? [NCERT Pg. 88]**
(1) 6 F (2) 3 F
(3) 2 F (4) 1 F

20. **Faradays charge required for conversion of 1 mol MnO_4^- to Mn^{2+}, is**
(1) 5 (2) 2.5
(3) 3 (4) 7

21. **When 0.1 mol MnO_4^{2-} is oxidised the quantity of electricity required to completely oxidise MnO_4^{2-} to MnO_4^- is :-**
(1) 96500 C (2) 2×96500 C
(3) 9650 C (4) 96.50 C

22. **The charge required for the reduction of 1 mol of MnO_4^- to MnO_2 is :**
(1) 1F (2) 3F
(3) 5F (4) 7F

23. **How many faraday charge is required for $KMnO_4/Mn^{2+}$:-**
(1) 3F (2) 2F (3) 5F (4) 1F

24. **On electrolysis, 1 mole of calcium will be deposited from its molten salt by**
(1) 1 mole of electrons (2) 2 mole of electrons
(3) 3 mole of electrons (4) 4 mole of electrons

25. **One Faraday of electricity will liberate one mole of the metal from the solution of**
(1) Auric chloride (2) Silver nitrate
(3) Calcium chloride (4) Copper sulphate

26. **When electricity is passed through a solution of $AlCl_3$, 13.5 g Al is deposited. The number of Faradays must be :–**
(1) 5.0 (2) 1.0
(3) 1.5 (4) 3.0

27. **Amount of charge is required to convert 17 g H_2O_2 into O_2 :-**
(1) 1F (2) 2F
(3) 6F (4) None of these

28. **Aluminium oxide may be electrolysed at 1000 °C to furnish aluminium metal (At. Mass = 27 amu; 1 Faraday = 96500 C). The cathode reaction is $Al^{3+} + 3e^- \longrightarrow Al$**
To prepare 5.12 kg of aluminium metal by this method would require.
(1) 5.49×10^4 C of electric charge
(2) 5.49×10^1 C of electric charge
(3) 5.49×10^7 C of electric charge
(4) 1.83×10^7 C of electric charge

29. How many coulombs of electricity are required for the oxidation of 1 mol of H_2O to O_2 ?

(1) 9.65×10^4 C (2) 4.825×10^5 C

(3) 1.93×10^5 C (4) 1.93×10^4 C

TYPE–4 : Comparison & Ratio Problems (Series Cells)

30. 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)

(1) 22 kg (2) 18 kg

(3) 9 kg (4) 27 kg

31. 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 in the other cell is :-
(at. wt. of Ni = 59, at. wt. of Cr = 52)

(1) 0.1 g (2) 0.17 g

(3) 0.3 g (4) 0.6 g

32. Same quantity of current is passed through molten NaCl and molten Al_2O_3. If 2.3 g of Na was deposited in one cell, the mass of Al deposited in other cells

(1) 1.8 gm (2) 0.9 gm

(3) 2.7 gm (4) 3.6 gm

33. Same quantity of current is passed through molten NaCl and molten Al_2O_3. If 4.6 g of Na was deposited in one cell, the mass of Al deposited in other cell is :-

(1) 0.9 g (2) 1.8 g

(3) 2.7 g (4) 3.6 g

34. A direct current deposits 54 g of silver (atomic mass = 108) during the electrolysis. The same quantity of electricity would deposit aluminium (atomic mass = 27) from aluminium chloride in molten state equal to

(1) 4.5 g (2) 5.4 g

(3) 54 g (4) 27 g

35. The mass of carbon anode consumed (giving only carbon dioxide) in the production of 270 kg of aluminium metal from bauxite by the Hall process is (Atomic Mass of Al = 27)

(1) 270 kg (2) 540 kg

(3) 90 kg (4) 180 kg

36. Two different electrolytic cells are connected in series, containing aq.$AgNO_3$ and aq.$CuSO_4$ respectively. The mole ratio of copper to silver deposited at cathodes in the two cells will be [NCERT Pg. 85]

(1) $\left(\frac{2}{1}\right)$ (2) $\left(\frac{1}{2}\right)$

(3) $\left(\frac{3}{2}\right)$ (4) $\left(\frac{2}{3}\right)$

37. Two electrolytic cells one containing acidified ferrous chloride and another acidified

ferric chloride are connected in series. The ratio of iron deposited at cathodes in the two cells when electricity is passed through the cells will be :

(1) 3 : 1 (2) 2 : 1

(3) 1 : 1 (4) 3 : 2

38. What would be the ratio of moles each of Ag^{+}, Cu^{2+}, Fe^{3+} ions would be deposited by passage of same quantity of electricity through solutions of their salts :–

(1) 1 : 1 : 1

(2) $1 : \frac{1}{2} : \frac{1}{3}$

(3) $\frac{1}{3} : \frac{1}{2} : 1$

(4) 1 : 2 : 3

39. Four faradays of electricity were passed through $AgNO_3(\ell)$, $CdSO_4(\ell)$, $AlCl_3(\ell)$ and $PbCl_4(\ell)$ kept in four vessels using inert electrodes. The ratio of moles of Ag, Cd, Al and Pb deposited will be

(1) 12 : 4 : 6 : 3 (2) 1 : 2 : 3 : 4

(3) 12 : 6 : 4 : 3 (4) 4 : 3 : 2 : 1

40. Three faraday of electricity is passed through three electrolytic cells connected in series containing Ag^{+}, Ca^{2+} and Al^{3+} ions respectively. The molar ratio in which the three metal ions are liberated at the electrodes is

(1) 1 : 2 : 3 (2) 3 : 2 : 1

(3) 6 : 3 : 2 (4) 3 : 4 : 2

41. A current of 'i' A was passed for 't' s. through three cells P, Q and R connected in a series. These contain respectively silver nitrate, mercuric nitrate and mercurous nitrate. At the cathode of the cell P, 0.216 g of Ag was deposited. The weights of mercury deposited in the cathode of Q and R respectively are : (at. wt. of Hg = 200.59)

(1) 0.4012 g and 0.8024 g

(2) 0.4012 g and 0.2006 g

(3) 0.2006 g and 0.4012 g

(4) 0.1003 g and 0.2006 g

42. On passing electricity through dilute H_2SO_4 solution the amount of substance librated at the cathode and anode are in the ratio :

(1) 1 : 8 (2) 8 : 1

(3) 16 : 1 (4) 1 : 16

TYPE–5 Mass / Volume Deposited or Liberated :

43. When an electric current is passed through acidified water, 112 mL of hydrogen gas at STP collects at the cathode in 965 s. The current passed, in ampere is :

(1) 1.0 (2) 0.5

(3) 0.1 (4) 2.0

44. The volume of $O_2(g)$ released by 1 C electricity at NTP would be

(1) 5.6 L (2) $\frac{5.6}{96500}$ L

(3) $\frac{11.2}{96500}$ L (4) $\frac{22.4}{96500}$ L

45. **A certain current liberates 0.5 g of hydrogen in 2 hr. How many grams of copper can be deposited by the same current flowing for the same time in a copper sulphate solution?**
(1) 12.7 g (2) 15.9 g
(3) 31.8 g (4) 63.5 g

46. **The weight of silver (at wt. = 108) displaced by a quantity of electricity which displaces 5600 mL of O_2 at STP will be :-**
(1) 5.4 g (2) 10.8 g
(3) 54.0 g (4) 108.0 g

47. **An electrolytic cell contains aqueous solution of Ag_2SO_4 and has Platinum electrodes. A current is passed until 1.6 g of O_2 is liberated at anode. The amount of silver deposited at cathode would be**
(1) 107.88 g (2) 1.6 g
(3) 0.8 g (4) 21.6 g

48. **$CuSO_4$ (aq) electrolysed using platinum electrodes. A current is passed until 1.6 g of O_2 liberated at anode. The amount of Cu deposited at the cathode during same time period**
(1) 6.35 g (2) 63.5 g
(3) 12.7 g (4) 3.2 g

49. **When a quantity of electricity equal to that required to liberate 2.24 L of hydrogen at STP from 0.1 M aqueous H_2SO_4 is passed (At. mass of Cu = 63.5) then the mass of copper that will be deposited at cathode in electrolysis of 0.2 M solution of copper sulphate will be :**
(1) 1.59 g (2) 3.18 g
(3) 6.35 g (4) 12.70 g

50. **An electric current is passed through silver voltameter connected to a water voltameter. The cathode of the silver voltameter weighed 0.108 g more at the end of the electrolysis. The volume of oxygen evolved at STP is :**
(1) 56 cm^3 (2) 550 cm^3
(3) 5.6 cm^3 (4) 11.2 cm^3
(5) 22.4 cm^3

51. **A quantity of electric charge that brings about the deposition of 4.5 g Al from Al^{+3} at the cathode will also produce the following volume (STP) of $H_2(g)$ from H^+ at the cathode**
(1) 44.8 L (2) 22.4 L
(3) 11.2 L (4) 5.6 L

52. **If 0.224 L of H_2 gas is formed at the cathode, the volume of O_2 gas formed at the anode under identical conditions, is**
(1) 0.224 L (2) 0.448 L
(3) 0.112 L (4) 1.12 L

53. **What volume of gases at STP will evolve if 1 L of 0.01 M solution of H_2SO_4 is electrolysed?**
(1) 33.6 L (2) 336 ml
(3) 3.36 ml (4) 3.36 L

54. **During the electrolysis of water, 4 mol of electrons were transferred from anode to**

cathode. The total volume of gases produced at STP will be approximately

(1) 67.2 L (2) 22.4 L

(3) 44.8 L (4) 89.4 L

TYPE–6 : Electrochemical Equivalent & Reactions

55. Electrochemical equivalent of Cu in the reaction $Cu^{2+}(aq) + 2e^- \longrightarrow Cu$ is

(1) $\frac{63.5}{96.5}$ (2) $\frac{63.5}{96500 \times 2}$

(3) $\frac{63.5 \times 2}{96500}$ (4) $\frac{96500}{63.5 \times 2}$

56. The electrochemical equivalent of silver is 0.0011180 g. When an electric current of 0.5 A is passed through an aqueous silver nitrate solution for 200 s, the amount of silver deposited is :

(1) 1.1180 g (2) 0.11180 g

(3) 5.590 g (4) 0.5590 g

57. A current of 9.65 A flowing for 10 minute deposits 3.0 g of a metal. The equivalent weight of the metal is :

(1) 10 (2) 30

(3) 50 (4) 96.5

58. 10800 C of electricity through the electrolyte deposited 2.977 g of metal with atomic mass 106.4 g mol^{-1}. The charge on the metal cation is -

(1) +4 (2) +3

(3) +2 (4) +1

59. A current of 2.0 A is passed for 5 hours through a molten metal salt deposits 22.2 g of metal (At. mass: 177). The oxidation state of the metal in metal salt is

(1) +1 (2) +2

(3) +3 (4) +4

TYPE–7 : Advanced & Miscellaneous Problems

60. A current of 0.965 ampere is passed through 500 ml of 0.2 M solution of $ZnSO_4$ for 10 minutes. The molarity of Zn^{2+} after deposition of zinc is (Atomic mass of Zn is 65 u)

(1) 0.1 M (2) 0.5 M

(3) 0.8 M (4) 0.194 M

61. 1 L of 1 M $CuSO_4$ solution is electrolysed. After passing 2 F charge, the molarity of $CuSO_4$ will be

(1) M/2 (2) M/4

(3) M (4) zero

62. The quantity of electricity required to reduce 12.3 g of nitro benzene to aniline assuming 50% current efficiency is

(1) 115800 C (2) 57900 C

(3) 231600 C (4) 28950 C

63. **A galvanic cell is set up from a zinc bar weighing 100 g and 1.0 L of 1.0 M $CuSO_4$ solution. How long would the cell will run if it is assumed to deliver a steady current of 1.0 A. (Atomic mass of Zn = 65)**

(1) 1.1 hr. (2) 46 hr.

(3) 53.6 hr. (4) 24.00 hr.

64. **On the basis of the information available from the reaction of O_2,**

$\frac{4}{3}\,Al + O_2 \rightarrow \frac{2}{3}\,Al_2O_3, \quad \Delta G = -827\ kJ\ mol^{-1}$,

the minimum e.m.f. required to carry out electrolysis of Al_2O_3 is ($F = 96500\ C\ mol^{-1}$)

(1) 2.14 V (2) 4.28 V

(3) 6.42 V (4) 8.56 V