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CHEMISTRY

DAILY PRACTICE PAPER

(DPP) - 3

ELECTROCHEMISTRY – For Electrolysis

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Unit - Electrochemistry **Topic - Electrolysis**

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Objective Problems

01. The density of copper is 8.94 g mL^{-1}. Find the charge needed to plate an area of 10 × 10 cm^2 to a thickness of 10^{-2}cm using a $CuSO_4$ solution as electrolyte : (atomic weight of Cu = 63.6)

(A) 2.7×10^4C (B) 8.8×10^4C
(C) 18.3×10^4C (D) 1.7×10^4C

02. Acidified water was electrolysed using an inert electrode. The volume of gases liberated at STP was 168 mL. The amount of electricity passed through the acidified water was

(A) 96,500C (B) 9,650C (C) 965C (D) 168C

03. A current of 2.6 ampere was passed through $CuSO_4$ solution for 380 sec. The amount of Cu deposited is (at. wt. of Cu = 63.5)

(A) 0.325g (B) 0.635g (C) 6.35g (D) 3.175g

04. Salts of A (atomic weight 7), B (atomic weight 27) and C (atomic weight 48) were electrolysed under identical condition using the same quantity of electricity. It was found that when 2.1 g of A was deposited, the weights of B and C deposited were 2.7 and 7.2 g. The valencies of A, B and C respectively

(A) 3, 1 and 2 (B) 1, 3 and 2
(C) 3, 1 and 3 (D) 2, 3 and 2

05. Passage of three faraday of charge through aqueous solution of $AgNO_3$, $CuSO_4$, $Al(NO_3)_3$ and NaCl respectively will deposit the metals in the ratio(molar)

(A) 1 : 2 : 3 : 1 (B) 6 : 3 : 2 : 6
(C) 6 : 3 : 0 : 0 (D) 3 : 2 : 1 : 0

06. Lead storage battery contains

(A) Pb rods battery contains
(B) Electrolyte is H_2SO_4
(C) Pb plates coated with PbO_2 act as cathode
(D) All the above

07. How many coulomb are required to deposit 28 gm Mg on passing through molten $MgCl_2$ in the presence of Pt electrodes

(A) 229166.67 (B) 225166.67
(C) 32600 C (D) 325166.75

08. Calculate the vol. of gas liberated at anode at NTP from electrolysis of $CuSO_4$ solution by current of four ampere passed for 10 minutes.

(A) 0.07 litre (B) 0.14 litre
(C) 0.0696 litre (D) None of these

09. The cost of electricity required to deposite 1 g of Mg is Rs 5.00. How much would it cost to deposite 30 gm of Al.

(A) 10.00 Rs (B) 27.00 Rs
(C) 66.67 Rs (D) 200 Rs

10. When 9.65 coulombs of electricity is passed through a solution of silver nitrate (atomic mass of Ag = 108 g mol^{-1}), the amount of silver deposited is

(A) 16.2 mg (B) 21.2 mg
(C) 10.8 mg (D) 6.4 mg

11. The quantity of electricity needed to deposit 127.08 g of copper is

(A) 1 Faraday (B) 4 coulombs
(C) 4 Faraday (D) 1 ampere

12. The charge required to deposit 9 g of Al from Al^{3+} solution is (At. wt. of Al = 27)

(A) 3216.3 C (B) 96500 C
(C) 9650 C (D) 32163 C

13. A smuggler could not carry gold by depositing iron on the gold surface since

(A) Gold of denser
(B) Iron rusts
(C) Gold has higher reduction potential than iron
(D) Gold has lower reduction potential than iron

14. Which of the following reaction is possible at anode ?

(A) $2Cr^{3+} + 7H_2O \longrightarrow Cr_2O_7^{2-} + 14H^+$
(B) $F_2 \longrightarrow 2F^-$
(C) $\frac{1}{2}O_2 + 2H^+ \longrightarrow H_2O$
(D) None of these

15. The most convenient method to protect the botom of ship made of iron is

(A) Coating it with red lead oxide
(B) White tin plating
(C) Connecting it with Mg block
(D) Connecting it with Pb block

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16. Electrolytic reduction of alumina to aluminium by Hall–Heroult process is carried out

(A) in the presence of NaCl
(B) in the presence of fluorite
(C) in the presence of cryolite which forms a melt with lower melting temperature.
(D) in the presence of cryolite which forms a melt with higher melting temperature.

17. What is the amount of chlorine evolved when 2 amperes of current is passed for 30 minutes in an aqueous solution of NaCl?

(A) 66 g (B) 1.32 g (C) 33 g (D) 99 g

18. When the sample of copper with zinc impurity is to be purified by electrolysis, the appropriate electrodes are

	Cathode	Anode
(A)	Pure zinc	Pure copper
(B)	Impure sample	Pure copper
(C)	Impure zinc	Impure sample
(D)	Pure copper	Impure sample

19. Faraday's laws of electrolysis are related to the

(A) Atomic number of carbon
(B) Atomic number of anion
(C) Equivalent mass of the products
(D) Speed of cations

20. The electric charge for electrode deposition of one gram equivalent of a substance is

(A) One ampere per second
(B) 96500 coulombs per second
(C) One ampere for one hour
(D) Charge on one mole of electrons

21. A galvanic cell is set up from a zinc bar weighing 50 g and 1.0 litre of 1.0 M, $CuSO_4$ solution. How long would the cell run, assuming it delivers a steady current of 1.0 ampere :

(A) 48 hrs (B) 41 hrs (C) 21 hrs (D) 1 hrs

22. The quantity of electricity needed to deposit 127.08 g of copper is

(A) 2 Faraday (B) 4 coulombs
(C) 4 Faraday (D) 1 Ampere

23. In the standardization of $Na_2S_2O_3$ using $K_2Cr_2O_7$ by using iodometry, the equivalent weight of $K_2Cr_2O_7$ is

(A) molecular weight / 2
(B) molecular weight / 6
(C) molecular weight / 3
(D) same as molecular weight

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

(A) H_2, O_2 (B) O_2, H_2
(C) O_2, Na (D) O_2, SO_2

25. 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

26. A certain current liberated 0.504 g of hydrogen in 2 hours. How many grams of copper can be liberated by the same current flowing for the same time in $CuSO_4$ solution?

(A) 12.7 g (B) 15.9 g
(C) 31.8 g (D) 63.5 g

27. A 5 A current is passed through a solution of zinc sulphate for 40 minutes. Find the amount of zinc deposited at the cathode

(A) 40.65 g (B) 4.065 g
(C) 0.4065 g (D) 65.04 g

28. The current in a given wire is 1.8 A. In 1.36 minutes the number of coulombs transferred in wire is

(A) 136.44 C (B) 138.88 C
(C) 146.88 C (D) 150.66 C

29. 1 A of current is passed to supply 72000 C of change in

(A) 10 h (B) 5 h
(C) 10 h (D) 20 h

30. The metal that does not displace hydrogen from an acid is

(A) Al (B) Ca (C) Zn (D) Hg

31. Zn gives H_2 gas with H_2SO_4 and HCl but not with HNO_3 because

(A) Zn acts as oxidising agent when reacts with HNO_3
(B) HNO_3 is weaker acid then H_2SO_4 and HCl
(C) in electrochemical series Zn is above hydrogen
(D) NO_3^- is reduced in preference to hydronium ion

32. In the silver plating of copper, $K[Ag(CN)_2]$ is used instead of $AgNo_3$. The reason is

(A) a thin layer of Ag is formed on Cu
(B) more voltage is required
(C) Ag^+ ions are completely removed from solution
(D) less availability of Ag^+ ions, as Cu cannot displace Ag from $[Ag(CN)_2]^-$ ion

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33. In electrolysis of NaCl when Pt electrode is taken then H_2 is liberated at cathode while with Hg cathode it forms sodium amalgam because

(A) Hg is more inert than Pt

(B) more voltage is required to reduce H^+ at Hg than at Pt

(C) Na is dissolved in Hg while it does not dissolve in Pt

(D) conc. of H^+ ions is larger when Pt electrode is taken

34. Through a solution of $CuSO_4$ a current of 3 amperes was passed for 2 hours. At cathode 3 g of Cu^{2+} ions were discharged. The current efficiency is [At wt. of Cu = 63.5]

(A) 33% (B) 42.2% (C) 48.7% (D) 54.4%

35. For reducing 1 mol of $Cr_2O_7^{2-}$ to Cr^{3+} the charge required is

(A) 3 x 96500 C (B) 6 x 96500 C

(C) 0.3 F (D) 0.6 F

36. Which of the following reactions is used to make a fuel cell?

(A) $Cd(s) + 2Ni(OH)_3(s) \rightarrow CdO(s) + 22Ni(OH)_2(s) + H_2O(l)$

(B) $Pb(s) + PbO_2(s) + 2H_2SO_4(aq) \rightarrow 2PbSO_4(s) + 2H_2O(l)$

(C) $2H_2(g) + O_2(g) \rightarrow 2H_2O(l)$

(D) $2Fe(s) + O_2(g) \rightarrow 2Fe^{2+}(aq) + 2H_2O(l)$

37. Time required to deposit 1 milimol of aluminium metal by the passage of 9.65 amperes through aqueous solution of aluminium ion is

(A) 30 s (B) 10 s (C) 30000 s (D) 10000 s

38. Electrolysis rule of Faraday's states that mass deposited on electrode is proportional to

(A) $M \alpha I$ (B) $M \alpha Q$

(C) $M \alpha Q^2$ (D) $M \alpha I^2$

39. The amount of chlorine evolved by passing 2 A of current in an aqueous solution of NaCl for 30 minutes is

(A) 0.84 g (B) 1.32 g (C) 3.34 g (D) 5.47 g

40. By passing 0.50 ampere current in an aqueous solution 0.5 g of an element (eq. wt. = 96.5) is liberated. The time of passing current in seconds is

(A) 100 s (B) 500 s (C) 1000 s (D) 2000 s

41. The metal that does not displace hydrogen from an acid is

(A) Al (B) Ca (C) Zn (D) Hg

42. The electroplating technique was given by

(A) Brugan (B) Edison

(C) Thomas Graham (D) Faraday

43. In an aqueous solution hydrogen will not reduce

(A) Ag^+ (B) Cu^{2+} (C) Zn^{2+} (D) Fe^{3+}

44. When a Zn strip is placed in $CuSO_4$ solution, the cu gets precipitated because standard oxidation potential of Zn is

(A) < Cu (B) > Cu (C) < SO_4 (D) > SO_4

45. The efficiency of a fuel cell is given by

(A) $\frac{\Delta H}{\Delta G}$ (B) $\frac{\Delta G}{\Delta S}$ (C) $\frac{\Delta G}{\Delta H}$ (D) $\frac{\Delta S}{\Delta G}$

46. In an electrolytic cell, which of the following statement is not true?

(A) Cathode is negative terminal.

(B) Cathode is positive terminal.

(C) Reduction occures at cathode.

(D) Electorns enter into cathode from the external cell.

47. In lead storage battery, during discharging process

(A) PbO_2 gets oxidised

(B) H_2SO_4 is produced

(C) density of H_2SO_4 solution decreases

(D) density of H_2SO_4 solution increases

48. Which of the following statements is correct for a solid-state lithium battery?

(A) The electrolyte is made of a polymer material that permits the passage of electrons but not ions, and the battery is not rechargable.

(B) The electrolyte is made of a polymer material that permits the passage of ions but not electrons, and the battery is rechargable.

(C) The voltage of the battery can go up to 12 Volt.

(D) The anode is made of what is known as an insertion compound.

49. Electrolysis of a solutoin of $MnSO_4$ in aqueous sulphuric acid is a method for the preparation of MnO_2 as per reaction

$Mn^{2+}(aq.) + 2H_2O \rightleftharpoons MnO_2(s) + 2H^+(aq) + H_2(g)$

Passing a current of 27 A for 24 hours gives one kg of MnO_2. What is the value of current efficiently

(A) 50% (B) 94.8% (C) 95.9% (D) 78.3%

50. Calculate the quantity of electricity that would be required to reduce 12.3 g of nitrobenzene to aniline. If current efficient is 50%. If the potential drops across the cell is 3.0 volts

(A) 369000 C (B) 115800 C

(C) 32100 C (D) 521900 C

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51. During the elctrolysis of $AgNO_3$ (using Pt electrodes) concentration around cathode as well as anode falls from 4 M to 3 M. What will happen if this happened with Ag electrodes:

(A) Result will remain same

(B) Concentration around cathode will fall from 4 M to 3 M but around anode will increases from 4 M to 5 M.

(C) Reverse of statement 'b'

(D) Concentration increases from 4 M to 5 M on both the electrodes

52. A solution containing one mole per litre of each $Cu(NO_3)_2$; $AgNO_3$; $Hg_2(NO_3)_2$; $Mg(NO_3)_2$ is being electrolysed by using inert electrodes. The values of standard electrode potentials in volts are: Ag^+/Ag = +0.80 V, Hg_2^{2+}/Hg = +0.79 V; Cu^{2+}/Ci = +0.34 V and Mg^{2+}/Mg = –2.37 V. With increasing voltage, the sequence of deposition of metals on the cathode will be :

(A) Ag, Hg, Cu, Mg (B) Mg, Cu, Hg, Ag

(C) Ag, Hg, Cu (D) Cu, Hg, Ag

53. In corrosion of iron:

(A) an electrochemical (galvanic cell) is formed in which Fe acts as anode and cathode where O_2 is reduced

(B) electrons flow from anode to cathode through the metal while ions flow through the water droplets

(C) dissolved O_2 oxidizes Fe^{2+} to Fe^{3+} before it is deposited as rust ($Fe_2O_3 . H_2O$)

(D) all of the above takes place.

54. When the electric current is passed through a cell having an electrolyte, the positive ions move towards cathode and negative ions towards the anode. If the cathode is pulled out of the solution

(A) the positive and negative ions will move towards anode

(B) the positive ions will start moving towards the anode while negative ions will stop moving

(C) the negative ions will continue to move towards anode while positive ions will stop moving

(D) the positive and negative ions will start moving randomly

55. The position of some metals in the electrochemical series in decreasing electropositive character is given as Mg > Al > Zn > Cu > Ag. What will happen if a copper spoon is used to stir a solution of aluminium nitrate?

(A) The spoon will get coated with aluminium

(B) An alloy of aluminium and copper nitrate

(C) The solution becomes blue

(D) There is no reaction

Subjective Problems

01. 0.2864 g of Cu was deposited on passage of a current of 0.5 ampere for 30 minutes through a solution of copper sulphate. What is the electrochemical equivalent of copper? (1 F = 96500 coulomb;At. wt. of Cu = 63.5)

Ans. 3.18×10^{-4} g/coulomb

02. Calculate how much current is necessary to produce hydrogen gas at the rate of 1 cc per second under standard conditions.

Ans. 8.62 amp

03. In an industrial electrolytic cell it is desired to produce 36 kg of magnesium metal per hour. Calculate the current required. (Mg = 24)

Ans. 8.04×10^4 amp

04. In the electrolysis of an aqueous $SnCl_2$ solution, 4.48 litres of chlorine (in standard conditions) is liberated at the anode. Find the mass of tin deposited at the cathode. (Sn = 119; Cl = 35.5)

Ans. 23.80g

05. In the electrolysis of an aqueous solution of NaOH, 2.8 litres of oxygen was liberated at the anode at NTP. Calculate the volume of hydrogen gas at NTP liberated at the cathode?

Ans. 5.6 litres

06. 30 ml of 0.13 M of $NiSO_4$ is electrolysed using a current of 360 milliamperes for 35.3 minutes. How much of the metal would have been plated out if current efficiency was only 60%? (At. wt. of Ni = 58.7)

Ans. 0.1391 g

07. Calculate the quantity of electricity that would be required to reduce 12.3 g of nitrobenzene to aniline, if the current efficiency for the process is 50%. If the potential drop across the cell is 3 volts, how much energy will be consumed?

Ans. 115800C, 347.40kJ

10. How long a current of 3 amp has to be passed through a solution of $AgNO_3$ to coat a metal surface of 80 cm^2 with 0.005 mm thick layer? Density of Ag is 10.5 g/cm^3; At. wt. of Ag = 108.

Ans. 125 sec (appox)

11. A 100-watt, 110-volt incandescent lamp is connected in series with an electrolytic cell containing Cadmium sulphate solution. What weight of cadmium will be deposited by the current flowing for 10 hours?(At. wt. of Cd = 112.4)

Ans. 19.060 g

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09. After electrolysis of a sodium chloride (NaCl) solution with inert electrodes for a certain period of time, 600 ml of the solution was left which was found to be 1 N in sodium hydroxide. During the same time 31.75 g of Cu was deposited in a Cu voltmeter in series with the electrolytic cell. Calculate the percentage of theoretical yield of the sodium hydroxide obtained. (At. wt. of Cu = 63.5)

Ans. 60%

08. Potassium chlorate is prepared by electrolysis of KCl in basic solution:

$6OH^- + Cl^- \rightarrow ClO_3^- + 3H_2O + 6e^-$

If only 60% of the current is utilised in the reaction, what time will be required to produce 10 g of $KClO_3$ using a current of 2 amp? (At. wt.: K = 39; Cl = 35.5; O =16)

Ans. 10.95 hours

12. A mixture of hydrogen and oxygen is evolved when a dilute solution of NaOH is electrolysed. How many moles of each gas would be liberated by a current which deposited 20.942 g of Ag?(At. wt. of Ag = 108)

Ans. 9.695×10^{-2} moles of H_2; 4.848×10^{-2} moles of O_2

13. A current of 3.7 amp is passed for 6 hours between inert electrodes in 0.5 litre of a 2M solution of $Ni(NO_3)_2$. What will be the molarity of the solution at the end of electrolysis?

Ans. 1.172 M

14. A current of 1.70 A is passed through 300 ml of 0.16 M solution of $ZnSO_4$ for 230 seconds with a current efficiency of 90%. Find out molarity of Zn^{2+} after the deposition of Zn. Assume the volume of the solution to remain constant during the electrolysis.

Ans. 0.153 M

17. 19 g of molten $SnCl_2$ is electrolysed for some time using inert electrodes until 0.119 g of Sn is deposited at the cathode. No substance is lost during electrolysis. Find the ratio of the masses of $SnCl_2$: $SnCl_4$ after electrolysis.

Ans. 71.34 : 1

15. For the electrolytic production of $NaClO_4$ from $NaClO_3$ as per reactions:

$ClO^-_3 + H_2O \rightarrow ClO^-_4 + 2H^+ + 2e^-$

(i) How many faraday of electricity would be required to produce 1 mole of $NaClO_4$?

(ii) What volume of H_2 at STP would be liberated at the cathode in the time that it takes to form 12.25 g of $NaClO_4$?

Ans. 2 F, 2.24 litres

16. During the discharge of a lead storage battery the density of sulphuric acid fell from 1.294 to 1.139 $g.ml^{-1}$. H_2SO_4 of density 1.294 g mL^{-1} is 39% and that of density 1.39 g mL^{-1} is 20% by weight. The battery holds 3.5L of acid and the volume practically remains constant during the discharge. Calculate the number of ampere hours for which the battery must have been used. The discharging reactions are:

$Pb + SO_4^{2-} \rightarrow PbSO_4 + 2e^-$ (anode)

$PbO_2 + 4H^+ + SO_4^{2-} + 2e^- \rightarrow PbSO_4 + 2H_2O$ (cathode)

Ans. 265 Amp. hr.

18. A current of 1.70 ampere is passed through 300 mL of 0.160 M solution of zinc suphate for 230 seconds with a current efficiency of 90 per cent. Find out the molarity of Zn^{2+} ions after the deposition of zinc. Assume the volume of the solution to remain constant during electrolysis.

Ans. 0.154M

19. Same quantity of electricity is being used to liberate iodine (at anode) and a metal x (at cathode). The mass of x liberated is 0.617 g and the iodine liberated is completely reduced by 46.3 cc of 0.124 M sodium thiosulphate. Find the equivalent mass of metal x.

Ans. Eq.wt = 107.468

20. Assume that impure copper contains only iron, silver and a gold as impurities. After passage of 140 A, for 482.5 sec, of the mass of the anode decreased by 22.260 g and the cathode increased in mass by 22.011 g. Estimate the %ge of iron and %ge of copper originally present.

Ans. Cu = 98.88%, Fe = 0.85%

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ANSWER KEYS

Chapter – Electrochemistry

Topic – Electrolysis

DPP – 3

Q.	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15
Ans.	A	C	A	B	C	D	B	D	D	C	C	B	C	A	C
Q.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	C	B	D	C	D	C	C	B	A	C	B	B	C	D	D
Q.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	D	D	B	B	B	C	A	B	B	C	D	D	C	B	C
Q.	46	47	48	49	50	51	52	53	54	55					
Ans.	B	C	B	B	B	B	C	D	D	D					

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Regards from Learnaf team

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