

NCERT



CHAPTER WISE TOPIC WISE

LINE BY LINE QUESTIONS

2024



BY
SCHOOL OF
EDUCATORS

Electrode Potential
Potential difference between electrode and electrolyte.
 $E_{cell} = E^0_{right} - E^0_{left}$

Also known as Daniell Cell:

Cathode: Copper
Anode: Zinc
Salt bridge: $ZnSO_4, CuSO_4$
Electrolyte: $ZnSO_4, CuSO_4$
Cell reaction:
 $Zn + CuSO_4 \rightarrow ZnSO_4 + Cu$
Cell representation:
 $Zn | ZnSO_4(aq) || CuSO_4(aq) | Cu$

Corrosion

Electro chemical phenomenon in which metal oxide of metal forms coating on metal surface.

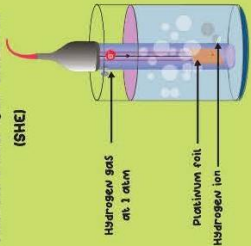
Prevention

Painting, barrier protection, rust solution.

Example

Rusting of iron, Furnishing of silver.

Standard Hydrogen electrode (SHE)



For SHE, $E_{cell} = 0$

Standard Half-Reaction	$E^0(V)$
Stronger oxidising agent	2.87
$F_2(g) + 2e^- \rightarrow 2F^-(aq)$	2.87
$H_2O_2(aq) + 2H^+(aq) + 2e^- \rightarrow 2H_2O(l)$	1.78
$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O(l)$	1.51
$Cl_2(g) + 2e^- \rightarrow 2Cl^-(aq)$	1.36
$Cr_2O_7^{2-}(aq) + 14H^+(aq) + 6e^- \rightarrow 2Cr^{3+}(aq) + 7H_2O(l)$	1.33
$O_2(g) + 4H^+(aq) + 4e^- \rightarrow 2H_2O(l)$	1.23
$Br_2(l) + 2e^- \rightarrow 2Br^-(aq)$	1.09
$AgCl(s) + e^- \rightarrow Ag(s) + Cl^-(aq)$	0.80
$Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$	0.77
$IO_3^-(aq) + 6H^+(aq) + 5e^- \rightarrow I_2(s) + 3H_2O(l)$	0.70
$UO_2^{2+}(aq) + 4H^+(aq) + 2e^- \rightarrow U^{4+}(aq) + 2H_2O(l)$	0.54
$O_2(g) + 2H^+(aq) + 2e^- \rightarrow H_2O(l)$	0.40
$Cu^{2+}(aq) + 2e^- \rightarrow Cu(s)$	0.34
$Sr^{2+}(aq) + 2e^- \rightarrow Sr(s)$	0.15
$2H^+(aq) + 2e^- \rightarrow H_2(g)$	0
$Pb^{2+}(aq) + 2e^- \rightarrow Pb(s)$	-0.13
$Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$	-0.26
$Ca^{2+}(aq) + 2e^- \rightarrow Ca(s)$	-0.40
$Fe^{2+}(aq) + 2e^- \rightarrow Fe(s)$	-0.45
$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$	-0.76
$2H^+(aq) + 2e^- \rightarrow H_2(g)$	0.83
$Al^{3+}(aq) + 3e^- \rightarrow Al(s)$	1.46
$Mg^{2+}(aq) + 2e^- \rightarrow Mg(s)$	2.37
Stronger reducing agent	2.71
$Li^{+}(aq) + e^- \rightarrow Li(s)$	3.04

Battery

(Primary)

(reaction occurs only once cannot be reused)

(Secondary)

(can be recharged by pairing current & in opposite direction.)

Mercury

Anode: Zn-Hg
Cathode: Paste HgO & C
Electrolyte: Paste of $NH_4Cl + ZnCl_2$

Lectanche cell (dry cell)

Zn Graphite Powdered $MnO_2 + C +$ Paste of $NH_4Cl + ZnCl_2$

Lead Storage battery Ni-cd cell

Pb + PbO
 H_2SO_4 (38% by loss)

Electrochemistry

Electrical Properties

Conductance (G) = $\frac{1}{Resistance}$
Unit: Ohm^{-1} or Siemens
Specific conductivity (K) = $G \cdot \frac{l}{a}$ (l = cell constant)
Unit: $Ohm^{-1} cm^{-1}$ or $S cm^{-1}$
Molar conductance (Λ_m) = $\frac{1000 \times K}{M}$
Unit: $S cm^2 mol^{-1}$
Equivalent conductance (Λ_{eq}) = $\frac{1000 \times K}{N}$
Unit: $cm^2 ohm^{-1} g^{-eq^{-1}}$

Kohlrausch's Law of Independent Migration of Ions

At infinite dilution the molar conductivity of electrolyte is given by sum of ionic conductivities of cation & anions.

$\Lambda_m^0 = \nu_+ \lambda_+^0 + \nu_- \lambda_-^0$

APPLICATION

1 To determine Λ_m^0 & λ_{ion}^0 of weak electrolyte infinite dilution.

2 To calculate degree of dissociation or dissociation constant of weak electrolyte.
 $\alpha = \frac{\Lambda_m}{\Lambda_m^0}$
 $\alpha = \frac{\nu_+}{\nu_+ + \nu_-}$

3 To calculate dissociation constant of weak electrolyte.
 $k_c = \frac{c - x}{1 - x}$

Faraday's 1st Law

Amount of chemical reactions which occurs at any electrode during electrolysis is proportional to the quantity of electricity passed through electrolyte $\rightarrow w = zit$

Faraday's 2nd Law

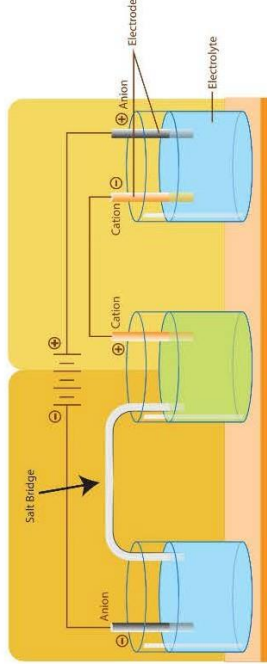
Amount of substance deposited at electrodes during electrolysis is proportional to their chemical equivalents weights $\rightarrow \frac{w_1}{E_1} = \frac{w_2}{E_2} = \frac{w_3}{E_3}$

Faraday Laws

Quantitative aspects

Quantitative aspect depend on

Galvanic/Voltaic Cell



Electrolytic Cell

Device converting electrical energy into chemical energy.

Anode \rightarrow +vely charged: oxidation occurs
Cathode \rightarrow -vely charged: reduction occurs

Cell representation
Oxidation half / Reduction half

Nature of Electrode

Medium of Electrolyte

NCERT LINE BY LINE QUESTIONS

- (1.) In hydrogen-oxygen fuel cell, combustion of hydrogen occurs to
- (a.) Produce high purity water (b.) Create potential difference between two electrodes
- (c.) generate heat (d.) remove adsorbed oxygen from electrode surface
- (2.) Fluorine is a best oxidising agent because it has
- (a.) highest electron affinity (b.) highest E°_{red}
- (c.) highest E°_{oxid} (d.) lowest electron affinity
- (3.) (180.) E° for the half cell $\text{Zn}^{2+} / \text{Zn}$ is -0.76 emf of the cell
 $\text{Zn} / \text{Zn}^{2+} (1\text{M}) \parallel 2\text{H}^+ (1\text{M}) | \text{H}_2 (1 \text{ atm})$ is
- (a.) -0.76V
- (b.) $+0.76$
- (c.) -0.38V
- (d.) $+0.38\text{V}$
- (4.) The electrolyte used in Leclanche cell
- (a.) Paste of KOH and ZnO (b.) 38% solution of H_2SO_4
- (c.) Moist paste of NH_4Cl and ZnCl_2 (d.) Moist NaOH
- (5.) **Assertion:** $E_{\text{Ag}^+/\text{Ag}}$ increases with increase in concentration of Ag^+ ions.
Reason: $E_{\text{Ag}^+/\text{Ag}}$ has a positive value.
- (a.) Both A and R are true and R is correct explanation of A. (b.) Both A and R are true and R is not correct explanation of A.
- (c.) A is true but R is false. (d.) Both A and R are false.
- (6.) Hydrogen electrode is placed in the solution where pH is 10. The potential of this electrode will be
- (a.) $+0.591\text{ V}$ (b.) -0.591 V
- (c.) 0 V (d.) none of these
- (7.) For a reaction
 $\text{A(s)} + 2\text{B}^+ \rightarrow \text{A}^{2+} + 2\text{B(s)}$
 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
- (8.) The order of equivalent conductance at infinite dilution of LiCl, NaCl and KCl?
- (a.) $\text{LiCl} > \text{NaCl} > \text{KCl}$ (b.) $\text{KCl} > \text{NaCl} > \text{LiCl}$
- (c.) $\text{NaCl} > \text{KCl} > \text{LiCl}$ (d.) $\text{LiCl} > \text{KCl} > \text{NaCl}$
- (9.) The reference electrode is made by using

- (a.) ZnCl_2 (b.) CuSO_4
 (c.) HgCl_2 (d.) Hg_2Cl_2

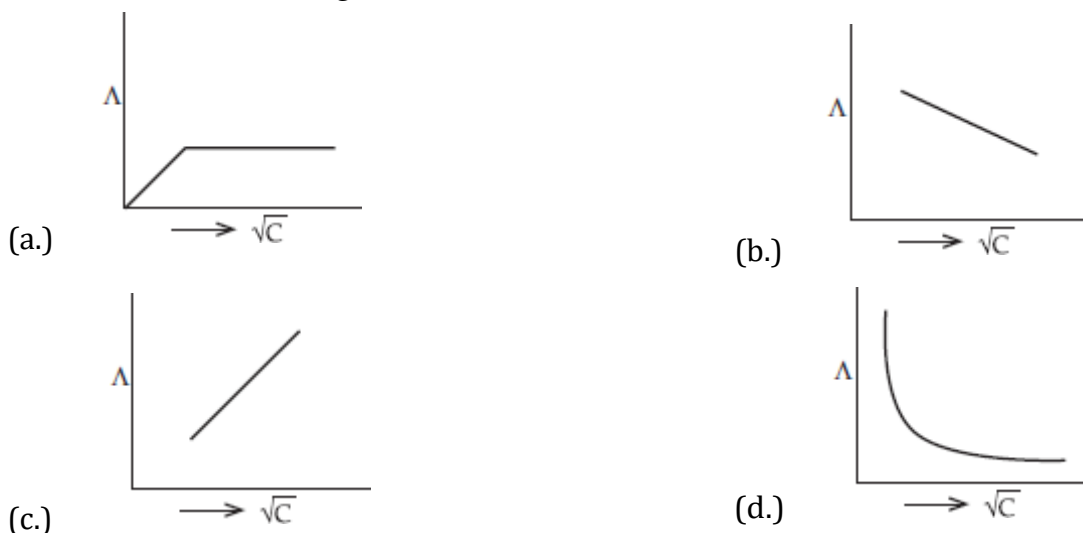
(10.) Which one of the following is a strong electrolyte?

- (a.) $\text{Ca}(\text{NO}_3)_2$ (b.) HCN
 (c.) H_2SO_3 (d.) NH_4OH

(11.) Which of the following decrease on dilution of electrolyte solution?

- (a.) equivalent conductance (b.) molar conductance
 (c.) specific conductance (d.) conductance

(12.) The variation of equivalent conductance of strong electrolyte with concentration is correctly shown in which figure:



(13.) The quantity of charge required to obtain one mole of aluminum from Al_2O_3 is

- (a.) 1 F (b.) 6 F
 (c.) 3 F (d.) 2 F

(14.) Electrolysis of H_2SO_4 (conc.) gives the following at anode?

(A) H_2 (B) O_2 (C) $\text{H}_2\text{S}_2\text{O}_3$ (D) $\text{H}_2\text{S}_2\text{O}_8$

- (a.) $\Lambda = \frac{X \times 1000}{0.1}$ (b.) $\Lambda = \frac{2 \times 1000}{X \times 0.1}$
 (c.) $\Lambda = \frac{X \times 1000}{0.5}$ (d.) $\Lambda = \frac{0.5}{1000X}$

(15.) Using the data given below find out the strong oxidising agent

$$E^\circ_{\text{Cl}_2\text{O}_7/\text{Cr}^{3+}} = 1.33\text{V} \quad E^\circ_{\text{Cl}_2/\text{Cl}^-} = 1.36\text{V}$$

$$E^\circ_{\text{MnO}_4^-/\text{Mn}^{2+}} = 1.51\text{V} \quad E^\circ_{\text{Cr}^{3+}/\text{Cr}} = -0.74\text{V}$$

- (a.) Cl^-
 (b.) Mn^{2+}
 (c.) MnO_4^-

(d.) Cr^{3+}

(16.) E° for the cell $\text{Zn}|\text{Zn}^{2+}(\text{aq})||\text{Cu}^{2+}(\text{aq})/\text{Cu}$ is 1.10V at 25°C . The equilibrium constant for the cell reaction

$\text{Zn} + \text{Cu}^{2+}(\text{aq}) \rightleftharpoons \text{Cu} + \text{Zn}^{2+}(\text{aq})$ is of the order of

(a.) 10^{-37}

(b.) 10^{37}

(c.) 10^{-17}

(d.) 10^{17}

(17.) When dil. HNO_3 is electrolysed

(a.) $\text{H}_2(\text{g})$ is formed at anode

(b.) $\text{O}_2(\text{g})$ is formed at anode

(c.) NO_2 is formed at anode

(d.) N_2 is formed at anode

(18.) The equivalent conductivity of a solution containing 2.54 g of CuSO_4 per litre is $91\Omega^{-1}\text{cm}^2\text{eq}^{-1}$. Its conductivity would be

(a.) $2.9 \times 10^{-3}\Omega^{-1}\text{cm}^{-1}$

(b.) $1.8 \times 10^{-2}\Omega^{-1}\text{cm}^{-1}$

(c.) $2.4 \times 10^{-4}\Omega^{-1}\text{cm}^{-1}$

(d.) $3.6 \times 10^{-3}\Omega^{-1}\text{cm}^{-1}$

(19.) Prevention of corrosion of iron by zinc coating is called

(a.) electrolysis

(b.) Photoelectrolysis

(c.) cathodic protection

(d.) galvanization

(20.) Which of the following is not an anodic reaction?

(a.) $\text{Ag}^+ \rightarrow \text{Ag} - \text{e}^-$

(b.) $\text{Cu} \rightarrow \text{Cu}^{2+} + 2\text{e}^-$

(c.) $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+} + \text{e}^-$

(d.) $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2 + 4\text{e}^-$

(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

(a.) 96500 C

(b.) $2 \times 96500\text{C}$

(c.) 9650 C

(d.) 96.50 C

(22.) The oxidation potential of a hydrogen electrode at $\text{pH} = 1$ is ($T = 298\text{K}$)

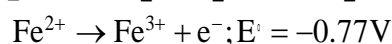
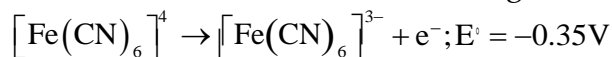
(a.) 0.059 V

(b.) 0

(c.) -0.059 V

(d.) 0.59 V

(23.) On the basis of E° values, the strongest oxidizing agent is



(a.) Fe^{3+}

(b.) $[\text{Fe}(\text{CN})_6]^{3-}$

(c.) $[\text{Fe}(\text{CN})_6]^{4-}$

(d.) Fe^{2+}

(24.) Molar conductance (Λ_m°) at infinite dilution of NaCl, HCl and CH_3COONa are 126.4, 425.9 and $91.0 \text{ Scm}^2\text{mol}^{-1}$ resp.

Λ_m° for CH_3COOH will be

- (a.) $425.5 \text{ Scm}^2\text{mol}^{-1}$ (b.) $180.5 \text{ Scm}^2\text{mol}^{-1}$
(c.) $290.8 \text{ Scm}^2\text{mol}^{-1}$ (d.) $390.5 \text{ Scm}^2\text{mol}^{-1}$

(25.) The passage of electricity in the Daniel cell when Zn and Cu electrodes are connected is:

- (a.) From Cu to Zn in the cell (b.) From Cu to Zn outside the cell
(c.) From Zn to Cu outside the cell (d.) In any direction of cell

(26.) KCl is used in salt bridge because [

- (a.) it forms a good jelly with agar-agar (b.) it is a strong electrolyte
(c.) it is a good conductor of electricity (d.) the transference number of K^+ and Cl^- ions are almost equal

(27.) The cell constant of a conductivity cell —

- (a.) changes with change of electrolyte (b.) changes with change of concentration of electrolyte
(c.) change with temperature of electrolyte (d.) remains constant for a cell

(28.) The number of electrons delivered at the cathode during the electrolysis by a current of 1 A in 60 seconds is (charge one electron = $1.6 \times 10^{-19} \text{ C}$)

- (a.) 6×10^{23} (b.) 6×10^{20}
(c.) 3.75×10^{20} (d.) 7.48×10^{23}

(29.) The specific conductance in $\text{ohm}^{-1}\text{cm}^{-1}$ of four electrolytes P, Q, R and S are given below:

$$P = 5 \times 10^{-5}$$

$$Q = 7 \times 10^{-8}$$

$$R = 1 \times 10^{-10}$$

$$S = 9.2 \times 10^{-3}$$

The one that offers highest resistance to the passage of current is

- (a.) P (b.) S
(c.) R (d.) Q

(30.) Which of the following is a cathode $\text{R} \times \text{N}$?

- (a.) $\text{Fe}^{2+} \rightarrow \text{Fe}^{3+}$ (b.) $4\text{OH}^- \rightarrow 2\text{H}_2\text{O} + \text{O}_2$
(c.) $2\text{H}_2\text{O} \rightarrow 2\text{OH}^- + \text{H}_2$ (d.) $2\text{SO}_4^{2-} \rightarrow \text{S}_2\text{O}_8^{2-}$

(31.) If the E_{cell}° for a given reaction has negative value, which of the following gives the correct relationship for the values of ΔG° and K_{eq} ?

- (a.) $\Delta G^\circ > 0; K_{\text{eq}} < 1$ (b.) $\Delta G^\circ > 0; K_{\text{eq}} > 1$
(c.) $\Delta G^\circ < 0; K_{\text{eq}} > 1$ (d.) $\Delta G^\circ < 0; K_{\text{eq}} < 1$

(32.) Cell reaction is spontaneous when

- (a.) ΔG^\ddagger is negative
 (c.) $\Delta E_{\text{red}}^\circ$ is positive

- (b.) ΔG° is positive
 (d.) $\Delta E_{\text{red}}^\circ$ is negative

(33.) For a given half cell: $\text{Al}^{3+} + 3\text{e}^- \rightarrow \text{Al}$, on increasing $[\text{Al}^{3+}]$, the electrode potential

- (a.) increase
 (c.) No change
- (b.) decrease
 (d.) first decrease then increase

(34.) **Assertion:** Mercury cell does not give steady potential.

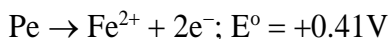
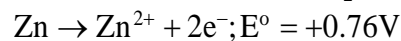
Reason: In the cell reaction, ions are not involved in solution.

- (a.) Both A and R are true but R is correct explanation of A.
 (c.) A is true bur R is false.
- (b.) Both A and R are true and R is not correct explanation of A.
 (d.) A is false but R is true.

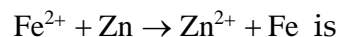
(35.) Which of the following statements is not correct about an inert electrode in a cell

- (a.) It does not participate in the cell reaction.
 (c.) It provides surface for the conduction of electrons.
- (b.) It provides the surface either for oxidation or reduction reaction.
 (d.) It provides surface for redox reaction.

(36.) The standard oxidation potentials for the half cell reactions are



The emf of the cell reaction:



- (a.) -0.35V
 (c.) $+1.17\text{V}$
- (b.) $+0.35\text{V}$
 (d.) -1.17V

(37.) (186.) Zn cannot displace following ions from their aqueous solution:

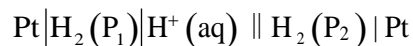
- (a.) Ag^+
 (c.) Fe^{2+}
- (b.) Cu^{2+}
 (d.) Na^+

(38.) Matrix match.

Column 1	Column 2
(A) Λ_m	(p) Scm^{-1}
(B) E_{cell}	(q) m^{-1}
(C) K	(r) $\text{Scm}^2\text{mol}^{-1}$
(D) G^\ddagger	(s) V

- (a.) $A \rightarrow r, B \rightarrow p, C \rightarrow q, D \rightarrow s$
 (c.) $A \rightarrow r, B \rightarrow s, C \rightarrow p, D \rightarrow q$
- (b.) $A \rightarrow r, B \rightarrow s, C \rightarrow p, D \rightarrow q$
 (d.) $A \rightarrow r, B \rightarrow q, C \rightarrow p, D \rightarrow s$

(39.) What will be the emf for the given cell



- (a.) $\frac{RT}{F} \log e \frac{P_1}{P_2}$ (b.) $\frac{RT}{2F} \log e \frac{P_1}{P_2}$
(c.) $\frac{RT}{F} \log e \frac{P_2}{P_1}$ (d.) none of the above

(40.) How much electric charge is required to oxidize 1 mole of FeO to Fe_2O_3 ?

- (a.) 49600 C (b.) $2 \times 96500\text{C}$
(c.) 96500 C (d.) $4 \times 96500\text{C}$

(41.) **Assertion:** Λ_m for weak electrolytes show a sharp increase when the electrolytic solution is diluted. **Reason:** For weak electrolytes degree of dissociation increases with dilution of solution.

- (a.) Both A and R are true and R is correct explanation of A. (b.) Both A and R are true and R is not correct explanation of A.
(c.) A is true but R is false. (d.) Both A and R are false.

(42.) Which one is not called a anode reaction from the following?

- (a.) $\text{Cl}^- \rightarrow \frac{1}{2} \text{Cl}_2 + e^-$ (b.) $\text{Cu} \rightarrow \text{Cu}^{2+} + 2e^-$
(c.) $\text{Hg}^+ \rightarrow \text{Hg}^{2+} + e^-$ (d.) $\text{Zn}^{2+} + 2e^- \rightarrow \text{Zn}$

(43.) The unit of equivalent conductivity is

- (a.) ohm cm (b.) $\text{ohm}^{-1}\text{cm}^2 (\text{g equivalent})^{-1}$
(c.) $\text{ohm cm}^2 (\text{g equivalent})$ (d.) S cm^{-2}

(44.) The molar conductivity of a 0.5 mol/dm^3 solution of AgNO_3 with electrolytic conductivity of $5.76 \times 10^{-3} \text{ S cm}^{-1}$ at 298 K is

- (a.) $2.88 \text{ S cm}^2 / \text{mol}$ (b.) $11.52 \text{ S cm}^2 / \text{mol}$
(c.) $0.086 \text{ S cm}^2 / \text{mol}$ (d.) $28.8 \text{ S cm}^2 / \text{mol}$

(45.) **Assertion:** Cu is less reactive than hydrogen.

Reason: $E_{\text{Cu}^{2+}/\text{Cu}}^\circ$ is negative.

- (a.) Both A and R are true R is correct explanation of A. (b.) Both A and R are true and R is not the correct explanation of A.
(c.) A is true but reason is false. (d.) Both A and R are false.

(46.) The emf of the cell $\text{Zn} | \text{Zn}^{2+} (a = 0.1/1\text{M}) || \text{Fe}^{2+} (a = 0.01\text{M}) / \text{Fe}$ is 0.2905 V. The equilibrium constant for the cell reaction is

- (a.) $10^{0.32/0.591}$ (b.) $10^{0.32/0.0295}$
(c.) $10^{0.26/0.0295}$ (d.) $10^{0.32/0.295}$

- (47.) How many moles of electrons are needed for the reduction of 20 ml of 0.5 M solution of KMnO_4 in acidic medium
- (a.) 5×10^{-2} (b.) 5×10^{-3}
 (c.) 10^{-2} (d.) 10^{-5}
- (48.) Standard reduction potentials at 25°C , Li^+/Li , Ba^{2+}/Ba , Na^+/Na and Mg^{2+}/Mg are -3.05 , -2.90 , -2.71 and -2.37V respectively. Which one of the following is strongest oxidising agent?
- (a.) Ba^{2+} (b.) Mg^{2+}
 (c.) Na^+ (d.) Li^+
- (49.) How many gram of cobalt metal will be deposited when a solution of cobalt (II) chloride is electrolyzed with a current of 10 A for 109 minutes ($1\text{F} = 96500\text{C}$, atomic mass of $\text{Co} = 59\text{u}$)
- (a.) 4.0 (b.) 20.0
 (c.) 40.0 (d.) 0.66
- (50.) In SHE, the pH of acid solution should be
- (a.) 7 (b.) 14
 (c.) 0 (d.) 4

TOPIC WISE PRACTICE QUESTIONS

TOPIC 1: Cells and Electrode Potential

- The function of a salt bridge is to
 - maintain electrical neutrality of both half cells.
 - increase the cell potential at the positive electrode.
 - decrease the cell potential at the negative electrode.
 - eliminated the impurities present in the electrolyte.
- Standard electrode potential of SHE at 298 K is:
 - 0.05 V
 - 0.10 V
 - 0.50 V
 - 0.00 V
- The standard EMF of quinhydrone electrode is 0.699 V. The EMF of the quinhydrone electrode dipped in a solution with $\text{pH} = 10$ is:
 - 0.109 V
 - 0.109 V
 - 1.289 V
 - 1.289 V
- $E_{\text{Fe}^{2+}/\text{Fe}}^\circ = -0.441\text{V}$ and $E_{\text{Fe}^{3+}/\text{Fe}^{2+}}^\circ = +0.771\text{V}$ the standard EMF of the reaction $\text{Fe} + 2\text{Fe}^{3+} \rightarrow 3\text{Fe}^{2+}$ will be
 - 1.653 V
 - 1.212 V
 - 0.111 V
 - 0.330 V
- In the electrolytic cell, flow of electrons is from
 - cathode to anode in solution.
 - cathode to anode through external supply.
 - cathode to anode through internal supply.
 - anode to cathode through internal supply.
- Which device converts chemical energy of a spontaneous redox reaction into electrical energy?
 - Galvanic cell
 - Electrolytic cell
 - Daniell cell
 - both 1) and 3)
- Which of the following reaction is possible at anode?
 - $2\text{Cr}^{3+} + 7\text{H}_2\text{O} \rightarrow \text{Cr}_2\text{O}_7^{2-} + 14\text{H}^+$
 - $\text{F}_2 \rightarrow 2\text{F}^-$
 - $(1/2)\text{O}_2 + 2\text{H}^+ \rightarrow \text{H}_2\text{O}$
 - None of these
- Which one is not called a anode reaction from the following?
 - $\text{Cl}^- \rightarrow \frac{1}{2}\text{Cl}_2 + \text{e}^-$
 - $\text{Cu} \rightarrow \text{Cu}^{++} + 2\text{e}^-$
 - $\text{Hg}^+ \rightarrow \text{Hg}^{++} + \text{e}^-$
 - $\text{Zn}^{2+} + 2\text{e}^- \rightarrow \text{Zn}$

9. Which one of the following statement is true for a electrochemical cell?
 1) H₂ is cathode and Cu is anode. 2) H₂ is anode and Cu is cathode.
 3) Reduction occurs at H₂ electrode. 4) Oxidation occurs at Cu electrode.
10. $Zn(s) | Zn^{2+}(aq) || Cu^{2+}(aq) | Cu(s)$ is
 (anode) (cathode)
 1) Weston cell 2) Daniel cell 3) Calomel cell 4) Faraday cell
11. If the following half cells have E° values as
 $A^{3+} + e^{-} \rightarrow A^{2+}, E^{\circ} = y_2 V$
 $A^{2+} + 2e^{-} \rightarrow A, E^{\circ} = -y_1 V$
 The E° of the half-cell $A^{3+} + 3e^{-} \rightarrow A$ will be
 1) $\frac{2y_1 - y_2}{3}$ 2) $\frac{y_2 - 2y_1}{3}$ 3) $2y_1 - 3y_2$ 4) $y_2 - 2y_1$
12. A concentration cell is a galvanic cell in which
 1) Decrease in free energy in a spontaneous chemical process appears as electrical energy.
 2) Decrease in free energy in a spontaneous physical process appears as electrical energy.
 3) Decrease in free energy in a spontaneous physical or chemical process appears as electrical energy.
 4) A non-spontaneous physical or chemical process produces electrical energy.
13. Based on the cell notation for a spontaneous reaction, at the anode :
 $Ag(s) | AgCl(s) | Cl^{-}(aq) || Br^{-}(aq) | Br_2(l) | C(s)$
 1) AgCl gets reduced 2) Ag gets oxidized 3) Br⁻ gets oxidized 4) Br₂ gets reduced
14. Zn can displace:
 1) Mg from its aqueous solution. 2) Cu from its aqueous solution.
 3) Na from its aqueous solution. 4) Al from its aqueous solution.
15. The oxidation potential of a hydrogen electrode at pH = 10 and H₂ p = 1 atm is
 1) -0.59 V 2) 0.00 V 3) +0.59 V 4) 0.059 V
16. The tendency of an electrode to lose electrons is known as
 1) Electrode potential 2) reduction potential 3) Oxidation potential 4) e.m.f.
17. A smuggler could not carry gold by depositing iron on the gold surface since
 1) Gold is denser 2) iron rusts
 3) Gold has higher reduction potential than iron 4) Gold has lower reduction potential than iron
18. The correct order of E°_{M²⁺/M} values with negative sign for the four successive elements Cr, Mn, Fe and Co is
 1) Mn > Cr > Fe > Co 2) Cr < Fe > Mn > Co 3) Fe > Mn > Cr > Co 4) Cr > Mn > Fe > Co

TOPIC 2: Nernst Equation

19. The E° at 25 °C for the following reaction is 0.22 V. Calculate the equilibrium constant at 25° C :
 $H_2(g) + 2AgCl(s) \rightarrow 2Ag(s) + 2HCl(aq)$
 1) 2.8×10^7 2) 5.2×10^8 3) 5.2×10^6 4) 5.2×10^3
20. For the given Nernst equation

$$E_{\text{cell}} = E^{\circ}_{\text{cell}} - \frac{RT}{2F} \ln \frac{[Mg^{2+}]}{[Ag^+]^2}$$
 Which of the following representation is correct?
 (a) $Ag^+ | Ag || Mg^{2+} | Mg$ (b) $Mg^{2+} | Mg || Ag | Ag^+$
 (c) $Mg | Mg^{2+} || Ag^+ | Ag$ (d) $Mg | Mg^{2+} || Ag | Ag^+$
21. For a given reaction: $M(x+n) + ne^{-} \rightarrow M^{x+}$, E⁻ red is known along with M^(x+n) and M^{x+} ion concentrations. Then
 1) n can be evaluated. 2) x can be evaluated.
 3) (x + n) can be evaluated. 4) n, x, (x + n) can be evaluated.
22. Without losing its concentration ZnCl₂ solution cannot be kept in contact with
 1) Au 2) Al 3) Pb 4) Ag
23. The oxidation potentials of A and B are +2.37 and +1.66 V respectively. In chemical reactions
 1) A will be replaced by B 2) A will replace B

- 3) A will not replace B
4) A and B will not replace each other
24. The emf of the cell
 $\text{Ni} | \text{Ni}^{2+} (1.0 \text{ M}) || \text{Au}^{3+} (1.0 \text{ M}) | \text{Au}$ is
 [Given $E^{\circ} \text{Ni}^{2+} / \text{Ni} = -0.25 \text{ V}$ and $E^{\circ} \text{Au}^{3+} / \text{Au} = +1.5 \text{ V}$]
 1) 2.00 V 2) 1.25 V 3) -1.25 V 4) 1.75 V
25. In the cell reaction
 $\text{Cu(s)} + 2\text{Ag}^+(\text{aq}) \rightarrow \text{Cu}^{2+}(\text{aq}) + 2\text{Ag(s)}$,
 $E^{\circ}_{\text{cell}} = 0.46 \text{ V}$. By doubling the concentration of Cu^{2+} , E°_{cell} will become
 1) Doubled 2) halved
 3) Increases but less than double 4) decreases by a small fraction
26. Following cell has EMF 0.7995V.
 $\text{Pt} | \text{H}_2 (1 \text{ atm}) | \text{HNO}_3 (1 \text{ M}) || \text{AgNO}_3 (1 \text{ M}) | \text{Ag}$
 If we add enough KCl to the Ag cell so that the final Cl^- is 1M. Now the measured emf of the cell is 0.222 V. The K_{sp} of AgCl would be –
 1) $1 \times 10^{-9.8}$ 2) $1 \times 10^{-19.6}$ 3) 2×10^{-10} 4) 2.64×10^{-14}
27. In a cell that utilises the reaction
 $\text{Zn(s)} + 2\text{H}^+(\text{aq}) \rightarrow \text{Zn}^{2+}(\text{aq}) + \text{H}_2(\text{g})$ addition of H_2SO_4 to cathode compartment, will
 1) Increase the E and shift equilibrium to the right
 2) Lower the E and shift equilibrium to the right
 3) Lower the E and shift equilibrium to the left
 4) Increase the E and shift equilibrium to the left
28. At equilibrium:
 1) $E^{\circ}_{\text{cell}} = 0, \Delta G^{\circ} = 0$ 2) $E_{\text{cell}} = 0, \Delta G = 0$ 3) Both are correct 4) None is correct
29. Equivalent conductivity can be expressed in terms of specific conductance (κ) and concentration (N) in gram equivalent dm^{-3} as :
 1) $\kappa \times N$ 2) $\frac{\kappa \times 1000}{N}$ 3) $\frac{\kappa \times N}{1000}$ 4) $\kappa \times N \times 1000$
30. The ionic conductivity of Ba^{2+} and Cl^- at infinite dilution are 127 and 76 $\text{ohm}^{-1} \text{cm}^2 \text{eq}^{-1}$ respectively. The equivalent conductivity of BaCl_2 at infinity dilution (in $\text{ohm}^{-1} \text{cm}^2 \text{eq}^{-1}$) would be :
 1) 203 2) 279 3) 101.5 4) 139.5
31. The increase in equivalent conductivity of a weak electrolyte with dilution is due to
 1) increase in degree of dissociation and decrease in ionic mobility.
 2) decrease in degree of dissociation and decrease in ionic mobility.
 3) increase in degree of dissociation and increase in ionic mobility.
 4) decrease in degree of dissociation and increase in ionic mobility.
32. For a relation
 $\Delta_r G = -nFE_{\text{cell}}$
 $E_{\text{cell}} = E^{\circ}_{\text{cell}}$ in which of the following condition?
 1) Concentration of any one of the reacting species should be unity
 2) Concentration of all the product species should be unity.
 3) Concentration of all the reacting species should be unity.
 4) Concentration of all reacting and product species should be unity.
33. If x is the specific resistance of the solution and N is the normality of the solution, the equivalent conductivity of the solution is given by
 1) 1000 x/N 2) $1000/\text{Nx}$ 3) 1000N/x 4) $\text{Nx}/1000$
34. For an electrolyte solution of 0.05 mol L^{-1} , the conductivity has been found to be 0.0110 S cm^{-1} . The molar conductivity is
 1) $0.055 \text{ S cm}^2 \text{mol}^{-1}$ 2) $550 \text{ S cm}^2 \text{mol}^{-1}$ 3) $0.22 \text{ S cm}^2 \text{mol}^{-1}$ 4) $220 \text{ S cm}^2 \text{mol}^{-1}$
35. On which of the following magnitude of conductivity does not depends?
 1) Nature of material 2) Temperature 3) Pressure 4) Mass of the material
36. The resistance of 0.01 N solution of an electrolyte was found to be 220 ohm at 298 K using a conductivity cell with a cell constant of 0.88 cm^{-1} . The value of equivalent conductance of solution is –
 1) $400 \text{ mho cm}^2 \text{g eq}^{-1}$ 2) $295 \text{ mho cm}^2 \text{g eq}^{-1}$

37. 3) $419 \text{ mho cm}^2 \text{ g eq}^{-1}$ 4) $425 \text{ mho cm}^2 \text{ g eq}^{-1}$
 The correct order of equivalent conductance at infinite dilution of LiCl, NaCl and KCl is
 1) LiCl > NaCl > KCl 2) KCl > NaCl > LiCl
 3) NaCl > KCl > LiCl 4) LiCl > KCl > NaCl
38. Which of the following expression correctly represents molar conductivity?
 1) $\Lambda_m = \frac{K}{C}$ 2) $\Lambda_m = \frac{KA}{1}$ 3) $\Lambda_m = KV$ 4) all of these
39. At 25°C , the molar conductance at infinite dilution for the strong electrolytes NaOH, NaCl and BaCl_2 are 248×10^{-4} , 126×10^{-4} and $280 \times 10^{-4} \text{ Sm}^2\text{mol}^{-1}$ respectively.
 $\Lambda_m^0 \text{ Ba(OH)}_2$ in $\text{S m}^2\text{mol}^{-1}$ is
 1) 52.4×10^{-4} 2) 524×10^{-4} 3) 402×10^{-4} 4) 262×10^{-4}
40. The ion of least limiting molar conductivity among the following is
 1) SO_4^{2-} 2) H^+ 3) Ca^{2+} 4) CH_3COO^-
41. Specific conductance of a 0.1 N KCl solution at 23°C is $0.012 \text{ ohm}^{-1} \text{ cm}^{-1}$. Resistance of cell containing the solution at same temperature was found to be 55 ohm. The cell constant is
 1) 0.0616 cm^{-1} 2) 0.66 cm^{-1} 3) 6.60 cm^{-1} 4) 660 cm^{-1}
42. The equivalent conductances of two strong electrolytes at infinite dilution in H_2O (where ions move freely through a solution) at 25°C are given below:
 $\Lambda_{\text{CH}_3\text{COONa}}^0 = 91.0 \text{ S cm}^2 / \text{equiv.}$
 $\Lambda_{\text{HCl}}^0 = 426.2 \text{ S cm}^2 / \text{equiv.}$
 What additional information/ quantity one needs to calculate Λ^0 of an aqueous solution of acetic acid?
 1) Λ^0 of chloroacetic acid (ClCH_2COOH) 2) Λ^0 of NaCl
 3) Λ^0 of CH_3COOK 4) the limiting equivalent conductance of H^+ ($\lambda_{\text{H}^+}^0$)

TOPIC 4: Electrolysis and Types of Electrolysis

43. The electric charge required for electrode deposition of one gram - equivalent of a substance is :
 1) one ampere per second. 2) 96500 coulombs per second.
 3) one ampere for one hour. 4) charge on one mole of electrons.
44. How many minutes will it take to plate out 5.2 g of Cr from a $\text{Cr}_2(\text{SO}_4)_3$ solution using a current of 9.65 A?
 (Atomic mass: Cr = 52.0)
 1) 200 2) 50 3) 100 4) 103
45. Which of the following is the use of electrolysis?
 1) Electrorefining 2) Electroplating 3) Both 1) & 2) 4) None of these
46. By virtue of Faraday's second law of electrolysis, the electrochemical equivalent of the two metals liberated at the electrodes has the same ratio as that of their
 1) atomic masses 2) molecular masses 3) equivalent masses 4) any of three
47. In electrolysis of very dilute NaOH using platinum electrodes
 1) H_2 is evolved at cathode and O_2 at anode 2) NH_3 is produced at anode
 3) Cl_2 is obtained at cathode
 4) O_2 is produced at cathode and H_2 at anode
48. Reaction that takes place at graphite anode in dry cell is
 1) $\text{Zn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Zn}(\text{s})$ 2) $\text{Zn}(\text{s}) \rightarrow \text{Zn}^{2+}(\text{aq}) + 2\text{e}^-$
 3) $\text{Mn}^{2+}(\text{aq}) + 2\text{e}^- \rightarrow \text{Mn}(\text{s})$ 4) $\text{Mn}(\text{s}) \rightarrow \text{Mn}^+(\text{aq}) + \text{e}^- + 1.5\text{V}$
49. Electrolysis of fused NaCl will give
 1) Na 2) NaOH 3) NaClO 4) None of these
50. An unknown metal M displaces nickel from nickel (II) sulphate solution but does not displace manganese from manganese sulphate solution. Which order represents the correct order of reducing power?
 1) $\text{Mn} > \text{Ni} > \text{M}$ 2) $\text{Ni} > \text{Mn} > \text{M}$ 3) $\text{Mn} > \text{M} > \text{Ni}$ 4) $\text{M} > \text{Ni} > \text{Mn}$

51. A solution of sodium sulphate in water is electrolysed using inert electrodes. The products at the cathode and anode are respectively
 1) H_2, O_2 2) O_2, H_2 3) O_2, Na 4) O_2, SO_2
52. If 0.5 amp. current is passed through acidified silver nitrate solution for 100 minutes. The mass of silver deposited on cathode, is (eq.wt.of silver = 108)
 1) 2.3523 g 2) 3.3575 g 3) 5.3578 g 4) 6.3575 g
53. Find the charge in coulombs required to convert 0.2 mole VO_3^{2-} into VO_4^{3-}
 1) 1.93×10^4 2) 9.65×10^4 3) 1.93×10^5 4) 9.65×10^5
54. The amount of electricity that can deposit 108 g of Ag from AgNO_3 solution is:
 1) 1 F 2) 2 A 3) 1 C 4) 1 A
55. Three faradays electricity was passed through an aqueous solution of iron (II) bromide. The weight of iron metal (at. wt = 65) deposited at the cathode (in gm) is
 1) 56 2) 84 3) 112 4) 168

TOPIC 5: Commercial Cell and Corrosion

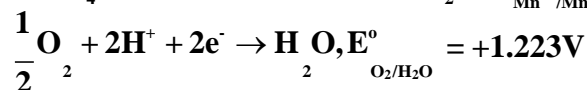
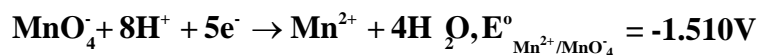
56. Which of the following statement is false for fuel cells?
 1) They are more efficient 2) They are free from pollution
 3) They run till reactants are active 4) Fuel burned with O_2
57. Among the following cells:
 (i) Leclanche cell (ii) Nickel-Cadmium cell (iii) Lead storage battery (iv) Mercury cell
 primary cells are
 1) (i) and (ii) 2) (i) and (iii) 3) (ii) and (iii) 4) (i) and (iv)
58. Identify the correct statement :
 1) Corrosion of iron can be minimized by forming a contact with another metal with a higher reduction potential.
 2) Iron corrodes in oxygen free water
 3) Corrosion of iron can be minimized by forming an impermeable barrier at its surface.
 4) Iron corrodes more rapidly in salt water because its electrochemical potential is higher.
59. Several blocks of magnesium are fixed to the bottom of a ship
 1) make the ship lighter. 2) prevent action of water and salt.
 3) prevent puncturing by under-sea rocks. 4) keep away the sharks.
60. Which of the following batteries cannot be reused?
 1) Lead storage battery 2) Ni-Cd cell 3) Mercury cell 4) Both (2) and (3)

NEET PREVIOUS YEARS QUESTIONS

1. In the electrochemical cell :
 $\text{Zn} | \text{ZnSO}_4 (0.01\text{M}) || \text{CuSO}_4 (1.0\text{M}) | \text{Cu}$, the emf of this Daniel cell is E_1 . When the concentration of ZnSO_4 is changed to 1.0M and that of CuSO_4 changed to 0.01M, the emf changes to E_2 . From the followings, which one is the relationship between E_1 and E_2 ? (Given, $RT/F = 0.059$) [2017]
 1) $E_1 < E_2$ 2) $E_1 > E_2$ 3) $E_2 = 0 \neq E_1$ 4) $E_1 = E_2$
2. The pressure of H_2 required to make the potential of H_2 -electrode zero in pure water at 298 K is : [2016]
 1) 10^{-14} atm 2) 10^{-12} atm 3) 10^{-10} atm 4) 10^{-4} atm
3. A device that converts energy of combustion of fuels like hydrogen and methane, directly into electrical energy is known as : [2015]
 1) Electrolytic cell 2) Dynamo 3) Ni-Cd cell 4) Fuel Cell
4. When 0.1 mol MnO_4^{2-} is oxidised the quantity of electricity required to completely oxidise MnO_4^{2-} to MnO_4^- is: [2014]
 1) 96500 C 2) 2×96500 C 3) 9650 C 4) 96.50 C

5. The weight of silver (at wt. = 108) displaced by a quantity of electricity which displaces 5600 mL of O₂ at STP will be :-
[2014]
 1) 5.4 g 2) 10.8 g 3) 54.9 g 4) 108.0 g
6. For a cell involving one electron $E_{\text{cell}}^{\ominus} = 0.59\text{V}$ at 298 K, the equilibrium constant for the cell reaction is :-
 [Given that $\frac{2.303RT}{F} = 0.059\text{V}$ at $T = 298\text{K}$] **[2019]**
 (1) 1.0×10^2 (2) 1.0×10^5 (3) 1.0×10^{10} (4) 1.0×10^{30}
7. For the cell reaction $2\text{Fe}^{3+}(\text{aq}) + 2\text{I}^{-}(\text{aq}) \rightarrow 2\text{Fe}^{2+}(\text{aq}) + \text{I}_2(\text{aq})$
 $E_{\text{cell}}^{\ominus} = 0.24\text{V}$ at 298 K. The standard Gibbs energy ($\Delta^{\circ}G^{\ominus}$) of the cell reaction is : **[2019]**
 [Given that Faraday constant $F = 96500\text{C mol}^{-1}$]
 (1) -46.32kJ mol^{-1} (2) -23.16kJ mol^{-1} (3) 46.32kJ mol^{-1} (4) 23.16kJ mol^{-1}
8. Following limiting molar conductivities are given as **[2019-ODISSA]**
 $\lambda_{\text{m}(\text{H}_2\text{SO}_4)}^{\circ} = x\text{Scm}^2\text{mol}^{-1}$
 $\lambda_{\text{m}(\text{K}_2\text{SO}_4)}^{\circ} = y\text{Scm}^2\text{mol}^{-1}$
 $\lambda_{\text{m}(\text{CH}_3\text{COOK})}^{\circ} = z\text{Scm}^2\text{mol}^{-1}$
 $\lambda_{\text{m}}^{\circ}$ (in $\text{Scm}^2\text{mol}^{-1}$) for CH_3COOH will be
 (1) $x - y + 2z$ (2) $x + y - z$ (3) $x - y + z$ (4) $\frac{(x - y)}{2} + z$
9. The standard electrode potential (E_{\circ}) values of Al^{3+}/Al , Ag^{+}/Ag , K^{+}/K and Cr^{3+}/Cr are .1.66 V, 0.80V, -- 2.93 V and -0.74V , respectively. The correct decreasing order of reducing power of the metal is : **[2019-ODISSA]**
 (1) $\text{Ag} > \text{Cr} > \text{Al} > \text{K}$ (2) $\text{K} > \text{Al} > \text{Cr} > \text{Ag}$ (3) $\text{K} > \text{Al} > \text{Ag} > \text{Cr}$ (4) $\text{Al} > \text{K} > \text{Ag} > \text{Cr}$
10. Identify the reaction from following having top position in EMF series (Std.red. potential) according to their electrode potential at 298 K. **[2020-COVID-19]**
 (1) $\text{Mg}^{2+} + 2\text{e}^{-} \rightarrow \text{Mg}(\text{s})$ (2) $\text{Fe}^{2+} + 2\text{e}^{-} \rightarrow \text{Fe}(\text{s})$ (3) $\text{Au}^{3+} + 3\text{e}^{-} \rightarrow \text{Au}(\text{s})$ (4) $\text{K}^{+} + \text{e}^{-} \rightarrow \text{K}(\text{s})$
11. In a typical fuel cell, the reactants (R) and product (P) are :- **[2020-COVID-19]**
 (1) $\text{R} = \text{H}_2(\text{g}), \text{O}_2(\text{g}); \text{P} = \text{H}_2\text{O}_2(\text{l})$ (2) $\text{R} = \text{H}_2(\text{g}), \text{O}_2(\text{g}); \text{P} = \text{H}_2\text{O}(\text{l})$
 (3) $\text{R} = \text{H}_2(\text{g}), \text{O}_2(\text{g}), \text{Cl}_2(\text{g}); \text{P} = \text{HClO}_4(\text{aq})$ (4) $\text{R} = \text{H}_2(\text{g}), \text{N}_2(\text{g}); \text{P} = \text{NH}_3(\text{aq})$
12. On electrolysis of dil sulphuric acid using platinum (Pt) electrode, the product obtained at anode will be **[2020]**
 1. SO_2 gas 2. Hydrogen gas 3. Oxygen gas 4. H_2S gas
13. The number of Faradays (F) required to produce 20g of calcium from molten CaCl_2 (Atomic mass of Ca = 40g mol^{-1}) is **[2020]**
 1) 4 2) 1 3) 2 4) 3
14. The molar conductance of NaCl , HCl and CH_3COONa at infinite dilution are 126.45, 426.16 and $91.0\text{S cm}^2\text{mol}^{-1}$ respectively. The molar conductance of CH_3COOH at infinite dilution is. Choose the right option for your answer **[NEET-2021]**
 1) $390.71\text{S cm}^2\text{mol}^{-1}$ 2) $698.28\text{S cm}^2\text{mol}^{-1}$ 3) $540.48\text{S cm}^2\text{mol}^{-1}$ 4) $201.28\text{S cm}^2\text{mol}^{-1}$
15. The molar conductivity of 0.007 M acetic acid is $20\text{S cm}^2\text{mol}^{-1}$. What is the dissociation constant of acetic acid? Choose the correct option. **[NEET-2021]**
 $\left[\Lambda_{\text{H}^{+}}^{\circ} = 350\text{S cm}^2\text{mol}^{-1} \right]$
 $\left[\Lambda_{\text{CH}_3\text{COO}^{-}}^{\circ} = 50\text{S cm}^2\text{mol}^{-1} \right]$
 1) $2.50 \times 10^{-4}\text{mol L}^{-1}$ 2) $1.75 \times 10^{-5}\text{mol L}^{-1}$ 3) $2.50 \times 10^{-5}\text{mol L}^{-1}$ 4) $1.75 \times 10^{-4}\text{mol L}^{-1}$

16. Given below are half-cell reactions: [NEET-2022]



Will the permanganate ion, MnO_4^- liberate O_2 from water in the presence of an acid?

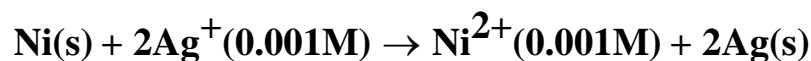
- 1) Yes, because $E^\circ_{\text{cell}} = +0.287\text{V}$ 2) No, because $E^\circ_{\text{cell}} = -0.287\text{V}$
3) Yes, because $E^\circ_{\text{cell}} = +2.733\text{V}$ 4) No, because $E^\circ_{\text{cell}} = -2.733\text{V}$

17. At 298 K, the standard electrode potentials of Cu^{2+}/Cu , Zn^{2+}/Zn , Fe^{2+}/Fe and Ag^+/Ag are 0.34V, -0.76V, -0.44V and 0.80V respectively. [NEET-2022]

On the basis of standard electrode potential, predict which of the following reaction cannot occur?

- 1) $\text{CuSO}_4(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Cu}(\text{s})$
2) $\text{CuSO}_4(\text{aq}) + \text{Fe}(\text{s}) \rightarrow \text{FeSO}_4(\text{aq}) + \text{Cu}(\text{s})$
3) $\text{FeSO}_4(\text{aq}) + \text{Zn}(\text{s}) \rightarrow \text{ZnSO}_4(\text{aq}) + \text{Fe}(\text{s})$
4) $2\text{CuSO}_4(\text{aq}) + 2\text{Ag}(\text{s}) \rightarrow 2\text{Cu}(\text{s}) + \text{Ag}_2\text{SO}_4(\text{aq})$

18. Find the emf of the cell in which the following reaction takes place at 298 K [NEET-2022]



(Given that $E^\circ_{\text{cell}} = 1.05\text{V}$, $\frac{2.303RT}{F} = 0.059$ at 298 K)

- 1) 1.385 V 2) 1.385 V 3) 0.9615 V 4) 1.05 V

NCERT LINE BY LINE QUESTIONS – ANSWERS

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

TOPIC WISE PRACTICE QUESTIONS - ANSWERS

1) 1	2) 4	3) 1	4) 2	5) 4	6) 4	7) 1	8) 4	9) 2	10) 2
11) 2	12) 2	13) 2	14) 2	15) 3	16) 3	17) 3	18) 1	19) 1	20) 3
21) 1	22) 2	23) 2	24) 4	25) 4	26) 1	27) 1	28) 2	29) 2	30) 2
31) 3	32) 3	33) 2	34) 4	35) 4	36) 1	37) 2	38) 4	39) 2	40) 4
41) 2	42) 2	43) 4	44) 2	45) 3	46) 3	47) 1	48) 2	49) 1	50) 3
51) 1	52) 2	53) 1	54) 1	55) 2	56) 4	57) 4	58) 3	59) 2	60) 3

NEET PREVIOUS YEARS QUESTIONS- ANSWERS

1) 2	2) 1	3) 4	4) 3	5) 4	6) 3	7) 1	8) 4	9) 2	10) 3
11) 2	12) 3	13) 2	14) 1	15) 2	16) 1	17) 4	18) 3		

NCERT LINE BY LINE QUESTIONS – SOLUTIONS

(1.) (b) In $H_2 - O_2$ fuel cell, the combustion of H_2 occurs to create potential difference between the two electrodes.

(4.) (c) The electrolyte used in Leclanche cell is moist paste of NH_4Cl and $ZnCl_2$.

(5.) (b) $Ag^+ + e^- \rightarrow Ag$

$$E_{Ag^+/Ag} = E_{Ag^+/Ag}^\circ - \frac{0.059}{1} \log \frac{1}{[Ag^+]}$$

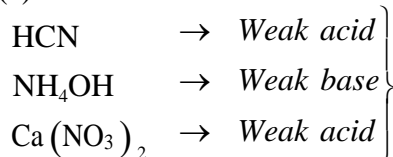
$$= E_{Ag^+/Ag}^\circ + 0.059 [Ag^+]$$

On increasing $[Ag^+]$, $E_{Ag^+/Ag}$ will increase and it has a positive value.

(6.) (b) $-0.591V$

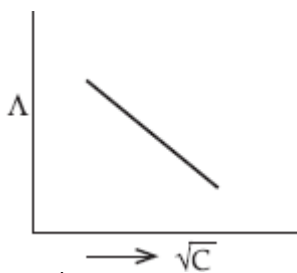
(9.) (d) Calomel electrode is used as reference electrode.

(10.) (a) Weak acid

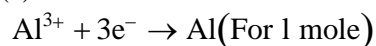
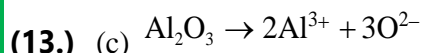


Weak electrolytes $\rightarrow Ca(NO_3)_2 \rightarrow$ Strong Base \rightarrow

Strong Acidic Salt \rightarrow Strong electrolyte

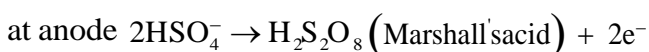
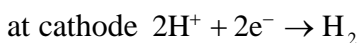
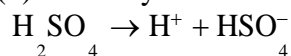


(12.) (b) i.e., on \uparrow concentration dissociation of electrolytes decrease Λ_m or Λ_n^o decrease.



3 F charge require to obtain 1 mole Al from Al_2O_3

(14.) (d) Electrolysis of Conc. H_2SO_4



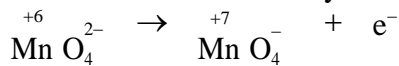
(15.) (c)

(16.) (b) $E_{\text{cell}}^o = \frac{0.059}{2} \log K_c$ or $\frac{1.10 \times 2}{0.059} = \log K_c$

$K_c = 1.9 \times 10^{37}$

(17.) (b) O_2 is formed at anode and H_2 is formed at cathode.

(19.) (d) Prevention of corrosion by zinc coating is called galvanization.

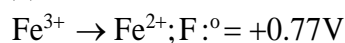


(21.) (c) 0.1 mol 0.1 mol

$Q = 0.1 \times F = 0.1 \times 96500 \text{ C} = 9650 \text{ C}$

(22.) (a) 0.059 V

(23.) (a) $[\text{Fe}(\text{CN})_6]^{3-} \rightarrow [\text{Fe}(\text{CN})_6]^{4-}$; $B^o = +0.35\text{V}$



Higher the positive reduction potential, stronger will be the oxidising agent. Oxidising agent oxidises other compounds and get itself reduced easily.

(24.) (d) $\Lambda_{\text{NaCl}}^o = 126.4 \text{ S cm}^2 \text{ mol}^{-1}$

$\Lambda_{\text{HCl}}^o = 425.9 \text{ S cm}^2 \text{ mol}^{-1}$

$\Lambda_{\text{CH}_3\text{COONa}}^o = 91.0 \text{ S cm}^2 \text{ mol}^{-1}$

$\Lambda_{\text{CH}_3\text{COOH}}^o = \Lambda_{\text{CH}_3\text{COONa}}^o + \Lambda_{\text{HCl}}^o = -\Lambda_{\text{NaCl}}^o$

$= 91 + 425.9 - 126.4 = 390.5 \text{ S cm}^2 \text{ mol}^{-1}$

(25.) (b) From Cu to Zn outside the cell.

(27.) (d) The cell constant of a conductivity cell remain constant for a cell.

(28.) (c) $Q = 1 \times t$

$Q = 1 \times 60 = 60 \text{ C}$

Now, $1.60 \times 10^{19} \text{ C} = 1 \text{ electron}$

$\therefore 60 \text{ C} = \frac{60}{1.6 \times 10^{19}} = 37.5 \times 10^{19} = 3.75 \times 10^{20} \text{ electrons}$

(31.) (a) $\Delta G^o = -nFE_{\text{cell}}^o$

If $E_{\text{cell}}^o = -ve$ then $\Delta G^o = +ve$

i.e. $\Delta G^\circ > 0$

$$\Delta G^\circ = -nRT \log k_{eq}$$

For $\Delta G^\circ = +ve$, $K_{eq} = -ve$ i.e., $K_{eq} < 1$

$$E = E^\circ + \frac{0.059}{3} \log \frac{[Al^{3+}]}{[Al]}$$

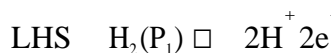
(33.) (a) so, if $[Al^{3+}] \uparrow = E \uparrow$

(34.) (d) A is false but R is true.

(35.) (d)

(38.) (c) $A \rightarrow r, B \rightarrow s, C \rightarrow p_2D \rightarrow q$

(39.) (b) RHS $2H^+ + 2e^- \rightleftharpoons H_2 (P_2)$



Overall Rxn: $H_2(P_1) \rightleftharpoons H_2(P_2)$

$$E = E^\circ - \frac{RT}{nF} \ln \frac{P_2}{P_1} = 0 - \frac{RT}{nF} \ln \frac{P_2}{P_1} = \frac{RT}{nF} \ln \frac{P_1}{P_2}$$

(41.) (a) For weak electrolyte, Λ_m increase steeply on dilution due to increase in the no. of ions (or degree of dissociation).

(42.) (d) $Zn^{2+} + 2e^- \rightarrow Zn$

(43.) (b) $ohm^{-1}cm^2 (geq)^{-1}$

(44.) (b)
$$\Lambda_m = \frac{K \times 100}{\text{Molarity (M)}}$$

$$= 5.76 \times \frac{10^{-3} S cm^{-1} \times 1000}{0.5 \text{ mol cm}^{-3}} = 11.52 \text{ S cm}^2 \text{ mol}^{-1}$$

(45.) (c) Cu is less reactive than hydrogen because SRP $E^\circ_{Cu^{2+}/Cu} = 0.34V$ and $E^\circ_{H^+/H} = 0.0V$

$$E = E^\circ - \frac{0.0591}{n} \log Q$$

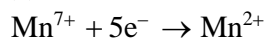
(46.) (b)
$$0.2905 = E^\circ - \frac{0.0591}{2} \log \frac{[0.1]}{[0.01]}$$

$$E^\circ = 0.295 + 0.0295 = +0.32V$$

$$0.32 = \frac{0.0591}{2} \log K$$

$$K = 10^{0.32/0.265}$$

(47.) (a) $n_{KMnO_4} = 0.5 \times 20 \times 10^{-8} = 10^{-2}$



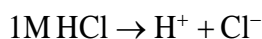
So, 1 mole $KMnO_4 \rightarrow 5$ mole of e^-

$$10^{-2} \text{ mol } KMnO_4 \rightarrow 5 \times 10^{-2} \text{ mole } e^-$$

(48.) (b) A cation with maximum value of SRP has the strongest oxidising power.

(49.) (b)
$$W = \frac{I \times T \times E}{96500} = \frac{10 \times 109 \times 60 \times 59}{96500 \times 2} = 20$$

(50.) (c) In SHE concentration of solution is 1M HCl



$$pH = -\log [H^+] = -\log 1 = 0$$

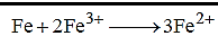
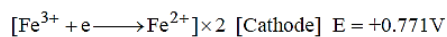
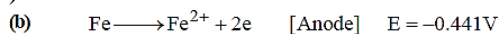
TOPIC WISE PRACTICE QUESTIONS – SOLUTIONS

1. (1) Maintain electrical neutrality of both half cells.

4) $E_{\text{H}_2|\text{H}^+}^\circ = E_{\text{H}_2|\text{H}^+}^\circ = 0\text{V}$

3. 1) $E = E^\circ - 0.059 \text{ Ph} = 0.699 - 0.059 \times 10 = 0.109 \text{ V}$

2)



$$E_{\text{cell}}^\circ = E_{\text{cathode}}^\circ - E_{\text{Anode}}^\circ$$

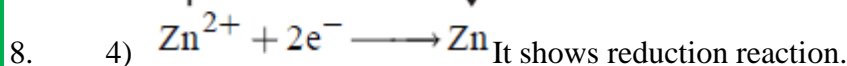
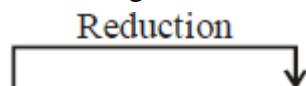
$$= .771 - (-.441) = .771 + .441 = 1.212 \text{ V}$$

5. (4) In electrolytic cell the flow of electrons is from anode to cathode through internal supply.

6. (4)



O.S. of Cr changes from +3 to +6 by loss of electrons. At anode oxidation takes place.

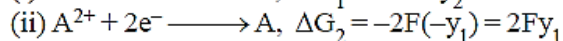
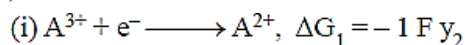


9. (2) In electrochemical cell H_2 has greater tendency to release electrons.

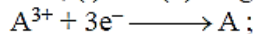
$\therefore \text{H}_2$ is liberated at anode and Cu is deposited at the cathode.

10. (2) The cell in which Cu and Zn rods are dipped in its solution is called Daniel cell.

11. 2)



Add, (i) and (ii) we get



$$\Delta G_3 = \Delta G_1 + \Delta G_2$$

$$-3FE^\circ = -Fy_2 + 2Fy_1$$

$$-3FE^\circ = -F(y_2 - 2y_1)$$

$$E^\circ = \frac{y_2 - 2y_1}{3}$$

12. 2) In concentration cell the spontaneous process is physical in nature involving transfer of matter from higher concentration to lower concentration in indirect manner.

13. (2) Ag becomes oxidized and Br^- becomes reduced.

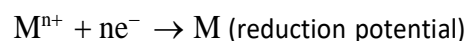
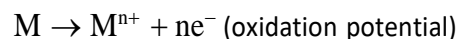
14. 2)

$$E_{\text{Zn}^{2+}|\text{Zn}}^\circ < E_{\text{Cu}^{2+}|\text{Cu}}^\circ ;$$

$$E_{\text{Cu}^{2+}|\text{Cu}}^\circ + E_{\text{Zn}|\text{Zn}^{2+}}^\circ = +ve$$

15. 3) $E_{\text{oxidation}} = 0.059 \text{ pH} = 0.059 \times 10 = 0.59\text{V}$

16. 3) The magnitude of the electrode potential of a metal is a measure of its relative tendency to loose or gain electrons. i.e., it is a measure of the relative tendency to undergo oxidation (loss of electrons) or reduction (gain of electrons).



17. 3) Gold having higher E_{Red}° oxidises $\text{Fe} \rightarrow \text{Fe}^{2+}$

18. 1)

The value of $E_{M^{2+}/M}^\circ$ for given metal ions are

$$E_{Mn^{2+}/Mn}^\circ = -1.18 \text{ V},$$

$$E_{Cr^{2+}/Cr}^\circ = -0.9 \text{ V},$$

$$E_{Fe^{2+}/Fe}^\circ = -0.44 \text{ V and}$$

$$E_{Co^{2+}/Co}^\circ = -0.28 \text{ V}.$$

The correct order of $E_{M^{2+}/M}^\circ$ values without considering negative sign would be

$$Mn^{2+} > Cr^{2+} > Fe^{2+} > Co^{2+}.$$

19. 1) $E^\circ = \frac{0.0591}{2} \log K_{eq} ; \log K_{eq} = \frac{2 \times 0.22}{0.0591} \Rightarrow 7.44$ or $K_{eq} \approx 2.8 \times 10^7$

20. 3)

21. 1) $E_{red} = E_{red}^\circ + \frac{0.059}{n} \log \frac{[M^{(x+n)}]}{[M^{x+}]}$

22. 2) Without losing its concentration $ZnCl_2$ solution cannot be kept in contact with Al because Al is more reactive than Zn due to its highly negative electrode reduction potential.

23. (2) A will replace B.

24. (4) Here Ni is anode and Au is cathode

Given $E_{Ni^{2+}/Ni}^\circ = 0.25 \text{ V}$ and $E_{Au^{3+}/Au}^\circ = +1.5 \text{ V}$

$$E_{cell}^\circ = E_C^\circ - E_A^\circ = 1.5 - (-0.25) = 1.5 + 0.25 = 1.75 \text{ V}$$

25. 4) emf will decrease

26. 1)



$$E = E^\circ - \frac{0.0591}{2} \log \frac{[H^+]^2}{P_{H_2} \times [Ag^+]^2}$$

$$0.222 = 0.7995 - \frac{0.0591}{2} \log \frac{1}{[Ag^+]^2}$$

$$[Ag^+] = 10^{-9.8}$$

$$K_{sp} = [Ag^+][Cl^-] = (10^{-9.8}) \times (1) = 10^{-9.8}$$

27. 1)



$$E_{cell} = E_{cell}^\circ - \frac{0.059}{2} \log \frac{[Zn^{2+}][H_2]}{[H^+]^2}$$

Addition of H_2SO_4 will increase $[H^+]$ and E_{cell} will also increase and the equilibrium will shift towards RHS.

28. 2) At equilibrium, $\Delta G = 0$, $E_{cell} = 0$

29. 2) $\Lambda_{eq} = \frac{\kappa \times 1000}{N}$

30. 2) $\Lambda_m^\infty(BaCl_2) = \lambda_m^\infty(Ba^{2+}) + 2\lambda_m^\infty(Cl^-) = 127 + 2 \times 76 = 279 \text{ ohm}^{-1} \text{ cm}^2 \text{ eq}^{-1}$

31. (3) On dilution degree of dissociation of a weak electrolyte increases, hence increases in ionic mobility.

32. (3) When the concentration of all reacting species is kept unity, then $E_{cell} = E_{cell}^\circ$ and the given relation will become

$$\Delta_r G = -nFE_{cell}^\circ$$

33. (2) Specific resistance = x

$$\therefore \text{Specific conductance (or conductivity)} = \kappa = \frac{1}{x}$$

$$\therefore \Lambda_{\text{eq}} = \frac{\kappa \times 1000}{N} = \frac{1000}{N}$$

$$34. \quad 4) \Lambda_{\text{m}} = \frac{\kappa \times 1000}{M} = \frac{0.0110 \times 1000}{0.05} = 220 \text{ S cm}^2 \text{ mol}^{-1}$$

35. 4) Conductivity does not depend upon mass or weight of material.

$$36. \quad 1) \Lambda_{\text{eq}} = \kappa \times \frac{1000}{N} = \frac{1}{R} \times \frac{l}{a} \times \frac{1000}{N} = \frac{1}{R} \times \text{cell constant} \times \frac{1000}{N} = \frac{1}{220} \times 0.88 \times \frac{1000}{0.01} = 400 \text{ mho cm}^2 \text{ g eq}^{-1}$$

37. (2) As we go down the group 1 (i.e. from Li^+ to K^+), the ionic radius increases, degree of solvation decreases and hence effective size decreases resulting in increase in ionic mobility. Hence equivalent conductance at infinite dilution increases in the same order.

38. 4)

39. 2)

$$\Lambda_{\text{Na}^+}^{\circ} + \Lambda_{\text{OH}^-}^{\circ} = 248 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$$

$$\Lambda_{\text{Na}^+}^{\circ} + \Lambda_{\text{Cl}^-}^{\circ} = 126 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$$

$$\Lambda_{\text{Ba}^{2+}}^{\circ} + \Lambda_{2\text{Cl}^-}^{\circ} = 280 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$$

$$\text{Now, } \Lambda_{\text{Ba(OH)}_2}^{\circ} = \Lambda_{\text{BaCl}_2}^{\circ} + 2\Lambda_{\text{NaOH}}^{\circ} - 2\Lambda_{\text{NaCl}}^{\circ}$$

$$\Lambda_{\text{Ba(OH)}_2}^{\circ} = 280 \times 10^{-4} + 2 \times 248 \times 10^{-4} - 2 \times 126 \times 10^{-4}$$

$$\Lambda_{\text{Ba(OH)}_2}^{\circ} = 524 \times 10^{-4} \text{ S m}^2 \text{ mol}^{-1}$$

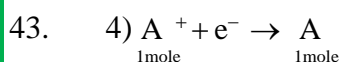
40. (4) Larger the size, lower the speed.

41. (2) Specific conductance of the solution (κ) = $0.012 \text{ ohm}^{-1} \text{ cm}^{-1}$ and resistance (R) = 55 ohm .
Cell constant = Specific conductance \times Observed resistance = $0.012 \times 55 = 0.66 \text{ cm}^{-1}$.

42. (b) According to Kohlrausch's law, molar conductivity of weak electrolyte acetic acid (CH_3COOH) can be calculated as follows:

$$\Lambda_{\text{CH}_3\text{COOH}}^{\circ} = (\Lambda_{\text{CH}_3\text{COONa}}^{\circ} + \Lambda_{\text{HCl}}^{\circ}) - \Lambda_{\text{NaCl}}^{\circ}$$

\therefore Value of $\Lambda_{\text{NaCl}}^{\circ}$ should also be known for calculating value of $\Lambda_{\text{CH}_3\text{COOH}}^{\circ}$.



\therefore Charge of 1 mole electron is required for deposition of 1 equivalent of substance.

$$44. \quad 2) 5.2 = \frac{52}{3} \times \frac{9.65}{96,500} \times t \text{ (sec)}$$

$$t \text{ (sec)} = 3000$$

$$t \text{ (min)} = 50$$

45. (3) Electrorefining and electroplating are done by electrolysis.

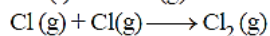
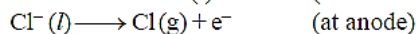
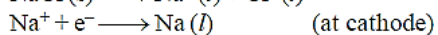
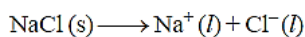
46. (3)

47. (1) Reduction and oxidation of H_2O occurs to give H_2 at cathode and O_2 at anode.

48. (2)

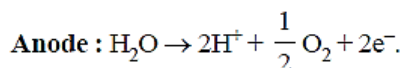
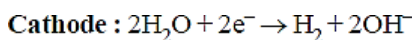
49. (1) When molten or fused NaCl is electrolysed, it yields metallic sodium and gaseous chlorine.

Reactions involved are as follows:



50. (3) Oxidation potential of M is more than Ni and less than Mn . Hence reducing power $\text{Mn} > M > \text{Ni}$

51. (1) Water is reduced at the cathode and oxidized at the anode instead of Na^+ and SO_4^{2-}



52. (b) Given current (i) = 0.5 amp;
Time (t) = 100 minutes \times 60 = 6000 sec
Equivalent weight of silver (E) = 108.
According to Faraday's first law of electrolysis
$$W = \frac{Eit}{96500} = \frac{108 \times 0.5 \times 6000}{96500} = 3.3575\text{g}$$
53. (1) Charge = 0.2×1 Faraday = 0.2×96500 coulombs = 19300 = 1.93×10^4 coulombs
54. (1) According to Faraday law's of electrolysis, amount of electricity required to deposit 1 mole of metal = 96500 C = 1 F i.e., for deposition of 108 g Ag electricity required = 1 F
55. (2) $\text{Fe}^{2+} + 2\text{e}^- \rightarrow \text{Fe}$; $E_{\text{Fe}} = \frac{56}{2} = 28$
1 Faraday liberates = 28 g of Fe
3 Faraday liberates = $3 \times 28 = 84$ g
56. (4) Combustion takes place.
57. (4) Primary cells are those cells, in which the reaction occurs only once and after use over a period of time, it becomes dead and cannot be reused again. e.g., Leclanche cell and mercury cell.
58. (3) Corrosion of iron can be minimized by forming an impermeable barrier at its surface.
59. (2) Magnesium provides cathodic protection and prevent rusting or corrosion.
60. (3) Mercury cell being primary in nature can be used only once.

NEET PREVIOUS YEARS QUESTIONS- EXPLANATIONS

1. 2)
For cell,
 $\text{Zn}|\text{ZnSO}_4(0.01\text{ M})||\text{CuSO}_4(1.0\text{ M})|\text{Cu}$
- $$E_{\text{cell}} = E^\circ_{\text{cell}} - \frac{2.303RT}{nF} \log \frac{[\text{Zn}^{2+}]}{[\text{Cu}^{2+}]^2}$$
- $$\therefore E_1 = E^\circ_{\text{cell}} - \frac{2.303RT}{2 \times F} \times \log \frac{(0.01)}{(1)^2}$$
- When concentrations are changed for ZnSO_4 and CuSO_4 , we can write

$$E_2 = E^\circ_{\text{cell}} - \frac{2.303RT}{2F} \times \log \frac{1}{(0.01)^2} \therefore E_1 > E_2$$

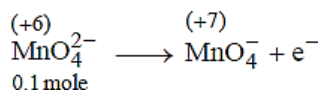
2. 1) $2\text{H}^+(\text{aq}) + 2\text{e}^- \rightarrow \text{H}_2(\text{g})$
$$\therefore E = E^0 - \frac{0.0591}{2} \log \frac{P_{\text{H}_2}}{[\text{H}^+]^2}$$

$$0 = 0 - 0.0295 \log \frac{P_{\text{H}_2}}{(10^{-7})^2}$$

$$\frac{P_{\text{H}_2}}{(10^{-7})^2} = 1$$

$$P_{\text{H}_2} = 10^{-14} \text{ atm}$$

3. 4) A device that converts energy of combustion of fuels, directly into electrical energy is known as fuel cell.



4. 3) 0.1 mole
Quantity of electricity required = $0.1F = 0.1 \times 96500 = 9650 \text{ C}$

5. 4) $w_{\text{O}_2} = n_{\text{O}_2} \times 32$

$$w_{\text{O}_2} = \frac{5600}{22400} \times 32 = 8\text{g} = 1 \text{ equivalent of } \text{O}_2 = 1 \text{ equivalent of } \text{Ag} = 108$$

6. 3)

$$E_{\text{cell}} = E_{\text{cell}}^{\circ} - \frac{2.303 RT}{nF} \log_{10} Q$$

at equilibrium $E_{\text{cell}} = 0$, $Q = K_{\text{eq}}$.

$$0 = E_{\text{cell}}^{\circ} - \frac{0.0591}{1} \log_{10} K_{\text{eq}}$$

$$E_{\text{cell}}^{\circ} = +0.0591 \log_{10} K_{\text{eq}}$$

$$0.59 = +0.0591 \log_{10} K_{\text{eq}}$$

$$+10 = \log_{10} K_{\text{eq}}$$

$$K_{\text{eq}} = 10^{+10}$$

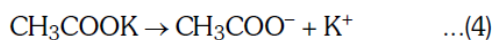
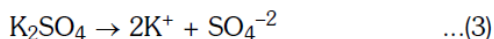
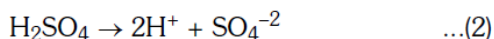
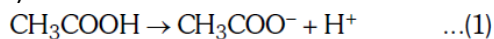
7. 1) $2\text{Fe}^{3+}(\text{aq}) + 2\text{I}^{-}(\text{aq}) \rightarrow 2\text{Fe}^{2+}(\text{aq}) + \text{I}_2(\text{aq})$

$$n = 2 ; \Delta G^{\circ} = -nFE^{\circ}$$

$$= -2 \times 96500 \times (0.24) = -46320\text{J}$$

$$= -46.32 \text{ kJ mol}^{-1}$$

8. 4)



According to Kohlrausch's law-

$$\lambda_{\text{CH}_3\text{COOH}}^{\circ} = \lambda_{\text{CH}_3\text{COO}^{-}}^{\circ} + \lambda_{\text{H}^{+}}^{\circ}$$

$$\text{eq. (1)} = \text{eq. (4)} + \text{eq. (2)} - \text{eq. (3)}$$

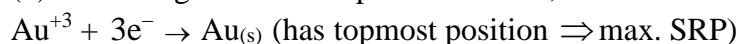
$$\therefore \lambda_{\text{CH}_3\text{COOH}}^{\circ} = z + \frac{x}{2} - \frac{y}{2}$$

$$\lambda_{\text{CH}_3\text{COOH}}^{\circ} = \frac{(x - y)}{2} + z(\text{S} \times \text{cm}^2 \text{mol}^{-1})$$

$$\text{Reducing power of metal} \propto \frac{1}{\text{SRP}}$$

9. 2) **K > Al > Cr > Ag.**

10. (3) According to electrode potential series,



11. (2) In typical fuel cell

Reactants = H_2 , O_2

Products = H_2O

12. 3) On electrolysis of dil H_2SO_4

As anodes $H_2O \rightarrow 2H^+ + \frac{1}{2}O_2 + 2e^-$ oxygen gas is liberated

13. 2) E of Ca = $40/2 = 20$ gr

For the deposition of 1gram equivalent wt (20gr) 1F is required

14. 1) $\Delta_m^0 CH_3OOH = \Delta_{HCl}^0 + \Delta_{CH_3COONa}^0 - \Delta_{NaCl}^0 = (426.16 + 91) - 126.45 = 390.71 S cm^2 mol^{-1}$

15. 2) $\lambda_0 = \Lambda_{H^+}^0 + \lambda_0(CH_3COO^-) = 350 + 50 = 400$; $\lambda = 20$; $C = 0.007$ m

$$K_a = \frac{C\lambda^2}{\lambda_0(\lambda_0 - \lambda)} = \frac{7 \times 10^{-3} \times (20)^2}{400(400 - 20)} ; K_c = 1.8 \times 10^{-5}$$

16. In this reaction CuO_4^- reduce at cathode and H_2O oxidise at anode. So given $E_{MnO_4^-/Mn^{+2}}^0 = +1.510V$,

$$E_{O_2/H_2O}^0 = +1.223V$$

$E_{cell}^0 = 1.510 - 1.223 = +0.287$ so, the reaction is spontaneous

17. $2CuSO_4 + 2Ag \rightarrow 2Cu + Ag_2SO_4$ Ag cannot displace copper from $CuSO_4$ solute

18.: $E = 1.05 - 0.0295 \log \frac{0.001}{(0.001)^2 \cdot 10^{-3}} = 1.05 - 0.0295 \times 3 = 1.05 - 0.0885 = 0.9615$.

