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PRE-MEDICAL

# PHYSICAL CHEMISTRY

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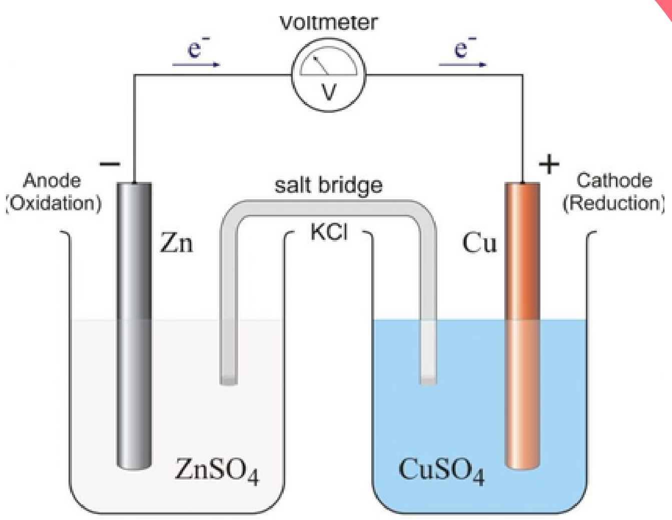



## EXERCISE

## Electrochemistry

ENGLISH MEDIUM

## EXERCISE-I (Conceptual Questions) — Build Up Your Understanding

### ELECTROLYTIC CONDUCTANCE

**1.** Strong electrolytes are those which :
(1) dissolve readily in water
(2) conduct electricity
(3) dissociate into ions even at high concentration
(4) dissociate into ions at high dilution.
**EC0001**

**2.** Molten sodium chloride conducts electricity due to the presence of :
(1) free electrons
(2) free ions
(3) free molecules
(4) free atoms of Na and Cl
**EC0002**

**3.** Electrolytic conduction is due to the movement of :
(1) molecules (2) atoms
(3) ions (4) electrons
**EC0003**

**4.** Which of the following solutions of KCl has the lowest value of equivalent conductance ?
(1) 1 M (2) 0.1 M
(3) 0.01 M (4) 0.001 M
**EC0004**

**5.** If the specific resistance of a solution of concentration C geq $L^{-1}$ is R, then its equivalent conductance is :
(1) $\frac{100R}{C}$ (2) $\frac{RC}{1000}$
(3) $\frac{1000}{RC}$ (4) $\frac{C}{1000R}$
**EC0006**

**6.** The specific conductances in $ohm^{-1}$ $cm^{-1}$ of four electrolytes P, Q, R and S are given in brackets :
P $(5.0 \times 10^{-5})$ Q $(7.0 \times 10^{-8})$
R $(1.0 \times 10^{-10})$ S $(9.2 \times 10^{-3})$
The one that offers highest resistance to the passage of electric current is
(1) P (2) S (3) R (4) Q
**EC0007**

**7.** The specific conductance of a salt of 0.01 M concentration is $1.061 \times 10^{-4}$ S $cm^{-1}$. Molar conductance of the same solution will be :
(1) $1.061 \times 10^{-4}$ S $cm^2$ $mol^{-1}$
(2) 1.061 S $cm^2$ $mol^{-1}$
(3) 10.61 S $cm^2$ $mol^{-1}$
(4) 106.1 S $cm^2$ $mol^{-1}$
**EC0008**

**8.** Which statement is not correct :–
(1) Conductance of an electrolytic solution increases with dilution
(2) Conductance of an electrolytic solution decreases with dilution
(3) Specific conductance of an electrolytic solution decreases with dilution
(4) Equivalent conductance of an electrolytic solution increases with dilution.
**EC0011**

**9.** The resistance of 0.01 N solution of an electrolyte was found to be 210 ohm at 298 K using a conductivity cell of cell constant 0.66 $cm^{-1}$. The equivalent conductance of solution is :–
(1) 314.28 mho $cm^2$ $eq^{-1}$
(2) 3.14 mho $cm^2$ $eq^{-1}$
(3) 314.28 $mho^{-1}$ $cm^2$ $eq^{-1}$
(4) 3.14 $mho^{-1}$ $cm^2$ $eq^{-1}$
**EC0012**

**10.** Electrolytic conduction differs from metallic conduction from the fact that in the former
(1) The resistance increases with increasing temperature
(2) The resistance decreases with increasing temperature
(3) The resistance remains constant with increasing temperature
(4) The resistance is independent of the length of the conductor
**EC0013**

**11.** The specific conductance of a 0.01 M solution of KCl is 0.0014 $ohm^{-1}$ $cm^{-1}$at 25° C. Its equivalent conductance ($cm^2$ $ohm^{-1}$ $eq^{-1}$) is :–
(1) 140 (2) 14
(3) 1.4 (4) 0.14
**EC0014**

**12.** Which one of the following is wrong :–
(1) Specific conductance increases on dilution.
(2) Specific conductance decreases on dilution.
(3) Equivalent conductance increases on dilution.
(4) Molar conductance increases on dilution.
**EC0015**

## KOHLRAUSCH LAW

**13.** At infinite dilution, the equivalent conductances of $CH_3COONa$, HCl and $CH_3COOH$ are 91, 426 and 391 mho $cm^2$ $eq^{-1}$ respectively at 25 °C. The eq. conductance of NaCl at infinite dilution will be :

(1) 126 (2) 209 (3) 391 (4) 908

**EC0016**

**14.** For HCl solution at 25 °C, equivalent conductance at infinite dilution is 425 $ohm^{-1}$ $cm^2$ $eq^{-1}$. The specific conductance of a solution of HCl is 3.825 $ohm^{-1}$ $cm^{-1}$. If the degree of dissociation is 90%, the normality of the solution is :-

(1) 0.90 N (2) 1.0 N
(3) 10 N (4) 1.2 N

**EC0019**

**15.** The molar conductivities $\wedge^0_{NaOAc}$ and $\wedge^0_{HCl}$ at infinite dilution in water at 25°C are 91.0 and 426.2 S $cm^2$ $mol^{-1}$ respectively. To calculate $\wedge^0_{HOAc}$ the additional value required is :

(1) $\wedge^0_{NaCl}$ (2) $\wedge^0_{H_2O}$ (3) $\wedge^0_{KCl}$ (4) $\wedge^0_{NaOH}$

**EC0020**

**16.** The molar conductance of $AgNO_3$, AgCl and NaCl at infinite dilution are 116.5, 121.6 and 110.3 S $cm^2$ $mol^{-1}$ respectively. The molar conductance of $NaNO_3$ is :

(1) 111.4 S $cm^2$ $mol^{-1}$ (2) 105.2 S $cm^2$ $mol^{-1}$
(3) 130.6 S $cm^2$ $mol^{-1}$ (4) 150.2 S $cm^2$ $mol^{-1}$

**EC0021**

**17.** The conductivity of a saturated solution of $BaSO_4$ is $3.06 \times 10^{-6}$ $ohm^{-1}$ $cm^{-1}$and its molar conductance is 1.53 $ohm^{-1}$ $cm^2$ $mol^{-1}$. The $K_{sp}$ of $BaSO_4$ will be

(1) $4 \times 10^{-12}$ (2) $2.5 \times 10^{-9}$
(3) $2.5 \times 10^{-13}$ (4) $4 \times 10^{-6}$

**EC0022**

**18.** Kohlrausch's law states that at :-

(1) Infinite dilution, each ion makes definite contribution to conductance of an electrolyte whatever be the nature of the other ion of the electrolyte.

(2) Infinite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte whatever be the nature of the other ion of the electrolyte.

(3) Finite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte whatever be the nature of the other ion of the electrolyte.

(4) Infinite dilution, each ion makes definite contribution to equivalent conductance of an electrolyte depending on the nature of the other ion of electrolyte.

**EC0099**

## GALVANIC CELL

**19.** In the galvanic cell

$Cu(s) \mid Cu^{2+}$ (1 M) $\mid\mid Ag^{+}$ (1 M) $\mid$ Ag(s)

the electrons will travel in the external circuit :

(1) from Ag to Cu

(2) from Cu to Ag

(3) electrons do not travel in the external circuit

(4) in any direction

**EC0023**

**20.** The direction of current in the Daniell cell when Zn and Cu electrodes are connected is :

(1) from Cu to Zn in the cell

(2) from Cu to Zn out side the cell

(3) from Zn to Cu outside the cell

(4) in any direction in the cell

**EC0024**

**21.** The equation representing the process by which standard reduction potential of zinc can be defined is

(1) $Zn^{2+}$ (s) + $2e^- \longrightarrow$ Zn (s)

(2) Zn (g) $\longrightarrow Zn^{2+}$ (g) + $2e^-$

(3) $Zn^{2+}$ (g) + $2e^- \longrightarrow$ Zn (s)

(4) $Zn^{2+}$ (aq.) + $2e^- \longrightarrow$ Zn (s)

**EC0025**

**22.** A standard hydrogen electrode has zero electrode potential because :

(1) Hydrogen is easiest to oxidize.

(2) This electrode potential is assumed to be zero.

(3) Hydrogen atom has only one electron.

(4) Hydrogen is the lightest element.

**EC0026**

**23.** Which is not true for a standard hydrogen electrode ?

(1) The hydrogen ion concentration is 1 M.

(2) Temperature is 25°C.

(3) Pressure of hydrogen is 1 bar.

(4) It contains a metallic conductor which does not adsorb hydrogen.

**EC0027**

**24.** E° for the half cell
$Zn^{2+}$ | Zn is –0.76 V. E.M.F. of the cell
Zn | $Zn^{2+}$ (1M) || $2H^{+}$ (1M) | $H_2$ (1 atm) is :
(1) –0.76 V (2) +0.76 V
(3) –0.38 V (4) + 0.38 V
**EC0028**

**25.** Cu(s) | $Cu^{+2}$(1 M) || $Zn^{+2}$(1 M) | Zn(s)
A cell represented above should have emf.
(1) Positive
(2) Negative
(3) Zero
(4) Cannot be predicted
**EC0030**

**26.** Given electrode potentials :
$Fe^{3+} + e \longrightarrow Fe^{2+}$ ; E° = 0.771 V
$I_2 + 2e \longrightarrow 2I^-$ ; E° = 0.536 V
$E°_{cell}$ for the cell reaction
$2Fe^{3+} + 2I^- \rightarrow 2Fe^{2+} + I_2$ is -
(1) (2 ×0.771 – 0.536) = 1.006 V
(2) (0.771 – 0.5 ×0.536) = 0.503 V
(3) 0.771 – 0.536 = 0.235 V
(4) 0.536 – 0.771 = –0.235 V
**EC0031**

**27.** Which of the following is not an anodic half reaction:-
(1) $Ag^+ \rightarrow Ag - e^-$
(2) $Cu \rightarrow Cu^{2+} + 2e^-$
(3) $Fe^{2+} \rightarrow Fe^{3+} + e^-$
(4) $4OH^- \rightarrow 2H_2O + O_2 + 4e^-$
**EC0032**

**28.** Which of the following statements is correct :–
(1) Oxidation occurs at anode in both galvanic and electrolytic cell.
(2) Reduction occurs at anode in both galvanic and electrolytic cell
(3) Reduction occurs at anode in electrolytic cell where as oxidation occurs at cathode in galvanic cell
(4) Oxidation occurs at anode in electrolytic cell where as reduction occurs at anode in a galvanic cell,
**EC0033**

**29.** Other things being equal, the life of a Daniell cell may be increased by :–
(1) Keeping low temperature
(2) Using large copper electrode
(3) Decreasing concentration of copper ions
(4) Using large zinc electrodes
**EC0034**

## ELECTROCHEMICAL SERIES

**30.** Zn can not displace following ions from their aqueous solution :-
(1) $Ag^+$ (2) $Cu^{2+}$ (3) $Fe^{2+}$ (4) $Na^+$
**EC0035**

**31.** The standard reduction potentials at 25 °C for the following half reactions are given against each :-
$Zn^{2+}$ (aq) + $2e^-$ ⇌ Zn(s), –0.762 V
$Cr^{3+}$ (aq) + $3e^-$ ⇌ Cr(s), –0.740 V
$2H^+ + 2e^-$ ⇌ $H_2$(g), 0.00 V
$Fe^{3+} + 2e^-$ ⇌ $Fe^{2+}$, 0.77 V
Which is the strongest reducing agent ?
(1) Zn (2) Cr
(3) $H_2$(g) (4) $Fe^{2+}$ (aq)
**EC0036**

**32.** Using the standard electrode potential values given below, decide which of the statements, I, II, III and IV are correct. Choose the right answer from (1), (2), (3) and (4).
$Fe^{2+} + 2e^-$ ⇌ Fe ; E° = –0.44 V
$Cu^{2+} + 2e^-$ ⇌ Cu ; E° = +0.34 V
$Ag^+ + e^-$ ⇌ Ag ; E° = +0.80 V
I. Copper can displace iron from $FeSO_4$ solution.
II. Iron can displace copper from $CuSO_4$ solution.
III. Silver can displace copper from $CuSO_4$ solution.
IV. Iron can displace silver from $AgNO_3$ solution.
(1) I and II (2) II and III
(3) II and IV (4) I and IV
**EC0041**

**33.** The standard electrode potentials for the elements A, B and C are 0.68, –2.50 and 0.50 V respectively. The order of their reducing power is :
(1) A > B > C (2) A > C > B
(3) C > B > A (4) B > C > A
**EC0042**

**34.** The oxidation potential of Zn, Cu, Ag, $H_2$ and Ni electrodes are 0.76 V, –0.34 V, –0.80 V, 0 V, 0.55 V respectively. Which of the following reaction will provide maximum voltage ?
(1) $Zn + Cu^{2+} \longrightarrow Cu + Zn^{2+}$
(2) $Zn + 2Ag^+ \longrightarrow 2Ag + Zn^{2+}$
(3) $H_2 + Cu^{2+} \longrightarrow 2H^+ + Cu$
(4) $H_2 + Ni^{2+} \longrightarrow 2H^+ + Ni$
**EC0043**

**35.** The standard reduction potential at 25 °C of $Li^+$ / Li, $Ba^{2+}$ / Ba, $Na^+$ / Na and $Mg^{2+}$ / Mg are –3.05 V, –2.73 V, –2.71 V and –2.37 V respectively. Which one of the following is the strongest oxidising agent ?
(1) $Na^+$ (2) $Li^+$ (3) $Ba^{2+}$ (4) $Mg^{2+}$
**EC0045**

**36.** A gas X at 1 atm is bubbled through a solution containing a mixture of 1 M $Y^-$ and 1 M $Z^-$ at 25 °C. If the reduction potential of $(Z/Z^-) > (Y/Y^-) > (X/X^-)$ then :
(1) Y will oxidise $X^-$ and not $Z^-$
(2) Y will oxidise $Z^-$ and not $X^-$
(3) Y will oxidise both $X^-$ and $Z^-$
(4) Y will reduce both $X^-$ and $Z^-$
**EC0046**

**37.** The standard electrode potential of Zn, Ag and Cu electrodes are –0.76 V, 0.80 V and 0.34 V respectively, then :
(1) Ag can oxidise Zn and Cu
(2) Ag can reduce $Zn^{2+}$ and $Cu^{2+}$
(3) Zn can reduce $Ag^+$ and $Cu^{2+}$
(4) Cu can oxidise Zn and Ag
**EC0047**

**38.** Standard reduction potentials of four metal electrodes are
A = – 0.250 V , B = – 0.140 V
C = – 0.126 V , D = – 0.402 V
The metal that displaces A from aqueous solution of its compounds is :-
(1) B (2) C
(3) D (4) None of the above
**EC0049**

**39.** The following four colourless salt solutions are placed in separate test tubes and a strip of Cu is placed in each solution. Which solution finally turns blue :–
(1) $Zn(NO_3)_2$ (2) $Mg(NO_3)_2$
(3) $KNO_3$ (4) $AgNO_3$
**EC0050**

**40.** Which of the following displacement does not occur
(1) $Zn + 2H^+ \rightarrow Zn^{2+} + H_2\uparrow$
(2) $Fe + 2Ag^+ \rightarrow Fe^{2+} + Ag\downarrow$
(3) $Cu + Fe^{2+} \rightarrow Cu^{2+} + Fe\downarrow$
(4) $Zn + Pb^{2+} \rightarrow Zn^{2+} + Pb\downarrow$
**EC0051**

**41.** On the basis of the following E° values, the strongest oxidizing agent is :-
$[Fe(CN)_6]^{4-} \rightarrow [Fe(CN)_6]^{3-} + e^{-1}, E° = -0.35$ V
$Fe^{2+} \rightarrow Fe^{3+} + e^{-1}$ ; E° = – 0.77 V
(1) $Fe^{3+}$
(2) $[Fe(CN)_6]^{3-}$
(3) $[Fe(CN)_6]^{4-}$
(4) $Fe^{2+}$
**EC0098**

## NERNST EQUATION

**42.** $E°(Ni^{2+}/Ni) = -0.25$ V
$E° (Au^{3+} / Au) = 1.50$ V
The emf of the voltaic cell.
Ni | $Ni^{2+}$ (1.0 M) | | $Au^{3+}$ (1.0 M) | Au is :
(1) 1.25 V (2) –1.75 V
(3) 1.75 V (4) 4.0 V
**EC0052**

**43.** The emf of the cell
Tl(s) | $Tl^+$ (0.0001 M) | | $Cu^{2+}$ (0.01M) | Cu(s) is 0.83 V
The emf of this cell will be increased by :–
(1) Increasing the concentration of $Cu^{+2}$ ions
(2) Decreasing the concentration of $Tl^+$
(3) Increasing the concentration of both
(4) (1) & (2) both
**EC0054**

**44.** Which of the following represents the electrode potential of silver electrode dipped into 0.1 M $AgNO_3$ solution at 25° C ?
(1) $E°_{red}$ (2) $(E°_{red} + 0.059)$
(3) $(E°_{ox} - 0.059)$ (4) $(E°_{red} - 0.059)$
**EC0056**

**45.** The electrode potential of a hydrogen electrode dipped in solution of pH = 1 is
(1) 0.059 V (2) 0.00 V
(3) –0.059 V (4) 0.59 V
**EC0057**

**46.** Consider the reaction
$Cl_2(g) + 2Br^-(aq) \longrightarrow 2Cl^-(aq) + Br_2(\ell)$
The emf of the cell when
$[Cl^-] = [Br^-] = 0.01$ M and $Cl_2$ gas at 0.25 atm pressure will be (E° for the above reaction is = 0.29 V)
(1) 0.54 V (2) 0.272 V
(3) 0.29 V (4) –0.29 V
**EC0058**

**47.** The standard emf for the cell reaction
$Zn + Cu^{2+} \longrightarrow Zn^{2+} + Cu$ is 1.10 V at 25 °C. The emf for the cell reaction when 0.1 M $Cu^{2+}$ and 0.1 M $Zn^{2+}$ solution are used at 25 °C is :
(1) 1.10 V (2) 0.110 V
(3) –1.10 V (4) –0.110 V
**EC0059**

**48.** E° for $F_2 + 2e^- \rightarrow 2F^-$ is 2.8 V,

E° for $\frac{1}{2}F_2 + e^- \rightarrow F^-$ is ?

(1) 2.8 V (2) 1.4 V (3) –2.8 V (4) –1.4 V

**EC0060**

**49.** How much will the potential of Zn | $Zn^{2+}$ change if the solution of $Zn^{2+}$ is diluted 10 times

(1) increases by 0.03 V
(2) decreases by 0.03 V
(3) increases by 0.059 V
(4) decreases by 0.059 V

**EC0062**

**50.** How much will the potential of a hydrogen electrode change when its solution initially at pH = 0 is neutralised to pH = 7 ?

(1) increases by 0.059 V
(2) decreases by 0.059 V
(3) increases by 0.41 V
(4) decreases by 0.41 V

**EC0063**

**51.** Which of the following will increase the voltage of the cell with following cell reaction

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

(1) Increase in the size of silver rod
(2) Increase in the concentration of $Sn^{+2}$ ions
(3) Increase in the concentration of $Ag^+$ ions
(4) Decrease in the concentration of $Ag^+$ ions

**EC0064**

**52.** E° for the reaction $Fe + Zn^{2+} \rightarrow Zn + Fe^{2+}$ is –0.35 V. The given cell reaction is :

(1) spontaneous (2) non-spontaneous
(3) in equilibrium (4) can't say anything

**EC0065**

**53.** For a reaction - $A(s) + 2B^+ \rightleftharpoons A^{2+} + 2B(s)$

$K_C$ has been found to be $10^{12}$. The $E^\circ_{cell}$ is:

(1) 0.354 V (2) 0.708 V
(3) 0.0098 V (4) 1.36 V

**EC0066**

**54.** The standard electrode potential (E°) for $OCl^-/Cl^-$ and $Cl^-$ / ½$Cl_2$ respectively are 0.94 V and –1.36 V. The E° value of $OCl^-/\frac{1}{2}Cl_2$ will be :

(1) –2.20 V (2) –0.42 V (3) 0.52 V (4) 1.04 V

**EC0067**

**55.** The hydrogen electrode is dipped in a solution of pH = 3 at 25 °C. The electrode potential of the half cell would be :

(1) 0.177 V (2) – 0.177 V
(3) 0.087 V (4) 0.059 V

**EC0069**

**56.** What is the potential of the cell containing two hydrogen electrodes as represented below

Pt; $H_2(g)$ | $H^+(10^{-8})M$ || $H^+(0.001\ M)$ | $H_2(g)$.Pt ;

(1) – 0.295 V (2) – 0.0591 V
(3) 0.295 V (4) 0.0591 V

**EC0070**

**57.** Consider the cell Cu | $Cu^{+2}$ || $Ag^+$ | Ag. If the concentration of $Cu^{+2}$ and $Ag^+$ ions becomes ten times, then the emf of the cell will :–

(1) Becomes 10 times
(2) Remains same
(3) Increases by 0.0295 V
(4) Decreases by 0.0295 V

**EC0071**

**58.** The emf of the cell

Ni | $Ni^{+2}$ (1.0 M) | | $Au^{+3}$ (0.1M) | Au

[E° for $Ni^{+2}$ | Ni = –0.25 V,

E° for $Au^{+3}$ | Au = 1.50 V] is given as:-

(1) 1.25 V (2) – 1.75 V
(3) 1.78 V (4) 1.73 V

**EC0072**

**59.** The equilibrium constant (in approx) of the cell reaction :

$Cu(s) + 2Ag^+(aq.) \rightleftharpoons Cu^{+2}(aq.) + 2Ag(s)$

if $E^\circ_{cell}$ = 0.465 V at 298 K is :-

(1) $2.0 \times 10^{10}$ (2) $3.16 \times 10^{12}$
(3) $3.16 \times 10^{15}$ (4) $4 \times 10^{10}$

**EC0097**

**60.** The emf of the cell in which the following reaction

$Zn(s) + Ni^{2+}\ (a = 0.1) \rightleftharpoons Zn^{2+}(a = 1.0) + Ni(s)$

occurs, is found to be 0.5105 V at 298 K. The standard e.m.f. of the cell is :-

(1) –0.5105 V (2) 0.5400 V
(3) 0.4810 V (4) 0.5696 V

**EC0053**

**61.** If $E^\circ_{Fe^{+2}/Fe}$ = – 0.441V and $E^\circ_{Fe^{+3}/Fe^{+2}}$ = 0.771V the standard EMF of the reaction $Fe + 2Fe^{+3} \rightarrow 3Fe^{+2}$ will be :

(1) 0.330 V (2) 1.653 V
(3) 1.212 V (4) 0.111 V

**EC0093**

## ELECTROLYSIS

**62.** 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

**EC0073**

**63.** 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

**EC0074**

**64.** 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

**EC0075**

**65.** How many coulombs of electric charge are required for the oxidation of 1 mol of $H_2O$ to $O_2$ ?

(1) $9.65 \times 10^4$ C (2) $4.825 \times 10^5$ C
(3) $1.93 \times 10^5$ C (4) $1.93 \times 10^4$ C

**EC0077**

**66.** On passing 10800 C through electrolytic solution, 2.977 g of metal (atomic mass 106.4 g $mol^{-1}$) was deposited, the charge on the metal cation is -

(1) +4 (2) +3 (3) +2 (4) +1

**EC0079**

**67.** On passing electricity through dilute $H_2SO_4$ solution the amount of substance liberated at the cathode and anode are in the ratio :

(1) 1 : 8 (2) 8 : 1
(3) 16 : 1 (4) 1 : 16

**EC0080**

**68.** During electrolysis of fused calcium hydride, the hydrogen is produced at :

(1) Cathode
(2) Anode
(3) Hydrogen is not liberated at all
(4) $H_2$ produced reacts with oxygen to form water

**EC0081**

**69.** 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.

**EC0082**

**70.** When electricity is passed through molten $AlCl_3$, 13.5 g Al is deposited. The number of Faradays must be :–

(1) 5.0 (2) 1.0 (3) 1.5 (4) 3.0

**EC0083**

**71.** A solution of sodium sulphate in water is electrolysed using inert electrodes. The product at the cathode and anode are respectively :–

(1) $H_2$, $SO_2$ (2) $O_2$, $H_2$
(3) $O_2$, Na (4) $H_2$, $O_2$

**EC0084**

**72.** One Faraday of electricity will liberate one mole of the metal from the solution of

(1) Auric chloride ($AuCl_3$) (2) Silver nitrate
(3) Calcium chloride (4) Copper sulphate

**EC0085**

**73.** When 96500 C of electricity are passed through molten 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

**EC0086**

**74.** 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 :–

(1) 22 kg (2) 18 kg (3) 9 kg (4) 27 kg

**EC0087**

**75.** What would be the ratio of moles of Ag, Cu, Fe that would be deposited by passage of same quantity of electricity through solutions of salts containing $Ag^+$, $Cu^{+2}$, $Fe^{+3}$ :-

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

(3) $\frac{1}{3} : \frac{1}{2} : 1$ (4) 1 : 2 : 3

**EC0088**

**76.** Electrolysis of aq. $CuSO_4$ causes :–

(1) An increase in pH
(2) A decrease in pH
(3) Either decrease or increase in pH
(4) None

**EC0089**

**77.** The passage of current liberates $H_2$ at cathode and $Cl_2$ at anode. The solution is :–

(1) $CuSO_4$ (aq) (2) $CuCl_2$ (aq.)

(3) NaCl (aq.) (4) Water

**EC0090**

## COMMERCIAL CELLS

**78.** When lead accumulator is charged, it acts as :

(1) an electrolytic cell (2) a galvanic cell

(3) a Daniel cell (4) none of the above

**EC0091**

**79.** The thermodynamic efficiency of cell is given by -

(1) $\frac{\Delta H}{\Delta G} \times 100$ (2) $\frac{nFE}{\Delta G} \times 100$

(3) $-\frac{nFE}{\Delta H} \times 100$ (4) Zero

**EC0169**

## EXERCISE-I (Conceptual Questions) ANSWER KEY

| **Que.** | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Ans.** | 3 | 2 | 3 | 1 | 3 | 3 | 3 | 2 | 1 | 2 | 1 | 1 | 1 | 3 | 1 |
| **Que.** | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| **Ans.** | 2 | 4 | 2 | 2 | 2 | 4 | 2 | 4 | 2 | 2 | 3 | 1 | 1 | 4 | 4 |
| **Que.** | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| **Ans.** | 1 | 3 | 4 | 2 | 4 | 1 | 3 | 3 | 4 | 3 | 1 | 3 | 4 | 4 | 3 |
| **Que.** | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| **Ans.** | 2 | 1 | 1 | 1 | 4 | 3 | 2 | 1 | 3 | 2 | 3 | 3 | 4 | 3 | 2 |
| **Que.** | 61 | 62 | 63 | 64 | 65 | 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 |
| **Ans.** | 3 | 1 | 4 | 3 | 3 | 1 | 1 | 2 | 3 | 3 | 4 | 2 | 1 | 2 | 2 |
| **Que.** | 76 | 77 | 78 | 79 | | | | | | | | | | | |
| **Ans.** | 2 | 3 | 1 | 3 | | | | | | | | | | | |

## EXERCISE-II (Previous Year Questions) AIPMT/NEET

### AIPMT 2009

**1.** Given :
(i) $Cu^{2+} + 2e^- \rightarrow Cu$, E° = 0.337 V
(ii) $Cu^{2+} + e^- \rightarrow Cu^+$, E° = 0.153 V
Electrode potential, E° for the reaction, $Cu^+ + e^- \rightarrow Cu$, will be :-
(1) 0.38 V (2) 0.52 V
(3) 0.90 V (4) 0.30 V

**EC0100**

**2.** The equivalent conductance of $\frac{M}{32}$ solution of a weak monobasic acid is 8.0 mho cm$^2$ eq$^{-1}$ and at infinite dilution is 400 mho cm$^2$ eq$^{-1}$. The dissociation constant of this acid is :-
(1) $1.25 \times 10^{-4}$ (2) $1.25 \times 10^{-5}$
(3) $1.25 \times 10^{-6}$ (4) $6.25 \times 10^{-4}$

**EC0101**

**3.** $Al_2O_3$ 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) $1.3 \times 10^4$ g (2) $9.0 \times 10^3$ g
(3) $8.1 \times 10^4$ g (4) $2.4 \times 10^5$ g

**EC0102**

### AIPMT 2010

**4.** An increase in equivalent conductance of a strong electrolyte with dilution is mainly due to:-
(1) Increase in number of ions.
(2) Increase in ionic mobility of ions.
(3) 100% ionisation of electrolyte at normal dilution.
(4) Increase in both i.e. number of ions and ionic mobility of ions.

**EC0103**

**5.** Consider the following relations for emf of a electrochemical cell :
(a) emf of cell =(Oxidation potential of anode) – (Reduction potential of cathode)
(b) emf of cell = (Oxidation potential of anode) + (Reduction potential of cathode)
(c) emf of cell = (Reduction potential of anode) + (Reduction potential of cathode)
(d) emf of cell = (Oxidation potential of anode) – (Oxidation potential of cathode)
Which of the above relations are correct :
(1) (a) and (b) (2) (c) and (d)
(3) (b) and (d) (4) (c) and (a)

**EC0104**

**6.** Which of the following expressions correctly represents the equivalent conductance of $Al_2(SO_4)_3$ at infinite dilution. Given that $\Lambda^\circ_{Al^{3+}}$ and $\Lambda^\circ_{SO_4^{2-}}$ are the equivalent conductances at infinite dilution of the respective ions :-
(1) $\Lambda^\circ_{Al^{3+}} + \Lambda^\circ_{SO_4^{2-}}$
(2) $\left(\Lambda^\circ_{Al^{3+}} + \Lambda^\circ_{SO_4^{2-}}\right) \times 6$
(3) $\frac{1}{3}\wedge^0_{Al^{3+}} + \frac{1}{2}\wedge^0_{SO_4^{2-}}$
(4) $2\Lambda^\circ_{Al^{3+}} + 3\Lambda^\circ_{SO_4^{2-}}$

**EC0105**

**7.** For the reduction of silver ions with copper metals, the standard cell potential was found to be +0.46 V at 25 °C. The value of standard Gibbs energy. ΔG° will be (F = 96500 C mol$^{-1}$)
(1) –98.0 kJ (2) –89.0 kJ
(3) –89.0 J (4) –44.5 kJ

**EC0106**

### AIPMT Pre. 2011

**8.** Standard electrode potential of three metals X, Y and Z are –1.2 V, +0.5 V and –3.0 V respectively. The reducing power of these metals will be :-
(1) Y > Z > X (2) Y > X > Z
(3) Z > X > Y (4) X > Y > Z

**EC0109**

**9.** The electrode potentials for
$Cu^{2+}(aq) + e^- \rightarrow Cu^+(aq)$
and $Cu^+(aq) + e^- \rightarrow Cu(s)$
are +0.15 V and +0.50 V respectively. The value of $E^0_{Cu^{+2}/Cu}$ will be :-
(1) 0.500 V (2) 0.325 V
(3) 0.650 V (4) 0.150 V

**EC0110**

**10.** Standard electrode potential for $Sn^{4+}/Sn^{2+}$ couple is +0.15 V and that for the $Cr^{3+}/Cr$ couples is –0.74 V. These two couples in their standard state are connected to make a cell. The standard cell potential will be :-
(1) +1.19 V (2) +0.89 V
(3) +0.18 V (4) +1.83 V

**EC0111**

**11.** If the $E^\circ_{cell}$ for a given reaction has a negative value, then which of the following gives the correct relationship for the values of $\Delta G^\circ$ and $K_{eq}$?

(1) $\Delta G^\circ > 0; K_{eq} > 1$ (2) $\Delta G^\circ < 0; K_{eq} > 1$

(3) $\Delta G^\circ < 0; K_{eq} < 1$ (4) $\Delta G^\circ > 0; K_{eq} < 1$

**EC0112**

## AIPMT Mains 2011

**12.** A solution contains $Fe^{2+}$, $Fe^{3+}$ and $I^-$ ions. This solution was treated with iodine at 35 °C. E° for $Fe^{3+} \mid Fe^{2+}$ is +0.77 V and E° for $I_2 \mid 2I^-$ = 0.536 V. The favourable redox reaction is :-

(1) $Fe^{2+}$ will be oxidised to $Fe^{3+}$

(2) $I_2$ will be reduced to $I^-$

(3) There will be no redox reaction

(4) $I^-$ will be oxidised to $I_2$

**EC0113**

## AIPMT Pre. 2012

**13.** Limiting molar conductivity of $NH_4OH$

$\left(\text{i.e. } \overset{\circ}{\Lambda}_{m(NH_4OH)}\right)$ is equal to:-

(1) $\overset{\circ}{\Lambda}_{m(NH_4OH)} + \overset{\circ}{\Lambda}_{m(NH_4Cl)} - \overset{\circ}{\Lambda}_{m(HCl)}$

(2) $\overset{\circ}{\Lambda}_{m(NH_4Cl)} + \overset{\circ}{\Lambda}_{m(NaOH)} - \overset{\circ}{\Lambda}_{m(NaCl)}$

(3) $\overset{\circ}{\Lambda}_{m(NH_4Cl)} + \overset{\circ}{\Lambda}_{m(NaCl)} - \overset{\circ}{\Lambda}_{m(NaOH)}$

(4) $\overset{\circ}{\Lambda}_{m(NaOH)} + \overset{\circ}{\Lambda}_{m(NaCl)} - \overset{\circ}{\Lambda}_{m(NH_4Cl)}$

**EC0114**

## AIPMT Mains 2012

**14.** Molar conductivities ($\Lambda^\circ_m$) at infinite dilution of NaCl, HCl and $CH_3COONa$ are 126.4, 425.9 and 91.0 S cm$^2$ mol$^{-1}$ respectively. $\Lambda^\circ_m$ for $CH_3COOH$ will be :-

(1) 290.8 S cm$^2$ mol$^{-1}$

(2) 390.5 S cm$^2$ mol$^{-1}$

(3) 425.5 S cm$^2$ mol$^{-1}$

(4) 180.5 S cm$^2$ mol$^{-1}$

**EC0115**

## NEET-UG 2013

**15.** At 25 °C molar conductance of 0.1 molar aqueous solution of ammonium hydroxide is 9.54 ohm$^{-1}$ cm$^2$ mol$^{-1}$ and at infinite dilution its molar conductance is 238 ohm$^{-1}$ cm$^2$ mol$^{-1}$. The degree of ionisation of ammonium hydroxide at the same concentration and temperature is :-

(1) 40.800 % (2) 2.080 %
(3) 20.800 % (4) 4.008 %

**EC0117**

**16.** A hydrogen gas electrode is made by dipping platinum wire in a solution of HCl of pH = 10 and by passing hydrogen gas around the platinum wire at 1 atm pressure. The oxidation potential of electrode would be ?

(1) 1.18 V (2) 0.059 V
(3) 0.59 V (4) 0.118 V

**EC0118**

**17.** A button cell used in watches function as following

$Zn(s) + Ag_2O(s) + H_2O(\ell) \rightleftharpoons 2Ag(s) + Zn^{2+}(aq) + 2OH^-(aq)$

If half cell potentials are

$Zn^{2+}(aq) + 2e^- \rightarrow Zn(s)$; E° = –0.76 V

$Ag_2O(s) + H_2O(\ell) + 2e^- \rightarrow 2Ag(s) + 2OH^-(aq)$;

E° = 0.34 V

The standard cell potential will be :-

(1) 1.34 V (2) 1.10 V
(3) 0.42 V (4) 0.84 V

**EC0119**

## AIPMT 2014

**18.** 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

**EC0121**

**19.** 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

**EC0122**

### AIPMT 2015

**20.** A device that converts energy of combustion of fuels like hydrogen and methane, directly into electrical energy is known as :-

(1) Electrolytic cell (2) Dynamo
(3) Ni-Cd cell (4) Fuel Cell

**EC0124**

### NEET-I 2016

**21.** The pressure of $H_2$ required to make the potential of $H_2$-electrode zero in pure water at 298 K is :-

(1) $10^{-14}$ atm (2) $10^{-12}$ atm
(3) $10^{-10}$ atm (4) $10^{-4}$ atm

**EC0127**

### NEET-II 2016

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

(1) 0.086 S cm$^2$/mol (2) 28.8 S cm$^2$/mol
(3) 2.88 S cm$^2$/mol (4) 11.52 S cm$^2$/mol

**EC0128**

**23.** 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

**EC0129**

**24.** If the $E^\circ_{cell}$ for a given reaction has a negative value, which of the following gives the **correct** relationships for the values of $\Delta G^\circ$ and $K_{eq}$ ?

(1) $\Delta G^\circ < 0;\ K_{eq} > 1$ (2) $\Delta G^\circ < 0;\ K_{eq} < 1$
(3) $\Delta G^\circ > 0;\ K_{eq} < 1$ (4) $\Delta G^\circ > 0;\ K_{eq} > 1$

**EC0130**

**25.** The number of electrons delivered at the cathode during electrolysis by a current of 1 A in 60 s is (charge on electron = $1.60 \times 10^{-19}$ C)

(1) $3.75 \times 10^{20}$ (2) $7.48 \times 10^{23}$
(3) $6 \times 10^{23}$ (4) $6 \times 10^{20}$

**EC0131**

### NEET(UG) 2017

**26.** In the electrochemical cell :-

$Zn \mid ZnSO_4(0.01M) \mid\mid CuSO_4(1.0\ M) \mid Cu$, 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 $E_2$.

Which one of the relationship is correct between $E_1$ and $E_2$?

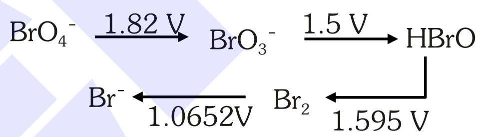
(Given, $\frac{RT}{F} = 0.059$)

(1) $E_1 < E_2$ (2) $E_1 > E_2$
(3) $E_2 = 0 \neq E_1$ (4) $E_1 = E_2$

**EC0133**

### NEET(UG) 2018

**27.** Consider the change in oxidation state of Bromine corresponding to different EMF values as shown in the diagram below:




Then the species undergoing disproportionation is:-

(1) $BrO_3^-$ (2) $BrO_4^-$
(3) $Br_2$ (4) HBrO

**EC0135**

### NEET(UG) 2019

**28.** For a cell involving one electron $E^\circ_{cell}$ = 0.59V at 298 K, the equilibrium constant for the cell reaction is :-

$\left[\text{Given that } \frac{2.303RT}{F} = 0.059V \text{ at } T = 298K\right]$

(1) $1.0 \times 10^2$ (2) $1.0 \times 10^5$
(3) $1.0 \times 10^{10}$ (4) $1.0 \times 10^{30}$

**EC0192**

**29.** For the cell reaction

$2Fe^{3+}(aq) + 2I^-(aq) \rightarrow 2Fe^{2+}(aq) + I_2(aq)$

$E^\circ_{cell} = 0.24V$ at 298 K. The standard Gibbs energy $(\Delta_r G^\circ)$ of the cell reaction is :

[Given that Faraday constant F = 96500 C mol$^{-1}$]

(1) – 46.32 kJ mol$^{-1}$ (2) – 23.16 kJ mol$^{-1}$
(3) 46.32 kJ mol$^{-1}$ (4) 23.16 kJ mol$^{-1}$

**EC0193**

## NEET(UG) (Odisha) 2019

**30.** Following limiting molar conductivities are given as

$\lambda^0_{m(H_2SO_4)} = x\ S\,cm^2\,mol^{-1}$

$\lambda^0_{m(K_2SO_4)} = y\ S\,cm^2\,mol^{-1}$

$\lambda^0_{m(CH_3COOK)} = z\ S\,cm^2\,mol^{-1}$

$\lambda^0_m$ (in S cm$^2$ mol$^{-1}$) for $CH_3COOH$ will be-

(1) $x - y + 2z$ (2) $x + y - z$

(3) $x - y + z$ (4) $\frac{(x-y)}{2} + z$

**EC0194**

**31.** The standard electrode potential (E°) values of $Al^{3+}|Al$, $Ag^+|Ag$, $K^+|K$ and $Cr^{3+}|Cr$ are –1.66 V, 0.80V, –2.93 V and –0.74 V respectively. The correct decreasing order of reducing power of the metal is :

(1) Ag > Cr > Al > K (2) K > Al > Cr > Ag

(3) K > Al > Ag > Cr (4) Al > K > Ag > Cr

**EC0195**

## NEET (UG) 2020

**32.** The number of Faradays(F) required to produce 20 g of calcium from molten $CaCl_2$ (Atomic mass of Ca = 40 g mol$^{-1}$) is :

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

**EC0205**

**33.** On electrolysis of dil. sulphuric acid using Platinum (Pt) electrode, the product obtained at anode will be:

(1) $SO_2$ gas (2) Hydrogen gas

(3) Oxygen gas (4) $H_2S$ gas

**EC0206**

## NEET (UG) 2020 (COVID-19)

**34.** Identify the reaction from following having top position in EMF series (Std.red. potential) according to their electrode potential at 298 K.

(1) $Mg^{2+} + 2e^- \rightarrow Mg(s)$ (2) $Fe^{2+} + 2e^- \rightarrow Fe(s)$

(3) $Au^{3+} + 3e^- \rightarrow Au(s)$ (4) $K^+ + 1e^- \rightarrow K(s)$

**EC0207**

**35.** In a typical fuel cell, the reactants (R) and product (P) are :-

(1) R = $H_{2(g)}$, $O_{2(g)}$; P = $H_2O_{2(\ell)}$

(2) R = $H_{2(g)}$, $O_{2(g)}$; P = $H_2O_{(\ell)}$

(3) R = $H_{2(g)}$, $O_{2(g)}$, $Cl_{2(g)}$; P = $HClO_{4(aq)}$

(4) R = $H_{2(g)}$, $N_{2(g)}$; P = $NH_{3(aq)}$

**EC0208**

## NEET (UG) 2021

**36.** The molar conductance of NaCl, HCl and $CH_3COONa$ at infinite dilution are 126.45,426.16 and 91.0 S cm$^2$ mol$^{-1}$ respectively. The molar conductance of $CH_3COOH$ at infinite dilution is. Choose the right option for your answer.

(1) 201.28 S cm$^2$ mol$^{-1}$

(2) 390.71 S cm$^2$ mol$^{-1}$

(3) 698.28 S cm$^2$ mol$^{-1}$

(4) 540.48 S cm$^2$ mol$^{-1}$

**EC0209**

**37.** The molar conductivity of 0.007 M acetic acid is 20 S cm$^2$ mol$^{-1}$. What is the dissociation constant of acetic acid ? Choose the correct option.

$$\left[\begin{array}{l}\Lambda^\circ_{H^+} = 350\,S\,cm^2mol^{-1}\\ \Lambda^\circ_{CH_3COO^-} = 50\,S\,cm^2mol^{-1}\end{array}\right]$$

(1) $1.75 \times 10^{-4}$ mol L$^{-1}$

(2) $2.50 \times 10^{-4}$ mol L$^{-1}$

(3) $1.75 \times 10^{-5}$ mol L$^{-1}$

(4) $2.50 \times 10^{-5}$ mol L$^{-1}$

**EC0210**

## NEET (UG) 2021 (Paper-2)

**38.** An electrolytic cell contains a solution of $Ag_2SO_4$ and has platinum electrodes. A current is passed until 1.6g of $O_2$ has been liberated at anode. The amount of silver deposited at cathode will be

(1) 108 g (2) 1.6 g

(3) 0.8 g (4) 21.60 g

**EC0211**

**39.** The specific conductance of a saturated solution of silver bromide is k S cm$^{-1}$. The limiting ionic conductivity of $Ag^+$ and $Br^-$ ions are x and y, respectively. The solubility of silver bromide in gL$^{-1}$ is : (Molar mass of AgBr = 188)

(1) $\frac{k \times 1000}{x - y}$ (2) $\frac{k}{x+y} \times 188$

(3) $\frac{k \times 1000 \times 188}{x+y}$ (4) $\frac{x+y}{k} \times \frac{1000}{188}$

**EC0212**

## NEET (UG) 2022

**40.** At 298 K, the standard electrode potentials of $Cu^{2+}/Cu$, $Zn^{2+}/Zn$, $Fe^{2+}/Fe$ and $Ag^{+}/Ag$ are 0.34V, – 0.76 V, – 0.44 V and 0.80 V, respectively.
On the basis of standard electrode potential, predict which of the following reaction can not occur ?
(1) $CuSO_4(aq) + Fe(s) \rightarrow FeSO_4(aq) + Cu(s)$
(2) $FeSO_4(aq) + Zn(s) \rightarrow ZnSO_4(aq) + Fe(s)$
(3) $2CuSO_4(aq) + 2Ag(s) \rightarrow 2Cu(s) + Ag_2SO_4(aq)$
(4) $CuSO_4(aq) + Zn(s) \rightarrow ZnSO_4(aq) + Cu(s)$
**EC0213**

**41.** Given below are half cell reactions :
$$MnO_4^- + 8H^+ + 5e^- \rightarrow Mn^{2+} + 4H_2O,$$
$$E^\circ_{Mn^{2+}/MnO_4^-} = -1.510\,V$$
$$\frac{1}{2}O_2 + 2H^+ + 2e^- \rightarrow H_2O,$$
$$E^\circ_{O_2/H_2O} = +1.223\,V$$
Will the permanganate ion, $MnO_4^-$ liberate $O_2$ from water in the presence of an acid ?
(1) No, because $E^\circ_{cell} = -0.287$ V
(2) Yes, because $E^\circ_{cell} = +2.733$ V
(3) No, because $E^\circ_{cell} = -2.733$ V
(4) Yes, because $E^\circ_{cell} = +0.287$ V
**EC0214**

**42.** Find the emf of the cell in which the following reaction takes place at 298 K
$Ni(s) + 2Ag^+(0.001\ M) \rightarrow Ni^{+2}\ (0.001\ M) + 2Ag(s)$
(Given that $E^\circ_{cell} = 10.5$ V, $\frac{2.303RT}{F} = 0.059$ at 298 K)
(1) 1.385 V (2) 0.9615 V
(3) 1.05 V (4) 1.0385 V
**EC0215**

## NEET (UG) 2022 (OVERSEAS)

**43.** The three cells with their $E^\circ_{(cell)}$ values are given below :

| Cells | $E^\circ_{(cell)}$ / V |
|---|---|
| (a) $Fe \mid Fe^{2+} \parallel Fe^{3+} \mid Fe$ | 0.404 |
| (b) $Fe \mid Fe^{2+} \parallel Fe^{3+}, Fe^{2+} \mid Pt$ | 1.211 |
| (c) $Fe \mid Fe^{3+} \parallel Fe^{3+}, Fe^{2+} \mid Pt$ | 0.807 |

The standard Gibbs free energy change values for three cells are, respectively
(F represents charge on 1 mole of electrons)
(1) +2.424 F, +2.422 F, +2.421 F
(2) –0.808 F, –2.422 F, –2.421 F
(3) –2.424 F, –2.422 F, –2.421 F
(4) –1.212 F, –1.211 F, –0.807 F
**EC0216**

**44.** $\Lambda^\circ_m$ for NaCl, HCl and $CH_3COONa$ are 126.4, 425.9 and 91.05 S cm$^2$ mol$^{-1}$ respectively. If conductivity of 0.001028 mol L$^{-1}$ acetic acid solution is $4.95 \times 10^{-5}$ S cm$^{-1}$, find the degree of dissociation of the acetic acid solution
(1) 1.00 (2) 0.1233
(3) 1.233 (4) 0.01233
**EC0217**

## Re-NEET (UG) 2022

**45.** Two half cell reactions are given below :
$Co^{3+} + e^- \rightarrow Co^{2+}$, $E^\circ_{Co^{2+}/Co^{3+}} = -1.81$ V
$2Al^{3+} + 6e^- \rightarrow 2\ Al(s)$, $E^\circ_{Al/Al^{3+}} = +1.66$ V
The standard EMF of a cell with feasible redox reaction will be :
(1) +7.09 V (2) +0.15 V
(3) +3.47 V (4) –3.47 V
**EC0218**

**46.** Standard electrode potential for the cell with cell reaction
$Zn(s) + Cu^{2+}(aq) \rightarrow Zn^{2+}(aq) + Cu(s)$
is 1.1 V. Calculate the standard gibbs energy change for the cell reaction.
(Given F = 96487 C mol$^{-1}$)
(1) –200.27 kJ mol$^{-1}$ (2) –212.27 kJ mol$^{-1}$
(3) –212.27 J mol$^{-1}$ (4) –200.27 J mol$^{-1}$
**EC0219**

## EXERCISE-II (Previous Year Questions) ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 2 | 2 | 3 | 2 | 3 | 1 | 2 | 3 | 2 | 2 | 4 | 4 | 2 | 2 | 4 |
| Que. | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| Ans. | 3 | 2 | 3 | 4 | 4 | 1 | 4 | 4 | 3 | 1 | 2 | 4 | 3 | 1 | 4 |
| Que. | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| Ans. | 2 | 2 | 3 | 3 | 2 | 2 | 3 | 4 | 3 | 3 | 4 | B | 3 | 2 | 3 |
| Que. | 46 | | | | | | | | | | | | | | |
| Ans. | 2 | | | | | | | | | | | | | | |

## EXERCISE-III (Analytical Questions)

Master Your Understanding

**1.** Specific conductance of 0.1 M Nitric acid is $6.3 \times 10^{-2}$ ohm$^{-1}$ cm$^{-1}$. The molar conductance of the solution is :

(1) 630 ohm$^{-1}$ cm$^{2}$ mol$^{-1}$

(2) 315 ohm$^{-1}$ cm$^{2}$ mol$^{-1}$

(3) 6.300 ohm$^{-1}$ cm$^{2}$ mol$^{-1}$

(4) 63.0 ohm$^{-1}$ cm$^{2}$ mol$^{-1}$

**EC0140**

**2.** The highest electrical conducitivity of the following aqueous solution is of

(1) 0.1 M fluoroacetic acid

(2) 0.1 M difluoroacetic acid

(3) 0.1 M acetic acid

(4) 0.1 M chloroacetic acid

**EC0141**

**3.** Resistance of a conductivity cell filled with a solution of an electrolyte of concentration 0.1 M is 100 Ω. The conductivity of this solution is 1.29 S m$^{-1}$. Resistance of the same cell when filled with 0.02 M solution of the same electrolyte is 520 Ω. The molar conductivity of 0.02 M solution of the electrolyte will be.

(1) $124 \times 10^{-4}$ S m$^2$ mol$^{-1}$

(2) $1240 \times 10^{-4}$ S m$^2$ mol$^{-1}$

(3) $1.24 \times 10^{-4}$ S m$^2$ mol$^{-1}$

(4) $12.4 \times 10^{-4}$ S m$^2$ mol$^{-1}$

**EC0142**

**4.** Resistance of 0.2 M solution of an electrolyte is 50 Ω. The specific conductance of the solution is 1.3 S m$^{-1}$. If resistance of the 0.4 M solution of the same electrolyte is 260 Ω then its molar conductivity is:-

(1) 6250 S m$^2$ mol$^{-1}$

(2) $6.25 \times 10^{-4}$ S m$^2$ mol$^{-1}$

(3) $625 \times 10^{-4}$ S m$^2$ mol$^{-1}$

(4) 62.5 S m$^2$ mol$^{-1}$

**EC0144**

**5.** The equivalent conductance of NaCl at concentration C and at infinite dilution are $\lambda_C$ and $\lambda^\infty$, respectively. The correct relationship between $\lambda_C$ and $\lambda^\infty$ is given by :

(where the constant B is positive)

(1) $\lambda_C = \lambda^\infty - (B)\sqrt{C}$

(2) $\lambda_C = \lambda^\infty + (B)\sqrt{C}$

(3) $\lambda_C = \lambda^\infty + (B)\,C$

(4) $\lambda_C = \lambda^\infty - (B)\,C$

**EC0145**

**6.** Which of the following statements is TRUE for the electrochemical Daniel cell :

(1) Electrons flow from copper electrode to zinc electrode.

(2) Current flows from zinc electrode to copper electrode.

(3) Cations move toward copper electrode.

(4) Cations move toward zinc electrode.

**EC0147**

**7.** Standard reduction electrode potential of three metal electrodes A, B and C are respectively + 0.5 V, – 3.0 V and –1.2 V. The reducing power of these metals are :

(1) C > B > A (2) A > C > B

(3) B > C > A (4) A > B > C

**EC0149**

**8.** Consider the following $E^0$ values

$E^0_{Fe^{3+}/Fe^{2+}} = +0.77$ V

$E^0_{Sn^{2+}/Sn} = -0.14$ V

Under standard conditions the potential for the reaction

$Sn(s) + 2Fe^{3+}(aq) \longrightarrow 2Fe^{2+}(aq) + Sn^{2+}(aq)$ is

(1) 0.91 V (2) 1.40 V

(3) 1.68 V (4) 0.63 V

**EC0150**

**9.** For the redox reaction :

$Zn(s) + Cu^{2+}\ (0.1M) \rightarrow Zn^{2+}\ (1M) + Cu(s)$ taking place in a cell,

$E^\circ_{Cell}$ is 1.10 V. $E_{Cell}$ for the cell will be

$$\left(2.303\frac{RT}{F} = 0.0591\right)$$

(1) 1.07 V (2) 0.82 V

(3) 2.14 V (4) 1.80 V

**EC0151**

**10.** In a cell that utilises the reaction

$Zn(s) + 2H^+(aq.) \rightleftharpoons Zn^{2+}(aq) + H_2(g)$ addition of $H_2SO_4$ to cathode compartment, will

(1) increase the $E_{cell}$ and shift equilibrium to the right

(2) lower the $E_{cell}$ and shift equilibrium to the right

(3) lower the $E_{cell}$ and shift equilibrium to the left

(4) increase the $E_{cell}$ and shift equilibrium to the left

**EC0152**

**11.** The e.m.f. of a Daniell cell at 298 K is $E_1$.

$Zn \mid ZnSO_4 \mid\mid CuSO_4 \mid Cu$

(0.01M) (1.0M)

When the concentration of $ZnSO_4$ is 1.0 M and that of $CuSO_4$ is 0.01 M, the e.m.f. changed to $E_2$. What is the relationship between $E_1$ and $E_2$

(1) $E_1 > E_2$ (2) $E_1 < E_2$

(3) $E_1 = E_2$ (4) $E_2 = 0 \neq E_1$

**EC0153**

**12.** The reduction potential of hydrogen half-cell will be negative if :-

(1) $p(H_2) = 2$ atm and $[H^+] = 1.0$ M

(2) $p(H_2) = 2$ atm and $[H^+] = 2.0$ M

(3) $p(H_2) = 1$ atm and $[H^+] = 2.0$ M

(4) $p(H_2) = 1$ atm and $[H^+] = 1.0$ M

**EC0154**

**13.** For a spontaneous reaction; $\Delta G$, equilibrium constant (K) and $E^\circ_{Cell}$ will be respectively

(1) –ve, < 1, –ve (2) –ve, >1, –ve

(3) –ve, >1, +ve (4) +ve, >1, –ve

**EC0156**

**14.** The metal that cannot be obtained by electrolysis of an aqueous solution of its salts is:

(1) Cu (2) Cr (3) Ag (4) Ca

**EC0160**

**15.** During electrolysis of a solution of $AgNO_3$ 9650 C of charge is passed 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

**EC0161**

**16.** Aluminium oxide may be electrolysed at 1000 °C to furnish aluminium metal . The cathode reaction is

$Al^{3+} + 3e^- \longrightarrow Al$

The amount of charge required to prepare 5.12 kg of aluminium metal by this method would be :-

(1) $5.49 \times 10^4$ C

(2) $5.49 \times 10^1$ C

(3) $5.49 \times 10^7$ C

(4) $1.83 \times 10^7$ C

**EC0162**

**17.** A concentration cell involving a metal M is :

$M_{(s)} \mid M^+_{(aq)}(0.05M) \mid\mid M^+_{(aq)}\ (1M) \mid M_{(s)}$.

For this cell ;

(1) $E_{cell} > 0$ ; $\Delta G < 0$

(2) $E_{cell} = 0$ ; $\Delta G = 0$

(3) $E_{cell} > 0$ ; $\Delta G > 0$

(4) $E^\circ_{cell} > 0$ ; $\Delta G^\circ < 0$

**EC0196**

**18.** $M^{+n}(aq) + ne^- \longrightarrow M(s)$ ; $E^\circ_{M^{+n}/M} = xV$

$N^{+n}(aq) + ne^- \longrightarrow N(s)$ ; $E^\circ_{N^{+n}/N} = yV$

if x > y then :

(I) $M^{+n}(aq)$ is better oxidising agent compared to $N^{+n}(aq)$

(II) N(s) is better reducing agent compared to M(s)

(III) $N^{+n}(aq)$ is better oxidising agent compared to $M^{+n}(aq)$

(IV) M(s) is better reducing agent compared to N(s)

(1) I and III (2) II, III

(3) I and II (4) III, IV

**EC0197**

**19.** Which of the following is incorrect for

$Cu(s) \mid Cu^{+2}(aq, 1M) \mid\mid Ag^+(aq, 1M) \mid Ag(s)$

(1) $E^\circ_{cell} = E^\circ_{Cu/Cu^{+2}} + E^\circ_{Ag^+/Ag}$

(2) $E^\circ_{cell} = E^\circ_{Ag^+/Ag} - E^\circ_{Cu^{+2}/Cu}$

(3) $E^\circ_{cell} = E^\circ_{Cu/Cu^{+2}} - E^\circ_{Ag/Ag^+}$

(4) $E^\circ_{cell} = E^\circ_{Ag/Ag^+} - E^\circ_{Cu^{+2}/Cu}$

**EC0198**

**20.** Find the incorrect formula

(1) $E_{cell} = E^\circ_{cell} - \dfrac{2.303\ RT}{nF}\log_{10} Q$

(2) $\Delta G = \Delta G^\circ + RT \ln Q$

(3) $K_{eq} = 10^{\frac{nE^\circ_{cell}}{0.0591}}$

(4) At equilibrium $(\Delta G^\circ)_{T,P} = 0$

**EC0199**

**21.** $\Lambda_m^\circ NaCl = z\, S\, cm^2\, mol^{-1}$

$\Lambda_m^\circ CH_3COONa = y\, S\, cm^2\, mol^{-1}$

$\Lambda_m^\circ HCl = x\, S\, cm^2\, mol^{-1}$

$\Lambda_m^c CH_3COOH = w\, S\, cm^2\, mol^{-1}$

When its concentration is 0.1 M then pick the correct option :

(1) $\Lambda_m^\circ CH_3COOH = x + y + z$

(2) $\alpha_{CH_3COOH} = \dfrac{w}{x+y-z}$

(3) $K_a = 0.1\left[\dfrac{w}{x+y-z}\right]$ if $\alpha << 1$

(4) $\Lambda_m^\circ CH_3COOH = \dfrac{\Lambda_{eq}^\circ CH_3COOH}{2}$

**EC0200**

**22.** The emf of the cell : Pt(s) | $Br^-$ (0.01M) $Br_2(l)$ || $H^+$(0.001 M) | $H_2(g)$ | Pt(s) will be

[Given : $E^\circ_{Br_2/Br^-} = 1.09$ V and $E^\circ_{H^+/H_2} = 0$V]

(1) –0.79 V (2) –1.39 V
(3) –1.30 V (4) –1.90V

**EC0201**

**23.** Given $E^0_{K^+/K} = -2.93$ V, $E^0_{Ag^+/Ag} = 0.80$ V, $E^0_{Hg^{+2}/Hg} = 0.79$ V, $E^0_{Mg^{+2}/Mg} = -2.37$ V, $E^0_{Cr^{+3}/Cr} = -0.74$ V. Arrange these metals in increasing order of reducing power

(1) K, Mg, Cr, Hg, Ag (2) Ag, Hg, Cr, Mg, K
(3) Mg, K, Cr, Ag, Hg (4) Ag, Hg, K, Cr, Mg

**EC0202**

**24.** 4.5 gm of aluminium metal is deposited at cathode from $Al^{+3}$ ions by a certain quantity of electric charge. Find volume of $H_{2(g)}$, produced at S.T.P. from $H^+$ ions by the same quantity of electric charge?

(1) 5.6 litre (2) 11.2 litre
(3) 22.4 litre (4) 44.8 litre

**EC0203**

**25.** The molar conductivity of 0.02 M HCOOH is 40.4 S $cm^2$ $mol^{-1}$, If $\Lambda_m^\circ(H^+) = 350$ S $cm^2$ $mol^{-1}$ and $\Lambda_m^\circ(HCOO^-) = 54$ S $cm^2$ $mol^{-1}$ then dissociation constant of HCOOH is –

(1) $2.22 \times 10^{-3}$ (2) $2.22 \times 10^{-4}$
(3) $2.22 \times 10^{-5}$ (4) $1.22 \times 10^{-2}$

**EC0204**

EXERCISE-III (Analytical Questions) ANSWER KEY

| Que. | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Ans. | 1 | 2 | 1 | 2 | 1 | 3 | 3 | 1 | 1 | 1 | 1 | 1 | 3 | 4 | 4 |
| Que. | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | | | | | |
| Ans. | 3 | 1 | 3 | 4 | 4 | 2 | 2 | 2 | 1 | 2 | | | | | |