Chapter-05

Electrochemistry Marks-5 with option 7

Multiple choice questions (1 Mark)

i) Kohlrausch law is applicable for ----------

a) the solution at infinite dilution b) a concentrated solution

c) concentrated as well as dilute solution d) aqueous solution

ii) During electrolysis of molten NaCl, which of the following statement is Incorrect?

a) a pale green Cl_2 gas is released at anode

b) molten silvery white sodium is deposited at cathode

c) decomposition of NaCl into Na metal and Cl_2 gas

d) a pale green Cl_2 gas is released at anode

iii) SI unit of conductivity is _____

a) $\Omega^{-1}m^{-1}$ b) Ωcm^{-1} c) Ωm^{-1} d) $\Omega^{-1}m^2mol^{-1}$

iv) In case of weak electrolyte the graph Λ vs $\sqrt{c}$ is _____

a) Linear **b) Non linear** c) Straight line passing from origin d) Curved

v) In construction of Standard Hydrogen Electrode, platinum acts as _____

a) inert electrode b) positive ion producing electrode

c) negative ion producing electrode d) donor of electrons

vi) For hydrogen gas electrode E_{H2} is calculated through Nernst equation, where E^0_{H2} is always

a) 0V b) 0.0592V c) -1.1V d) 1.1V

vii) When molten ionic compound is electrolyzed a metal is formed at ___

a) Negative electrode b) Positive electrode c) Salt bridge d) Electrolyte

viii) The molar conductivity and conductivity of $AgNO_3$ solution are 121.4 $\Omega^{-1}cm^2mol^{-1}$ and 2.428×10^{-3} $\Omega^{-1}cm^{-1}$ respectively at 25^0C. What is molar concentration of $AgNO_3$ solution:

a) 0.02M **b)** 0.2M c) 2.0M d) 2.2M

ix) A cell constituted by two electrodes A ($E^0_{A+/A} = 0.35V$) and B ($E^0_{B+/B} = +0.42V$) has value of E^0_{cell} equal to

a) 0.07V b) -0.07 V c) -0.77V d) 0.77 V

x) Calculate E^0_{cell} for galvanic cell with electrodes Co/Co^{3+}, Mn^{2+}/Mn, $E^0_{Mn} = -1.18V$, $E^0_{Co} = 1.82$ V.

a) -3.0V **b) + 3.0V** c) 1.36V d) 0.268V

Very short answer questions (1 Mark)

i) Write SI unit of conductivity.

ii) What is cell voltage?

iii) Write a mathematical expression for Standard Cell Potential.

iv) Write the formula to calculate molar conductivity of the given solution.

v) Write the chemical composition present in the salt bridge.

vi) Write the potential produced through the NICAD storage cell.

vii)Write an equation that shows the relationship between molar conductivity and degree of dissociation of weak electrolyte.

viii) Write Arrhenius equation.

Short answer questions (Type- I) (2 Marks)

1) Draw a neat and labeled diagram of Standard Hydrogen Electrode.
2) What are the functions of a salt bridge in a galvanic cell?
3) Derive relation between equilibrium constant of reaction(K) and standard cell potential(E^0_{cell})
4) Write applications of Kohlrausch's Law.
5) What is the cell constant? Write its SI unit.
6) Mention difficulties in setting Standard Hydrogen Electrode.
7) What is the mass of copper metal produced at cathode during the passage of 2.03A current through the $CuSO_4$ solution for 1 hour. Molar mass of Cu = 63.5 g mol^{-1} **(Ans:2.405 g)**
8) Mercury battery provides more constant voltage than any other dry cell; Explain.
9) Represent the galvanic cell from following overall cell reaction

   $Cd\ (s) + Cu^{2+}(aq) \rightarrow Cd^{2+}\ (aq) + Cu\ (s)$

   Define:Anode
10) How many moles of electrons are required for reduction of 2 moles of Zn^{2+} to Zn ? (**Ans: 4 moles**)
11) Calculate standard cell potential of following galvanic cell:

    $Zn/Zn^{2+}(1\ M)\ //\ Pb^{2+}(1\ M)/Pb$. If $E^0_{Pb} = 0.126V$ and $E^0_{Zn} = -0.763V$ **(Ans: 0.889V)**

12) Draw a neat and labeled diagram of Lead accumulator.
13) Draw a neat and labeled diagram of Leclanche cell(Dry Cell)

Short answer questions (Type- II) (3 Marks)

1) State Kohlrausch law of independent migration of ions. Derive the relationship between Gibbs energy of cell reaction and cell potential.
2) Write the main difference between electrolytic conductivity and molar conductivity with respect to concentration. Also write one application of electrochemical series.
3) Write three important steps required to determine molar conductivity.
4) Draw a neat and well labeled diagram of Standard Hydrogen Electrode. Write one application.
5) Define reference electrode.Write two applications of electrochemical series.
6) Calculate the voltage of the cell Sn(s) / Sn^{2+}(0.02 M) // Ag^{+}(0.01 M) / Ag(s) at 25^0C.
   Given: E^0_{Sn} = -0.136V, E^0_{Ag} = 0.800V **(Ans: 0.8679V)**
7) Draw a well labeled diagram of a conductivity cell. Write net cell reaction involved in electrolysis of aqueous NaCl.
8) Write a mathematical formula for mole ratio. How long will it take to produce 2.415g of Ag metal from its salt solution by passing a current of 3A? Molar mass of Ag= 107.9 $gmol^{-1}$ **(Ans: 720 s or 12 min.)**

Long answer questions (4 Marks)

1) Why is the Nickel Cadmium cell referred to as a secondary cell? Write working of NICAD storage cells. Write its applications.
2) Write relation between electrolytic conductivity and molar conductivity.
   Calculate molar conductivity at zero concentration for $CaCl_2$ and NaCl.
   Given: molar ionic conductivities of Ca^{2+}, Cl^{-}, Na^{+} ions are respectively, 104, 76.4, 50.1 $\Omega^{-1}cm^{-2}mol^{-1}$
   (Ans:256.8$\Omega^{-1}cm^2mol^{-1}$ and 126.5$\Omega^{-1}cm^2mol^{-1}$)
3) Calculate E^0_{cell} of the following galvanic cell:
   Mg(s) / Mg^{2+}(1 M) // Ag^{+}(1 M) / Ag(s) if E^0_{Mg} = -2.37V and E^0_{Ag} = 0.8V. Write cell reactions involved in the above cell. Also mention if cell reaction is spontaneous or not. **(Ans: 3.17 V)**
4) Explain construction, working in terms of cell reactions and the results of electrolysis of fused NaCl.
5) Explain Construction of Standard Hydrogen electrode (SHE), write its applications and difficulties in setting.