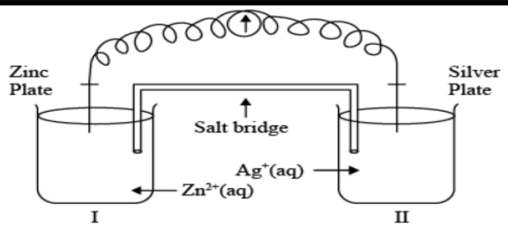
YEAR 2022



1.Read the passage given below and answer the questions that follow:
(i) Is silver plate the anode or cathode?
(ii)What will happen if the salt bridge is removed?
(iii) When does electro-chemical cell behaves like an electrolytic cel1?
(iv)What will happen to the concentration of Zn^{2+} and Ag^{+} when Ecell = 0.
(v) Why does conductivity of a solution decreases with dilution?
(vi) The molar conductivity of a 1.5 M solution of an electrolyte is found to be 138.9 S cm^2 mol^{-1}. Calculate the conductivity of this solution.

YEAR 2020

1.Kohlrausch given the following relation for strong electrolytes:

$\Lambda = \Lambda_0 - A\sqrt{C}$

Which of the following equality holds?
(a) $\Lambda = \Lambda_0$ as $C \rightarrow \sqrt{A}$ (b) $\Lambda = \Lambda_0$ as $C \rightarrow \infty$
(c) $\Lambda = \Lambda_0$ as $C \rightarrow 0$ (d) $\Lambda = \Lambda_0$ as $C \rightarrow 1$

2. In an electrochemical process, a salt bridge is used
as a reducing agent.
as an oxidizing agent.
to complete the circuit so that current can flow.
None of these

3. Assertion (A): Conductivity of an electrolyte increases with decrease in concentration.
Reason (R) : Number of ions per unit volume decreases on dilution.

4. When a steady current of 2A was passed through two electrolytic cells A and B containing electrolytes $ZnSO_4$ and $CuSO_4$ connected in series, 2g of Cu were deposited at the cathode of cell B.
(a)How long did the current flow?
(b) What mass of Zn was deposited at cathode of cell A? [Atomic mass: Cu = 63.5 g mol^{-1}, Zn = 65 g mol^{-1}; 1F = 96500 C mol^{-1}]

5. Name the cell used in hearing aids and watches.

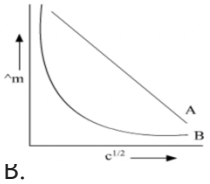
6. How much charge in terms of Faraday is required to reduce one mol of MnO_4^- to Mn^{2+}?

YEAR 2019

1. $E°_{cell}$ for the given redox reaction is 2.71 V $Mg_{(s)} + Cu^{2+}$ (0.01 M) $\rightarrow Mg^{2+}$(0.001 M) + $Cu_{(s)}$
Calculate E_{cell} for the reaction. Write the direction of flow of current when an external opposite potential applied is
(i) less than 2.71 V and
(ii) greater than 2.71 V

2. (a) A steady current of 2 amperes was passed through two electrolytic cells X and Y connected in series containing electrolytes $FeSO_4$ and $ZnSO_4$ until 2.8 g of Fe deposited at the cathode of cell X. How long did the current flow? Calculate the mass of Zn deposited at the cathode of cell Y. (Molar mass : Fe = 56 g mol^{-1} Zn = 65.3 g mol^{-1}, 1F = 96500 C mol^{-1})

(b) In the plot of molar conductivity ($\wedge m$) vs square root of concentration ($c^{1/2}$), following curves are obtained for two electrolytes A and B:



Answer the following:
Predict the nature of electrolytes A and ʙ.
What happens on extrapolation of Λ_m to concentration approaching zero for electrolytes A and B?

YEAR 2018

1. (a) Write the cell reaction and calculate the e.m.f of the following cell at 298 K: $Sn_{(s)}|\ Sn^{2+}$(0.004 M)$||H^+$(0.020 M)$|H2_{(g)}$(1 bar) $Pt_{(s)}$
(Given : $E^0Sn^{2+}/Sn = -0.14$ V)
(b)Give reasons:
(i) On the basis of E° values, O_2 gas should be liberated at anode but it is Cl_2 gas which is liberated in the electrolysis of aqueous NaCl.
(ii) Conductivity of CH_3COOH decreases on dilution.

2. (a) For the reaction. $2\ AgCl_{(s)} + H_{2\ (g)}$ (1atm) $\rightarrow$ $2\ Ag_{(s)} + 2H^+$ (0. 1 M) $+2\ Cl^-$ (0. 1 M), **$\Delta G° = -43600$ J at 25°C**
Calculate the e.m.f. of the cell. [log $10^{-n} = -n$]
(b) Define fuel cell and write its two advantages.

YEAR 2017

1.Calculate the degree of dissociation (α) of acetic acid if it's molar conductivity (Λ_m) is 39.05 S cm^2 mol^{-1}.Given, $\lambda°(H^+)$ = 349.8 S cm^2 mol^{-1} and $\lambda°(CH_3COO^-)$ = 40.9 S cm^2 mol^{-1}

2. Calculate the mass of Ag deposited at cathode when a current of 2 amperes was passed through a solution of $AgNO_3$ for 15 minutes.
(Given : Molar mass of Ag = 108 g mol^{-1}, 1 F = 96500 C mol^{-1})

3.(a) Define fuel cell
(b) Write the name of the cell which is generally used in transistors. Write the reactions taking place at the anode and the cathode of this cell.
4. The cell in which the following reaction occurs $2\,Fe^{3+}_{(aq)} + 2\,I^{-}_{(aq)} \longrightarrow 2\,Fe^{2+}_{(aq)} + I_{2(s)}$ has E^{o}_{cell} = 0·236 V at 298 K. Calculate the standard Gibbs energy of the cell reaction. (Given : 1 F = 96,500 C
5.How many electrons flow through a metllic wire if a current of 0·5 A is passed for 2 hours? (Given : 1 F = 96,500 C mol^{-1})

YEAR 2016

1. From the given cells: *Lead storage cell, Mercury cell, Fuel cell and Dry cell* Answer the following:
(i) Which cell is used in hearing aids?
(ii) Which cell was used in Apollo Space Programme?
(iii) Which cell is used in automobiles and inverters?
(iv) Which cell does not have long life?
2. Calculate e.m.f of the following cell at 298 K: $2Cr(s) + 3Fe^{2+}(0.1M) \rightarrow 2Cr^{3+}(0.01M) + 3\,Fe(s)$
Given: $E°(Cr^{3+}/Cr) = -0.74$ V $E°(Fe^{2+}/Fe) = -0.44$ V
3. (a) Calculate $E°_{cell}$ for the following reaction at 298 K: $2Al(s) + 3Cu^{2+}(0.01\ M) \rightarrow 2Al^{3+}(0.01M) + 3Cu(s)$
Given: E_{cell} = 1.98V
(b) Using the E° values of A and B, predict which is better for coating the surface of iron [$E°(Fe^{2+}/Fe) = -0.44$V] to prevent corrosion and why?
Given: $E°(A^{2+}/A) = -2.37$V : $E°(B^{2+}/B) = -0.14$V
4. The conductivity of 0.001 mol L^{-1} solution of CH_3COOH is 3.905×10^{-5} S cm^{-1}. Calculate its molar conductivity and degree of dissociation (α). [Given $\lambda^0(H^+) = 349.6$ S cm^2 mol^{-1} and $\lambda^0(CH_3COO^-) = 40.9$ S cm^2 mol^{-1}]
5. Define electrochemical cell. What happens if external potential applied becomes greater than $E°_{cell}$ of electrochemical cell?

YEAR 2015

1. How much charge is required for the reduction of 1 mol of Zn^{2+} to Zn?
Calculate e.m.f. and ΔG for the following cell: **$Mg(s)/Mg^{2+}(0.001\ M)\ //\ Cu^{2+}(0.0001\ M)/Cu(s)$**
Given :E^0 Mg2+/Mg= -2.37v. E^0 Cu2+/Cu = +0.34 v)
2. The conductivity of 0.20 mol L^{-1} solution of KCl is 2.48×10^{-2} S cm^{-1}. Calculate its molar conductivity and degree of dissociation (α). [Given $\lambda^0(K^+) = 73.5$ S cm^2 mol^{-1} and $\lambda^0(C1^-) = 76.5$ S cm^2 mol^{-1}.]
3. What type of battery is mercury cell? Why is it more advantageous than dry cell?
4. Following reactions occur at cathode during the electrolysis of aqueous copper(II) chloride solution :

$Cu^{2+}(aq) + 2e^- \longrightarrow Cu(s)$ $E° = 0.34$ V
$2H^+ + (aq) + e^- \longrightarrow H_2(g)$ $E° = 0.00$ V

5. On the basis of their standard reduction electrode potential (E°) values, which reaction is feasible at the cathode and why ? State Kohlrausch law of independent migration of ions. Write its one application.
6. Calculate the emf of the following cell at 25°C : **$Zn\ |\ Zn^{2+}\ (0.001\ M)\ ||\ H^+\ (0.01\ M)\ |\ H_2(g)\ (1\ bar)\ |\ Pt(s)$**
[$E^0 Zn^{2+}/Zn = -0.76$ V, $E^0(H+/H2) = 0.00$ V]
7. Define limiting molar conductivity. Why conductivity of an electrolyte solution decreases with the decrease in concentration ?

Calculate emf of the following cell at 25 °C :**$Fe/Fe^{2+}\ (0.001\ M)\ //\ H^+\ (0.01\ M)/H_2(g)/(1\ bar)Pt(s)$**
[$E°(Fe^{2+}/Fe) = -0.44$ v $E°(H^+ H_2) = 0.00$ v]

YEAR 2014

1. Define the following terms:
(a)Molar conductivity (Λ_m)
(b)Secondary batteries
2. Calculate $\Delta_r G°$ for the given reaction: **$Mg(s) + Cu^{2+}(aq.) \rightarrow Mg^{2+}(aq.) + Cu(s)$**
[Given : $E°_{cell}$ = +2·71 V, 1 F = 96500 C mol^{-1}]
3. Name the type of cell which was used in Apollo space program for providing electrical power.
4. Resistance of a conductivity cell filled with 0.1 mol L^{-1} KCl solution is 100 Ω. If the resistance of the same cell when filled with 0.02 M KCl solution is 520 Ω, calculate the conductivity and molar conductivity of 0.02 M KCl solution. The conductivity of 0.1 M KCl solution is 1.29×10^{-2} S cm^{-1}.
5. State Faraday's first law of electrolysis. How much charge in terms of Faraday is required for the reduction of 1 mol of Cu^{2+} to Cu.
Calculate emf of the following cell at 298 K:**$Mg(s)\ |\ Mg^{2+}(0.1\ M)\ ||\ Cu^{2+}\ (0.01)\ |\ Cu(s)$** [Given E^o_{cell} = +2.71 V, 1 F = 96500 C mol^{-1}]
6. Define the following terms :
(a) Limiting molar conductivity (b) Fuel cell
7. State Faraday's first law of electrolysis. How much charge in terms of Faraday is required for the reduction of 1 mol of Cu^{2+} to Cu.
8. Why does the conductivity of a solution decrease with dilution?