Electrochemistry

Q.No.1:
(a) State Kohlrausch law of independent migration of ions. Write an expression for the molar conductivity of acetic acid at infinite dilution according to Kohlrausch law.
(b) Calcualte $\wedge_m^\circ$ for acetic acid.

Given that $\wedge_m^\circ(HCl)$ = 426 S cm^2 mol^{-1}

$\wedge_m^\circ$ (NaCl) = 126 S cm^2 mol^{-1}

$\wedge_m^\circ$ (CH$_3$COONa) = 91 S cm^2 mol^{-1}

OR
(a) Write the anode and cathode reactions and the overall reaction occurring in a lead storage battery.
(b) A copper-silver cell is set up. The copper ion concentration is 0.10 M. The concentration of silver ion is not known. The cell potential when measured was 0.422 V. Determine the concentration of silver ions in the cell. (Given

$E^\circ_{Ag^+/Ag} = +0.80V, \ E^\circ_{Cu^{2+}/Cu} +0.34 \ V$)

CBSE Board Paper 2010

Q.No.2:
Express the relation among the conductivity of solution in the cell, the cell constant and the resistance of solution in the cell.
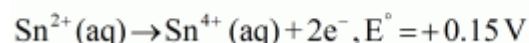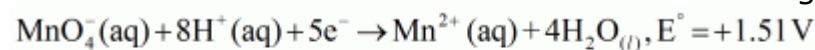
CBSE Board Paper 2011

Q.No.3:
What type of a battery is lead storage battery? Write the anode and the cathode reactions and the overall reactions occurring in a lead storage battery.

CBSE Board Paper 2011

Q.No.4:
Two half-reactions of an electrochemical cell are given below:

$MnO_4^-(aq) + 8H^+(aq) + 5e^- \rightarrow Mn^{2+}(aq) + 4H_2O_{(l)}, E^\circ = +1.51 \ V$

$Sn^{2+}(aq) \rightarrow Sn^{4+}(aq) + 2e^-, E^\circ = +0.15 \ V$

Construct the redox equation from the standard potential of the cell and predict it the reaction is reactant favoured or product favoured.
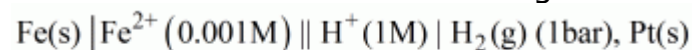
CBSE Board Paper 2011

Q.No.5:
The conductivity of 0.20 M solution of KCl at 298 K is 0.025 S cm^{-1}. Calculate its molar conductivity.

CBSE Board Paper 2013

Q.No.6:
Calculate the emf of the following cell at 298 K:

$$\text{Fe(s)} \,|\, \text{Fe}^{2+} \,(0.001\text{M}) \,\|\, \text{H}^+ \,(1\text{M}) \,|\, \text{H}_2\,(\text{g})\,(1\text{bar}),\, \text{Pt(s)}$$

$$\left(\text{Given } E^{\circ}_{cell} = +0.44 \text{ V}\right)$$

CBSE Board Paper 2013

Q.No.7:
(a) What type of a battery is the lead storage battery? Write the anode and the cathode reactions and the overall reaction occurring in a lead storage battery when current is drawn from it.
(b) In the button cell, widely used in watches, the following reaction takes place

$$\text{Zn}_{(s)} + \text{Ag}_2\text{O}_{(s)} + \text{H}_2\text{O}_{(l)} \rightarrow \text{Zn}^{2+}_{(aq)} + 2\text{Ag}_{(s)} + 2\text{OH}^-_{(aq)}$$
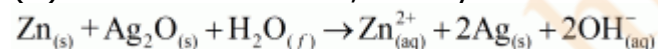
Determine E° and ΔG° for the reaction

$$\left(\text{given } E^{\circ}_{\text{Ag}^+/\text{Ag}} = +0.80\text{V}, E^{\circ}_{\text{Zn}^{2+}/\text{Zn}} = -0.76\text{V}\right)$$

OR

(a) Define molar conductivity of a solution and explain how molar conductivity changes with change in concentration of solution for a weak and a strong electrolyte.
(b) The resistance of a conductivity cell containing 0.001 M KCl solution at 298 K is 1500Ω. What is the cell constant if the conductivity of 0.001 M KCl solution at 298 K is 0.146×10^{-3} S cm^{-1}?

CBSE Board Paper 2012

Q.No.8: (a) Define the following terms :
(i) Limiting molar conductivity
(ii) Fuel cell
(b) 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 mol L^{-1} KCl solution is 520 Ω, calculate the conductivity and molar conductivity of 0.02 mol L^{-1} KCl solution. The conductivity of 0.1 mol L^{-1} KCl solution is 1.29×10^{-2} Ω^{-1} cm^{-1}.

OR

(a) 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.
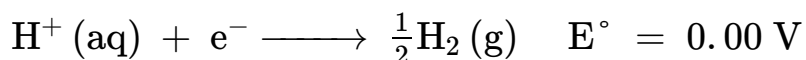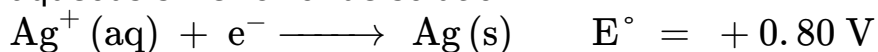(b) Calculate emf of the following cell at 298 K:
$Mg(s) | Mg^{2+}(0.1\ M) || Cu^{2+}\ (0.01) | Cu(s)$
[Given E^0_{cell} = +2.71 V, 1 F = 96500 C mol^{-1}]   **CBSE Board Paper 2014**

Q.No.9: (a) Following reactions occur at cathode during the electrolysis of aqueous silver chloride solution :

$$Ag^+\ (aq)\ +\ e^-\ \longrightarrow\ Ag\ (s) \qquad E^\circ\ =\ +0.80\ V$$

$$H^+\ (aq)\ +\ e^-\ \longrightarrow\ \tfrac{1}{2}H_2\ (g) \quad E^\circ\ =\ 0.00\ V$$
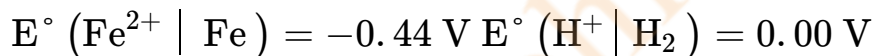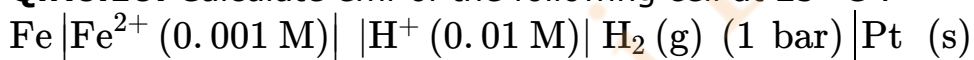
On the basis of their standard reduction electrode potential (E°) values, which reaction is feasible at the cathode and why ?
(b) Define limiting molar conductivity. Why conductivity of an electrolyte solution decreases with the decrease in concentration ?
          CBSE Board Paper 2015

Q.No.10: Calculate emf of the following cell at 25 °C :
$$Fe\left|Fe^{2+}\ (0.001\ M)\right|\ \left|H^+\ (0.01\ M)\right|\ H_2\ (g)\ (1\ bar)\left|Pt\ \ (s)\right.$$

$$E^\circ\left(Fe^{2+}\ |\ Fe\right) = -0.44\ V\quad E^\circ\left(H^+\ |\ H_2\right) = 0.00\ V$$

          CBSE Board Paper 2015

Q.No.11: From the given cells:
Lead storage cell, Mercury cell, Fuel cell and Dry cell
Answer the following:
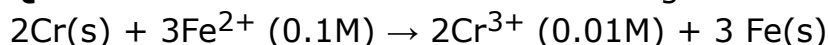(i) Which cell is used in hearing aids?
(ii) Which cell was used in Apollo Space Programme?
(iii) Which cell is used in automobiles and inverters?
(iv) Which cell does not have long life?   **CBSE Board Paper 2016**

Q.No.12: 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: $E°(Cr^{3+} | Cr) = -0.74\ V\quad E°\ (Fe^{2+} | Fe) = -0.44\ V$
          CBSE Board Paper 2016