Electrochemistry

Q.1 . Calculate electrode potential of hydrogen electrode having a pH = 10.

Ans. For hydrogen electrode Eo = 0, n = 1
pH = - log [H+]
[H+] = 10-10

$$\therefore [H^+] = 10\text{-}10$$

$$E = E^\circ + \frac{0.0591}{n} \log [H^+]$$

$$= 0 + \frac{0.0591}{1} \log 10^{-10}$$

$$= -0.59\ V$$

Q. 2. What is Nernst equation? Write its expression for single electrode and cell.

Ans. Nernst equation is relationship between temperature, concentration of electrolyte at electrode and electrode potential.

For reaction $M^{n+} + ne^- \rightarrow M_{(s)}$

$$E_{M^{n+}/M_{(s)}} = E^\circ_{M^{n+}/M_{(s)}} - \frac{2.303RT}{nF} \log \left[\frac{M_{(s)}}{M^{n+}}\right]$$

where $E_{M^{n+}/M}$ = Reduction potential

$E^\circ_{M^{n+}/M}$ = Standard potential

T = Temperature in K
n = No. of e– in balanced cell reaction
F = 96500 C
For cel

$$E_{cell} = E^\circ_{cell} - \frac{2.303RT}{nF} \log \left[\frac{\text{Product}}{\text{Reactant}}\right]$$

Q. 3. The conductivity of 0.001028 mol L^{-1} acetic acid is 4.95×10^{-5} S cm^{-1}Calculate its dissociation constant if Λ°m for acetic acid is 390.5 S cm2mol^{-1}

Ans. C = 0.001028 mol L^{-1}
κ = 4.95 x 10-5S cm^{-1}

$\Lambda om = 390.5\ S\ cm2\ mol^{-1}$

$$\Lambda_m^\circ = \frac{1000 \times \kappa}{C}$$

$$= \frac{1000 \times 4.95 \times 10^{-5}}{0.001028}$$

$$= 48.15\ S cm^2 mol^{-1}$$

$$\alpha = \frac{\Lambda_m}{\Lambda_m^\circ}$$

$$= \frac{48.15}{390.5}$$

$$= 0.1233$$

$$K = \frac{C\alpha^2}{(1-\alpha)}$$

$$= \frac{0.001028 \times (0.1233)^2}{(1-0.1233)}$$

$$= 1.78 \times 10^{-5}\ mol L^{-1}$$