4th sem

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Deepti

Nernst's equation

The study of the electrochemical cells we have determined the electrode potentials of the electrodes as well as the EMF of the cell under standard conditions i.e. electrolyte concentration in each half cell is 1M and the temprature is 298K.

The electrode potential depends upon concentration of electrolytic solution. Nernst gave a relation between electrode potential and the concentration of electrolytic solution known as nernst equation. For a general electrode reaction

$$M^{n+}_{(aq)} + ne^- \rightleftharpoons M_{(s)}$$

$$aA + bB \rightleftharpoons cC + dD$$

$$K = \frac{[C]^c [D]^d}{[A]^a [B]^b}$$

$$\Delta G = -nFE_{cell} \quad \text{—— (1)}$$

under standard conditions. ΔG°

$$\Delta G^\circ = -nFE^\circ_{cell} \quad \text{—— (1)}$$

Vant Hoff reaction isotherm

$$-nFE_{cell} = -nFE^\circ_{cell} + RT\ln \frac{[C]^c [D]^d}{[A]^a [B]^b} \quad \text{—— (2)}$$

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Dividing throughout by $-nF$ we get

$$E_{cell} = E^{\circ}_{cell} - \frac{RT}{nF} \ln \frac{[C]^c [D]^d}{[A]^a [B]^b} \quad \text{--- (3)}$$

$$E_{cell} = E^{\circ}_{cell} - \frac{2.303RT}{nF} \log_{10} \frac{[C]^c [D]^d}{[A]^a [B]^b} \quad \text{--- (4)}$$

when $T = 298K$, $F = 96500\,C$

$R = 8.314\,JK^{-1}mol^{-1}$. $\frac{2.303RT}{F} = 0.0592$

~~$E_{cell} = E^{\circ}_{cell} - \frac{2.303RT}{nF} \log$~~

$$E_{cell} = E^{\circ}_{cell} - \frac{0.0592}{n} \log_{10} \frac{[C]^c [D]^d}{[A]^a [B]^b} \quad \text{--- (5)}$$

eq (5) Nernst's equation