

THERMODYNAMICS AND ELECTROCHEMICAL EQUATIONS

Gibbs Free Energy

ΔG° is related to the equilibrium constant.

$$\Delta G^\circ = -RT \ln K_{\text{eq}} \quad \text{or} \quad K_{\text{eq}} = e^{\frac{-\Delta G^\circ}{RT}}$$

The general equation for Gibbs Free Energy is:

$$\Delta G = \Delta G^\circ + RT \ln Q$$

Free Energy for Oxidation-Reduction

Gibbs Free Energy is directly related to Electrochemical Voltage

$$\Delta G = -nFE$$

n is the number of moles of electrons transferred

F is the Faraday constant (96.49 kJ/V·mol)

E is the electrical potential (Voltage)

So, the equations above for G can be transformed into E .

$$E^\circ = \frac{RT}{nF} \ln K_{\text{eq}} \quad \text{or} \quad K_{\text{eq}} = e^{\frac{nFE^\circ}{RT}}$$

$$E = E^\circ - \frac{RT}{nF} \ln Q$$

(Also known as the Nernst Equation.)