GIBBS + FARADAY

Relationship Between emf and Free Energy

$$\Delta G = -nFE$$

- F: Faraday constant 96,485 C/mol
- n: number moles electron
- E: Electron Volt

$$\Delta G^\circ = -RT \ln K$$

- R: ideal gas constant 8.314 J/mK
- T: Absolute Temperature
- K: K value Equilibrium

$$\Delta G = \Delta H - T\Delta S$$

- ΔG: Free Energy
- ΔH: Enthalpy HEAT
- ΔS: Entropy

$$\Delta G^\circ = \sum_n \Delta G_f^\circ \text{ (Product)} - \sum_m \Delta G_f^\circ \text{ (Reactants)}$$

= Nernst Equation =

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

$$E = E^{\circ} - \frac{0.0592V}{n} \log Q$$

$$Zn_{(s)} + Cu^{2+}_{(aq)} \longrightarrow Zn^{+2}_{(aq)} + Cu_{(s)}$$

Standard EmF = +1.10V

$$E = 1.10V - \frac{0.0592V}{2} \log \frac{[Zn^{2+}]}{[Cu^{2+}]}$$

EmF increases as $[Cu^{+2}]$ increases and

$[Zn^{+2}]$ decreases

Copper Cu^{+2} = 5.0M

Zinc Zn^{+2} = 0.050M

$$E = 1.10V - \frac{0.0592V}{2} \log \left(\frac{0.050}{5.0}\right)$$

$$E = 1.10V - \frac{0.0592V}{2} (-2.00) = 1.16V$$