Gen Chem II w/ Doc M

Today: 4/3 Section 18.7 - 18.14 (skip 18.8)

Tuesday: NO Review!

Wednesday 4/5: Exam IV Ksp 31 pts
ΔG + Co 43 pts
Electrochem 26 pts

Doors open 15 min early

Thursday 4/6: Expt 11 $\Rightarrow$ Need Laptops

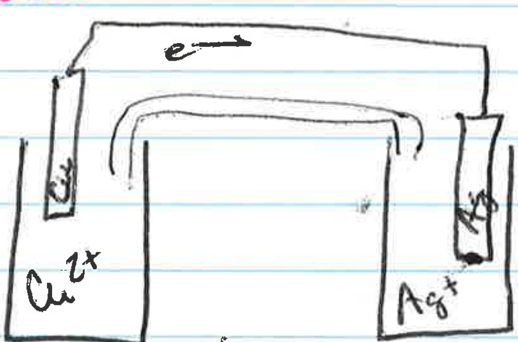
$\Delta G^{\circ} = -nFE^{\circ}$ $\Delta G = -nFE$

Spontaneous Rxn $\Delta G < 0$, $E > 0$

$Ag \mid Ag^{+}$ and $Cu \mid Cu^{+2}$

Cathode $2Ag^{+} + 2e^{-} \rightarrow 2Ag$ $E^{\circ}_{red} = +0.80\,V$

Anode $Cu \rightarrow Cu^{+2} + 2e$ $E^{\circ}_{ox} = -0.34\,V$



$Cu \mid Cu^{+2} \parallel Ag^{+} \mid Ag$

$2Ag^{+} + Cu \rightarrow 2Ag + Cu^{+2}$

$E_{rxn} = +0.46\,V$

$$\Delta G^\circ = -nFE^\circ$$

$$= -(2\ mole)\left(\frac{96.5\ kJ}{mole \cdot vol}\right)(0.46V)$$

$$= -88.8\ kJ$$

$$\Delta G = \underbrace{\Delta G^\circ}_{\text{constant}} + RT \ln \underbrace{Q}_{\text{MICE}}$$

At equilibrium $\Delta G = 0$

$$0 = \Delta G^\circ + RT \ln \underbrace{K}_{K_c \text{ for solutions}}$$

$$\Delta G^\circ = -RT \ln K_c \quad \therefore K_c \text{ should be big}$$

$$\Delta G = -nFE$$

$$-nFE = -nFE^\circ + RT \ln Q_c$$

$$E = E^\circ - \frac{Rt}{nF} \ln Q_c$$

$$E = E^\circ - \frac{Rt}{nF} 2.303 \log Q_c$$

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

At Equilibrium $E = 0$

$$0 = \underline{E^\circ - \frac{0.0592}{n} \log K_c}$$

M $2Ag^+ + Cu \rightarrow 2Ag + Cu^{+2}$ $E^o = 0.46V$

I 0.10

C

E

$$Q_c = \frac{[Cu^{+2}]}{[Ag^+]^2} = \frac{2.0}{0.10^2} = 200$$

Expect $E < E^o$

$$E = E^o - \frac{0.0592}{n} \log Q_c$$

$$= 0.46V - \frac{0.0592}{2} \log 200$$

$$= 0.39V$$

18.10 Batteries

Anode $Pb_{(s)} + HSO_4^- \rightarrow PbSO_{4\,(s)} + H^+ + 2e^-$

$E^o_{ox} = ^{o}0.296V$

Cathode $PbO_{2\,(s)} + 3H^+ + HSO_4^- + 2e^- \rightarrow PbSO_4 + 2H_2O$

$E^o_{red} = +1.628V$

$Pb_{(s)} + 2HSO_4^- + PbO_{2\,(s)} + 2H^+ \rightarrow 2PbSO_{4\,(s)} + 2H_2O$

$E^o_{rxn} = +1.924\ V$

$2Na^+ + 2e^- \rightarrow 2Na_{(s)}$ $E^\circ_{red} = 2.71V$

$2Cl^- \longrightarrow 2e^- + Cl_{2(g)}$ $E^\circ_{ox} = -1.36$

$2Na^+ + 2Cl^- \rightarrow 2Na_{(s)} + Cl_{2(g)}$ $E^\circ rxn = -4.07V$

Use a battery
to make this go

Cathode $\cancel{2}^{4}H_2O + \cancel{2}^{4}e^- \longrightarrow 2H_{2(g)} + \cancel{2}^{4}OH^-$ $E^\circ_{red} = -0.83V$

anode $2H_2O \longrightarrow O_2 + 4H^+ + 4e^-$ $E^\circ_{ox} = -1.23V$

LCM = 4 n = 4

$6H_2O \longrightarrow 2H_2 + 4OH^- + O_2 + 4H^+$ $E^\circ_{rxn} = -2.06V$

$2H_2O \rightarrow 2H_2 + O_2$ $E^\circ rxn = -2.06V$