

Lecture 22: Thermodynamics & Equilibrium... revisited!

Note Title

11/13/2011

Thermodynamics

$$\Delta G_{\text{rxn}} < 0 : \text{max work}$$

$$\Delta G_{\text{cell}}^{\circ} = -n F E_{\text{cell}}^{\circ}$$

Equilibrium

$$\Delta G_{\text{rxn}} = -RT \ln K_{\text{eq}}$$

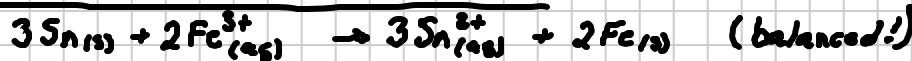
Electrochemistry

max work = $-q E_{\text{cell}}$
 electrical charge flow

max. work = $-n F E_{\text{cell}}$
 # moles e^- Faradays Const. = $\frac{96485 \text{C}}{\text{mole } e^-}$

$$E_{\text{cell}} = \frac{0.0592}{n} \log K_{\text{eq}}$$

Example: Det K_{eq} for following reaction:



How many mole of e^- are transferred? (Balanced)
 $6e^- \Rightarrow n = 6$

$$E_{\text{cell}} = E_{\text{cathode reduction}} - E_{\text{anode ox.}}$$

Fe^{3+} $\text{Sn}(\text{s})$

$$= -0.036 \text{V} - (-0.14 \text{V}) = +0.104 \text{Volts}$$

↑ spontaneous reaction

$$E_{\text{cell}}^{\circ} = \frac{0.0592}{n} \log K_{\text{eq}} \rightarrow K_{\text{eq}} = 10^{\left(\frac{n E_{\text{cell}}^{\circ}}{0.0592}\right)} = 10^{\left(\frac{6 \cdot (0.104)}{0.0592}\right)}$$

$K_{\text{eq}} = 3.47 \times 10^{10}$
 HUGE
 favors products.