CONCEPT: STANDARD CELL POTENTIAL & THE EQUILIBRIUM CONSTANT

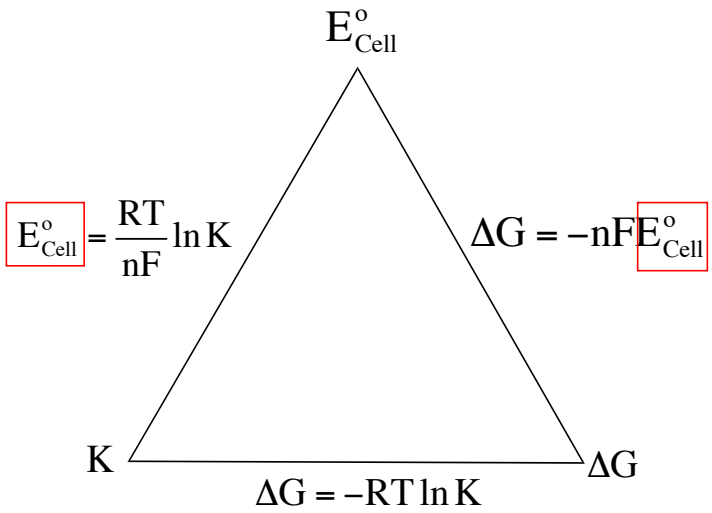
Galvanic and voltaic cells are able to produce electricity because they are not yet at equilibrium.

- Recall that the chemical reaction will eventually reach equilibrium and then Q = K.

$$E_{Cell} = E^{o}_{Cell} - \frac{0.05916\ V}{n}\log Q \ \rightarrow\ 0 = E^{o}_{Cell} - \frac{0.05916\ V}{n}\log K \ \rightarrow\ E^{o}_{Cell} = \frac{0.05916\ V}{n}\log K$$

Once we establish the correlation between the cell potential and the equilibrium constant we can reformat the equation:

The relationship between the cell potential, equilibrium constant and Gibbs Free Energy can be seen as:



$$E^{o}_{Cell} = E_{+} - E_{-}$$

PRACTICE: STANDARD CELL POTENTIAL & THE EQUILIBRIUM CONSTANT CALCULATIONS 1

EXAMPLE 1: Determine the equilibrium constant K for the following reaction:

Au^{+} (aq) + Ce (s) $\rightleftharpoons$ Ce^{3+} (aq) + Au (s)

The half reactions are determined as:

Au^{+} (aq) + e^{-} $\rightleftharpoons$ Au (s) $\qquad E^{o} = 1.690\ V$

Ce^{3+} (aq) + 3 e^{-} $\rightleftharpoons$ Ce (s) $\qquad E^{o} = -2.336\ V$

EXAMPLE 2: From the two half reactions provided the equilibrium constant is calculated as 6.79×10^{30}.

$ClO\,(g) + e^{-} \rightleftharpoons ClO^{-}\,(aq) \qquad E^{o}_{+} = ?$

$Bi\,(s) \rightleftharpoons Bi^{3+}(aq) + 3\,e^{-} \qquad E^{o}_{-} = 0.308\ V$

Determine the standard cell potential for:

$ClO\,(g) + e^{-} \rightleftharpoons ClO^{-}\,(aq) \qquad E^{o}_{+} = ?$