Answer on Question #77584, Chemistry / Physical Chemistry

For a certain oxidation-reduction reaction, Eo is
positive. This means that

ΔGo is negative and
K is less than 1.

ΔGo is negative and
K is greater than 1.

ΔGo is zero and K
is greater than 1.

ΔGo is positive and
K is greater than 1.

ΔGo is positive and
K is less than 1.

Solution

The electromotive force, E^0, is related to ΔG^0 by:

$$\Delta G^0 = -nFE^0 \quad (1)$$

Where

ΔG^0 is the Gibbs energy of reaction at 1 atm and 25^0C

n is number of electrons in the reaction

F is Faraday constant F= 96485 C/mol

If for a certain oxidation-reduction reaction E^0 is positive this means that ΔG^0 is negative, as

n>0, F>0, E^0 >0 and $-nFE^0$ <0, i.e. $\Delta G^0 = -nFE^0 \Rightarrow \Delta G^0 < 0$.

E^0 is related to the equilibrium constant, K, by:

$$E^0 = \frac{RT}{nF} \ln(K) \quad (2)$$

Where

R is universal gas constant, R=8.314 J/mol·K;

T- temperature in K

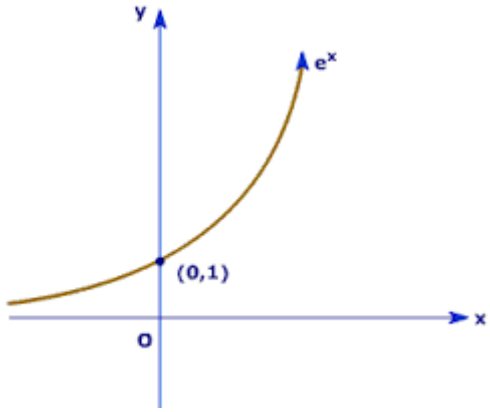
If for a certain oxidation-reduction reaction E^0 is positive this means that K>1. Let's prove that:

Express K from equation 2:

$$K = e^{\frac{nFE^0}{RT}}$$

E^0>0, R>0, T>0, n>0, F>0, i.e. $\frac{nFE^0}{RT} > 0$

From the graph of function f(x)= e^x we know that for every x>0 f(x)>1.



Consequently K>1 as $\frac{nFE^0}{RT} > 0$

Answer: ΔG^0 is negative and K is greater than 1.