FREE ENERGY AND THE EQUILIBRIUM CONSTANT

NAME _____ SECTION _____

1. The free energy drives a chemical reaction toward equilibrium. For the chemical reaction under standard conditions:

$$\underset{1\ M}{A} + \underset{1\ M}{B} \rightleftharpoons \underset{1\ M}{C} + \underset{1\ M}{D} \qquad Q_c = [C][D] / [A][B]$$

there are three possible values for free energy:

$\Delta G^\circ < 0$

$\Delta G^\circ > 0$

$\Delta G^\circ = 0$

For each value, indicate the direction the driving force will push the reaction (right, left) and the range of values for the equilibrium constant (>1, <1, =1).

2. Values for ΔG° and K were obtained for four reactions:

K	**ΔG°**
1.4×10^{-3}	16,270 J/mol
6.3×10^{-5}	23,950 J/mol
2.5×10^{-9}	49,050 J/mol
2.4×10^{-12}	66,260 J/mol

Plot these values in Excel and obtain the curve fitting equation (Hint: the proportionality constant consists of the temperature [in K] and R [in J/mol K]).

3. Determine $\Delta G°$ for the reaction, $N_2O_4(g) \rightarrow 2NO_2(g)$.

   a. Calculate K for the reaction at 25 °C.

   b. Calculate ΔG for the reaction if the partial pressure of NO_2 is 0.1 atm and the partial pressure of N_2O_4 is 1 atm. ($\Delta G = \Delta G^\circ + RT \ln Q$)