

AP Chemistry Daily Videos

9.5 Free Energy and Equilibrium

Video #1

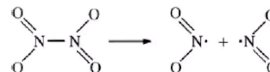
1. Relate ΔG° and K by completing the following table: [Khan Academy link](#)

Sign of ΔG° @ equilibrium	The sign of ΔG° indicates the reaction is spontaneous (thermodynamically favorable) or not spontaneous (not thermodynamically favorable)?	Product or Reactants Favored? Note, if the reaction is a go and favorable then what would you have more of, products or reactants?	Describe K
ΔG° is negative			
ΔG° is positive			
$\Delta G^\circ = \text{zero}$			

2. Try the problem on your own. Then evaluate your work and identify any errors you may have made.

Use principles of thermodynamics to answer the following questions.

a. The gas N_2O_4 decomposes to form the gas NO_2 , according to the equation below.



- i. Predict the sign of ΔH° for the reaction. Justify your answer.
- ii. Predict the sign of ΔS° for the reaction. Justify your answer.

b. One of the diagrams below best represents the relationship between ΔG° and temperature for the reaction given in part (a). Assume that ΔH° and ΔS° are independent of temperature.



Draw a circle around the correct graph. Explain why you chose that graph in terms of the relationship $\Delta G^\circ = \Delta H^\circ - T\Delta S^\circ$.

- c. A reaction mixture of N_2O_4 and NO_2 is at equilibrium. Heat is added to the mixture while it is maintained at constant pressure.
 - i. Explain why the concentration of N_2O_4 decreases.
 - ii. The value of K_{eq} at 25°C is 5.0×10^{-3} . Will the value of K_{eq} at 100°C be greater than, less than, or equal to this value?
- d. Using the value of K_{eq} at 25°C given in part (c)(ii), predict whether the value of ΔH° is expected to be greater than, less than, or equal to the value of $T\Delta S^\circ$. Explain.