

Part A: Using the Change in Gibbs Free Energy to predict spontaneity

Fill in the Blanks: Fill in the blanks with (<, >, =)

If ΔG ___ 0; the reaction is at equilibrium

If ΔG ___ 0; the reaction will proceed spontaneously towards products

If ΔG ___ 0; the reaction will proceed spontaneously towards reactants (is nonspontaneous in the forward direction).

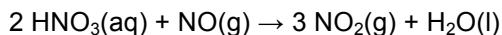
True and False:

True or false? All exothermic reactions are spontaneous? _____

Nature tends towards lower energy and more disorder. _____

Part B: Calculating the Change in Gibbs Free Energy under Non-standard Conditions

1. The reaction below is endothermic and spontaneous at $T = 525$ K. Please answer the following questions and discuss your answers with your PAL group.



a) Which of the following must be true? Circle your answer.

$\Delta G > 0$; $\Delta S > 0$; $\Delta H > 0$

$\Delta G < 0$; $\Delta S > 0$; $\Delta H > 0$

$\Delta G > 0$; $\Delta S < 0$; $\Delta H > 0$

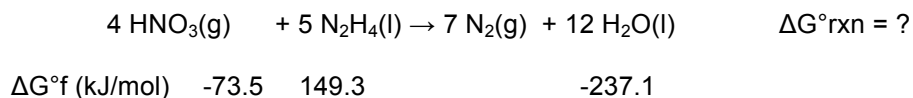
b) Calculate ΔG for the reaction above using the following information $\Delta H = +136.5$ kJ; $\Delta S = +287.5$ J/K at a Temp = 525 K.

c) Why do you think reaction is spontaneous? Take a look at the reaction. What do you notice?

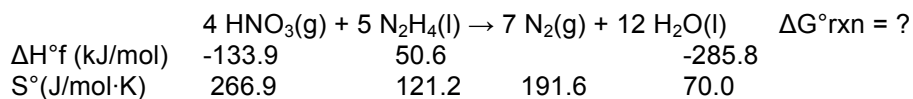
d) At what temperature will the reaction be non-spontaneous?

Part B: Calculating the Change in Gibbs Free Energy under standard conditions

2. Calculate the $\Delta G^\circ_{\text{rxn}}$ using the following information.



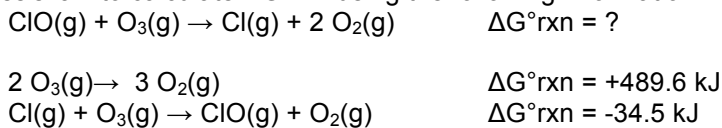
3. Calculate the $\Delta G^\circ_{\text{rxn}}$ using the following information.



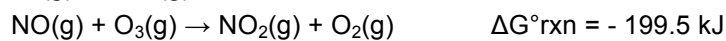
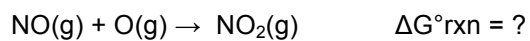
What do you notice about your answer to 2 and 3? Do they agree?

4. Calculate ΔG° by adding Gibbs Free Energies of Reactions ($\Delta G^\circ_1 + \Delta G^\circ_2 + \Delta G^\circ_3 \dots$)

Use Hess's law to calculate $\Delta G^\circ_{\text{rxn}}$ using the following information.



5. Calculate ΔG° by adding Gibbs Free Energies of Reactions ($\Delta G^\circ_1 + \Delta G^\circ_2 + \Delta G^\circ_3 \dots$)



- A) +753.5 kJ
- B) +277.0 kJ
- C) -676.0 kJ
- D) -1152.5 kJ
- E) -225.7 kJ