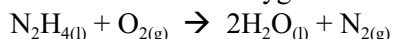


Review PROBLEMS: Entropy and Gibbs Free Energy

- Write a balanced equation that depicts the formation of 1 mol of $\text{Fe}_2\text{O}_3(\text{s})$ from its elements. What is the standard free energy of formation of 1.00 mol of $\text{Fe}_2\text{O}_3(\text{s})$? What is the value of $\Delta G^\circ_{\text{rxn}}$ when 454g (1 lb) of $\text{Fe}_2\text{O}_3(\text{s})$ is formed from the elements.

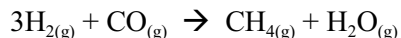
- Hydrazine is used to remove dissolved oxygen from the water in hot-water heating systems.



What is the value of $\Delta G^\circ_{\text{rxn}}$ when 1.00 mol of N_2H_4 is oxidized?

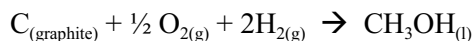
What is the value of $\Delta G^\circ_{\text{rxn}}$ for the oxidation of 1.00 kg of hydrazine?

- Synthesis gas, a mixture of H_2 and CO , can be converted to methane, CH_4 :



Calculate ΔH° , ΔS° , and ΔG° at 25° for the reaction. Is it predicted to be product or reactant favored under standard conditions?

- Methanol, CH_3OH , is now widely used as a fuel in race cars such as those that compete in the Indianapolis 500. The liquid fuel can be formed using the reaction...

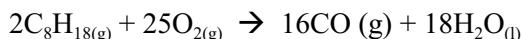


- What is ΔH° for the above reaction
- Calculate ΔS° for the above reaction
- Identify a thermodynamic function that can be used to predict reaction spontaneity.
- Use the values obtained in (a) and (b) above to determine if the above reaction is spontaneous or non spontaneous at 25°C .

- For

each of the following processes, give the algebraic sign of ΔH° , ΔS° , and ΔG° at 25°C for the following reactions. No calculations are necessary; use your common sense.

- the splitting of liquid water to give the gaseous oxygen and hydrogen, a process that requires a considerable amount of energy.
- The explosion of dynamite, a mixture of nitroglycerin, $\text{C}_3\text{H}_5\text{N}_3\text{O}_9$, and diatomaceous earth, gives gaseous products, such as water, CO_2 , and others; much heat is evolved.
- The combustion of gasoline in the engine of your car, as exemplified by the combustion of octane.



Answers:

1. $\Delta G^\circ_f(\text{Fe}_2\text{O}_3) = -742.2 \text{ kJmol}^{-1}$, ΔG° released by 454 g $\text{Fe}_2\text{O}_3 = -2.111 \times 10^3 \text{ kJ}$

2. $\Delta G^\circ_f(1.00 \text{ mol N}_2\text{H}_4) = -623.5 \text{ kJ}$, ΔG° for 1 kg $\text{N}_2\text{H}_4 = -19.48 \text{ kJ}$

3. $\Delta H^\circ_{\text{rxn}} = -206.1 \text{ kJ}$, $\Delta S^\circ_{\text{rxn}} = -214.7 \text{ J/K}$, $\Delta G^\circ_{\text{rxn}} = -142.1 \text{ kJ}$, Product-favoured

4. $\Delta H^\circ_{\text{rxn}} = -238.7 \text{ kJ}$, $\Delta S^\circ_{\text{rxn}} = -242.87 \text{ J/K}$, $\Delta G^\circ_{\text{rxn}} = -166.3 \text{ kJ}$, Yes, Spontaneous

5.	ΔH°	ΔS°	ΔG°
a)	+	+	+
b)	-	+	-
c)	-	+	-