

$$PV = nRT$$

$$R = 0.0821 \text{ L}\cdot\text{atm}/(\text{mole}\cdot\text{K})$$

$$\Delta G^\circ = \Delta H^\circ - T \Delta S^\circ$$

$$760 \text{ mm Hg} = 1 \text{ atm}$$

$$1 \text{ torr} = 1 \text{ mm Hg}$$

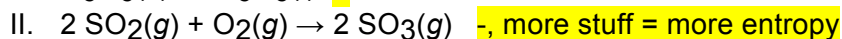
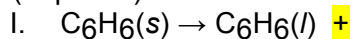
1. (2 points) At a given temperature and pressure, which of the following would be expected to have the greatest molar entropy?

- A) $\text{H}_2\text{O}(s)$ B) $\text{H}_2\text{O}(l)$ **C) $\text{H}_2\text{O}(g)$** D) All of these would be expected to have the same molar entropy.

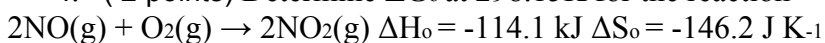
2. (2 points) For the following: $\text{NH}_3(g) \rightarrow \text{N}(g) + 3 \text{H}(g)$, one would expect

- A) ΔH° to be negative and ΔS° to be negative. **B) ΔH° to be negative and ΔS° to be positive.**
 C) ΔH° to be positive and ΔS° to be negative. **D) ΔH° to be positive and ΔS° to be positive.**

3. (2 points) Determine the sign of ΔS° for each of the following:



4. (2 points) Determine ΔG° at 298.15K for the reaction



$$\text{-7.05} \times 10^1 \text{ kJ/mole}$$

5. (2 points) Circle all of the conditions that always result in a spontaneous (favorable, exergonic) reaction:

ΔH is negative and ΔS is negative.

ΔH is negative and ΔS is positive.

ΔH is positive and ΔS is negative.

ΔH is positive and ΔS is positive.

6. (2 points) Three identical flasks contain three different gases at standard temperature and pressure. Flask A contains CH_4 , flask B contains CO_2 , flask C contains N_2 . Which flask contains the largest number of molecules?

- A) flask A B) flask B C) flask C **D) All flasks contain the same number of molecules.**

7. (4 points) The volume of 350. mL of gas at 25°C is decreased to 125 mL at constant pressure. What is the final temperature of the gas?

$$1.1 \times 10^2 \text{ K}$$

8. (4 points) A steel tank has a volume of 438 L and is filled with 0.885 kg of O_2 . Calculate the pressure of O_2 at 21°C .

$$1.5 \text{ atm}$$

$$PV = nRT$$

$$R = 0.0821 \text{ L}\cdot\text{atm}/(\text{mole}\cdot\text{K})$$

$$\Delta G^\circ = \Delta H^\circ - T \Delta S^\circ$$

$$760 \text{ mm Hg} = 1 \text{ atm}$$

$$1 \text{ torr} = 1 \text{ mm Hg}$$

1. (2 points) At a given temperature and pressure, which of the following would be expected to have the greatest molar entropy?
 A) $\text{H}_2\text{O}(s)$ B) $\text{H}_2\text{O}(l)$ **C) $\text{H}_2\text{O}(g)$** D) All of these would be expected to have the same molar entropy.
2. (2 points) For the following: $\text{N}(g) + 3 \text{H}(g) \rightarrow \text{NH}_3(g)$, one would expect
A) ΔH° to be negative and ΔS° to be negative. B) ΔH° to be negative and ΔS° to be positive.
 C) ΔH° to be positive and ΔS° to be negative. D) ΔH° to be positive and ΔS° to be positive.
3. (2 points) Determine the sign of ΔS° for each of the following:
 I. $2 \text{SO}_2(g) + \text{O}_2(g) \rightarrow 2 \text{SO}_3(g)$ **-**
 II. $\text{C}_6\text{H}_6(s) \rightarrow \text{C}_6\text{H}_6(l)$ **+**
4. (2 points) Determine ΔG° at 298.15K for the reaction
 $2\text{NO}(g) + \text{O}_2(g) \rightarrow 2\text{NO}_2(g)$ $\Delta H^\circ = -114.1 \text{ kJ}$ $\Delta S^\circ = -146.2 \text{ J K}^{-1}$
 $-7.05 \times 10^1 \text{ kJ/mole}$
5. (2 points) Circle all of the conditions that always result in a nonspontaneous (unfavorable, endergonic) reaction:
 ΔH is negative and ΔS is negative. ΔH is negative and ΔS is positive.
 ΔH is positive and ΔS is negative. ΔH is positive and ΔS is positive.
6. (2 points) Three identical flasks contain three different gases at standard temperature and pressure. Flask A contains CH_4 , flask B contains CO_2 , flask C contains N_2 . Which flask contains the largest number of molecules?
 A) flask A B) flask B C) flask C **D) All flasks contain the same number of molecules.**
7. (4 points) The volume of 402. mL of gas at 22°C is decreased to 112 mL at constant pressure. What is the final temperature of the gas?
 $8.2 \times 10^1 \text{ K}$
8. (4 points) A steel tank has a volume of 452 L and is filled with 0.775 kg of O_2 . Calculate the pressure of O_2 at 24°C .
1.3 atm