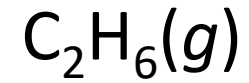


For the following example, identify the following.

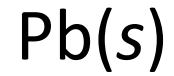


- A. a negative ΔH and a negative ΔS**
- B. a positive ΔH and a negative ΔS
- C. a negative ΔH and a positive ΔS
- D. a positive ΔH and a positive ΔS
- E. It is not possible to determine without more information.

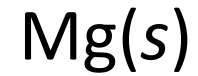
Place the following in order of increasing entropy at 298 K.



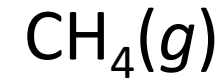
I



II



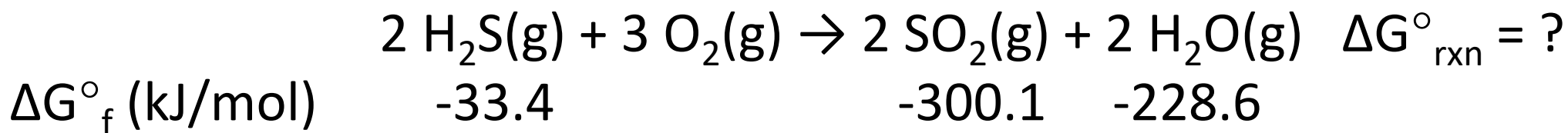
III



IV

Mg, Pb, CH₄, C₂H₆

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



$$\begin{aligned} & \sum \Delta G^\circ_f \text{ products} - \sum \Delta G^\circ_f \text{ reactants} \\ & [(-300.1 \times 2) + (-228.6 \times 2)] - (-33.4 \times 2) = \\ & \quad -1057.4 \qquad \qquad -(-66.8) = 990.6 \frac{\text{kJ}}{\text{mol}} \end{aligned}$$

For a given reaction, $\Delta H = + 29.9 \text{ kJ/mol}$ and $\Delta S = + 57.0 \text{ J/K}\cdot\text{mol}$. The reaction is spontaneous _____. Assume that ΔH and ΔS do not vary with temperature.

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

A. at $T < 525 \text{ K}$

B. at $T > 525 \text{ K}$

C. at $T > 298 \text{ K}$

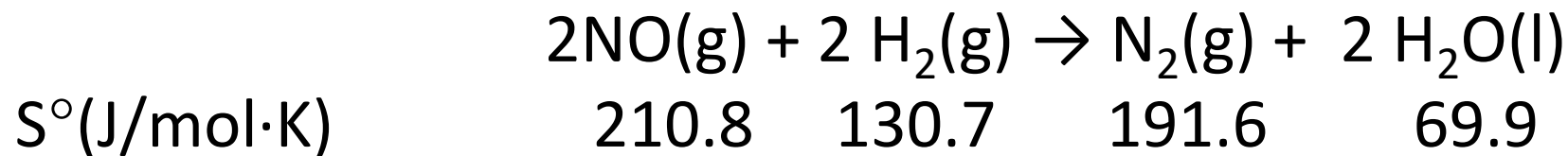
D. at $T < 298 \text{ K}$

E. at all temperatures

$$0 = 29.9 - T(.057)$$

$$T = \frac{29.9}{.057} = 524.6 \text{ K}$$

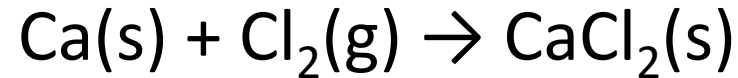
Calculate $\Delta S^\circ_{\text{rxn}}$ for the following reaction. The S° for each species is shown below the reaction.



$$\sum \Delta S^\circ_{\text{products}} - \sum \Delta S^\circ_{\text{reactants}}$$

$$\begin{aligned} & [(191.6) + (69.9 \times 2)] - [(210.8 \times 2) + (130.7 \times 2)] \\ & \quad 331.4 \qquad \qquad - \qquad \qquad 483 \qquad = 351.4 \frac{\text{J}}{\text{K}} \end{aligned}$$

The value of ΔG° at 221.0 °C for the formation of calcium chloride from its constituent elements:



is _____ kJ/mol. At 25.0 °C for this reaction, ΔH° is -795.8 kJ/mol, ΔG° is -748.1 kJ/mol, and ΔS° is -159.8 J/K.

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

$$\Delta G^\circ = -795.8 - (298)(-0.1598)$$
$$= -795.8 - (-47.64)$$

$$\Delta G^\circ = -748.1$$

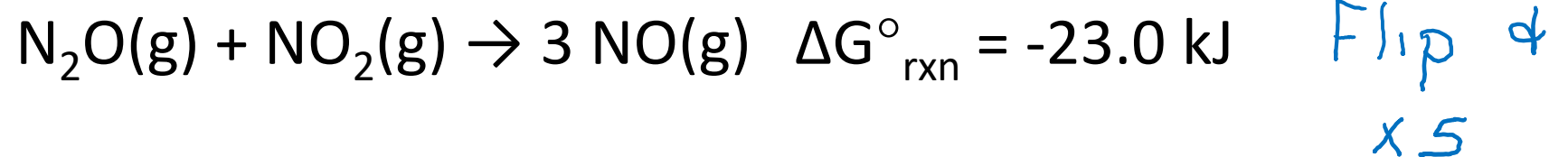
Determine $\Delta G^\circ_{\text{rxn}}$ for the following reaction at 378 K.



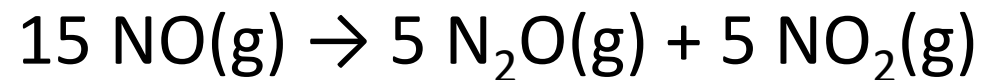
$$\Delta G^\circ = \Delta H^\circ - T \Delta S^\circ$$

$$\Delta G^\circ = 179.2 - (378)(.1602) = 118.6 \text{ kJ}$$

Given the following equation,

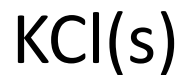


Calculate $\Delta G^\circ_{\text{rxn}}$ for the following reaction.



$$+ 23.0 \times 5 = 115 \text{ kJ}$$

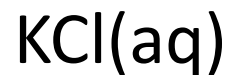
Place the following in order of decreasing standard molar entropy.



I



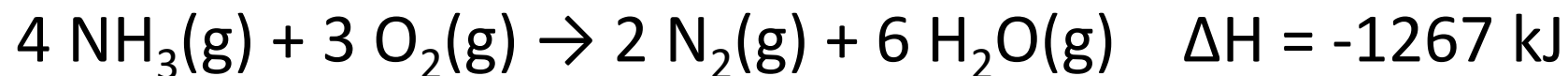
II



III



Consider the following reaction at constant P. Use the information here to determine the value of ΔS_{surr} at 398 K. Predict whether or not this reaction will be spontaneous at this temperature.



$$\Delta S_{\text{sys}} = \frac{\Delta H_{\text{rxn}}}{T} = \frac{-1267}{398} = -3.18 \text{ KJ}$$

$$\Delta S_{\text{sys}} = -\Delta S_{\text{surr}}$$

+ 3.18 KJ
spontaneous rxn

Which of the following processes have a $\Delta S > 0$?



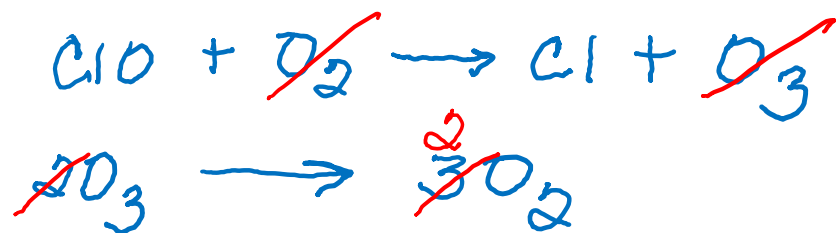
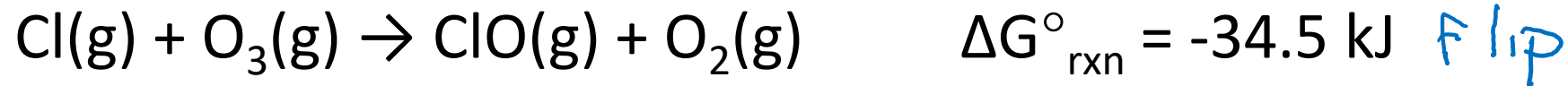
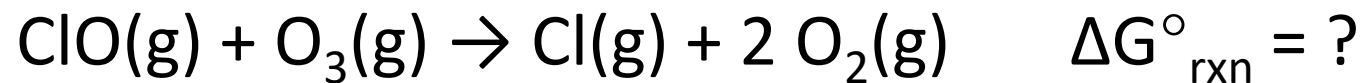
B. lithium fluoride forms from its elements



D. lithium chloride dissolves in pure water

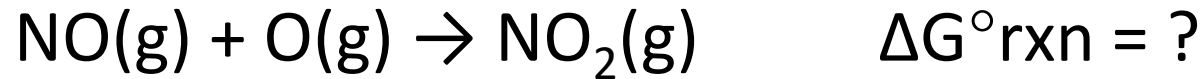
E. All of the above processes have a $\Delta S > 0$.

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



$$\begin{array}{r} + 34.5 \text{ kJ} \\ + 489.6 \text{ kJ} \\ \hline 524.1 \text{ kJ} \end{array}$$

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



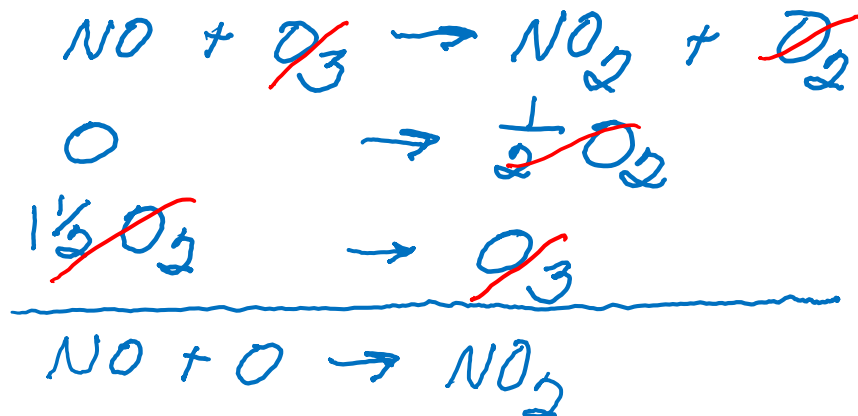
$$\Delta G^\circ_{\text{rxn}} = +489.6 \text{ kJ} \quad \text{flip} \div 2$$



$$\Delta G^\circ_{\text{rxn}} = +463.4 \text{ kJ} \quad \text{flip} \div 2$$



$$\Delta G^\circ_{\text{rxn}} = -199.5 \text{ kJ}$$



$$\begin{array}{r}
 -199.5 \text{ kJ} \\
 -463.4/2 \\
 -489.6/2 \\
 \hline
 676.0 \text{ kJ}
 \end{array}$$

Consider a reaction that has a negative ΔH and a negative ΔS . Which of the following statements is TRUE?

A. This reaction will be spontaneous only at low temperatures.

B. This reaction will be spontaneous at all temperatures.

C. This reaction will be nonspontaneous at all temperatures.

D. This reaction will be nonspontaneous only at low temperatures.

E. It is not possible to determine without more information.

} high T

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

— — — —

↑

low temp

The reaction $2 \text{H}_2\text{O}(g) + \text{CO}_2(g) \rightarrow \text{CH}_4(g) + 2 \text{CO}_2(g)$ is nonspontaneous at 25 °C. The addition of a catalyst will _____ (decrease, increase, not change) the rate of reaction and _____ (decrease, increase, not change) the spontaneity of the reaction.

increase, not change

Acetylene, C_2H_2 , has a standard enthalpy of formation, $\Delta H^\circ = 226.7 \text{ kJ/mol}$, and a standard entropy change for its formation from its elements, $\Delta S^\circ = 58.8 \text{ J/K}\cdot\text{mol}$. The standard free energy of formation of acetylene is _____ kJ/mol.

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

$$\Delta G^\circ = 226.7 - (298)(.0588)$$

$$\Delta G^\circ = 207.2 \text{ kJ/mol}$$