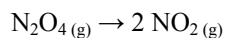


*Practice Questions Section 3.1***Entropy**

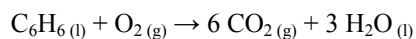
1. Predict whether entropy is increasing ($\Delta S > 0$) or decreasing ($\Delta S < 0$)? Give a reason for your answer.

steam condenses to water

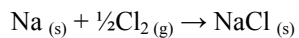
solid CO_2 sublimates



water is heated from 25°C to 50°C



2. Using a Table of Thermochemical Data, calculate ΔS for the following reaction. Is entropy increasing or decreasing? Is the system becoming more random or less random? Based on entropy changes only, would you predict the reaction to be spontaneous or not?



Practice Questions Section 3.1

Entropy**Answers**

1. Predict whether entropy is increasing ($\Delta S > 0$) or decreasing ($\Delta S < 0$)? Give a reason for your answer.

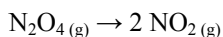
Answers:

steam condenses to water

$\Delta S < 0$; entropy decreases because liquid water is less random than gaseous water (steam)

solid CO_2 sublimates

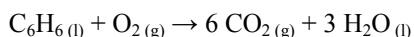
$\Delta S > 0$; entropy increases because gaseous CO_2 is more random than the solid state.



$\Delta S > 0$; entropy increases because two moles of a gas are more random than 1 mole of a gas.

water is heated from 25°C to 50°C

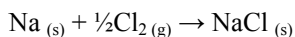
$\Delta S > 0$; entropy increases as particles move about more when heated.



$\Delta S > 0$;

entropy increases because there are more moles on the product side of the equation (9 vs 2)

2. Using a Table of Thermochemical Data, calculate ΔS for the following reaction. Is entropy increasing or decreasing? Is the system becoming more random or less random? Based on entropy changes only, would you predict the reaction to be spontaneous or not?

**Solution:**

Look up S° values for all reaction participants, taking care to look in the correct column of the table of thermochemical data. Multiply these values by any coefficients in the balanced equation, then simplify each side of the equation:

$$\begin{array}{rclcl}
 \text{Na} & + & \frac{1}{2} \text{Cl}_2 & \rightarrow & \text{NaCl}(\text{s}) \\
 51.2 & + & \frac{1}{2} \times 223.1 & & 72.1 \\
 \hline
 162.8 & & & & 72.1
 \end{array}$$

Use the following formula to find ΔS° :

$$\begin{aligned}
 \Delta S &= \Sigma S_{\text{products}} - \Sigma S_{\text{reactants}} \\
 &= 72.1 - 162.8 \\
 &= -90.7 \text{ J/K}
 \end{aligned}$$

A negative sign for ΔS° tells us that entropy is decreasing. The system becomes less random (or more ordered). **On the basis of entropy changes only we would NOT expect this reaction to occur spontaneously.**