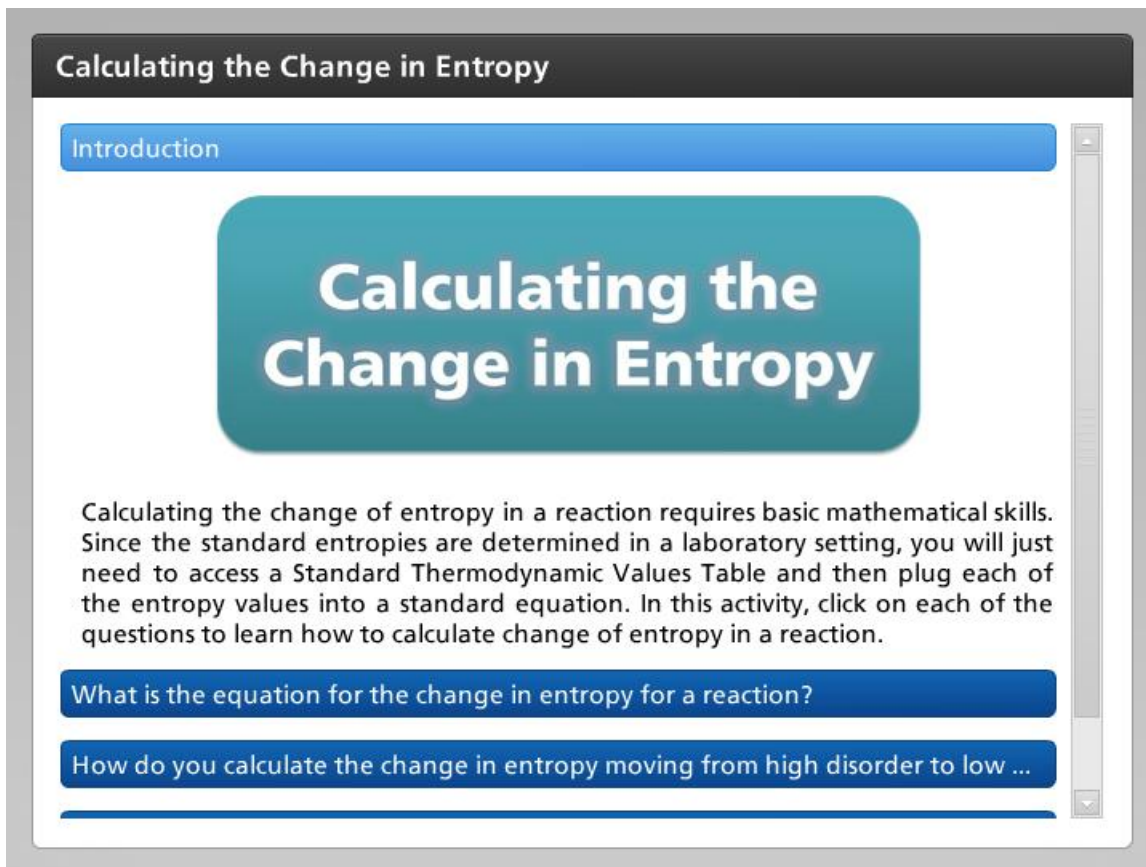


Module 8: Thermochemistry

Topic 4 Content: Calculating the Change in Entropy Notes

Introduction



The screenshot shows a digital learning interface with a dark grey header containing the title "Calculating the Change in Entropy". Below the header is a blue navigation bar with the word "Introduction". The main content area features a large teal rounded rectangle with the title "Calculating the Change in Entropy" in white. Below this, a paragraph of text explains that calculating entropy change requires basic mathematical skills and the use of a Standard Thermodynamic Values Table. At the bottom, there are two blue buttons with white text: "What is the equation for the change in entropy for a reaction?" and "How do you calculate the change in entropy moving from high disorder to low ...". A vertical scrollbar is visible on the right side of the content area.

Calculating the change of entropy in a reaction requires basic mathematical skills. Since the standard entropies are determined in a laboratory setting, you will just need to access a Standard Thermodynamic Values Table and then plug each of the entropy values into a standard equation. In this activity, click on each of the questions to learn how to calculate change of entropy in a reaction.

Module 8: Thermochemistry

Topic 4 Content: Calculating the Change in Entropy Notes

What is the equation for the change in entropy for a reaction?

Calculating the Change in Entropy

Introduction

What is the equation for the change in entropy for a reaction?

The change in entropy for a reaction (ΔS_{rxn}) is found using the following equation:

$$\Delta S_{\text{rxn}} = S_{\text{products}} - S_{\text{reactants}}$$

How do you calculate the change in entropy moving from high disorder to low ...

How do you calculate the change in entropy moving from low disorder to high ...

The change in entropy for a reaction (ΔS_{rxn}) is found using the following equation:

$$\Delta S_{\text{rxn}} = S_{\text{products}} - S_{\text{reactants}}$$

Module 8: Thermochemistry

Topic 4 Content: Calculating the Change in Entropy Notes

How do you calculate the change in entropy moving from high disorder to low disorder?

Calculating the Change in Entropy

How do you calculate the change in entropy moving from high disorder to low ...

Given the following data, calculate the ΔS_{rxn} for the following reaction:

$$\text{NH}_3(g) + \text{HCl}(g) \rightarrow \text{NH}_4\text{Cl}(s)$$

If you were given this problem, you would need to use the Standard Thermodynamic Values Table to look up each compounds entropy value. Then, using the formula, complete the mathematical problem. Once you have attained the given values, use the equation ($\Delta S_{\text{rxn}} = S_{\text{products}} - S_{\text{reactants}}$) to solve the problem. You can view each step and the solution to this problem in the image below.

Entropy Values

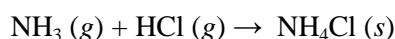
- $S(\text{NH}_3(g)) = 194.45 \text{ J/K}\cdot\text{mol}$
- $S(\text{HCl}(g)) = 186.9 \text{ J/K}\cdot\text{mol}$
- $S(\text{NH}_4\text{Cl}(s)) = 94.6 \text{ J/K}\cdot\text{mol}$

From the Standard Thermodynamic Values Table

Solution

$$\Delta S_{\text{rxn}} = S_{\text{products}} - S_{\text{reactants}}$$
$$\Delta S_{\text{rxn}} = S(\text{NH}_4\text{Cl}(s)) - S(\text{NH}_3(g)) + S(\text{HCl}(g))$$
$$\Delta S_{\text{rxn}} = (94.6 \text{ J/K}\cdot\text{mol}) - [(194.45 \text{ J/K}\cdot\text{mol}) + (186.9 \text{ J/K}\cdot\text{mol})]$$
$$\Delta S_{\text{rxn}} = (94.6 \text{ J/K}\cdot\text{mol}) - (381.35 \text{ J/K}\cdot\text{mol})$$
$$\Delta S_{\text{rxn}} = -286.75 \text{ J/K}\cdot\text{mol}$$

Given the following data, calculate the ΔS_{rxn} for the following reaction:



If you were given this problem, you would need to use the Standard Thermodynamic Values Table to look up each compounds entropy value. Then, using the formula, complete the mathematical problem. Once you have attained the given values, use the equation ($\Delta S_{\text{rxn}} = S_{\text{products}} - S_{\text{reactants}}$) to solve the problem. You can view each step and the solution to this problem in the image below.

Module 8: Thermochemistry

Topic 4 Content: Calculating the Change in Entropy Notes

How do you calculate the change in entropy moving from low disorder to high disorder?

Calculating the Change in Entropy

How do you calculate the change in entropy moving from high disorder to low ...

How do you calculate the change in entropy moving from low disorder to high ...

Given the following data, calculate the ΔS_{rxn} for the following reaction:

$$\text{CaCO}_3 (s) \rightarrow \text{CaO} (s) + \text{CO}_2 (g)$$

First, use the Standard Thermodynamic Values Table to look up each compound's entropy value. Then, using the formula, complete the mathematical problem. Once you have attained the given values, use the equation ($\Delta S_{\text{rxn}} = S_{\text{products}} - S_{\text{reactants}}$) to solve the problem. You can view each step and the solution to this problem in the image below.

Entropy Values

- $S(\text{CaCO}_3 (s)) = 92.9 \text{ J/K}\cdot\text{mol}$
- $S(\text{CaO} (s)) = 39.8 \text{ J/K}\cdot\text{mol}$
- $S(\text{CO}_2 (g)) = 213.6 \text{ J/K}\cdot\text{mol}$

From the Standard Thermodynamic Values Table

Solution

$$\Delta S_{\text{rxn}} = S_{\text{products}} - S_{\text{reactants}}$$
$$\Delta S_{\text{rxn}} = [S(\text{CaO} (s)) + S(\text{CO}_2 (g))] - S(\text{CaCO}_3 (s))$$
$$\Delta S_{\text{rxn}} = (39.8 \text{ J/K}\cdot\text{mol}) - (213.6 \text{ J/K}\cdot\text{mol}) + (92.9 \text{ J/K}\cdot\text{mol})$$
$$\Delta S_{\text{rxn}} = (253.4 \text{ J/K}\cdot\text{mol}) - (92.9 \text{ J/K}\cdot\text{mol})$$
$$\Delta S_{\text{rxn}} = 160.5 \text{ J/K}\cdot\text{mol}$$

Given the following data, calculate the ΔS_{rxn} for the following reaction:



First, use the Standard Thermodynamic Values Table to look up each compound's entropy value. Then, using the formula, complete the mathematical problem. Once you have attained the given values, use the equation ($\Delta S_{\text{rxn}} = S_{\text{products}} - S_{\text{reactants}}$) to solve the problem. You can view each step and the solution to this problem in the image below.