



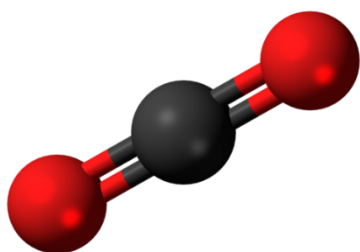
Methane vs. Carbon Dioxide

Discussion Exercise (approximately 15 minutes)

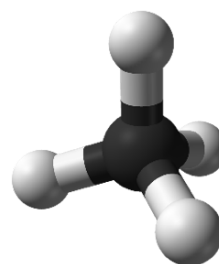
Task Description

Look at the card “Meal with beef” as a starting point for this exercise. One of the key reasons beef has such a high climate impact is due to the methane produced in cows' stomachs, primarily released through exhalation. Methane, like carbon dioxide, is a greenhouse gas, but it has a considerably larger climate impact than carbon dioxide. However, methane has a much shorter atmospheric lifespan than carbon dioxide.

Look at the molecular structures of methane and carbon dioxide in the figures below, and discuss why you think methane has a shorter atmospheric lifespan than carbon dioxide.



Molecular structure of carbon dioxide (CO₂).



Molecular structure of methane (CH₄).

Bonus Task

Balance a reaction where methane reacts with oxygen to form carbon dioxide and water (this reaction is one of several contributing to the breakdown of methane in the atmosphere).

Suggested Solutions

The structure of methane reveals single bonds between hydrogen and carbon atoms, which are weaker compared to the double bonds between oxygen and carbon in carbon dioxide. As a result, carbon dioxide is a more stable molecule and less likely to undergo chemical reactions compared to methane. Breaking double bonds requires more energy than breaking single bonds.

Solution Bonus Task: $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$

Expected Learning Outcomes

To explore the differences in the molecular structures of methane and carbon dioxide, understand the role of these greenhouse gases in climate change, and investigate the factors that contribute to the faster dissipation of methane in the atmosphere. Additionally, to practice chemical reaction balancing by analyzing the conversion of methane into carbon dioxide and water.