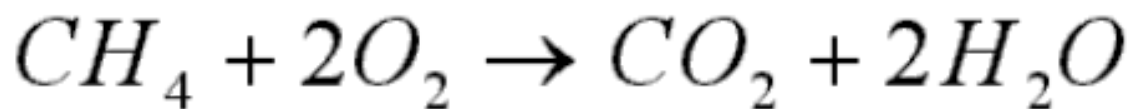


Unit 3: Stoichiometry
Chemical Equations and Reactions

Chemical equations are concise representations of chemical reactions, using symbols and formulas to show the transformation of substances. Reactants, or the starting materials, are shown on the left side of the equation, while products, the resulting substances, are on the right. Balancing equations is the process of ensuring that the number of atoms of each element on both sides of the equation remains equal, following the Law of Conservation of Matter. This fundamental law states that matter cannot be created or destroyed in a chemical reaction; instead, atoms are simply rearranged.



To balance a chemical equation, begin by addressing the atoms with the highest atomic number, typically found in Groups 1 or 2 of the periodic table. Subsequently, focus on balancing oxygen atoms, adjusting coefficients as necessary. Finally, balance hydrogen atoms, ensuring an equal count on both sides of the equation. Always double-check the overall atom count to confirm the equation's balance.

1. Propane has the equation C_3H_8 . It can be combusted with the addition of oxygen, producing carbon dioxide and water.
 - a. Provide an unbalanced chemical equation for the combustion of propane
 - b. Balance the equation.

2. Which side of a chemical equation typically represents the reactants?

Unit 3: Stoichiometry

3. What is the purpose of balancing a chemical equation, and what law does it demonstrate?

4. According to the Law of Conservation of Matter, what happens during a chemical reaction?

5. Write a balanced chemical equation for the reaction between hydrogen gas (H_2) and oxygen gas (O_2) to form water (H_2O).

6. Given the unbalanced chemical equation: $CH_4 + O_2 \rightarrow CO_2 + H_2O$, balance the equation by providing the coefficients for each compound.



Unit 3: Stoichiometry

7. Discuss the concept of reactants and products in the context of a chemical reaction you are familiar with, such as the combustion of gasoline in a car engine.

ANSWER KEY

1. Propane has the equation C_3H_8 . It can be combusted with the addition of oxygen, producing carbon dioxide and water.
 - a. Provide an unbalanced chemical equation for the combustion of propane
 - b. Balance the equation.

The unbalanced equation for the combustion of propane is: $C_3H_8 + O_2 \rightarrow CO_2 + H_2O$. The balanced equation for the combustion of propane is: $C_3H_8 + 5O_2 \rightarrow 3CO_2 + 4H_2O$.

2. Which side of a chemical equation typically represents the reactants?

In a chemical equation, the left side typically represents the reactants, showing that substances are involved at the beginning of the reaction.

3. What is the purpose of balancing a chemical equation, and what law does it demonstrate?

To obey the Law of Conservation of Matter. Balancing a chemical equation ensures that the Law of Conservation of Matter is followed, meaning that no atoms are created or destroyed during the reaction. This helps accurately represent the reaction.

4. According to the Law of Conservation of Matter, what happens during a chemical reaction?

Matter is conserved. According to the Law of Conservation of Matter, matter is neither created nor destroyed in a chemical reaction: it is conserved. This means the total number of atoms of each element remains the same before and after the reaction.

5. Write a balanced chemical equation for the reaction between hydrogen gas (H_2) and oxygen gas (O_2) to form water (H_2O).

Answer: $2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}$

Explanation: This balanced equation represents the synthesis of water from hydrogen and oxygen. It ensures that there are equal numbers of hydrogen and oxygen atoms on both sides of the equation.

6. Given the unbalanced chemical equation: $\text{CH}_4 + \text{O}_2 \rightarrow \text{CO}_2 + \text{H}_2\text{O}$, balance the equation by providing the coefficients for each compound.

Answer: $\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}$

Explanation: Balancing the equation requires adding coefficients to each compound to make the number of each type of atom equal on both sides. In this case, coefficients of 1, 2, 1, and 2 were added to CH_4 , O_2 , CO_2 , and H_2O , respectively.

7. Discuss the concept of reactants and products in the context of a chemical reaction you are familiar with, such as the combustion of gasoline in a car engine.

The reactants are what you start with (gasoline and oxygen), and the products are what you end up with (carbon dioxide, water vapor, and heat) after the combustion process. This process follows the Law of Conservation of Matter, as the total mass of the reactants equals the total mass of the products.