

Chapter 7 Chemical Reactions

Section 7.1 Describing Reactions

(pages 192–198)

**Balancing Chemical Equations****Content and Vocabulary Support****Chemical Equations**

In a chemical reaction, the substances that undergo change are called **reactants**. The new substances that are formed are called **products**. A **chemical equation** is a way of representing a chemical reaction in which the reactants and products are expressed as formulas. For example, carbon reacts with oxygen to form carbon monoxide. The chemical equation for this reaction is:



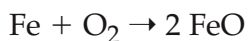
The number of each type of atom is always the same on both sides of the equation. This is due to the law of conservation of mass, which states that mass is neither created nor destroyed in a chemical reaction.

Balancing Chemical Equations

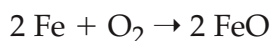
In order for some chemical equations to be balanced, there must be more of some reactants or products than others. For example, iron (Fe) reacts with oxide (O_2) to produce iron oxide (FeO). However, just writing:



leads to a chemical equation that is not balanced. The left side has twice as many oxygen atoms as the right side. The first step in balancing this equation is to double the number of oxygen atoms on the right side by writing the number “2” in front of the FeO:



This number is called a **coefficient**. Coefficients in a chemical equation give the ratios of reactants and products in the reaction. When there is no coefficient given, it is assumed to be 1. To finish balancing the equation, Fe also must be given a coefficient of 2:



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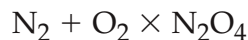
Solved Examples

Example 1: Nitrogen (N_2) reacts with oxygen (O_2) to produce dinitrogen tetroxide (N_2O_4), a component of rocket fuel. Write and balance the chemical equation for this reaction.

Given: Reactants = N_2, O_2
Product = N_2O_4

Unknown: Equation

Solution: Add the reactants on the left, and link them with an arrow to the product on the right:



Change the coefficient of O_2 to balance the number of oxygen atoms:



Example 2: In the burning of natural gas, methane (CH_4) reacts with oxygen (O_2) to form carbon dioxide (CO_2) and water (H_2O). Write and balance the chemical equation for this reaction.

Given: Reactants = CH_4, O_2
Products = $\text{CO}_2, \text{H}_2\text{O}$

Unknown: Equation

Solution: Place the reactants on the left and the products on the right:



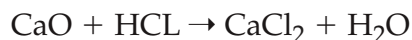
Balance the number of oxygen and hydrogen atoms by changing the coefficients of O_2 and H_2O :



Practice Exercises

Exercise 1: Hydrogen (H_2) and oxygen (O_2) react to form water (H_2O). Write and balance the equation for this reaction.

Exercise 2: Determine if the following equation is balanced, and then balance it if needed.



Exercise 3: Write and balance an equation for a reaction in which iron (Fe) and hydrochloric acid (HCL) react to form iron chloride (FeCl_2) and hydrogen (H_2).

Exercise 4: Dissolving sodium (Na) in water produces sodium oxide (NaOH) and hydrogen (H_2). Write a balanced equation for this reaction.

Exercise 5: If you add heat to potassium chlorate (KClO_3), it reacts and forms potassium chloride (KCl) and oxygen (O_2). Write and balance the equation for this reaction.