How to Balance Chemical Equations Step by Step

KS4 CHEMISTRY Ages 11-16 ⏰ 3 min read

What is a Chemical Equation?

A **chemical equation** is like a recipe that shows what happens when chemicals mix and react. It tells us which **reactants** (starting materials) combine and what **products** (new substances) form. For example, when hydrogen gas burns in oxygen, it makes water. We write this as: $H_2 + O_2 \rightarrow H_2O$.

Why Do We Need to Balance Equations?

Here's the tricky part: atoms cannot be created or destroyed in a **chemical reaction**. This is called the **Law of Conservation of Mass**. That means we must have the same number of each type of atom on both sides of the equation.

Think of it like a pizza party: if you start with **8 slices**, you must end with **8 slices**—they might be shared differently, but the total stays the same.

How to Balance an Equation: Five Simple Steps

Step 1: Count the atoms. On the left side (reactants) and right side (products), count how many of each atom you have. Write down the numbers.

Step 2: Look for imbalances. If the numbers don't match, you need to add **coefficients**—small numbers in front of the chemical formulas that multiply everything in that molecule.

Step 3: Start with the biggest molecules. Usually, balance elements that appear in only one place first. Avoid **oxygen** and **hydrogen** until the end—they're sneaky!

Step 4: Add coefficients. Place numbers in front of formulas to make atoms balance. For example, changing $H_2 + O_2 \rightarrow H_2O$ to $2H_2 + O_2 \rightarrow 2H_2O$ means we now have **4 hydrogen atoms** and **2 oxygen atoms** on both sides.

Think of coefficients like saying "2 boxes of crayons" instead of "1 box." You're just saying how many you need.

Step 5: Check your work. Count all atoms again on both sides. If every element has the same number on the left and right, you've balanced it!

A Real Example

Let's balance: $Fe + O_2 \rightarrow Fe_2O_3$ (iron burning in oxygen to make rust). Count: left side has **1 iron** and **2 oxygen**. Right side has **2 iron** and **3 oxygen**. We need to adjust! The answer is: **$4Fe + 3O_2 \rightarrow 2Fe_2O_3$.** Now both sides have **4 iron atoms** and **6 oxygen atoms**. Balanced!

Balancing takes practice, but once you get the rhythm, it becomes like solving a fun puzzle.