

## Chemical Reaction:

In a **chemical reaction**, the atoms and molecules that interact with each other are called reactants. ... No new atoms are created, and no atoms are destroyed. In a **chemical reaction**, reactants contact each other, bonds between atoms in the reactants are broken, and atoms rearrange and form new bonds to make the products

## Formulae and equations

(<https://www.bbc.com/bitesize/guides/zcpxfcw/revision/4>)

Chemists use symbols and formulae to represent elements, ions, and compounds. Word equations and balanced chemical equations model the changes that happen in chemical reactions.

## Word equations

A **word equation** models a chemical reaction using the names of the substances involved. Word equations do not show any chemical symbols or **formulae**.

## Reactants and products

1. **Reactants** are the substances that react together in a chemical reaction. In a chemical reaction, the **atoms** or **ions** in reactants separate from one another. They join back together in a different way to form **products**.

Word equations always take this form:

reactants → products

**A + sign** separates two or more reactants or two or more products.

2. Reactants and **Products in Chemical Reactions**. In a **chemical reaction**, substances (elements and/or compounds) called reactants are changed into other substances (compounds and/or elements) called **products**. ... Instead, you create a new substance **with chemical reactions**.

## Example Sentence Equations

Potassium hydroxide reacts with sulfuric acid.

Potassium sulfate and water are formed in the reaction.

This means that:

- the reactants are potassium hydroxide and sulfuric acid

- the products are potassium sulfate and water
- the word equation is: potassium hydroxide + sulfuric acid → potassium sulfate + water

**Chemical equations contain an arrow, not an equals sign.**

## Example Word Equations

There can be different numbers of reactants and products. For example:

- sodium + chlorine → sodium chloride
- calcium carbonate → calcium oxide + carbon dioxide

## Question

Nitrogen and hydrogen react together to form ammonia. Give the word equation for the reaction.

Here is your opportunity to try:

Answer Here:

## Balanced chemical equations

(<https://www.bbc.com/bitesize/guides/zcpxfcw/revision/5>)

A **balanced chemical equation** models a chemical reaction using the **formulae** of the **reactants** and **products**. It shows the **number** of units of each substance involved.

A **balanced chemical equation** is a chemists shorthand using chemical symbols to show the molecules and atoms of a chemical reaction. The reactants are presented on the left side of the equation and the products are on the right. **Coefficients give information regarding the number of molecules involved and the subscripts provide information about the number of atoms in each molecule.**

**\*\*Show that the reactant elements and molecules are the same on the reactant side of the arrow as the product sided just rearranged.**

## State symbols

Balanced chemical equations include **state symbols** in brackets after each formula. They show the physical state of that substance.

State symbol	Meaning
(s)	Solid
(l)	Liquid

(g)	Gas
(aq)	Aqueous solution

An **aqueous** solution forms when a substance dissolves in water.

State symbols are useful because they show what a substance is like. For example:

- $\text{H}_2\text{O}(\text{l})$  is liquid water, but  $\text{H}_2\text{O}(\text{g})$  is steam
- $\text{HCl}(\text{g})$  is hydrogen chloride gas, but  $\text{HCl}(\text{aq})$  is hydrochloric acid

## Balancing an equation

If an equation is written by just replacing names with formulae, it may not be balanced. The numbers of **atoms** of each **element** on the left must be the same as they are on the right.

To balance an unbalanced equation, numbers (**Coefficients**) need to be added to the left of one or more formulae. Here is one way to work out how to do this for the reaction between nitrogen and hydrogen.

Step	Result
Check to see if there are equal numbers of atoms of each element on both sides. There aren't.	$\text{N}_2 + \text{H}_2 \rightarrow \text{NH}_3$
There are two nitrogen atoms on the left but only one on the right, so put a big 2 on the left of the $\text{NH}_3$ .	$\text{N}_2 + \text{H}_2 \rightarrow 2\text{NH}_3$
Check again. There are two hydrogen atoms on the left but $(2 \times 3) = 6$ on the right, so put a big 3 in front of the $\text{H}_2$ .	$\text{N}_2 + 3\text{H}_2 \rightarrow 2\text{NH}_3$
Check again to see if there are equal numbers of each element on both sides. There are.	(Two nitrogen atoms and six hydrogen atoms)
Add the state symbols if asked to do this.	$\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$

**Balanced chemical equations only show formulae, not names. A balancing number multiplies all the atoms in the substance next to it.**