Balancing equations

Chemists communicate what is happening in chemical reactions using symbol equations. These are more visual than word equations and give more information. Using recognised chemical symbols and formulas means that speakers of different languages can all understand the symbol equation.

A balanced symbol equation is a concise illustration of the law of conservation of mass. The law of conservation of mass states that no atoms are made or destroyed during a chemical reaction (or physical change). Put simply, the number of atoms of each element in the reactants (on the left side of the equation) must equal the number of atoms of each element in the products (on the right side of the equation).

For example, when copper (Cu) is heated in air it reacts with oxygen (O_2) to produce copper oxide (CuO).

$$Cu + O_2 \rightarrow CuO$$

This equation is unbalanced.

Reactants	Products
1 x Cu **2 x O**	1 x Cu **1 x O**

First, we can balance the oxygen atoms by adding a 2 in front of the CuO

$$Cu + O_2 \rightarrow 2CuO$$

Doing this means the Cu now needs balancing with a 2, which gives us the final equation.

$$2Cu + O_2 \rightarrow 2CuO$$

Rules for balancing equations

- Only add multipliers to the equation before a formula. The multiplier applies to the whole formula.
- Do not change the formulas.

The best way to get better at balancing equations is to practise. When you first begin, use a pencil and eraser or a mini whiteboard so you can make changes easily.

Practice questions

Use the unbalanced equations below to practise. There are spaces before each formula, but not every formula will need a multiplier.

1. $\_\_\_Mg + \_\_\_O_2 \rightarrow \_\_\_MgO$
2. $\_\_\_Na + \_\_\_Cl_2 \rightarrow \_\_\_NaCl$
3. $\_\_\_H_2 + \_\_\_O_2 \rightarrow \_\_\_H_2O$
4. $\_\_\_O_2 \rightarrow \_\_\_O_3$
5. $\_\_\_Na + \_\_\_H_2O \rightarrow \_\_\_NaOH + \_\_\_H_2$
6. $\_\_\_FeCl_3 + \_\_\_Zn \rightarrow \_\_\_ZnCl_2 + \_\_\_Fe$
7. $\_\_\_C + \_\_\_S_8 \rightarrow \_\_\_CS_2$

Challenge questions

8. $\_\_\_Fe_2O_3 + \_\_\_C \rightarrow \_\_\_Fe + \_\_\_CO_2$
9. $\_\_\_C_2H_5OH + \_\_\_O_2 \rightarrow \_\_\_CO_2 + \_\_\_H_2O$
10. $\_\_\_H_3PO_4 + \_\_\_Mg(OH)_2 \rightarrow Mg_3(PO_4)_2 + \_\_\_H_2O$

Practice question answers

1. $2Mg + O_2 \rightarrow 2MgO$
2. $2Na + Cl_2 \rightarrow 2NaCl$
3. $2H_2 + O_2 \rightarrow 2H_2O$
4. $3O_2 \rightarrow 2O_3$
5. $2Na + 2H_2O \rightarrow 2NaOH + H_2$
6. $2FeCl_3 + 3Zn \rightarrow 3ZnCl_2 + 2Fe$
7. $4C + S_8 \rightarrow 4CS_2$

Challenge questions

8. $2Fe_2O_3 + 3C \rightarrow 4Fe + 3CO_2$
9. $2C_2H_5OH + 4O_2 \rightarrow 2CO_2 + 6H_2O$
10. $2H_3PO_4 + 3Mg(OH)_2 \rightarrow Mg_3(PO_4)_2 + 6H_2O$