Balancing equations 1

With guidance

Four steps to a balanced equation

The number of atoms of each element must match on both sides of the arrow. Change the coefficients before the formulas; keep the formulas themselves unchanged.

1. Count each element’s atoms on the left and right.
2. Change one coefficient at a time. It multiplies every atom in that formula.
3. Count again. Changing one substance may affect several elements.
4. Use the smallest possible positive whole numbers. Enter 1 in the boxes too.

Worked example: forming water

1. Unbalanced: $H_2 + O_2 \rightarrow H_2O$. There are 2 O atoms on the left and 1 on the right.
2. Put 2 before H_2O. There are now 2 O atoms on the right, but also 4 H atoms.
3. So put 2 before H_2. Result: $2\ H_2 + 1\ O_2 \rightarrow 2\ H_2O$. H: 4 = 4 and O: 2 = 2.

A coefficient and a subscript are different. $2\ H_2O$ represents 4 H atoms and 2 O atoms in total. A subscript outside brackets multiplies everything inside: $Ca(OH)_2$ has 1 Ca, 2 O and 2 H.

Continue on the next page: 10 questions with short prompts.

OpenStax, Chemistry 2e, 4.1 - Writing and Balancing Chemical Equations.

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Name: _____ Class: _____ Date: _____

Enter the smallest possible positive whole numbers. Write the coefficient 1 too.

01

☐ **Mg** + ☐ **O_2** → ☐ **MgO**

Start with oxygen. O_2 has two O atoms, while MgO has one. Then balance the Mg atoms.

02

☐ **Na** + ☐ **Cl_2** → ☐ **NaCl**

Compare the Cl atoms in Cl_2 and NaCl. Remember that the coefficient before NaCl multiplies both Na and Cl.

03

☐ **H_2O_2** → ☐ **H_2O** + ☐ **O_2**

Hydrogen appears only in H_2O_2 and H_2O. Match hydrogen, then count oxygen in both substances on the right.

04

☐ **N_2** + ☐ **H_2** → ☐ **NH_3**

Balance N first. Then count H in all the NH_3 units and compare with H_2.

05

☐ **Al** + ☐ **O_2** → ☐ **Al_2O_3**

Oxygen comes in groups of two and three. Find a small total divisible by both 2 and 3. Then balance Al.

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Enter the smallest possible positive whole numbers. Write the coefficient 1 too.

06

☐ CH_4 + ☐ O_2 → ☐ CO_2 + ☐ H_2O

Balance carbon first, then hydrogen. Finally count O in both CO_2 and H_2O to find the O_2 coefficient.

07

☐ $KClO_3$ → ☐ KCl + ☐ O_2

K and Cl stay in a 1:1 ratio. Find a shared oxygen total for groups of three and two.

08

☐ Zn + ☐ HCl → ☐ $ZnCl_2$ + ☐ H_2

Look at Cl_2 in $ZnCl_2$: each Zn atom has two Cl atoms. Then check whether the H atoms also match.

09

☐ $NaOH$ + ☐ H_2SO_4 → ☐ Na_2SO_4 + ☐ H_2O

Balance Na first. SO_4 is an unchanged group on both sides. Count H from both substances on the left and check O last.

10

☐ C_3H_8 + ☐ O_2 → ☐ CO_2 + ☐ H_2O

Start with C, continue with H and leave O until last. Include oxygen in both products.