Balancing chemical equations for Class 10

Visual learning guide - Science · Grade 10

Learn a reliable atom-count method, see five worked equations, and check fourteen original balancing tasks with explanations.

Start with the key idea

Balance a chemical equation by changing coefficients so each element has the same number of atoms on both sides. Keep every chemical formula unchanged, then reduce the coefficients to their simplest whole-number ratio.

1. Begin with the substances and the conservation rule

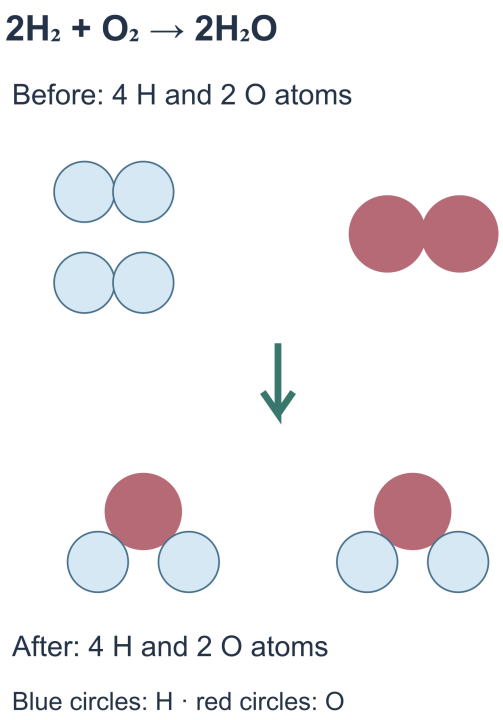
A chemical equation represents reactants changing into products. The arrow separates the two sides; it does not mean that the written formulae are interchangeable. Before balancing, check that the reactants and products are correctly identified. A mathematically balanced line with the wrong product is still a wrong chemical description.

In an ordinary chemical reaction, atoms are rearranged. The count of each element must match across the equation. For ionic equations, charge must also be conserved, though this guide practises neutral formula equations. An equation balanced only in its total number of atoms can still fail if individual element counts differ.

State symbols such as (s), (l), (g) and (aq) provide additional information. They do not alter atom counts, and balancing alone does not determine all the reaction conditions or whether a proposed reaction actually occurs.

2. Change coefficients, never subscripts

A coefficient multiplies the entire formula following it. In $2H_2O$, it gives four hydrogen atoms and two oxygen atoms. The subscript 2 within H_2O belongs to the chemical formula and must remain fixed. Changing H_2O into H_2O_2 would replace water with hydrogen peroxide rather than balance water formation.



Particle model shows four hydrogen atoms and two oxygen atoms before and after forming two water molecules.

A missing coefficient means one. Use whole-number coefficients in their simplest ratio for the final school answer. Fractions may help during working, but multiply every coefficient by a suitable common factor before finishing.

Keep a count table with one row per element and columns for left and right. Recount after every change because a coefficient can affect several elements at once. Circle the formula as a group if you are tempted to multiply only its first element.

3. Use an orderly inspection method

List the elements and count the current atoms. Choose an element appearing in relatively few formulae, often one in a more complex compound. Adjust a coefficient to balance it, then move to another element. Hydrogen and oxygen are often convenient to leave later in combustion equations, but this is a strategy rather than a universal law.

If a polyatomic group remains unchanged on both sides, it can sometimes be counted as a unit during working. You must still check individual atoms at the end. Do not use the shortcut when the group breaks apart or changes composition.

After each adjustment, return to earlier rows. For $Al + Cl_2 \rightarrow AlCl_3$, matching chlorine requires six chlorine atoms on each side: $3Cl_2$ and $2AlCl_3$. That product coefficient then requires $2Al$ on the left.

4. Handle odd and even counts without guessing

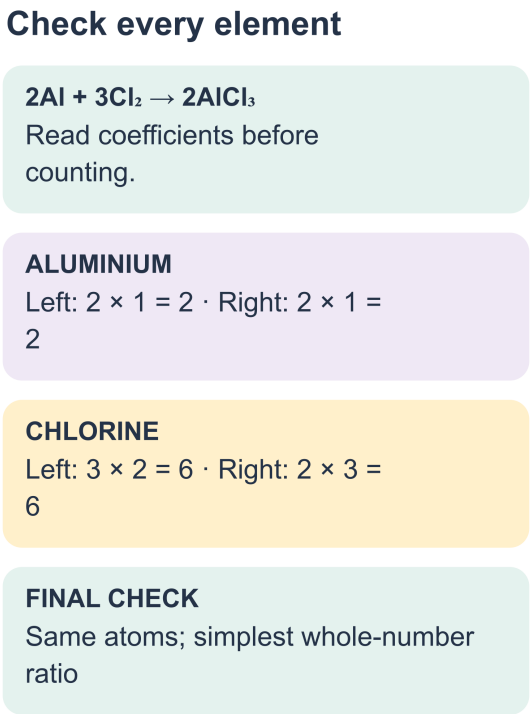
An odd oxygen count in a product and O_2 on the reactant side can create a temporary fraction. For $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$, balance carbon with $2CO_2$ and hydrogen with $3H_2O$. The product side then contains seven oxygen atoms, requiring 7/2 O_2.

Multiply the entire equation by two: $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$. Multiplying only the oxygen coefficient would spoil the other balances. Check carbon, hydrogen and oxygen again after clearing the fraction.

An alternative is to begin with two ethane molecules to avoid fractions, but both methods express the same final ratio. The useful habit is a transparent count table, not lucky trial and error. Never alter a formula to avoid an awkward number.

5. Perform an independent final audit

Read the completed equation afresh and calculate each count from coefficient × subscript. For $2Al + 3Cl_2 \rightarrow 2AlCl_3$, aluminium is 2 on each side and chlorine is 6 on each side. Check that the coefficients have no common factor greater than one.



An atom-count audit of aluminium and chlorine verifies the balanced equation 2Al plus 3Cl2 gives 2AlCl3.

A correct balance states a ratio, not a claim that only that many particles can react. Twice or ten times the quantities preserve the same ratio, although the simplest whole numbers are the expected conventional presentation. Do not infer a mass ratio directly from coefficients; particle ratios and mass ratios differ.

Finally check legibility. A leading 2 and a subscript 2 perform different jobs. On paper, leave space before formulae, write subscripts clearly and include the reaction arrow.

6. Use balancing to explain a reaction responsibly

A balanced equation does not tell you the reaction speed, yield, energy change or practical safety. It also cannot establish an unknown product without chemical evidence. The equations here are paper-based practice; they are not instructions to mix chemicals, burn fuels or generate gases at home.

When a question asks why an equation must be balanced, connect it with conservation of atoms and mass in the complete system. When it asks for a method, demonstrate counts and coefficients rather than writing only the final line. When it asks for state symbols or conditions, treat those as separate information requirements.

Use errors diagnostically: a wrong oxygen count after fixing hydrogen suggests you forgot to recount the whole product. A changed subscript suggests confusion between particle number and identity. Correct the specific habit, then solve a new equation without looking at the model.

5 worked examples with reasoning

1. Balance $H_2 + O_2 \rightarrow H_2O$.

1. Oxygen: place 2 before H_2O.

2. Hydrogen is now 4 on the right, so place 2 before H_2.

3. $2H_2 + O_2 \rightarrow 2H_2O$; H: 4 each, O: 2 each.

2. Balance $Fe + O_2 \rightarrow Fe_2O_3$.

1. Use $2Fe_2O_3$ to give 6 O atoms.

2. Use $3O_2$ and 4Fe on the left.

3. $4Fe + 3O_2 \rightarrow 2Fe_2O_3$; Fe: 4 each, O: 6 each.

3. Balance $Na + H_2O \rightarrow NaOH + H_2$.

1. Use $2H_2O$ and 2NaOH to give 2 O atoms each.

2. Their H counts leave two H atoms for H_2.

3. $2Na + 2H_2O \rightarrow 2NaOH + H_2$; Na: 2, O: 2, H: 4 each.

4. Balance $CaCO_3 \rightarrow CaO + CO_2$.

1. Count Ca: 1 each and C: 1 each.

2. Oxygen on the right is 1 + 2 = 3.

3. It is already balanced with coefficients 1:1:1.

5. Balance $C_2H_6 + O_2 \rightarrow CO_2 + H_2O$.

1. Balance C and H as $2CO_2$ and $3H_2O$.

2. Seven product O atoms need 7/2 O_2; multiply all terms by 2.

3. $2C_2H_6 + 7O_2 \rightarrow 4CO_2 + 6H_2O$; C: 4, H: 12, O: 14 each.

Use the ideas without looking at the notes

Choose three equations from the practice set. Draw a separate atom-count table for each, show every coefficient change, and ask a partner to audit the final formulae without seeing your working.

Common questions

Why not change subscripts?

They define the substances. Coefficients change the number of whole particles instead.

Can an equation already be balanced?

Yes. Always count before adding coefficients.

Must final coefficients be simplest whole numbers?

That is the usual school convention. Divide by a common factor when possible.

Do state symbols change atom counts?

No. They describe physical states.

Does balancing identify unknown products?

No. Correct reactants and products must be established first.

Connect your learning

- Review formulae and atom counts
- Distinguish physical separation from chemical change

Ask about guided Science learning if your child needs help explaining these ideas.

About this guide

Original explanations, examples, diagrams and practice by BananaLearn. The grade label indicates the intended learning level; this is not an official textbook extract or exam paper.

Balancing chemical equations for Class 10

Practice worksheet - Science · Grade 10

Name: _____ Date: _____

Show your working. Answers and explanations follow on a separate page.

Try each task before opening its answer. Give an example or reason, not only a label.

Write an answer and your reason before opening the explanation. Check the reasoning as well as the final answer.

1. How many H atoms are represented by $3H_2O$?

2. May H_2O be changed to H_2O_2 to balance oxygen?

3. Balance $Mg + O_2 \rightarrow MgO$.

4. Balance $N_2 + H_2 \rightarrow NH_3$.

5. Balance $Al + Cl_2 \rightarrow AlCl_3$.

6. Balance $KClO_3 \rightarrow KCl + O_2$.

7. Balance $Zn + HCl \rightarrow ZnCl_2 + H_2$.

8. Balance $CH_4 + O_2 \rightarrow CO_2 + H_2O$.

Practice continued

9. Balance $Na_2CO_3 + HCl \rightarrow NaCl + H_2O + CO_2$.

10. Simplify $4H_2 + 2O_2 \rightarrow 4H_2O$.

11. Is $C + O_2 \rightarrow CO_2$ already balanced?

12. Do equal total atom counts guarantee balance?

13. If one coefficient is 1/2, what must you multiply to remove it?

14. Does balancing prove a reaction is safe to perform?

Answers and explanations

Answer key - Science · Grade 10

Balancing chemical equations for Class 10

1. 6.

Multiply the coefficient 3 by subscript 2.

2. No.

That changes the substance.

3. $2Mg + O_2 \rightarrow 2MgO$.

Mg: 2 and O: 2 on each side.

4. $N_2 + 3H_2 \rightarrow 2NH_3$.

N: 2 and H: 6 on each side.

5. $2Al + 3Cl_2 \rightarrow 2AlCl_3$.

Al: 2 and Cl: 6 on each side.

6. $2KClO_3 \rightarrow 2KCl + 3O_2$.

K: 2, Cl: 2 and O: 6 each.

7. $Zn + 2HCl \rightarrow ZnCl_2 + H_2$.

Zn: 1, H: 2 and Cl: 2 each.

8. $CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$.

C: 1, H: 4 and O: 4 each.

9. $Na_2CO_3 + 2HCl \rightarrow 2NaCl + H_2O + CO_2$.

Na: 2, C: 1, O: 3, H: 2 and Cl: 2 each.

10. $2H_2 + O_2 \rightarrow 2H_2O$.

Divide every coefficient by 2.

11. Yes.

C: 1 and O: 2 each.

12. No.

Each individual element must match.

13. Every coefficient by 2.

The ratio must remain unchanged.

14. No.

It is a conservation check, not a safety assessment.