

Balanced chemical equations

These **Knowledge check worksheets** provide a series of questions to assess learners' knowledge and understanding of this topic at the end of a period of teaching or as revision. They are available at foundation and higher level and as fully editable versions so you can adapt them to suit learners' needs. Use for individual student work in class or at home. Find the full set of answers below.

Also available to assess this topic:

- **Review my learning** worksheets: available with three levels of scaffolded support to help build confidence in every learner. Use before, during or after teaching the relevant topic, to understand progress and identify misconceptions, rsc.li/44igB7V.
- **In context worksheets** ask learners to apply their knowledge to interesting contexts from everyday life, helping them develop their skills and prepare for examination, including calculation questions to practise mathematical skills within a genuine chemical context, rsc.li/411kQnF.

Answers

Foundation

1. The atoms of the **reactants** (1) present at the start of a chemical reaction are **rearranged** (1) to form the new substances, which are known as **products** (1). The number of atoms of each element present in the substances formed is **equal to** (1) the number of atoms of each element in the reacting substances. [4 marks]

2.

(a)

Chemical formulas	Names and number of atoms of each element present
ZnCl_2	1 zinc atom and 2 chlorine atoms
Na_2CO_3	2 sodium atoms, 1 carbon atom and 3 oxygen atoms
Fe_2O_3	2 iron atoms and 3 oxygen atoms
$\text{Mg}(\text{NO}_3)_2$	1 magnesium atom, 2 nitrogen atoms and 6 oxygen atoms

[1 mark per correct row: 3 marks]

(b)

State symbol	Physical state
(s)	solid
(l)	liquid
(g)	gas
(aq)	aqueous solution

[0.5 mark per correct answer: 2 marks]

(c)

Name	Chemical formula
nitric acid	HNO_3
hydrochloric acid	HCl
oxygen	O_2
hydrogen	H_2
carbon dioxide	CO_2
carbon monoxide	CO
sulfuric acid	H_2SO_4
water	H_2O
ammonia	NH_3

[0.5 marks per correct answer: 4 marks]

3.

- (a) i. **2** [1 mark]
 ii. **2** [1 mark]
 iii. **4** [1 mark]

(b)

Chemical equations	Balanced	Unbalanced
$\text{CaCO}_3 \rightarrow \text{CaO} + \text{CO}_2$	✓	
$2\text{Al} + \text{Br}_2 \rightarrow 2\text{AlBr}_3$		✓
$\text{Cu}_2\text{O} + \text{H}_2 \rightarrow 2\text{Cu} + \text{H}_2\text{O}$	✓	
$\text{Fe}_2\text{O}_3 + 3\text{C} \rightarrow \text{Fe} + 3\text{CO}_2$		✓

[1 mark per correct column: 2 marks]

- (c) i. $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ [1 mark]
ii. $\text{Mg} + 2\text{HNO}_3 \rightarrow \text{Mg}(\text{NO}_3)_2 + \text{H}_2$ [1 mark]
iii. $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$ [1 mark]
iv. $\text{Cl}_2 + 3\text{F}_2 \rightarrow 2\text{ClF}_3$ [1 mark]

- (d)
i. $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightarrow 2\text{NH}_3(\text{g})$
ii. $4\text{Na}(\text{s}) + \text{O}_2(\text{g}) \rightarrow 2\text{Na}_2\text{O}(\text{s})$
iii. $2\text{NaOH}(\text{aq}) + \text{H}_2\text{SO}_4(\text{aq}) \rightarrow \text{Na}_2\text{SO}_4(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$
iv. $\text{K}_2\text{CO}_3(\text{s}) + 2\text{HCl}(\text{aq}) \rightarrow 2\text{KCl}(\text{aq}) + \text{CO}_2(\text{g}) + \text{H}_2\text{O}(\text{l})$
[2 marks per equation: correct state symbols: 1 mark; correct balancing: 1 mark]

[Total: 30 marks]

Higher

1.

- (a) i. Reactants are the substances present at the start of a chemical reaction. [1 mark]
ii. Products are the substances formed during a chemical reaction. [1 mark]

- (b) For any chemical reaction, the **mass** (1) of the reactants used is always the same as that of the products formed.

During a chemical reaction, the atoms of the reactants are **rearranged** (1) to form the products.

The number of atoms of each element present in the products is **equal to** (1) the number of atoms of each element in the reactants.

[3 marks]

- (c)

State symbol	Physical state
(s)	solid
(l)	liquid
(g)	gas
(aq)	aqueous solution

[0.5 marks per correct answer: 2 marks]

2.

(a) A chemical formula uses chemical symbols to show the number of atoms of each element present in the molecule. [1 mark]

(b)

Name	Chemical formula
water	H_2O
oxygen	O_2
hydrogen	H_2
carbon dioxide	CO_2
carbon monoxide	CO
sulfur dioxide	SO_2
sulfur trioxide	SO_3
hydrochloric acid	HCl
sulfuric acid	H_2SO_4
nitric acid	HNO_3
chlorine	Cl_2
ammonia	NH_3

[0.5 marks per correct answer to max of 6 marks]

3.

(a)

i. $4\text{Al} + 3\text{O}_2 \rightarrow 2\text{Al}_2\text{O}_3$ [1 mark]

ii. $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$ [1 mark]

iii. $\text{Ca}(\text{OH})_2 + 2\text{HNO}_3 \rightarrow \text{Ca}(\text{NO}_3)_2 + 2\text{H}_2\text{O}$ [1 mark]

(b)

Chemical equations	Balanced	Unbalanced
$2\text{Al} + 3\text{Br}_2 \rightarrow 2\text{AlBr}_3$	✓	
$\text{Mg}(\text{OH})_2 + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2\text{O}$		✓
$\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$		✓
$\text{K}_2\text{CO}_3 + 2\text{HCl} \rightarrow 2\text{KCl} + \text{CO}_2 + \text{H}_2\text{O}$	✓	
$\text{FeCl}_3 + \text{NH}_4\text{OH} \rightarrow \text{Fe}(\text{OH})_3 + \text{NH}_4\text{Cl}$		✓
$\text{CuO} + \text{H}_2\text{SO}_4 \rightarrow \text{CuSO}_4 + \text{H}_2\text{O}$	✓	

[0.5 marks per correct answer: 3 marks]

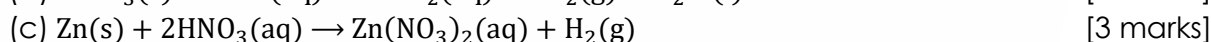
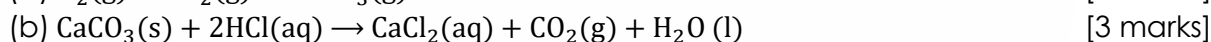
(c) $\text{Mg}(\text{OH})_2 + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + \text{H}_2\text{O}$ is not correctly balanced because the number of hydrogen atoms in the reactants is greater than in the products. The balanced chemical equation is: $\text{Mg}(\text{OH})_2 + \text{H}_2\text{SO}_4 \rightarrow \text{MgSO}_4 + 2\text{H}_2\text{O}$ [1 mark]

$\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + \text{H}_2\text{O}$ is not correctly balanced because the number of sodium atoms in the products is greater than in the reactants and the number of hydrogen atoms in the reactants is greater than in the products. The balanced chemical equation is: **$2\text{NaOH} + \text{H}_2\text{SO}_4 \rightarrow \text{Na}_2\text{SO}_4 + 2\text{H}_2\text{O}$** [1 mark]

$\text{FeCl}_3 + \text{NH}_4\text{OH} \rightarrow \text{Fe}(\text{OH})_3 + \text{NH}_4\text{Cl}$ is not correctly balanced because the number of hydrogen atoms and oxygen atoms in the products is greater than in the reactants. The balanced chemical equation is:

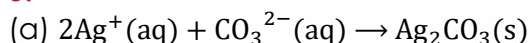


4.



[3 marks per equation – correct chemical formulas: 1 mark;
correct state symbols: 1 mark; correct balancing: 1 mark]

5.



[2 marks – 1 mark for correct equation and
1 mark for correct balancing]



[2 marks – 1 mark for correct equation and
1 mark for correct balancing]

[Total: 36 marks]