

GCSE Combined Science: Trilogy

Worksheet: Atoms, elements and compounds

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Atoms, elements and compounds

NAME	CLASS	DATE
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- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

Chalk is mainly calcium carbonate. The formula of calcium carbonate is CaCO_3 .

0 1 . 1

Which of these substances is an element?

Tick (✓) **one** box.

Carbon dioxide

☐

Magnesium

☐

Sodium chloride

☐

Water

☐

[1 mark]

0 1 . 2

Give the chemical symbol for calcium.

.....

.....

[1 mark]

0 1 . 3

Name the **three** elements in calcium carbonate.

.....

.....

[1 mark]

0 1 . 4

How many atoms are shown in the formula CaCO_3 ?

.....

.....

.....

.....

[1 mark]

0 1 . 5

Which statement describes an atom?

Tick (✓) **one** box.

A particle that always has an overall positive charge

☐

The smallest part of an element that can exist

☐

Two or more elements chemically combined

☐

A substance that contains more than one type of particle

☐

[1 mark]

0 2

Calcium phosphate has the formula $\text{Ca}_3(\text{PO}_4)_2$.

0 2 . 1

Show that one formula unit of calcium phosphate contains 8 oxygen atoms.

.....

.....

[1 mark]

0 2 . 2

Give the ratio of calcium atoms to phosphorus atoms in calcium phosphate.

.....

.....

.....

.....

[1 mark]

0 2 . 3

Which element is **not** present in calcium phosphate?

Tick (✓) **one** box.

Calcium

☐

Oxygen

☐

Phosphorus

☐

Sulfur

☐

[1 mark]

0 3

Table 1 shows the formulae of four substances, **A**, **B**, **C** and **D**.

Table 1

Substance	Formula
A	N ₂
B	NH ₃
C	Ne
D	KBr

0 3 . 1

Which **two** substances are elements?

Tick (✓) **two** boxes.

A

☐

B

☐

C

☐

D

☐

[2 marks]

0 3 . 2

Name substance **D**.

.....

.....

.....

.....
[1 mark]

0 3 . 3

Substance **B** is a compound.
Explain why.

.....

.....

.....

.....

[2 marks]

0 3 . 4

How many atoms are there in one molecule of substance **B**?

.....

.....

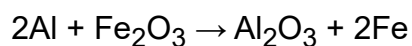
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[1 mark]

0 4

When a mixture of aluminium powder and iron(III) oxide is ignited, it glows white hot and molten iron is formed.



0 4 . 1

Name the compound Al_2O_3 .

.....

.....

.....

.....

[1 mark]

0 4 . 2

Write a word equation for this reaction.

.....

.....

[1 mark]

0 4 . 3

Show that the equation is balanced.

.....

.....

.....

.....

[2 marks]

0 4 . 4

Give **two** pieces of evidence from the description that a chemical reaction takes place.

.....

.....

.....

.....

[2 marks]

0 5

Epsom salts is hydrated magnesium sulfate, $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$.

The $\cdot 7\text{H}_2\text{O}$ in the formula shows that there are seven water molecules for every MgSO_4 unit.

0 5 . 1

Give the number of oxygen atoms in one formula unit of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$.

.....

.....

.....

Number of oxygen atoms =

[1 mark]

0 5 . 2

Show that the ratio of hydrogen atoms to magnesium atoms in $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$ is 14 : 1.

.....

.....

.....

.....

[2 marks]

0 5 . 3

Calculate the total number of atoms in one formula unit of $\text{MgSO}_4 \cdot 7\text{H}_2\text{O}$.

.....

.....

.....

.....

Total number of atoms =

[2 marks]

0 6

Lithium is the only Group 1 metal that reacts with nitrogen at room temperature. The product is lithium nitride, Li_3N .

0 6 . 1

Write a word equation for the reaction.

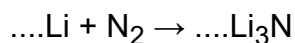
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.....

[1 mark]

0 6 . 2

Balance the symbol equation for the reaction.



.....

.....

[1 mark]

0 6 . 3

Compounds contain elements in fixed proportions.

Give the ratio of lithium atoms to nitrogen atoms in lithium nitride.

[1 mark]

0 6 . 4

Explain why lithium nitride can only be separated into lithium and nitrogen by a chemical reaction.

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Combined Science: Trilogy · Worksheet: Atoms, elements and compounds · 30 marks

Question 1 (5 marks)

01.1 [1 mark]

Correct: Magnesium

01.2 [1 mark]

Answer: Ca

- Ca (1)

Notes: The symbol must have a capital C and a lower-case a. Do not accept CA or ca.

01.3 [1 mark]

Answer: calcium, carbon and oxygen

- calcium, carbon and oxygen (1)

Notes: All three are needed for the mark. Allow Ca, C and O.

01.4 [1 mark]

Answer: 5

- 5 (1)
-

01.5 [1 mark]

Correct: The smallest part of an element that can exist

Question 2 (3 marks)

02.1 [1 mark]

Answer: $(\text{PO}_4)_2$ contains $2 \times 4 = 8$ oxygen atoms.

- $2 \times 4 = 8$ (oxygen atoms) (1)

02.2 [1 mark]

Answer: 3 : 2

- 3 : 2 (1)

Notes: Do not accept 2 : 3.

02.3 [1 mark]

Correct: Sulfur

Question 3 (6 marks)

03.1 [2 marks]

Correct: A; C

03.2 [1 mark]

Answer: potassium bromide

- potassium bromide (1)

Notes: Do not accept potassium bromine.

03.3 [2 marks]

Answer: It contains two different elements (nitrogen and hydrogen) that are chemically combined.

- (contains) two (or more) different elements / different types of atom (1)
- chemically combined / (chemically) bonded (together) (1)

Notes: Allow 'nitrogen and hydrogen' for 'two different elements'. 'Mixed' does not score the second mark.

03.4 [1 mark]

Answer: 4

- 4 (1)
-

Question 4 (6 marks)

04.1 [1 mark]

Answer: aluminium oxide

- aluminium oxide (1)

04.2 [1 mark]

Answer: aluminium + iron(III) oxide $\rightarrow$ aluminium oxide + iron

- aluminium + iron(III) oxide $\rightarrow$ aluminium oxide + iron (1)

Notes: Allow iron oxide for iron(III) oxide. Ignore state symbols.

04.3 [2 marks]

Answer: Left: 2 Al, 2 Fe, 3 O. Right: 2 Al, 2 Fe, 3 O.

- 2 aluminium atoms and 2 iron atoms on each side (1)
- 3 oxygen atoms on each side (1)

04.4 [2 marks]

Answer: A new substance (iron) is formed; energy is released (the mixture glows white hot).

- a new substance is formed (molten iron / aluminium oxide) (1)
- there is an energy change: energy is given out, making the mixture glow white hot (1)

Question 5 (5 marks)

05.1 [1 mark]

Answer: 11

- 11 (4 in MgSO_4 + 7 in the water molecules) (1)

05.2 [2 marks]

Answer: 7 water molecules contain $7 \times 2 = 14$ hydrogen atoms, and there is 1 magnesium atom.

- $7 \times 2 = 14$ hydrogen atoms (from the water molecules) (1)
- there is only 1 magnesium atom, so the ratio is 14 : 1 (1)

05.3 [2 marks]

Answer: 27

- 1 (Mg) + 1 (S) + 4 (O) + 7×3 (atoms in $7\text{H}_2\text{O}$) (1)
 - 27 (1)
-

Question 6 (5 marks)

06.1 [1 mark]

Answer: lithium + nitrogen $\rightarrow$ lithium nitride

- lithium + nitrogen $\rightarrow$ lithium nitride (1)

Notes: Do not accept an equals sign in place of the arrow.

06.2 [1 mark]

Answer: $6\text{Li} + \text{N}_2 \rightarrow 2\text{Li}_3\text{N}$

- $6\text{Li} + \text{N}_2 \rightarrow 2\text{Li}_3\text{N}$ (1)

Notes: Allow correct multiples.

06.3 [1 mark]

Answer: 3 : 1

- 3 : 1 (1)

Notes: Do not accept 1 : 3.

06.4 [2 marks]

Answer: The lithium and nitrogen are chemically combined (bonded); physical processes such as filtration or distillation cannot break these bonds.

- the elements / lithium and nitrogen are chemically combined / bonded (1)
- physical processes (such as filtration or distillation) cannot separate them / bonds must be broken (by a chemical reaction) (1)

Notes: 'It is a compound' on its own does not score the first mark: the answer must say that the elements / atoms are chemically combined or bonded.
