

GCSE Combined Science: Trilogy

Worksheet: Conservation of mass and balanced chemical equations

TIME 30 min	TOTAL 29 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
-----------------------	--------------------------	------------------------------	-----------------------------------

Topics: Conservation of mass and balanced chemical equations

NAME _____

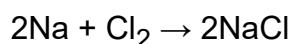
CLASS _____

DATE _____

- 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

Sodium reacts with chlorine to produce sodium chloride.



0 1 . 1

Complete the sentence.

Tick (✓) **one** box.

The total mass of the products of a chemical reaction is ...

less than the total mass of the reactants.

☐

equal to the total mass of the reactants.

☐

greater than the total mass of the reactants.

☐

half of the total mass of the reactants.

☐

[1 mark]

0 1 . 2

How many chlorine atoms are shown on the left-hand side of the equation?

.....

.....

.....

[1 mark]

0 1 . 3

A teacher reacted 2.30 g of sodium with 3.55 g of chlorine in a fume cupboard.
All of the sodium and all of the chlorine reacted.
Calculate the mass of sodium chloride produced.

.....
.....
.....

Mass of sodium chloride = g

[1 mark]

0 1 . 4

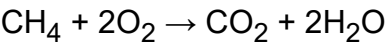
Explain why the mass of sodium chloride produced is equal to the total mass of the sodium and chlorine that reacted.

.....
.....

[1 mark]

0 2

Methane burns completely in air:



0 2 . 1

Which statement about the total mass of the products is correct?
Tick (✓) **one** box.

- It is greater than the total mass of the reactants.
- It is less than the total mass of the reactants.
- It is equal to the total mass of the reactants.
- It depends on how quickly the methane burns.

☐
☐
☐
☐

[1 mark]

0 2 . 2

How many hydrogen atoms are shown on the right-hand side of the equation?

.....
.....
.....

[1 mark]

0 2 . 3

0.64 g of methane burns completely in oxygen. The products are 1.76 g of carbon dioxide and 1.44 g of water.
Calculate the mass of oxygen that reacted.

.....

.....

.....

.....

Mass of oxygen = g

[2 marks]

0 2 . 4

Explain why the total mass of the products equals the total mass of the reactants.

.....

.....

[1 mark]

0 3

Symbol equations are balanced by changing the numbers written in front of formulae. The small numbers within a formula must never be changed.

0 3 . 1

How many oxygen atoms are shown in the formula $2\text{Fe}(\text{OH})_3$?

.....

.....

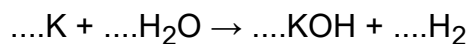
.....

.....

[1 mark]

0 3 . 2

Potassium reacts with water to produce potassium hydroxide and hydrogen.
Balance the equation.



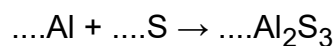
.....

.....

[1 mark]

0 3 . 3

Aluminium reacts with sulfur to produce aluminium sulfide, Al_2S_3 .
Balance the equation.



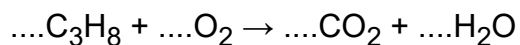
.....

.....

[1 mark]

0 3 . 4

Propane, C_3H_8 , burns completely in oxygen to produce carbon dioxide and water.
Balance the equation.



.....

.....

.....

.....

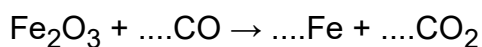
[2 marks]

0 4

Balanced symbol equations show the same number of atoms of each element on both sides.

0 4 . 1

Balance the equation for the reduction of iron(III) oxide by carbon monoxide.



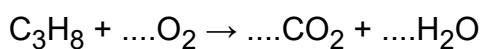
.....

.....

[1 mark]

0 4 . 2

Balance the equation for the complete combustion of propane.



.....

.....

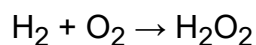
.....

.....

[2 marks]

0 4 . 3

Hydrogen reacts with oxygen to produce water. A student balanced the equation like this:



Explain why the student's equation is **not** correct.

.....

.....

.....

.....

[2 marks]

0 5

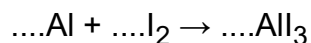
Aluminium reacts with iodine to produce aluminium iodide, AlI_3 .

A teacher sealed 2.70 g of aluminium powder and 25.40 g of iodine in a glass tube and warmed it. After the reaction:

- all of the iodine had reacted
- 0.90 g of aluminium had **not** reacted.

0 5 . 1

Balance the equation.



.....

.....

[1 mark]

0 5 . 2

Name the reactant that was in excess.

.....

.....

.....

.....

[1 mark]

0 5 . 3

Calculate the mass of aluminium iodide produced.

.....

.....

.....

.....

Mass of aluminium iodide = g

[2 marks]

0 5 . 4

At the end, the teacher weighed all of the solid in the tube. The mass of solid was 28.10 g.

Explain why this is more than the mass of aluminium iodide produced.

.....

.....

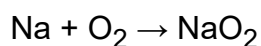
.....

.....

[2 marks]

0 6

A student was asked to write a balanced symbol equation for the reaction between sodium and oxygen to form sodium oxide. The student wrote:



0 6 . 1

The student's equation has the same number of atoms of each element on both sides, but it is still wrong.

Explain why.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Write the correct balanced symbol equation for the reaction between sodium and oxygen.

.....

.....

[1 mark]

0 6 . 3

Explain why changing a small number within a formula (a subscript) is not allowed when balancing an equation.

[1 mark]

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: Conservation of mass and balanced chemical equations · 29 marks

Question 1 (4 marks)

01.1 [1 mark]

Correct: equal to the total mass of the reactants.

01.2 [1 mark]

Answer: 2

- 2 (1)
-

01.3 [1 mark]

Answer: 5.85 g

- 5.85 (g) (1)
-

01.4 [1 mark]

- no atoms are lost or made during a chemical reaction (1)

Notes: Allow 'atoms are not created or destroyed, only rearranged'. Do not accept 'mass is conserved' on its own.

Question 2 (5 marks)

02.1 [1 mark]

Correct: It is equal to the total mass of the reactants.

02.2 [1 mark]

Answer: 4

- 4 (1)
-

02.3 [2 marks]

Answer: 2.56 g

- $1.76 + 1.44 - 0.64$ (1)
 - 2.56 (g) (1)
-

02.4 [1 mark]

- no atoms are lost or made in a chemical reaction / atoms are only rearranged (1)
-

Question 3 (5 marks)

03.1 [1 mark]

Answer: 6

- 6 (1)
-

03.2 [1 mark]

Answer: $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$

- $2\text{K} + 2\text{H}_2\text{O} \rightarrow 2\text{KOH} + \text{H}_2$ (1)
-

03.3 [1 mark]

Answer: $2\text{Al} + 3\text{S} \rightarrow \text{Al}_2\text{S}_3$

- $2\text{Al} + 3\text{S} \rightarrow \text{Al}_2\text{S}_3$ (1)
-

03.4 [2 marks]

Answer: $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$

- 3CO_2 and $4\text{H}_2\text{O}$ (1)
- 5O_2 with the rest of the equation correct (1)

Notes: A blank or 1 in front of C_3H_8 is acceptable. Allow multiples, e.g. $2\text{C}_3\text{H}_8 + 10\text{O}_2 \rightarrow 6\text{CO}_2 + 8\text{H}_2\text{O}$.

Question 4 (5 marks)

04.1 [1 mark]

Answer: $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$

- $\text{Fe}_2\text{O}_3 + 3\text{CO} \rightarrow 2\text{Fe} + 3\text{CO}_2$ (1)
-

04.2 [2 marks]

Answer: $\text{C}_3\text{H}_8 + 5\text{O}_2 \rightarrow 3\text{CO}_2 + 4\text{H}_2\text{O}$

- 3CO_2 and $4\text{H}_2\text{O}$ (1)
- 5O_2 (1)

Notes: Allow ECF for the number of O_2 molecules from incorrect numbers of CO_2 and H_2O .

04.3 [2 marks]

Answer: Changing the subscript changes the formula; H_2O_2 is not water. It should be $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$

- the student has changed the formula of the product / changed the small number within a formula (1)
 - H_2O_2 is a different substance (not water) / numbers should be put in front of the formulae:
 $2\text{H}_2 + \text{O}_2 \rightarrow 2\text{H}_2\text{O}$ (1)
-

Question 5 (6 marks)

05.1 [1 mark]

Answer: $2\text{Al} + 3\text{I}_2 \rightarrow 2\text{AlI}_3$

- $2\text{Al} + 3\text{I}_2 \rightarrow 2\text{AlI}_3$ (1)

05.2 [1 mark]

Answer: aluminium

- aluminium (1)

05.3 [2 marks]

Answer: 27.20 g

- mass of aluminium that reacted = $2.70 - 0.90 = 1.80$ (g) (1)
- $1.80 + 25.40 = 27.20$ (g) (1)

Notes: Correct answer with no working scores 2 marks.

05.4 [2 marks]

Answer: The solid also contains the 0.90 g of unreacted aluminium: $27.20 + 0.90 = 28.10$ g

- the solid also contains the unreacted aluminium / the excess aluminium (1)
- $27.20 + 0.90 = 28.10$ (g) / mass of solid = total mass of reactants because the tube was sealed (1)

Notes: Allow ECF from an incorrect mass of aluminium iodide for the second mark.

Question 6 (4 marks)

06.1 [2 marks]

- the formula of sodium oxide is wrong: it should be Na_2O (not NaO_2) (1)
- sodium ions are Na^+ and oxide ions are O^{2-} , so two sodium ions are needed for each oxide ion (1)

Notes: Do not accept 'the equation is not balanced'.

06.2 [1 mark]

Answer: $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$

- $4\text{Na} + \text{O}_2 \rightarrow 2\text{Na}_2\text{O}$ (1)

06.3 [1 mark]

- changing a subscript changes the substance / gives the formula of a different compound (that is not the one in the reaction) (1)
-