

GCSE Combined Science: Trilogy

Worksheet: Metal oxides

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Metal oxides

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

Gold and platinum are found in the Earth's crust as the uncombined metals, not as compounds.

0 1 . 1

 Explain why gold does not react with the oxygen in the air, even over thousands of years.

[1 mark]

0 1 . 2

 Suggest why gold is a good material for making jewellery that is worn every day.

[1 mark]

0 2

Metals react with oxygen to form metal oxides.

0 2 . 1

Which word describes a reaction in which a substance gains oxygen?

Tick (✓) **one** box.

Oxidation

☐

Reduction

☐

Neutralisation

☐

Electrolysis

☐

[1 mark]

0 2 . 2

Name the oxide formed when potassium burns in oxygen.

.....

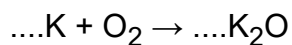
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[1 mark]

0 2 . 3

Balance the equation for the combustion of potassium.



.....

.....

[1 mark]

0 3

Metals react with oxygen to produce metal oxides.

0 3 . 1

Name the product formed when calcium reacts with oxygen.

.....

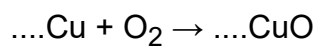
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[1 mark]

0 3 . 2

Balance the equation for the reaction of copper with oxygen.



[1 mark]

0 3 . 3

The reaction of a metal with oxygen is an oxidation reaction.
Explain why.

[1 mark]

0 3 . 4

Which change is a reduction?

Tick (✓) **one** box.

copper oxide → copper

☐

iron → iron oxide

☐

carbon → carbon dioxide

☐

magnesium → magnesium oxide

☐

[1 mark]

0 4

A teacher burned small pieces of four metals in air and noted the appearance of the flame and the product. Table 1 shows the results.

Table 1

Metal	Flame colour	Appearance of product
Magnesium	bright white	white powder
Calcium	brick-red	white powder
Copper	no visible flame	black solid forms slowly
Sodium	orange-yellow	white solid

0 4 . 1

Write a word equation for the reaction between calcium and oxygen.

.....

.....

[1 mark]

0 4 . 2

Suggest why copper does not burn with a visible flame like the other metals.

.....

.....

[1 mark]

0 4 . 3

Copper forms a black solid, copper(II) oxide, CuO, when heated in air.
Write a balanced symbol equation for this reaction.

.....

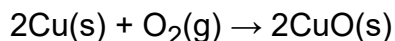
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[1 mark]

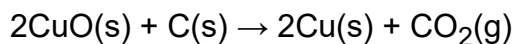
0 5

A student carries out three reactions.

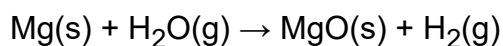
Reaction 1: copper foil is heated strongly in air. It turns black:



Reaction 2: the black copper(II) oxide is mixed with carbon powder and heated strongly. Pink-brown copper forms:



Reaction 3: burning magnesium ribbon is placed in steam. It keeps burning:



The student writes:

‘Reactions 1 and 3 are oxidations. Reaction 2 is a reduction.’

0 5 . 1

Evaluate the student’s statement.

Explain your answer in terms of oxygen.

.....

.....

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.....

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[6 marks]

0 6

Magnesium oxide and sodium oxide are metal oxides.

0 6 . 1

Magnesium oxide reacts with dilute hydrochloric acid.

Write a word equation for this reaction.

.....

.....

[1 mark]

0 6 . 2

Sodium oxide dissolves in water to form a solution with a pH greater than 7.

Explain what this shows about sodium oxide.

.....

.....

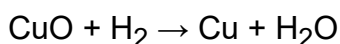
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[2 marks]

0 7

A student passed hydrogen gas over heated black copper(II) oxide. The powder turned pink-brown and droplets of water formed further along the tube.



0 7 . 1

Which substance was reduced? Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 7 . 2

Which substance was oxidised? Give a reason for your answer.

.....

.....

.....

.....

[2 marks]

0 7 . 3

The student let hydrogen flow through the tube for some time before heating it. Suggest why.

.....

.....

[1 mark]

0 8

A student holds a small piece of magnesium ribbon in tongs and places it into a Bunsen flame.

0 8 . 1

Describe what the student would see.

.....

.....

.....

.....

[2 marks]

0 8 . 2

Name the product formed, and give its formula.

.....

.....

[1 mark]

0 8 . 3

Give one safety precaution the student should take when carrying out this experiment.

.....

.....

[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: Metal oxides · 30 marks

Question 1 (2 marks)

01.1 [1 mark]

- gold is extremely unreactive / very low in the reactivity series, so it does not react with oxygen under normal conditions (1)
-

01.2 [1 mark]

- allow: it does not tarnish or corrode (react with oxygen or other substances in air or on skin), so it keeps its shiny appearance (1)
-

Question 2 (3 marks)

02.1 [1 mark]

Correct: Oxidation

02.2 [1 mark]

Answer: potassium oxide

- potassium oxide (1)
-

02.3 [1 mark]

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

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

Question 3 (4 marks)

03.1 [1 mark]

Answer: calcium oxide

- calcium oxide (1)
-

03.2 [1 mark]

Answer: $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$

- $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$ (1)
-

03.3 [1 mark]

- the metal gains oxygen (1)
-

03.4 [1 mark]

Correct: copper oxide $\rightarrow$ copper

Question 4 (3 marks)

04.1 [1 mark]

Answer: calcium + oxygen $\rightarrow$ calcium oxide

- calcium + oxygen $\rightarrow$ calcium oxide (1)
-

04.2 [1 mark]

- copper is much less reactive (than magnesium, calcium and sodium), so it reacts with oxygen far more slowly, without releasing energy quickly enough to sustain a flame (1)
-

04.3 [1 mark]

Answer: $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$

- $2\text{Cu} + \text{O}_2 \rightarrow 2\text{CuO}$ (1)
-

Question 5 (6 marks)

05.1 [6 marks]

Answer: Only partly correct. Reaction 1: copper gains oxygen, so it is oxidised. Reaction 2: copper(II) oxide loses oxygen (reduced) while carbon gains oxygen (oxidised). Reaction 3: magnesium gains oxygen (oxidised) while water loses oxygen (reduced). So reactions 2 and 3 each involve both oxidation and reduction (redox); in each, the more reactive element takes the oxygen.

Levels of response

- **Level 3 (5–6)** A detailed, coherent answer. Relevant points are accurate, linked in a logical sequence and use correct scientific terms.
- **Level 2 (3–4)** Several relevant points with some linking, but the answer has gaps, errors or lacks detail.
- **Level 1 (1–2)** Simple statements making one or two relevant points, with little or no linking.
- **No marks (0)** Nothing relevant or worthy of credit.

Indicative content

- reaction 1: copper gains oxygen to form copper(II) oxide, so copper is oxidised — this part of the statement is correct
- reaction 2: copper(II) oxide loses oxygen, so copper(II) oxide is reduced
- reaction 2: carbon gains oxygen to form carbon dioxide, so carbon is oxidised — reaction 2 is not only a reduction
- reaction 3: magnesium gains oxygen, so magnesium is oxidised
- reaction 3: water loses oxygen to form hydrogen, so water is reduced — reaction 3 is not only an oxidation
- in reactions 2 and 3, oxidation and reduction happen at the same time: the oxygen lost by one substance is gained by the other (redox reactions)
- in each case the more reactive element (carbon compared with copper; magnesium compared with hydrogen) gains the oxygen
- judgement: the statement is too simple — reaction 1 is an oxidation, but reactions 2 and 3 each involve both oxidation and reduction

Notes: Level 3 (5–6 marks): for each reaction identifies what gains oxygen and what loses oxygen, and concludes, with a judgement, that reactions 2 and 3 involve both oxidation and reduction.

Level 2 (3–4 marks): correctly identifies oxidation and reduction in terms of oxygen in at least two reactions, with some evaluation of the statement.

Level 1 (1–2 marks): gives definitions only (e.g. 'oxidation is gain of oxygen') or one correct identification.

Question 6 (3 marks)

06.1 [1 mark]

Answer: magnesium oxide + hydrochloric acid → magnesium chloride + water

- magnesium oxide + hydrochloric acid → magnesium chloride + water (1)
-

06.2 [2 marks]

- the solution is alkaline / contains hydroxide ions (OH^-) (1)
 - so sodium oxide is a base (a soluble base, which forms an alkali) (1)
-

Question 7 (5 marks)

07.1 [2 marks]

- copper(II) oxide (1)
 - it lost oxygen (1)
-

07.2 [2 marks]

- hydrogen (1)
 - it gained oxygen (to form water) (1)
-

07.3 [1 mark]

- to remove the air, because a mixture of hydrogen and air / oxygen can explode when heated (1)
-

Question 8 (4 marks)

08.1 [2 marks]

- the magnesium burns with a bright white flame/light (1)
 - a white solid (powder/ash) is formed (1)
-

08.2 [1 mark]

Answer: magnesium oxide, MgO

- magnesium oxide (MgO) (1)
-

08.3 [1 mark]

- allow: do not look directly at the bright flame / wear eye protection (1)
-