

GCSE Combined Science: Trilogy

Worksheet: Extraction of metals and reduction

TIME 25 min	TOTAL 25 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Extraction of metals and reduction

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

Most metals are found in the Earth's crust as compounds. Chemical reactions are needed to extract the metals.

0 1 . 1

Gold is found in the Earth as the metal itself.
Explain why.

[1 mark]

0 1 . 2

Which metal can be extracted by heating its oxide with carbon?

Tick (✓) **one** box.

Aluminium

☐

Iron

☐

Magnesium

☐

Sodium

☐

[1 mark]

0 1 . 3

Complete the sentence.

Reduction is the of oxygen.

.....

.....

.....

.....

[1 mark]

0 1 . 4

Zinc is extracted by heating zinc oxide with carbon:



Which substance is reduced in this reaction?

.....

.....

.....

.....

[1 mark]

0 2

Metals are extracted from their ores using different methods, depending on the metal's position in the reactivity series.

0 2 . 1

Zinc is below carbon in the reactivity series.

Which method is used to extract zinc from zinc oxide?

Tick (✓) **one** box.

Electrolysis of the molten compound

☐

Reduction by heating with carbon

☐

Found naturally as the uncombined metal

☐

Fractional distillation

☐

[1 mark]

0 2 . 2

Define oxidation in terms of oxygen.

.....

.....

[1 mark]

0 3

A student heats a mixture of black copper(II) oxide powder and carbon powder strongly in a boiling tube. The tube is connected to a second tube containing limewater.

0 3 . 1

Describe what the student would see in the first tube.

.....

.....

[1 mark]

0 3 . 2

Describe and explain the observation in the limewater.

.....

.....

.....

.....

[2 marks]

0 3 . 3

Give one safety precaution for this experiment.

.....

.....

[1 mark]

0 3 . 4

Write a word equation for the reaction in the first tube.

.....

.....

[1 mark]

0 4

Table 1 lists four metals and their position relative to carbon in the reactivity series.

Table 1

Metal	Position relative to carbon
Gold	far below carbon (found as the uncombined metal)
Iron	below carbon
Aluminium	above carbon
Zinc	below carbon

0 4 . 1

State the extraction method used for iron and for zinc, and explain why this method is suitable.

.....

.....

.....

.....

[2 marks]

0 4 . 2

Explain why aluminium cannot be extracted by the same method.

.....

.....

.....

.....

[2 marks]

0 5

A mining company discovers an ore containing a metal, M, that is more reactive than carbon.

0 5 . 1

Explain why heating the ore with carbon would **not** be a suitable method to extract metal M.

.....

.....

.....

.....

[2 marks]

0 5 . 2

Suggest a suitable method to extract metal M, and explain why it is needed.

.....

.....

.....

.....

[2 marks]

0 6

Part of the reactivity series is shown below, with the most reactive element first.
potassium, sodium, calcium, magnesium, aluminium, **carbon**, zinc, iron, tin, copper

0 6 . 1

Name **two** metals in the list that can be extracted by heating their oxides with carbon.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Explain why aluminium cannot be extracted by heating aluminium oxide with carbon.

[1 mark]

0 6 . 3

Tin is extracted by heating tin(IV) oxide, SnO_2 , with carbon. The products are tin and carbon dioxide.

Write a balanced symbol equation for this reaction.

[1 mark]

0 6 . 4

Identify the substance that is oxidised in the extraction of tin.
Give a reason for your answer.

[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: Extraction of metals and reduction · 25 marks

Question 1 (4 marks)

01.1 [1 mark]

- gold is very unreactive (so it does not form compounds) (1)
-

01.2 [1 mark]

Correct: Iron

01.3 [1 mark]

Answer: loss

- loss / removal (1)
-

01.4 [1 mark]

Answer: zinc oxide

- zinc oxide (1)
-

Question 2 (2 marks)

02.1 [1 mark]

Correct: Reduction by heating with carbon

02.2 [1 mark]

- oxidation is the gain of oxygen (1)
-

Question 3 (5 marks)

03.1 [1 mark]

- the black powder turns (orange-)brown / pink as copper forms (1)

03.2 [2 marks]

- the limewater turns cloudy/milky (1)
- this confirms carbon dioxide gas is produced and passes into the limewater (1)

03.3 [1 mark]

- allow: remove the delivery tube from the limewater before stopping heating (to prevent suck-back) / wear eye protection (1)

03.4 [1 mark]

Answer: copper oxide + carbon $\rightarrow$ copper + carbon dioxide

- copper oxide + carbon $\rightarrow$ copper + carbon dioxide (1)

Notes: Allow copper(II) oxide.

Question 4 (4 marks)

04.1 [2 marks]

- reduction by heating the metal oxide (ore) with carbon (1)
- both metals are less reactive than carbon, so carbon can displace/remove the oxygen from (reduce) their oxides (1)

04.2 [2 marks]

- aluminium is more reactive than carbon (1)
 - so carbon cannot remove the oxygen from (reduce) aluminium oxide; aluminium must be extracted by electrolysis instead (1)
-

Question 5 (4 marks)

05.1 [2 marks]

- carbon can only reduce the oxides of metals that are less reactive than carbon (1)
 - M is more reactive than carbon, so carbon cannot remove the oxygen from its oxide (cannot displace M) (1)
-

05.2 [2 marks]

- electrolysis of the molten compound (1)
 - electrolysis uses electrical energy (rather than a chemical reducing agent) to separate the metal, so it can extract metals more reactive than carbon (1)
-

Question 6 (6 marks)

06.1 [2 marks]

- one from zinc / iron / tin / copper (1)
 - a second, different metal from zinc / iron / tin / copper (1)
-

06.2 [1 mark]

- aluminium is more reactive than carbon (so carbon cannot remove oxygen from aluminium oxide) (1)
-

06.3 [1 mark]

Answer: $\text{SnO}_2 + \text{C} \rightarrow \text{Sn} + \text{CO}_2$

- $\text{SnO}_2 + \text{C} \rightarrow \text{Sn} + \text{CO}_2$ (1)
-

06.4 [2 marks]

- carbon (1)
 - it gains oxygen (to form carbon dioxide) (1)
-