

GCSE Combined Science: Trilogy

Worksheet: The reactivity series

TIME 30 min	TOTAL 29 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: The reactivity series

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

The reactivity series lists metals in order of reactivity.

0 1 . 1

Which list shows these metals in order of decreasing reactivity (most reactive first)?

Tick (✓) **one** box.

potassium, zinc, iron, copper

☐

copper, iron, zinc, potassium

☐

zinc, potassium, copper, iron

☐

iron, copper, potassium, zinc

☐

[1 mark]

0 1 . 2

Zinc reacts with dilute hydrochloric acid, but copper does not.

Name the gas produced when zinc reacts with the acid.

.....

.....

.....

[1 mark]

0 1 . 3 Explain, in terms of the ions that metals form, why zinc is more reactive than copper.

.....

.....

[1 mark]

0 2

A teacher added small pieces of three metals to cold water. Table 1 shows the observations.

Table 1

Metal	Observations
Lithium	fizzes steadily, floats and moves on the surface, gradually gets smaller
Potassium	fizzes violently, melts into a ball, burns with a lilac flame
Copper	no change

0 2 . 1 Put the three metals in order of reactivity. Start with the most reactive.

.....

.....

[1 mark]

0 2 . 2 Name the gas produced when lithium reacts with water.

.....

.....

.....

.....

[1 mark]

0 2 . 3 Magnesium reacts very slowly with cold water.
Where should magnesium be placed in your order of reactivity?

.....

.....

[1 mark]

0 2 . 4

Which metal is the least reactive?

Tick (✓) **one** box.

Calcium

☐

Copper

☐

Iron

☐

Zinc

☐

[1 mark]

0 3

A student added magnesium to copper sulfate solution and saw a reaction. As a control, the student added magnesium to magnesium sulfate solution and saw no reaction. The student concluded: 'This proves magnesium is more reactive than every other metal.'

0 3 . 1

Evaluate the student's conclusion.

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.....

.....

.....

[2 marks]

0 3 . 2

Suggest one metal salt solution the student could add magnesium to next, to test whether magnesium is more reactive than zinc.

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.....

[1 mark]

0 4

A student places a coil of clean copper wire into a beaker of colourless silver nitrate solution and leaves it for a day.

0 4 . 1

Predict what the student would see happen to the copper wire and to the solution.

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.....

.....

.....

[2 marks]

0 4 . 2

Write a word equation for this reaction.

.....

.....

[1 mark]

0 4 . 3

Explain, in terms of reactivity, why this reaction happens.

.....

.....

[1 mark]

0 5

When metals react with other substances the metal atoms form positive ions.

0 5 . 1

Which metal forms positive ions most easily?

Tick (✓) **one** box.

Calcium

☐

Copper

☐

Iron

☐

Zinc

☐

[1 mark]

0 5 . 2

Explain why potassium is more reactive than magnesium.
Use ideas about ions in your answer.

.....

.....

.....

.....

[2 marks]

0 5 . 3

Describe what you would see when a small piece of calcium is added to cold water.

.....

.....

.....

.....

[2 marks]

0 5 . 4

Hydrogen is often included in the reactivity series. Copper does not react with dilute acids.
Should hydrogen be placed above or below copper in the reactivity series? Give a reason.

.....

.....

[1 mark]

0 6

A student added four metals to solutions of metal sulfates. One of the metals is an unknown metal, X.

Table 2 shows the results.

Table 2

Metal added	Magnesium sulfate	X sulfate	Iron(II) sulfate	Copper(II) sulfate
Magnesium	–	reaction	reaction	reaction
X	no reaction	–	reaction	reaction
Iron	no reaction	no reaction	–	reaction
Copper	no reaction	no reaction	no reaction	–

0 6 . 1

Put the four metals in order of reactivity. Start with the most reactive.

.....

.....

.....

.....

[2 marks]

0 6 . 2

Explain how the results show that X is more reactive than iron.

.....

.....

[1 mark]

0 6 . 3

X is one of these metals: calcium, lead, zinc.
Suggest which metal X is.

.....

.....

.....

.....
[1 mark]

0 6 . 4

Describe what the student would see when magnesium is added to copper(II) sulfate solution.

.....

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.....

.....

[2 marks]

0 7

Table 3 shows whether a reaction (✓) or no reaction (X) was seen when four metals were added to three metal salt solutions.

Table 3

	Iron(II) sulfate	Zinc sulfate	Copper(II) sulfate
Magnesium	✓	✓	✓
Zinc	✓	X	✓
Iron	X	X	✓
Copper	X	X	X

0 7 . 1

Use Table 3 to put magnesium, zinc, iron and copper in order of reactivity, from most to least reactive.

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.....

[2 marks]

0 7 . 2

Explain why zinc does not react with zinc sulfate solution.

.....

.....

[1 mark]

Mark scheme

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Question 1 (3 marks)

01.1 [1 mark]

Correct: potassium, zinc, iron, copper

01.2 [1 mark]

Answer: hydrogen

- hydrogen (1)
-

01.3 [1 mark]

- zinc has a greater tendency than copper to form positive ions (to lose electrons) (1)
-
-

Question 2 (4 marks)

02.1 [1 mark]

Answer: potassium, lithium, copper

- potassium, lithium, copper (1)
-

02.2 [1 mark]

Answer: hydrogen

- hydrogen (1)
-

02.3 [1 mark]

- between lithium and copper (1)

Notes: Allow ECF from an incorrect order of reactivity.

02.4 [1 mark]

Correct: Copper

Question 3 (3 marks)

03.1 [2 marks]

- the conclusion is not fully justified — the experiment only compared magnesium with copper (and confirmed magnesium cannot displace itself) (1)
- to support the conclusion, magnesium would need to be tested against a wide range of other metals' salt solutions (1)

03.2 [1 mark]

Answer: zinc sulfate solution (or another soluble zinc salt)

- zinc sulfate (or another soluble zinc salt) solution (1)
-

Question 4 (4 marks)

04.1 [2 marks]

- silvery/grey crystals of silver grow on the copper wire (1)
- the colourless solution turns blue (1)

04.2 [1 mark]

Answer: copper + silver nitrate → copper nitrate + silver

- copper + silver nitrate → copper nitrate + silver (1)
-

04.3 [1 mark]

- copper is more reactive than silver, so copper displaces silver from silver nitrate solution (1)
-

Question 5 (6 marks)

05.1 [1 mark]

Correct: Calcium

05.2 [2 marks]

- potassium atoms lose electrons / form positive ions more easily than magnesium atoms (1)
 - so potassium reacts more vigorously / faster (with water and acids) (1)
-

05.3 [2 marks]

- fizzing / bubbles of gas (1)
- the calcium gets smaller / disappears (1)
- the solution turns cloudy / milky (1)

Any 2 of the points above.

Notes: Ignore 'calcium floats'. Do not accept 'flame'.

05.4 [1 mark]

- above copper, because copper does not displace hydrogen from acids (1)
-

Question 6 (6 marks)

06.1 [2 marks]

Answer: magnesium, X, iron, copper

- magnesium most reactive and copper least reactive (1)
 - X above iron: magnesium, X, iron, copper (1)
-

06.2 [1 mark]

- X displaces iron from iron(II) sulfate (solution) (1)
-

06.3 [1 mark]

Answer: zinc

- zinc (1)

Notes: Calcium would react with the water in the solution; lead is less reactive than iron.

06.4 [2 marks]

- the blue colour of the solution fades / the solution becomes colourless (1)
 - a brown / pink-brown solid forms (on the magnesium) (1)
-

Question 7 (3 marks)

07.1 [2 marks]

Answer: magnesium, zinc, iron, copper

- magnesium is most reactive (it displaces from all three solutions) (1)
- then zinc, then iron, then copper (which displaces nothing, so is least reactive) (1)

07.2 [1 mark]

- zinc cannot displace itself from its own salt solution — there is no more reactive metal present to cause a displacement reaction (1)
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