AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.4.1.2

The reactivity series

Past-paper questions

Tier	**Foundation**
Question groups	**8**
Available paper years	**2018–2024**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

5.4.1.2 The reactivity series

Question 01

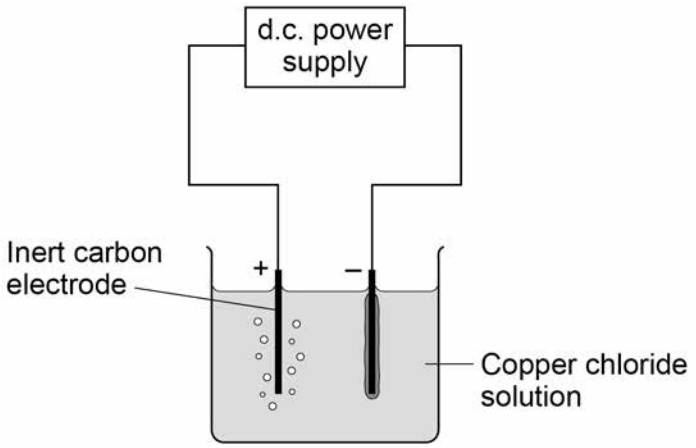
June 2018 | 8464/C/1F | Original Q5

0 5 This question is about electrolysis.

A student investigates the mass of copper produced during electrolysis of copper chloride solution.

Figure 12 shows the apparatus.

Figure 12



0 5 . 1 Which gas is produced at the positive electrode (anode)?

[1 mark]

Tick **one** box.

- carbon dioxide ☐
- chlorine ☐
- hydrogen ☐
- oxygen ☐

0 5 . 2 Copper is produced at the negative electrode (cathode).

What does this tell you about the reactivity of copper?

[1 mark]

Tick **one** box.

Copper is less reactive than hydrogen ☐

Copper is less reactive than oxygen ☐

Copper is more reactive than carbon ☐

Copper is more reactive than chlorine ☐

Table 4 shows the student's results.

Table 4

	Total mass of copper produced in mg			
Time in mins	**Experiment 1**	**Experiment 2**	**Experiment 3**	**Mean**
1	0.60	0.58	0.62	0.60
2	1.17	1.22	1.21	1.20
4	2.40	2.41	2.39	2.40
5	3.02	**X**	3.01	3.06

0 5 . 3 Determine the **mean** mass of copper produced after 3 minutes.

[1 mark]

Mass = _____ mg

Question 5 continues on the next page

5.4.1.2 The reactivity series

Question 01 · continued

0 5 . 4 Calculate the mass **X** of copper produced in **Experiment 2** after 5 minutes.

Use **Table 4** on page 19

[2 marks]

Mass **X** = _____ mg

0 5 . 5 The copper chloride solution used in the investigation contained 300 grams per dm^3 of solid $CuCl_2$ dissolved in 1 dm^3 of water.

The students used 50 cm^3 of copper chloride solution in each experiment.

Calculate the mass of solid copper chloride used in each experiment.

[3 marks]

Mass = _____ g

8

5.4.1.2 The reactivity series

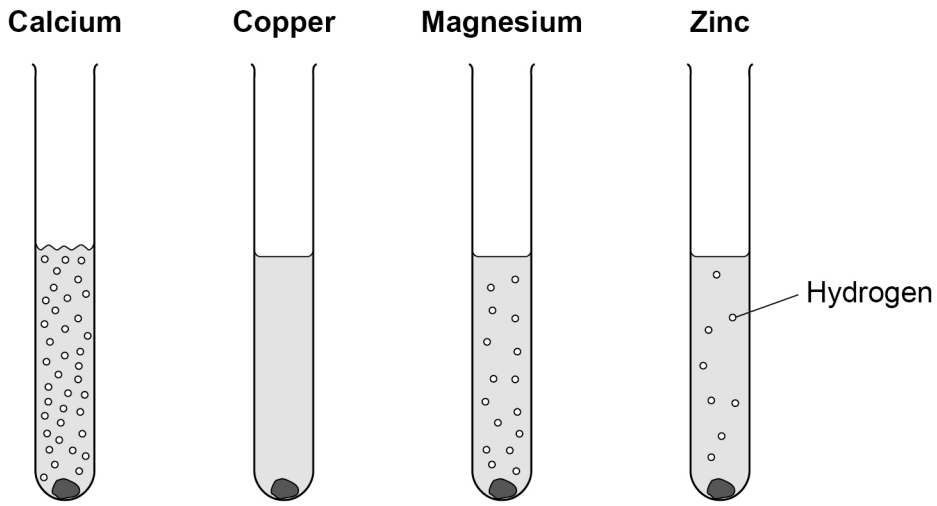
Question 02

June 2019 | 8464/C/1F | Original Q6

0 6 This question is about reactions of metals.

Figure 7 shows what happens when calcium, copper, magnesium and zinc are added to hydrochloric acid.

Figure 7



0 6 . 1 What is the order of decreasing reactivity of these four metals?

[1 mark]

Tick (✓) **one** box.

Zn Ca Cu Mg ☐

Ca Cu Mg Zn ☐

Cu Zn Ca Mg ☐

Ca Mg Zn Cu ☐

5.4.1.2 The reactivity series

Question 02 · continued

A student wants to make a fair comparison of the reactivity of the metals with hydrochloric acid.

0 6 . 2 Name **two** variables that must be kept constant.

[2 marks]

1 _____

_____

2 _____

_____

0 6 . 3 What is the independent variable in this reaction?

[1 mark]

_____

_____

0 6 . 4 Predict the reactivity of beryllium compared with magnesium.

Give a reason for your answer.

Use the periodic table.

[2 marks]

_____

Reason _____

_____

_____

0 6 . 5 A solution of hydrochloric acid contains 3.2 g of hydrogen chloride in 50 cm^3

Calculate the concentration of hydrogen chloride in g per dm^3

[3 marks]

_____

_____

_____

_____

Concentration = _____ g per dm^3

9

5.4.1.2 The reactivity series

Question 03

November 2020 | 8464/C/1F | Original Q2

0 2 A student investigated the temperature change when metal **X** was added to copper sulfate solution.

This is the method used.

1. Add 25 cm^3 of copper sulfate solution to a beaker.
2. Measure the temperature of the copper sulfate solution.
3. Add 1.0 g of metal **X** and stir.
4. Measure the highest temperature reached when metal **X** is added to copper sulfate solution.
5. Repeat steps 1 to 4 with different metals.

Figure 1 shows the apparatus used.

Figure 1

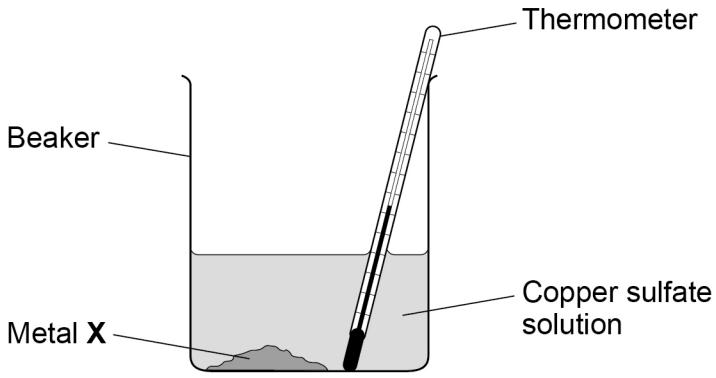
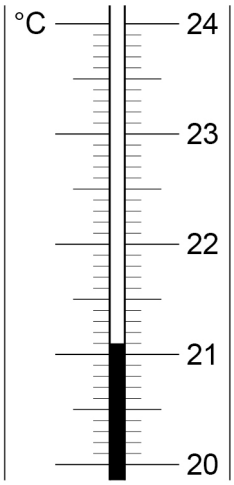


Figure 2 shows the thermometer reading of the copper sulfate solution at the start of the investigation.

Figure 2



Question 03 · continued

0 2 . 1 The highest temperature reached when metal **X** was added to copper sulfate solution was 35.5 °C

Determine the temperature change when metal **X** is added to copper sulfate solution.

Use **Figure 2**.

[2 marks]

Highest temperature = 35.5 °C

Temperature at start = _____ °C

Temperature change = _____ °C

0 2 . 2 Give **two** variables the student should keep the same in this investigation.

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 3 The student repeated the experiment with metal **Y**.

Table 1 shows four results for metal **Y**.

Table 1

	Test 1	Test 2	Test 3	Test 4
Temperature change in °C	9.2	7.3	9.5	9.2

Calculate the mean temperature change for metal **Y**.

Do **not** include the anomalous result in your calculation.

[2 marks]

_____

_____

_____

_____

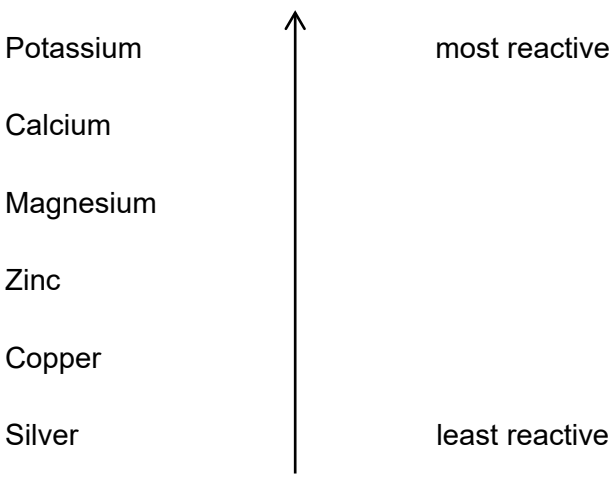
Mean temperature change = _____ °C

Question 03 · continued

The more reactive the metal added to copper sulfate solution, the greater the temperature change.

Figure 3 shows a reactivity series.

Figure 3



0 2 . 4 The student repeated the experiment.

The student added:

- magnesium to copper sulfate solution
- an unknown metal **A** to copper sulfate solution.

Table 2 shows the results.

Table 2

Metal	Temperature change in °C
Magnesium	12
Metal **A**	8

The student concludes metal **A** is zinc.

Give **one** reason why the student is correct.

Use **Figure 3** and **Table 2**.

[1 mark]

Question 03 · continued

0 2 . 5 The student did the experiment with silver and copper sulfate solution.

What happens to the temperature of the mixture?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

Decreases ☐

Increases ☐

Stays the same ☐

0 2 . 6 Suggest **one** reason why the student should **not** add potassium metal to copper sulfate solution.

[1 mark]

0 2 . 7 100 cm^3 of the copper sulfate solution contains 1.8 g of copper sulfate.

Calculate the mass of copper sulfate in 25 cm^3 of this copper sulfate solution.

[2 marks]

Mass = _____ g

11

5.4.1.2 The reactivity series

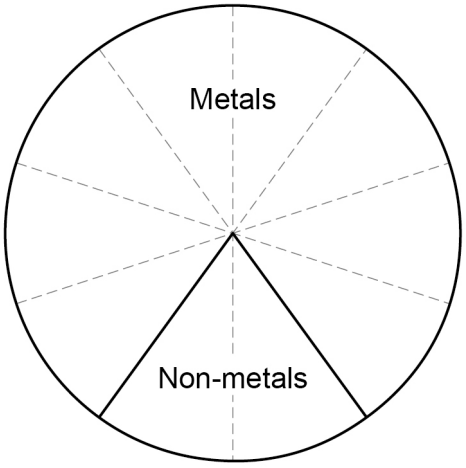
Question 04

November 2020 | 8464/C/1F | Original Q4

0 4 This question is about elements and compounds.

0 4 . 1 **Figure 5** shows the proportion of elements in the periodic table that are metals and non-metals.

Figure 5



Determine the percentage of the elements in **Figure 5** that are metals.

[2 marks]

Percentage = _____ %

0 4 . 2 Give **two** physical properties of metals.

[2 marks]

1 _____

2 _____

0 4 . 3 Sodium reacts with chlorine to produce sodium chloride.

Balance the equation for the reaction.

[1 mark]

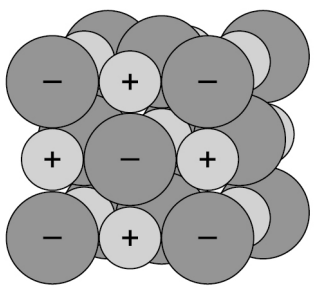
_____ $Na + Cl_2 \rightarrow$ _____ $NaCl$

5.4.1.2 The reactivity series

Question 04 · continued

Figure 6 shows part of the structure of sodium chloride (NaCl).

Figure 6



Sodium chloride

0 4 . 4 What holds the particles together in sodium chloride?

Use **Figure 6**.

[1 mark]

Tick (✓) **one** box.

Electrostatic attractions ☐

Intermolecular forces ☐

Metallic bonds ☐

0 4 . 5 Solid sodium chloride does not conduct electricity.

Give **two** ways in which sodium chloride can be made to conduct electricity.

[2 marks]

1 _____

_____

2 _____

_____

8

5.4.1.2 The reactivity series

Question 05

November 2021 | 8464/C/1F | Original Q4

0 4 Sodium and potassium are Group 1 elements.

0 4 . 1 What is the name of Group 1 elements?

[1 mark]

Tick (✓) **one** box.

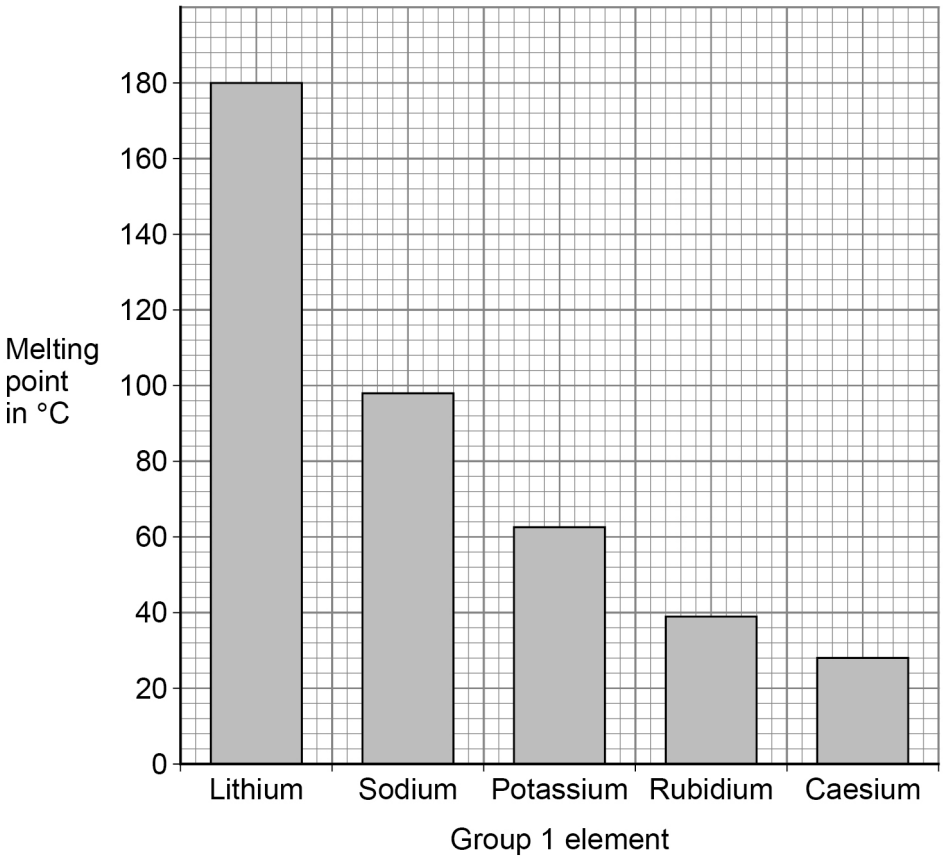
- Alkali metals ☐
- Halogens ☐
- Noble gases ☐

5.4.1.2 The reactivity series

Question 05 · continued

0 4 . 2 **Figure 5** represents the melting points of Group 1 elements.

Figure 5



What is the melting point of sodium?

[1 mark]

Melting point of sodium = _____ °C

0 4 . 3 Sodium reacts with water to produce sodium hydroxide and hydrogen.

Balance the equation for the reaction.

[1 mark]

$$____ Na + 2H_2O \rightarrow 2NaOH + H_2$$

0 4 . 4 Calculate the relative formula mass (M_r) of sodium hydroxide (NaOH).

Relative atomic masses (A_r): H = 1 O = 16 Na = 23

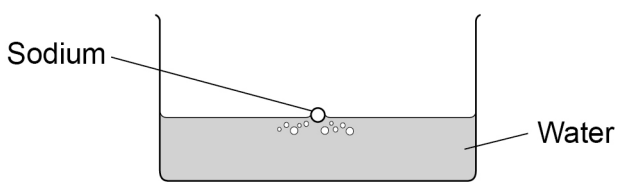
[2 marks]

Relative formula mass (M_r) = _____

0 4 . 5 Sodium and potassium both react with water.

Figure 6 shows sodium reacting with water.

Figure 6



Compare what is seen when sodium reacts with water and when potassium reacts with water.

[4 marks]

9

5.4.1.2 The reactivity series

Question 06

June 2022 | 8464/C/1F | Original Q4

0 4 This question is about elements and compounds.

0 4 . 1 Magnesium and oxygen react to produce magnesium oxide.

Balance the equation for the reaction.

[1 mark]

$$_____ Mg + O_2 \rightarrow 2\,MgO$$

0 4 . 2 Suggest **one** safety precaution that should be taken when heating magnesium and oxygen.

[1 mark]

0 4 . 3 Calculate the relative formula mass (M_r) of magnesium fluoride (MgF_2).

Relative atomic masses (A_r): F = 19 Mg = 24

[2 marks]

Relative formula mass (M_r) = _____

0 4 . 4 Argon is a noble gas.

Explain why **no** product is formed when magnesium and argon are heated together.

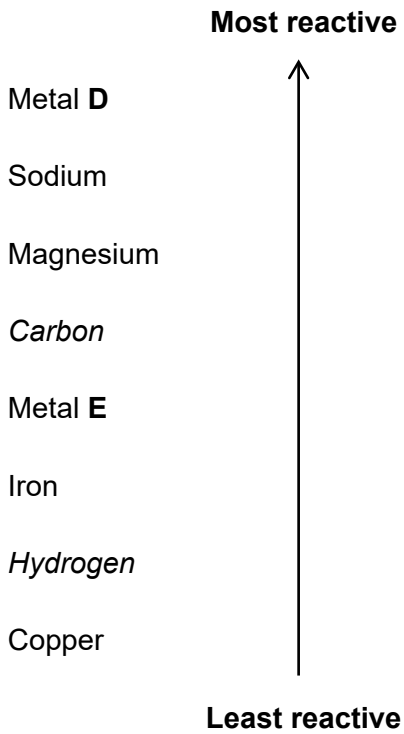
[2 marks]

5.4.1.2 The reactivity series

Question 06 · continued

0 4 . 5 **Figure 10** shows a reactivity series.

Figure 10



Question 06 · continued

Draw **one** line from each metal to the method used to extract that metal.

Use **Figure 10**.

[2 marks]

Metal	Method used to extract that metal
	Extracted by electrolysis of a molten ionic compound.
Metal **D**	Extracted from its oxide by reduction with carbon.
	Extracted from its oxide by reduction with hydrogen.
Metal **E**	
	Removed from the Earth as the metal itself.

Question 4 continues on the next page

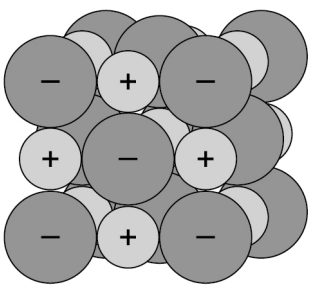
5.4.1.2 The reactivity series

Question 06 · continued

A substance conducts electricity when it has charged particles that are free to move.

0 4 . 6 **Figure 11** represents the structure of sodium chloride.

Figure 11



Sodium chloride

Explain why sodium chloride conducts electricity when molten but **not** when solid.

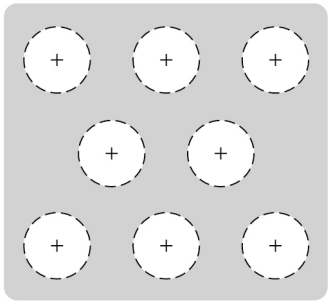
[3 marks]

5.4.1.2 The reactivity series

Question 06 · continued

0 4 . 7 **Figure 12** represents the structure of sodium metal.

Figure 12



Sodium metal

Explain why sodium metal conducts electricity when solid.

[2 marks]

13

5.4.1.2 The reactivity series

Question 07

June 2022 | 8464/C/1F | Original Q7

0 7 Plan an investigation to find the order of reactivity of three metals.

You should use the temperature change when each metal reacts with hydrochloric acid.

[6 marks]

6

5.4.1.2 The reactivity series

Question 08

June 2024 | 8464/C/1F | Original Q5

0 5 Magnesium chloride is a soluble salt.

0 5 . 1 Magnesium reacts with hydrochloric acid to produce magnesium chloride and a gas.

Which gas is produced?

[1 mark]

Tick (✓) **one** box.

Hydrogen ☐

Nitrogen ☐

Oxygen ☐

Question 5 continues on the next page

5.4.1.2 The reactivity series

Question 08 · continued

Magnesium chloride ($MgCl_2$) can be electrolysed when molten.

0 5 . 2 Which represents molten magnesium chloride?

[1 mark]

Tick (✓) **one** box.

$MgCl_2(g)$ ☐

$MgCl_2(l)$ ☐

$MgCl_2(s)$ ☐

0 5 . 3 Magnesium chloride contains Mg^{2+} ions and Cl^- ions.

Name the product at each electrode when molten magnesium chloride is electrolysed.

[2 marks]

Negative electrode _____

Positive electrode _____

Question 08 · continued

A student investigated the reactivity of three metals: copper, magnesium and iron.

The student mixed each metal with each metal chloride solution.

Table 6 shows the results.

Table 6

	Copper chloride solution	**Magnesium chloride solution**	**Iron chloride solution**
Copper	No reaction	No reaction	No reaction
Magnesium	Reaction	No reaction	Reaction
Iron	Reaction	No reaction	No reaction

0 5 . 4 What is the order of reactivity for copper, magnesium and iron?

Give **two** reasons for your answer.

Use **Table 6**.

[3 marks]

Most reactive _____

_____

Least reactive _____

Reason 1 _____

_____

Reason 2 _____

_____

Question 5 continues on the next page

5.4.1.2 The reactivity series

Question 08 · continued

0 5 . 5 When heated 0.72 g of magnesium reacts with iron oxide to produce 2.32 g of products.

Calculate the mass of iron oxide that reacts with 0.72 g of magnesium.

[1 mark]

Mass of iron oxide = _____ g

0 5 . 6 The student used 30 cm^3 of magnesium chloride solution.

1 dm^3 of magnesium chloride solution contains 180 g of magnesium chloride.

1 dm^3 = 1000 cm^3

Calculate the mass of magnesium chloride in 30 cm^3 of magnesium chloride solution.

[3 marks]

Mass of magnesium chloride = _____ g

11