

# Reactivity of Metals

## Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.4 Chemical Changes
Sub-Topic	Reactivity of Metals
Difficulty Level	Bronze Level
Booklet	Question Paper 1

Time Allowed: 59 minutes

Score: /57

Percentage: /100

Grade Boundaries:

**Q1.** Some students investigated the reactivity of four unknown metals, **W**, **X**, **Y** and **Z**.

The letters are not the symbols of these elements.

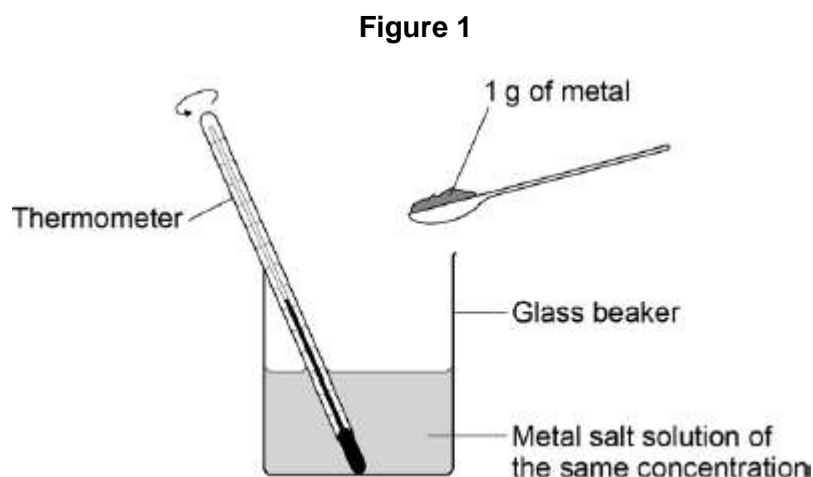
The students used metal salt solutions of copper nitrate, magnesium sulfate and zinc chloride.

This is the method used.

1. Pour a solution of a metal salt into a glass beaker.
2. Measure the temperature of the solution.
3. Add 1 g of metal to the solution.
4. Measure the temperature of the solution.
5. Calculate the temperature increase.

The students did the experiment using each salt solution with each metal.

**Figure 1** shows the apparatus the students used.



The table below shows the students' results.

Solution	Temperature increase in °C			
	Metal W	Metal X	Metal Y	Metal Z
Copper nitrate	46	10	29	No change
Magnesium sulfate	No change	No change	No change	No change
Zinc chloride	15	No change	No change	No change

(a) Which metal is **least** reactive?

Tick **one** box.

Metal W

☐

Metal X

☐

Metal Y

☐

Metal Z

☐

(1)

- (b) How do the results show that magnesium is **more** reactive than the metals **W**, **X**, **Y** and **Z**?

.....

.....

(1)

- (c) How do the results show that the reaction between metal **Y** and copper nitrate solution is exothermic?

.....

.....

(1)

- (d) One student said that the investigation was not valid (a fair test).

Write a plan for the investigation that includes improvements to the method and apparatus.

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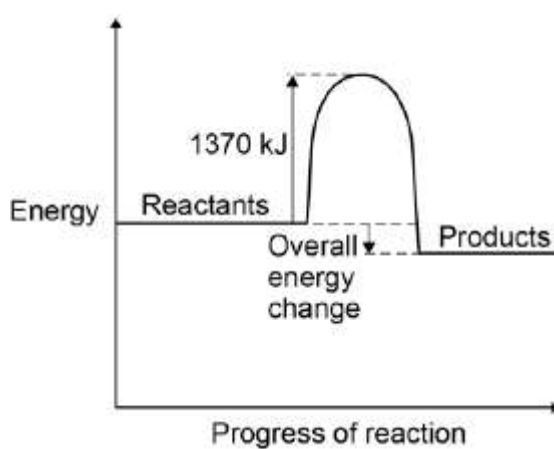
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(4)

- (e) **Figure 2** shows the reaction profile of an exothermic reaction.

**Figure 2**



What does the energy value of 1370 kJ represent?

Tick **one** box.

Activation energy

☐

Products energy

☐

Reactants energy

☐

Released energy

☐

(1)

- (f) The overall energy change is 386 kJ.

What percentage of 1370 kJ is this?

Give your answer to two significant figures.

.....

Percentage = ..... %

(2)

(Total 10 marks)

**Q2.** This question is about the reactions of acids.

- (a) When dilute hydrochloric acid is reacted with sodium hydroxide solution there is a temperature change.

Explain how the temperature changes.

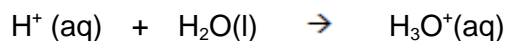
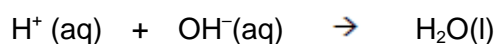
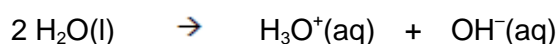
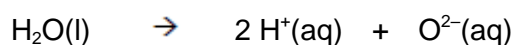
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(2)

- (b) Acids produce hydrogen ions in aqueous solutions.

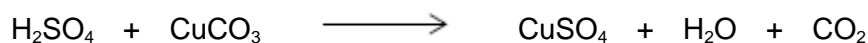
What is the ionic equation for neutralisation reactions?

Tick **one** box.

☐☐☐☐

(1)

- (c) Sulfuric acid reacts with copper carbonate to produce a salt, water and carbon dioxide.



What is the name of the salt produced?

.....

(1)

- (d) A student reacted four metals with water and with a dilute acid to work out the order of reactivity of the metals.

The table below shows some of the observations.

Metal	Reaction with water	Reaction with dilute acid
Calcium	Bubbles of gas	<b>X</b>
Copper	<b>Y</b>	No bubbles of gas
Magnesium	Few bubbles of gas	Bubbles of gas
Zinc	No bubbles of gas	Bubbles of gas

Write the observations for **X** and **Y**.

Observation at **X** .....

Observation at **Y** .....

(2)

- (e) Write the four metals, calcium, copper, magnesium and zinc, in order of reactivity.

Start with the **most** reactive metal.

.....

(2)

- (f) Some gases given off in reactions can be identified by chemical tests.

Draw **one** line from each chemical test to the name of the gas.

**Chemical test**

**Gas**

Put in a lighted splint. The gas burns with a pop sound.	Carbon dioxide
Put in a glowing splint. The gas relights the splint.	Chlorine
Put into limewater. The gas turns limewater cloudy.	Hydrogen
	Nitrogen
	Oxygen

(3)

- (g) Acids react with bases to produce salts and water ( $\text{H}_2\text{O}$ ).

The electronic structure of a hydrogen atom is 2,1

The electronic structure of an oxygen atom is 2,6

Draw a diagram to show the arrangement of the outer shell electrons in a molecule of water.

(2)

(Total 13 marks)

**Q3.** This question is about metals.

- (a) Which unreactive metal is found in the Earth as the metal itself?

Tick (✓) **one** box.

aluminium

☐

gold

☐

magnesium



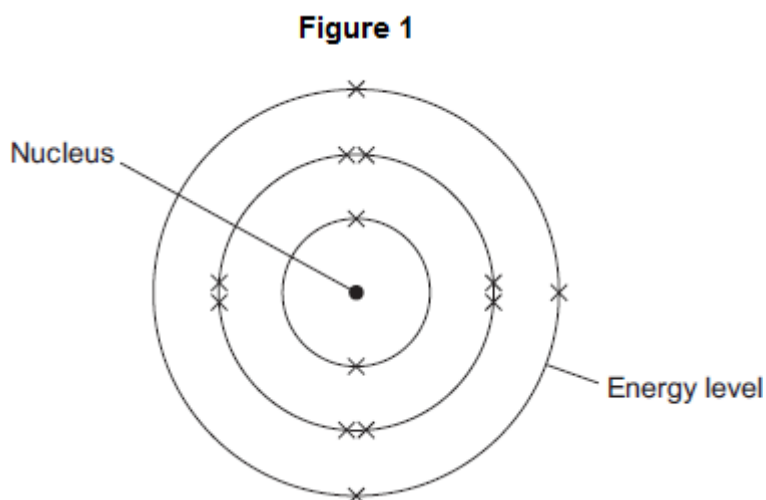
(1)

- (b) Complete the sentence.

Aluminium is an element because aluminium is made of  
only one type of .....

(1)

- (c) **Figure 1** shows the electronic structure of an aluminium atom.



- (i) Use the correct words from the box to complete the sentence.

electrons	ions	protons	neutrons	shells
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The nucleus of an aluminium atom contains ..... and  
.....

(2)

- (ii) Complete the sentence.

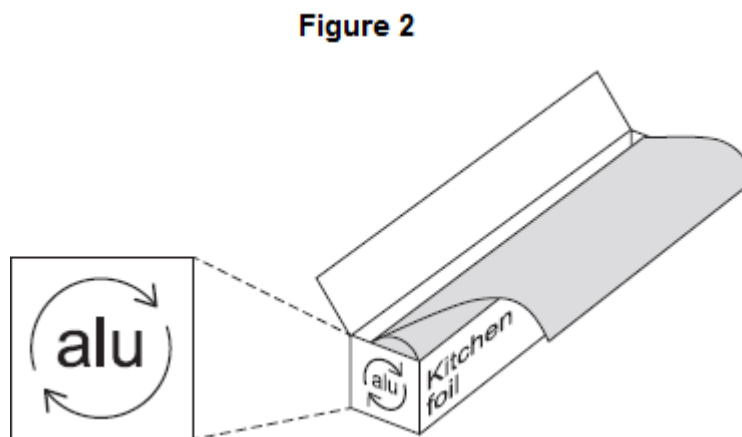
In the periodic table, aluminium is in Group .....

(1)



- (d) Aluminium is used for kitchen foil.

**Figure 2** shows a symbol on a box of kitchen foil.



The symbol means that aluminium can be recycled. It does not show the correct chemical symbol for aluminium.

- (i) What is the correct chemical symbol for aluminium?

.....

(1)

- (ii) Give **two** reasons why aluminium should be recycled.

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

(2)

- (e) Aluminium has a low density, conducts electricity and is resistant to corrosion.

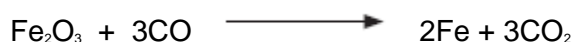
Which **one** of these properties makes aluminium suitable to use as kitchen foil?  
Give a reason for your answer.

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.....  
.....

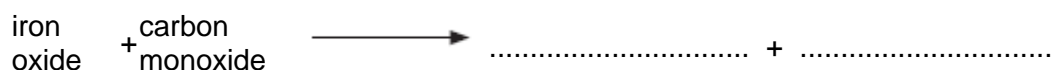
(2)  
(Total 10 marks)

**Q4.** Iron is extracted from iron oxide in the blast furnace.

- (a) The equation for one of the reactions in the blast furnace is:



- (i) Complete the word equation for this reaction.



(2)

- (ii) Oxygen is removed from iron oxide in the blast furnace.

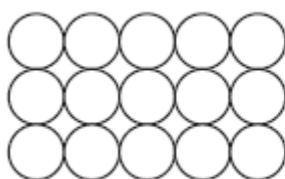
Draw a ring around the correct answer to complete the sentence.

The iron oxide is

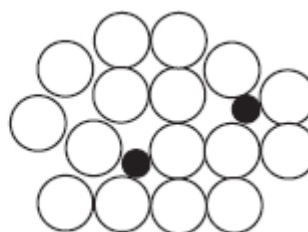
neutralised.
oxidised.
reduced.

(1)

- (b) The diagrams represent pure iron and iron from the blast furnace.



Pure iron



Iron from the blast furnace

- (i) Draw **one** line from each statement to the correct explanation.

Statement	Explanation
Pure iron is an element because .....	it is made of one sort of atom only.
	it contains two elements not chemically combined.
Iron from the blast furnace is a mixture because .....	every atom has the same number of neutrons.
	it contains two elements chemically combined.

(2)

- (ii) Explain why iron from the blast furnace is harder than pure iron.

Use the diagrams on page 4 to help you.

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.....

(2)

(Total 7 marks)

**Q5.**Where copper ore has been mined there are areas of land that contain very low percentages of copper compounds.

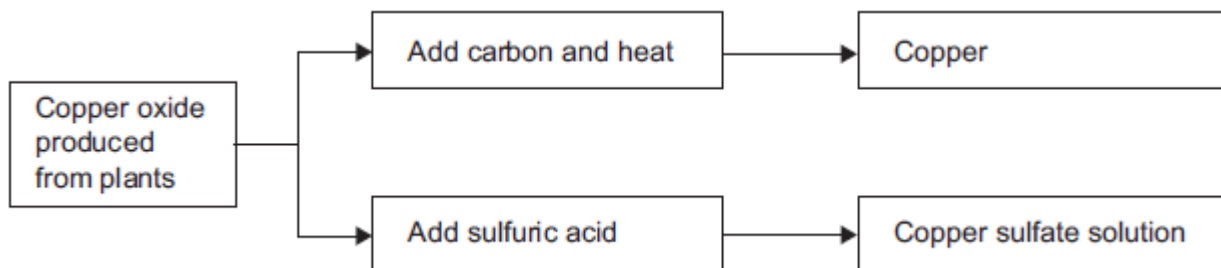
One way to extract the copper is to grow plants on the land.

The plants absorb copper compounds through their roots.

The plants are burned to produce copper oxide.

The copper oxide produced from plants can be reacted to produce copper or copper sulfate solution, as shown in **Figure 1**.

**Figure 1**



(a) Draw a ring around the correct answer to complete each sentence.

(i) Copper ores contain enough copper to make extraction of the metal

carbon neutral.  
economical.  
reversible.

(1)

(ii) Using plants to extract metals is called

photosynthesis.  
phytomining.  
polymerisation.

(1)

(iii) Copper oxide reacts with carbon to produce copper and

carbon dioxide.  
oxygen.  
sulfur dioxide.

(1)

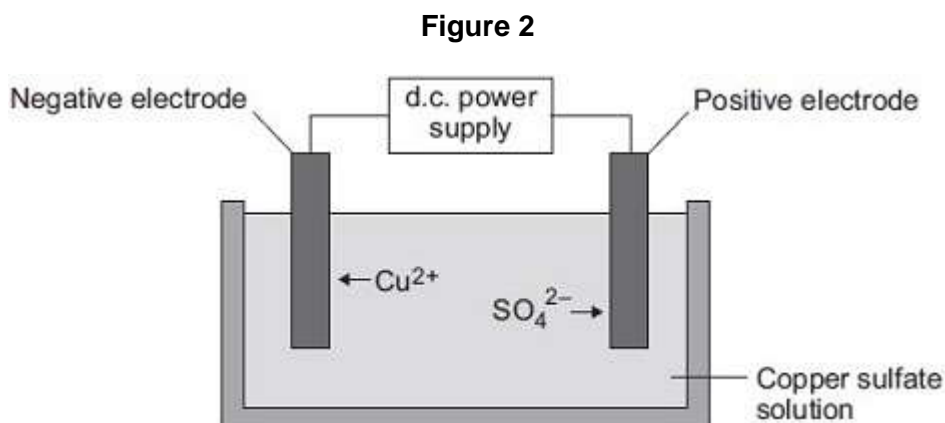
- (b) Copper is produced from copper sulfate solution by displacement using iron or by electrolysis.

- (i) Complete the word equation.

copper sulfate + iron  $\longrightarrow$  ..... + .....

(2)

- (ii) **Figure 2** shows the electrolysis of copper sulfate solution.



Why do copper ions go to the negative electrode?

.....  
 .....

(1)

- (c) Suggest **two** reasons why copper should **not** be disposed of in landfill sites.

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

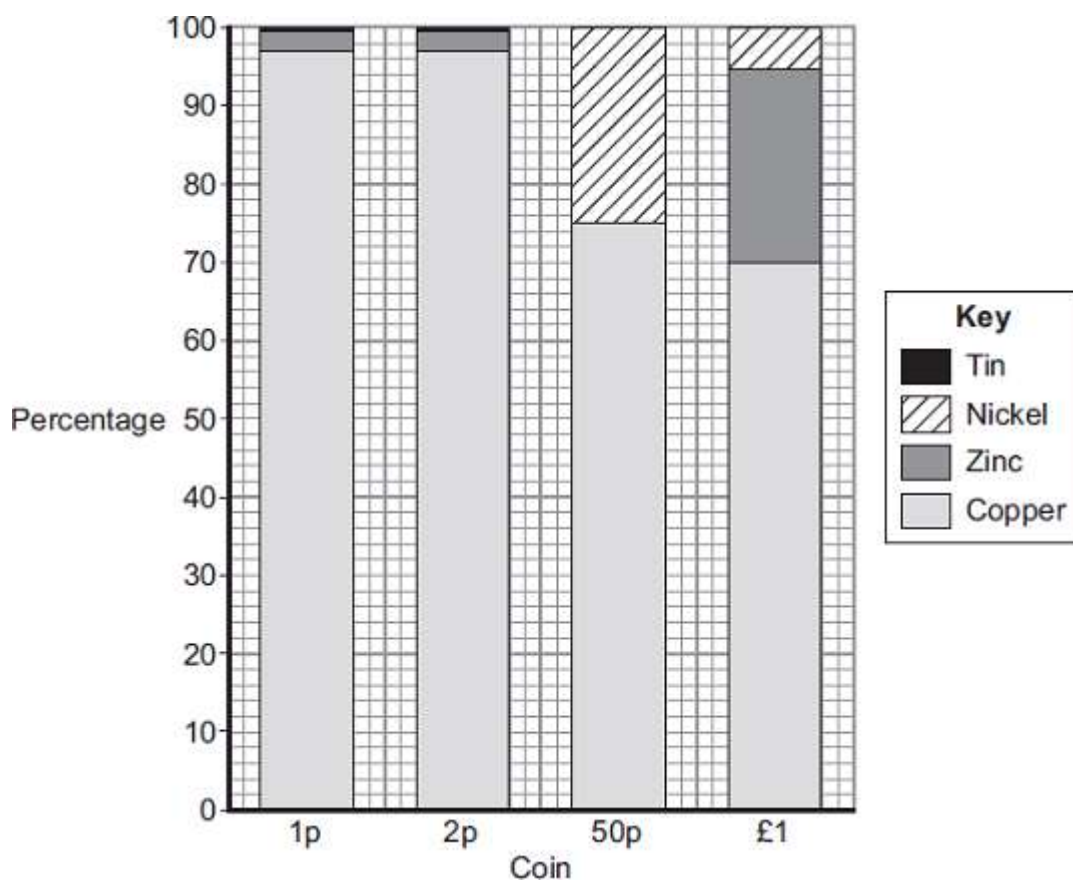
(2)

(Total 8 marks)

Q6. This is the headline from a newspaper:

'Why is a 2p coin worth 3.3p?'

(a) The bar chart shows the percentage of metals in UK coins in 1991.



Use the bar chart to answer these questions.

(i) Which metal is in all of these coins?

.....

(1)

(ii) Which coin does **not** contain zinc?

.....

(1)

- (iii) What is the percentage of nickel in a 50 p coin?

Percentage = ..... %

(1)

- (iv) Draw a ring around the correct metal to complete the sentence.

Pure copper is too soft to be used for 1 p and 2 p coins.

Copper is mixed with zinc and

iron

nickel

tin

for 1 p and 2 p coins.

(1)

- (b) The value of the metal in 2 p coins, made in 1991, is now 3.3 p.

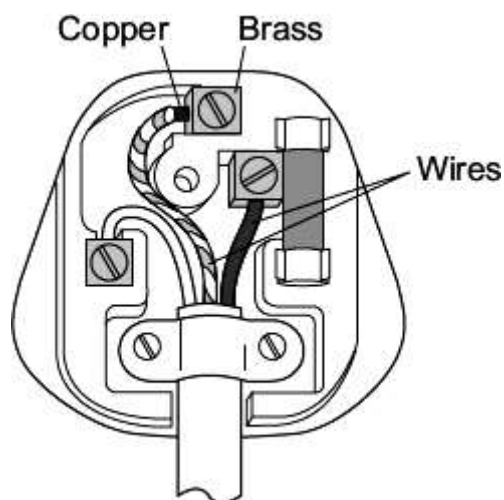
Suggest why a 2 p coin made in 1991 is worth 3.3 p.

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

(1)

(Total 5 marks)

**Q7.** The diagram shows an electric plug.



- (a) (i) Draw a ring around the correct answer to complete the sentence.

Copper is used for the wires because it

conducts electricity.

conducts heat.

is shiny.

(1)

- (ii) Brass is an *alloy* of copper and zinc.

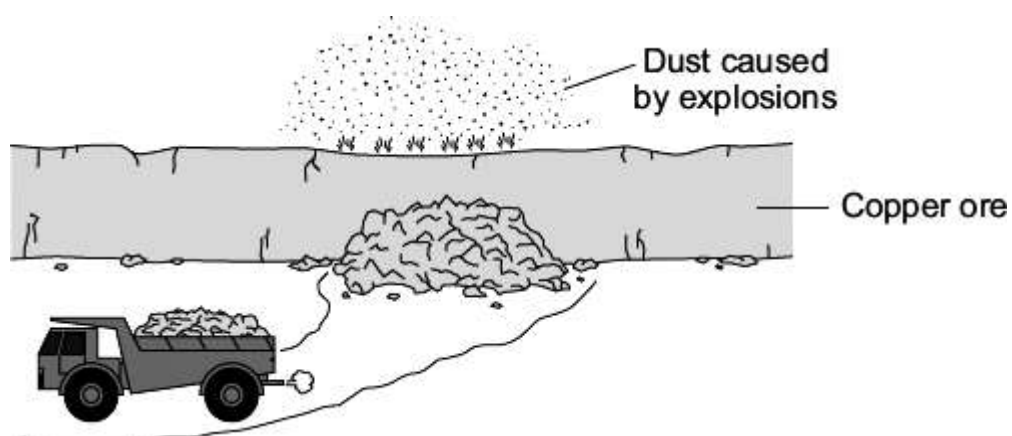
What is an *alloy*?

.....  
.....

(1)

- (b) Open-cast mines are used to obtain copper ore.





Suggest **two** reasons why people would **not** like to live near an open-cast mine.

1 .....

.....

2 .....

.....

(2)  
(Total 4 marks)