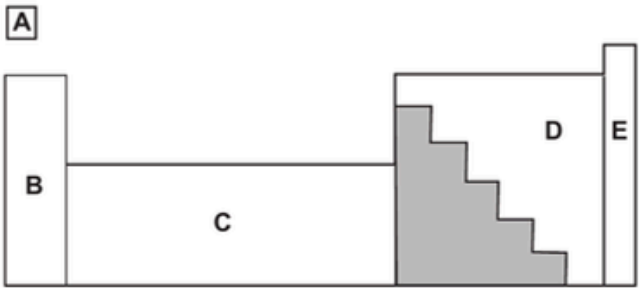
Periodic Table, Metals and Reactivity

The periodic table organises every known element — understanding its patterns and how metals react is essential KS3 chemistry knowledge for GCSE Science.

15. (a) The diagram below shows part of the periodic table of elements.



The shaded area contains **only** metal elements.

Two other areas also contain **only** metal elements.

Which areas contain only metal elements?
Tick the **two** correct boxes.

15a
1 mark

A ☐ B ☐ C ☐ D ☐ E ☐

(b) Copper is a metal.

At room temperature copper is a strong solid.
Give **two** other properties of copper that show it is a metal.

15b
1 mark

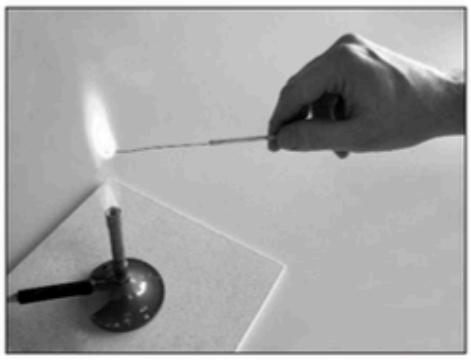
1. _____

15b
1 mark

2. _____

KS3 Science SATs, Tier 3-6, Paper 1 (2009) - Q15(a)-(b)

(c) When copper metal is heated it reacts with a gas in air.



What is the chemical name of the **product** formed when copper reacts with a gas in air?

_____

15c
1 mark

(d) Which statement below describes what happens in a **chemical change** but **not** in a physical change?

Tick the correct box.

The product is a solid.	☐
The change only happens at a high temperature.	☐
The atoms have combined in a different way to make a new substance.	☐
The types of atoms at the start are the same as in the end product.	☐

15d
1 mark

Modern Tuition

(c) (i) A gas in the air reacts with iron to make it rusty.
Give the name of this gas.

_____ 5ci

1 mark

(ii) What could you do to an iron gate to protect it from this gas in the air?

_____ 5cii

1 mark

(d) Sophie tests each material with a magnet.

Which two materials are attracted to the magnet?
Tick the **two** correct boxes.

aluminium	☐	slate	☐
iron	☐	plastic	☐
marble	☐	steel	☐

5d

1 mark

5d

1 mark

KS3 Science SATs, Tier 3-6, Paper 1 (2009) - Q5(c)-(d)

(d) Before 1992, two-pence coins were made of bronze.
Steel rusts but bronze does not rust.

(i) Why does bronze not rust?
Use information in the table opposite to help you.

_____

_____ 12di

1 mark

(ii) Rusting requires water and a gas from the air.
Give the name of this gas.

_____ 12dii

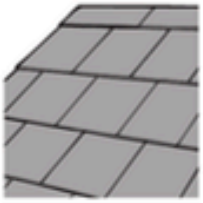
1 mark

KS3 Science SATs, Tier 3-6, Paper 1 (2006) - Q12(d)

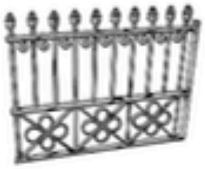
5. The drawings below show six objects found in Sophie's garden.
The objects are all made of different materials as shown.



aluminium
greenhouse frame



slate
roof tile



iron
gate



plastic
plant pot



marble
statue



steel
watering can

not to scale

(a) Which two **objects** shown above are made of **rock**?

1. _____

2. _____

5a
1 mark

(b) Write two of the **objects** shown above which are made of **metal.**

1. _____

2. _____

5b
1 mark

Modern Tuition

4. The drawings show six objects made from different materials.



iron nail



steel paper-clip



silver earrings



gold ring



copper bracelet



aluminium can

not to scale

(a) Fill the gaps in the sentences below.

The objects are made from materials that are all types of _____. All the materials are good conductors of electricity and _____.

4a
1 mark

4a
1 mark

(b) From the drawings above give **one** object that could rust.

_____

4b
1 mark

Modern Tuition

(d) The table below gives information about the brass and steel balls.

	Is it attracted to a magnet?	elements in the ball
brass	no	copper and zinc
steel	yes	iron and carbon

(i) Which element is **not** a metal?
Tick the correct box.

carbon ☐ copper ☐

iron ☐ zinc ☐

☐ 6di
1 mark

(ii) Look at the elements in the brass ball and the steel ball.

Why is steel attracted to a magnet but brass is **not**?

_____

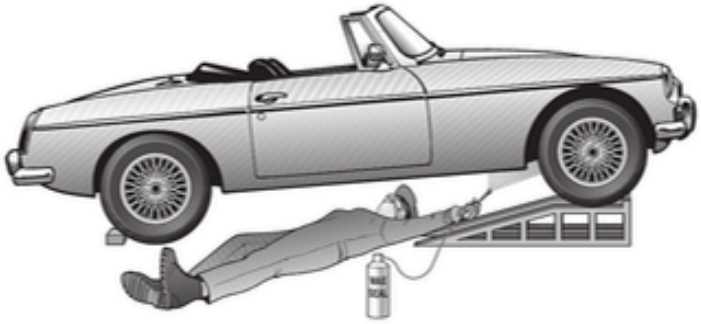
☐ 6dii

Modern Tuition

12. Jill bought a can of Wax Seal to spray the parts underneath her car.



Wax Seal helps to prevent these parts rusting.
It is a mixture of wax and a liquid called white spirit.



(a) (i) The body of Jill's car is made from steel. Steel contains iron.

Give **two** substances that are needed for iron to rust.

12ai 1 mark

1. _____

12ai 1 mark

2. _____

(ii) How does Wax Seal help to protect the car from rusting?

12aii 1 mark

_____

_____

(iii) Wax Seal can also be used on the upper parts of a car.
What else protects parts such as the doors from rusting?

12aiii 1 mark

_____

(b) The metal parts of a car may corrode.
What type of air pollution could cause corrosion?

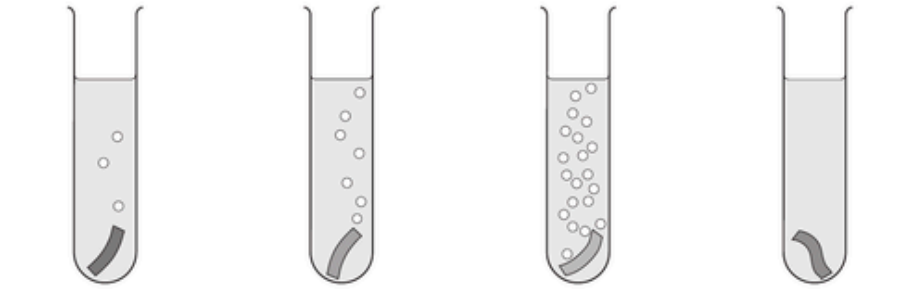
12b

_____

Modern Tuition

4. (a) Ruth put a piece of a different metal in each of four test tubes.

She poured 10 cm^3 of hydrochloric acid onto each metal.



iron + hydrochloric acid | **zinc** + hydrochloric acid | **magnesium** + hydrochloric acid | **copper** + hydrochloric acid

Look at the diagrams above.

(i) How do these show if a metal reacts with the acid?

_____ 4ai

1 mark

(ii) **On the lines below**, put the **four** metals in the order of how strongly they react with the acid.

most reactive _____

_____

_____

least reactive _____ 4aii

1 mark

Modern Tuition

(c) Raj held a magnet near to each of the three chemicals.

By each chemical in the table, write **yes** or **no** to show if the chemical was magnetic.

One has been done for you.

chemical	Was the chemical magnetic?
sulphur	
iron	
iron sulphide	no

14c
1 mark

(d) (i) When iron is heated with sulphur, iron sulphide is formed.
Give the name of the solid formed when **zinc** is heated with sulphur.

_____

14di
1 mark

(ii) Some fossil fuels contain sulphur.
When fuels burn, sulphur reacts with oxygen.

Complete the word equation for this reaction.

sulphur + oxygen → _____

14dii
1 mark

Modern Tuition

12. (a) The table below shows the melting points and boiling points of four elements.

element	melting point (°C)	boiling point (°C)
aluminium	660	2520
iron	1540	2760
magnesium	650	1100
mercury	–39	357

When answering the questions below, you may give the name of an element more than once.

Which element in the table is:

(i) a liquid at 0°C?

12ai
1 mark

(ii) a solid at 1500°C?

12aii
1 mark

(iii) a gas at 500°C?

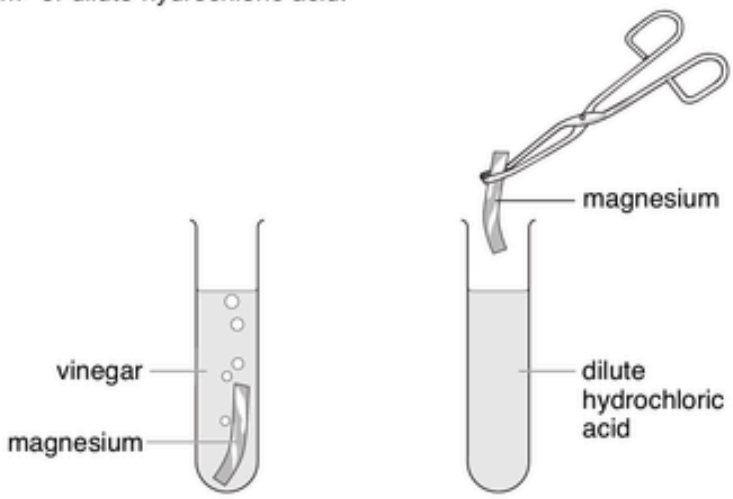
12aiii
1 mark

(iv) a liquid over the biggest temperature range?

12aiv
1 mark

Modern Tuition

(c) Molly put a piece of magnesium into a test-tube containing 20 cm^3 of vinegar. She put another piece of magnesium into a test-tube containing 20 cm^3 of dilute hydrochloric acid.



(i) Molly thought that magnesium would react more vigorously with hydrochloric acid than with vinegar.
What information in the table made Molly think this?

_____

_____

11ci
1 mark

(ii) How would Molly be able to tell if a more vigorous reaction took place with hydrochloric acid than with vinegar?

_____

_____

11cii
1 mark

(d) (i) Complete the word equation for the reaction between magnesium and hydrochloric acid.

11di
1 mark

magnesium + hydrochloric acid → _____ + _____

11di
1 mark

(ii) After some time this reaction stopped. Why did the reaction stop?

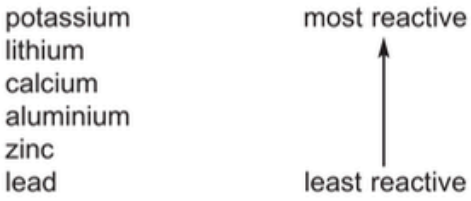
_____

_____

11dii
1 mark

Modern Tuition

(c) Part of the reactivity series of metals is shown below.



Use the information above.
Which **two** metals would react with aluminium nitrate in a displacement reaction?

Tick the **two** correct boxes.

calcium ☐ potassium ☐

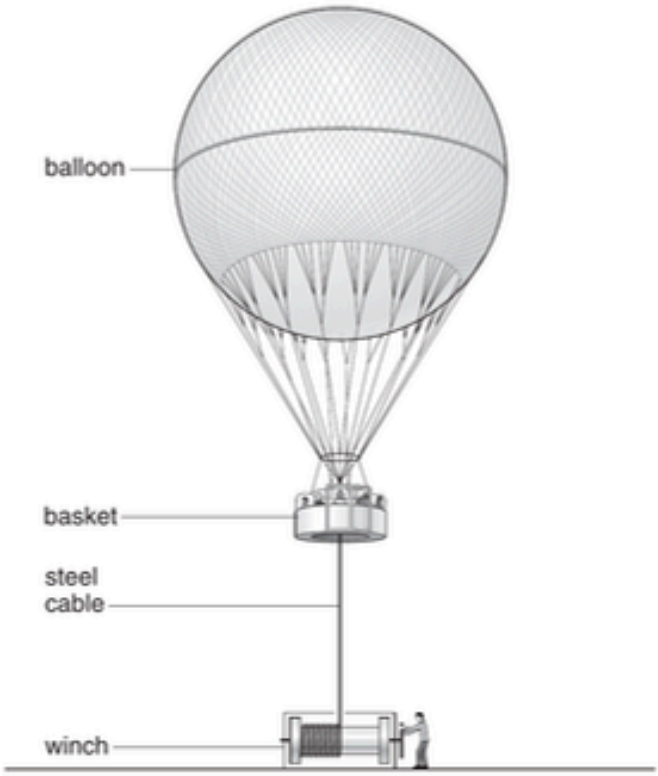
zinc ☐ lead ☐

☐ 13c

1 mark

Modern Tuition

6. The drawing shows some people in a balloon ride.
The basket of the balloon is fixed to the end of a steel cable.



(a) A man brings the balloon down by winding the steel cable around a winch.
Six properties of steel are given below.

(i) Which **two** properties of steel make it suitable for the **cable**?
Tick the **two** correct boxes.

It conducts electricity.	☐	It conducts heat.	☐
It is flexible.	☐	It is magnetic.	☐
It becomes rusty.	☐	It is strong.	☐

6ai 1 mark

6ai 1 mark

(ii) From these six properties of steel, give **one** property that is **never** useful.

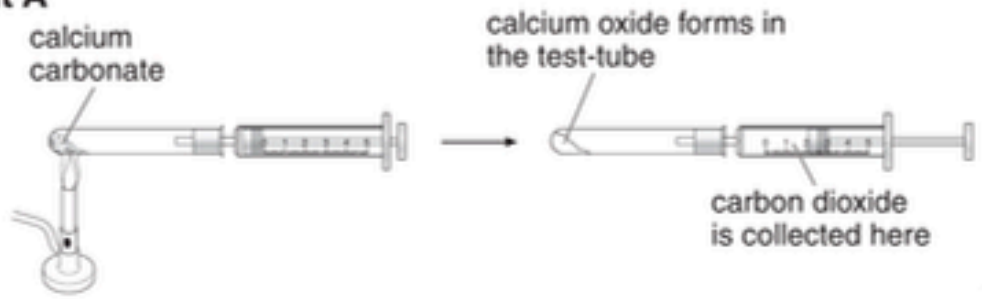
_____

6aii 1 mark

Modern Tuition

12. A science teacher showed her class three experiments, A, B and C.
The experiments and the word equations for the reactions that took place are shown below.
All the experiments were done in a fume cupboard.

experiment A



word equation calcium carbonate → calcium oxide + carbon dioxide

experiment B

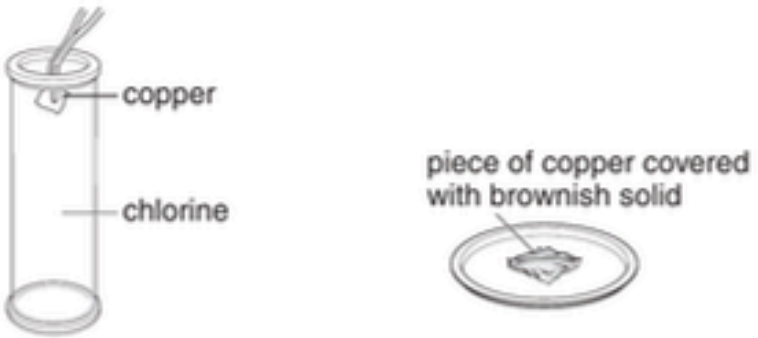
iron filings and sulphur are heated together



word equation iron + sulphur → iron sulphide

experiment C

hot copper is added to chlorine



word equation copper + chlorine → _____

KS3 Science SATs, Tier 3-6, Paper 2 (2006) - Q12 (experiments A-C)

(a) From the substances in experiments A, B and C, opposite, give the name of:

(i) **one** metallic element;

_____

(ii) **one** non-metallic element;

_____

(iii) **two** compounds.

_____ and _____

(b) In experiment B, the iron filings weighed 2.0 g at the beginning of the experiment and the iron sulphide produced weighed 2.8 g.

Explain this increase in mass.

_____

_____

(c) Complete the word equation for the chemical reaction in experiment C.

copper + chlorine → _____

Modern Tuition

5. (a) The drawings below show three objects made from copper.

Draw a line from each object to the reason for using copper for that object.
Draw only **three** lines.

object made from copper	reason for using copper
 base of a saucepan	It does **not** rust.
 coin	It is a good conductor of electricity.
 wires in a cable	It is a good conductor of heat.
	It is **not** magnetic.

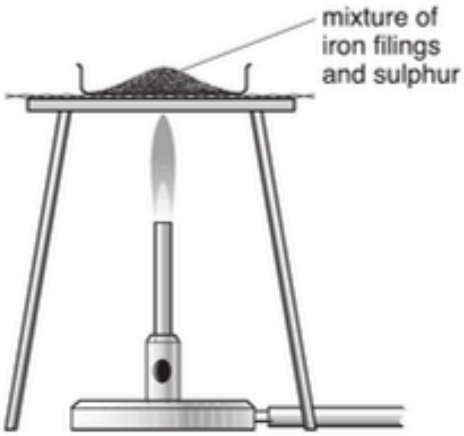
5a 1 mark

5a 1 mark

5a 1 mark

Modern Tuition

14. A teacher mixed iron filings with sulphur on a metal tray.
She heated the mixture in a fume cupboard.
Sulphur is yellow. Iron filings are grey.



The mixture glowed very brightly. The teacher turned off the bunsen burner.
The glow spread through the mixture.
When the mixture cooled, a black solid called iron sulphide was left.

(a) From this information, give **one** way you can tell that a chemical reaction took place.

_____

_____

14a
1 mark

(b) What type of substance is each of the chemicals involved in this reaction?
Choose from:

metallic element	mixture	non-metallic element	compound

iron _____

sulphur _____

iron sulphide _____

14b
1 mark

14b
1 mark

Modern Tuition

(c) Gemstones called rubies are made from an aluminium compound with the formula Al_2O_3.

The chemical symbol for aluminium is Al.

(i) Give the name of the element that is combined with aluminium in this compound.

_____

12ci
1 mark

(ii) Suggest the name of the compound with the formula Al_2O_3.

_____

12cii
1 mark

(iii) How many atoms are there in the formula Al_2O_3?

_____

12ciii
1 mark

(d) (i) The gemstone in the drawing is set into a gold ring.
Gold is an element that is found in rocks.
Gold is never found combined with other elements.

Part of the reactivity series of metals is shown below.

more reactive	aluminium
	zinc
	lead
less reactive	copper

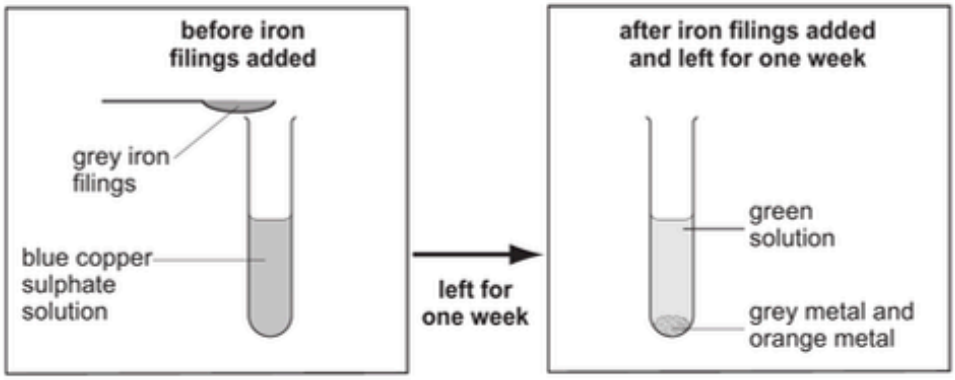
Where should gold be placed in this reactivity series?

_____

12di
1 mark

Modern Tuition

13. Joanne added iron filings to copper sulphate solution.
She observed the reaction after one week.



(a) What evidence in the diagrams shows that a chemical reaction has taken place?

13a
1 mark

(b) The reaction between iron and copper sulphate is a **displacement** reaction.

(i) Give the name of the orange metal visible after one week.

13bi
1 mark

(ii) What is the name of the compound formed in this reaction?

13bii
1 mark

(iii) Joanne poured the green solution into another test tube. She added some copper pieces to the solution.

Will a displacement reaction occur?

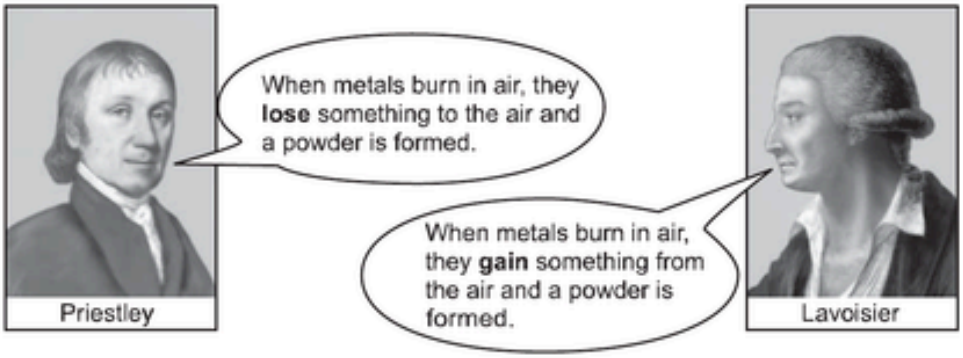
yes ☐ no ☐

Explain your answer.

13biii
1 mark

Modern Tuition

12. In the eighteenth century, scientists had different ideas about what happens when metals burn in air.



(a) Imagine you want to investigate the ideas of Priestley and Lavoisier.
Assume you have been given three pieces of different metals.
In a laboratory, metals are heated to high temperatures in crucibles.



You would also have access to all the usual laboratory equipment.

In your plan you must give:

- the **one** factor you would change as you carry out your investigation (the independent variable);
- **one** factor you would observe or measure to collect your results (the dependent variable);
- **one** of the factors you would keep the same as you carry out your investigation;
- the **evidence** that would support Lavoisier's idea.

12a 1 mark

12a 1 mark

12a 1 mark

12a 1 mark

Modern Tuition

12. (a) Sasha placed small samples of four different metals on a spotting tile. She added drops of calcium nitrate solution to each metal.



Sasha repeated the experiment with:

- fresh samples of the four metals and copper nitrate solution
- fresh samples of the four metals and iron nitrate solution.

Will a reaction take place when each of the metals is added to each of the solutions?
Use the reactivity series below to help you.

most reactive	calcium
	magnesium
	aluminium
	zinc
	iron
	lead
least reactive	copper

In the table below:

- place a tick, ✓, to show that a reaction took place
- place a cross, X, to show that **no** reaction took place.

Two have been done for you.

salt solution	**metal**			
	copper	**iron**	**magnesium**	**zinc**
calcium nitrate				
copper nitrate	X			
iron nitrate		X		

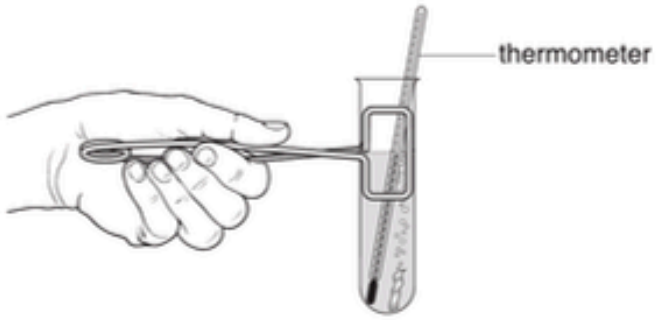
12a 1 mark

12a 1 mark

12a 1 mark

Modern Tuition

12. Harry mixed zinc with copper sulphate solution in a test-tube.
A displacement reaction took place and the temperature increased.



(a) The word equation for the reaction is shown below.

zinc + copper sulphate → zinc sulphate + copper

Why is this reaction called a displacement reaction?

12a

1 mark

(b) Harry repeated the experiment with two other metals.
He wanted to calculate the temperature rise each time.
His results are shown below.

metal added to copper sulphate	temperature at the start (°C)	highest temperature reached (°C)	rise in temperature (°C)
zinc	20.0	36.5	16.5
iron	25.5	38.5	13.0
magnesium	19.5	87.5	68.0

Harry used different starting temperatures.
Explain why this did **not** affect his results.

12b

Modern Tuition

(c) Part of the reactivity series of metals is shown below.

most reactive	sodium
	calcium
	magnesium
	aluminium
	zinc
	iron
	lead
least reactive	copper

Use the reactivity series above to answer all the questions below.

(i) Why was the highest rise in temperature obtained with magnesium and copper sulphate?

_____

_____

12ci

1 mark

(ii) Why was the rise in temperature obtained with zinc and copper sulphate **not** much higher than the rise in temperature obtained with iron and copper sulphate?

_____

_____

12cii

1 mark

(iii) In which of the following mixtures would there be a rise in temperature? Write **yes** or **no** in each blank box.

mixture	Would there be a rise in temperature?
aluminium + sodium chloride	
calcium + zinc sulphate	
lead + zinc chloride	
magnesium + iron chloride	

12ciii

1 mark

12ciii

1 mark

Modern Tuition