AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.4.1.2

The reactivity series

Past-paper questions

Tier	**Foundation**
Question groups	**36**
Available paper years	**2007–2025**

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.

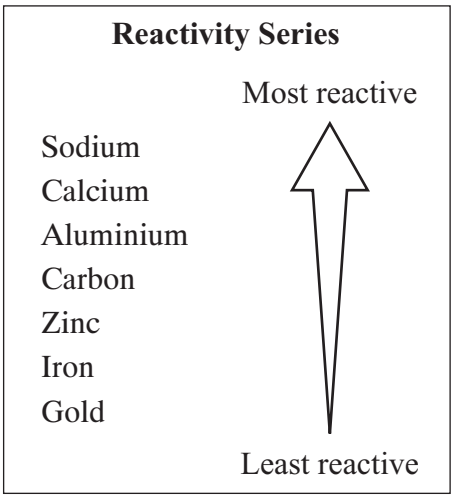
4.4.1.2 The reactivity series

Question 01

March 2007 | CHY1A | Original Q5 | Legacy

QUESTION FIVE

This question is about metals.



Match metals, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A aluminium

B calcium

C sodium

D zinc

	What we can say about the metal
1	It has the symbol Na
2	Its oxide is called quicklime.
3	It is more reactive than iron but can be extracted from its oxide by heating with carbon.
4	It is less reactive than calcium but cannot be extracted from its oxide by reduction with carbon.

4.4.1.2 The reactivity series

Question 02

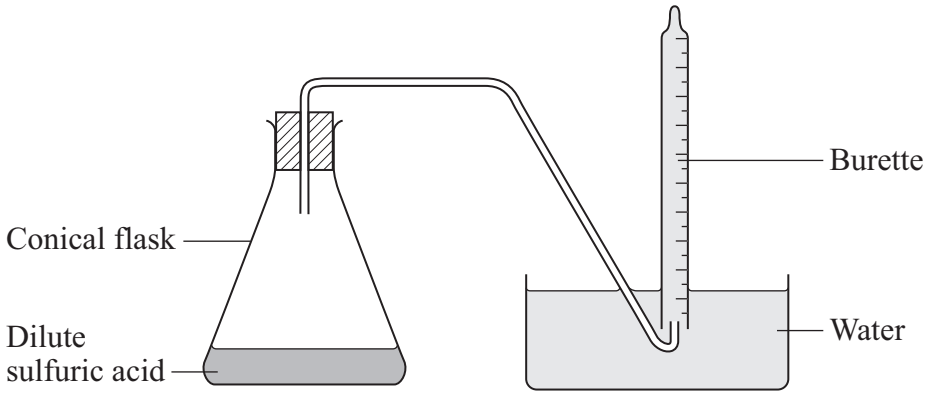
March 2007 | CHY1A | Original Q7 | Legacy

QUESTION SEVEN

Metals can react with acids to produce hydrogen gas.

Iron reacts with sulfuric acid to produce hydrogen gas.

Five students, **A**, **B**, **C**, **D** and **E**, reacted iron with dilute sulfuric acid in the apparatus shown below.



- In the first experiment, each student weighed out 0.04 grams of iron.
- The students then dropped the iron into the acid in the conical flask.
- The students replaced the bung in the flask as quickly as possible.
- They recorded the volume of hydrogen collected when all the iron had reacted.
- They repeated the experiment using 0.08, 0.12, 0.16 and 0.20 grams of iron.

Results

Mass of iron in grams	**Volume of hydrogen in cm^3**					
	Student **A**	Student **B**	Student **C**	Student **D**	Student **E**	Mean
0.04	14	10	11	12	13	12
0.08	32	23	30	33	29	31
0.12	53	49	49	48	46	49

4.4.1.2 The reactivity series

Question 02 · continued

7A The expected volume of hydrogen produced from 0.04 grams of iron and this volume of sulfuric acid is 17 cm^3.
All five students collected less hydrogen than this.

The most likely reason for this similar error is that . . .

1 the conical flask was too big.

2 the burette was not accurate enough.

3 some of the hydrogen gas escaped.

4 the acid was too dilute.

7B Student **B**'s result was not used to calculate the mean for 0.08 grams of iron.
This was because it was . . .

1 a systematic error.

2 an anomalous result.

3 a categoric error.

4 a negative result.

7C 86 cm^3 is the true value for the volume of hydrogen produced from 0.20 grams of iron.
All the students carried out the tests with greater accuracy by the time they reached the last of the five experiments.
Their results, using 0.20 grams of iron, are more accurate because they . . .

1 are much higher than their first results.

2 are close to 100 cm^3.

3 are about five times higher than their first results.

4 are all close to the true value.

7D Each student's results would be best shown as . . .

1 a pie chart.

2 a line graph.

3 a bar chart.

4 a scattergram.

4.4.1.2 The reactivity series

Question 03

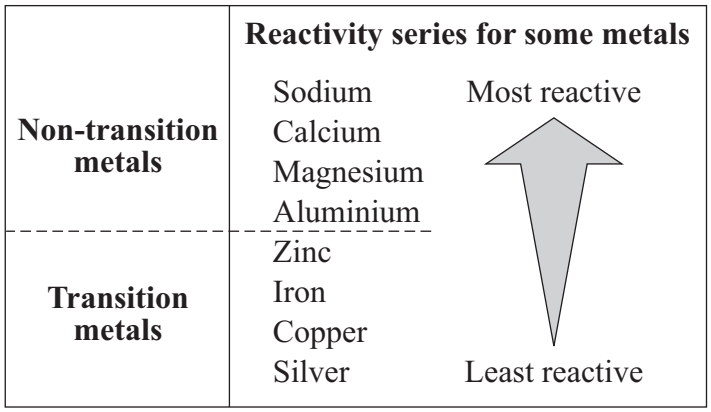
June 2007 | CHY1A | Original Q7 | Legacy

QUESTION SEVEN

The table shows what happens to some metal carbonates when they are heated in a Bunsen burner flame.

Name of carbonate	What happens when heated
Sodium carbonate	melts at 851°C but decomposes only at much higher temperatures
Calcium carbonate	decomposes at 825 °C
Magnesium carbonate	decomposes at 350 °C
Zinc carbonate	decomposes at 300 °C
Silver carbonate	decomposes at 220 °C

The information below may help you to answer some parts of this question.



7A What pattern, if any, can be seen in these results for the action of heat on metal carbonates?

1 All metal carbonates decompose when they are heated in a Bunsen burner flame.

2 Carbonates of the more reactive metals decompose at higher temperatures.

3 Carbonates of the transition metals decompose at higher temperatures.

4 There is no pattern to the results.

4.4.1.2 The reactivity series

Question 03 · continued

7B Potassium carbonate melts at 891°C but does not decompose.

What is the probable position of potassium in the reactivity series?

1 below silver

2 between silver and copper

3 between calcium and sodium

4 above sodium

7C What is produced by all metal carbonates when they decompose?

1 oxygen

2 hydrogen

3 a metal oxide

4 a hydrocarbon

7D 3.10 grams of copper carbonate are heated in a test tube until completely decomposed.
1.10 grams of carbon dioxide are collected and a black compound is left in the test tube.

What is the mass of the black compound?

1 1.10 grams

2 2.00 grams

3 3.41 grams

4 4.20 grams

4.4.1.2 The reactivity series

Question 04

June 2007 | CHY1B | Original Q4 | Legacy

QUESTION FOUR

The list below shows the first five noble gases, in the order in which they appear in Group 0 of the periodic table, and their boiling points.

Noble gas	Boiling point in °C
Helium	–269
Neon	–246
Argon	–186
Krypton	–152
Xenon	–107

Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A boiling point

B colour

C density

D reactivity

Argon is used in filament lamps because of its low chemical . . . **1** . . . .

In electric discharge tubes, used for advertisement signs, each noble gas glows with a different . . . **2** . . . .

Helium is used in balloons because it has a low . . . **3** . . . .

Xenon is the noble gas in the list that has the highest . . . **4** . . . .

4.4.1.2 The reactivity series

Question 05

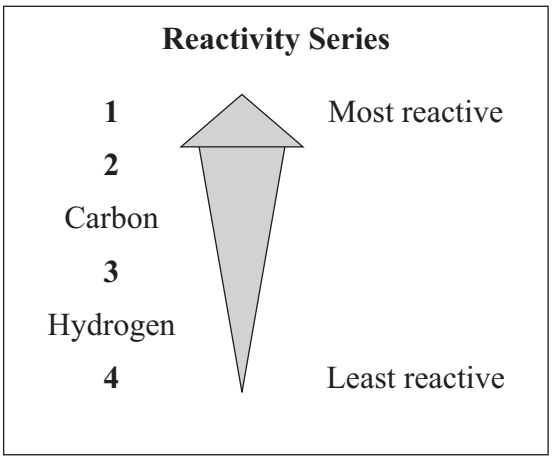
November 2007 | CHY1A | Original Q5 | Legacy

QUESTION FIVE

This question is about the positions of four metals, **A**, **B**, **C** and **D**, in the reactivity series.

- Only metals **A** and **C** can be extracted from their oxides by strongly heating their oxides mixed with carbon.
- Metal **C**, but not metal **A**, can be extracted from its oxide by heating the oxide in a stream of hydrogen.
- Metal **D** is more reactive than metal **B**.

Match metals, **A**, **B**, **C** and **D**, with the numbers **1–4** in the reactivity series.



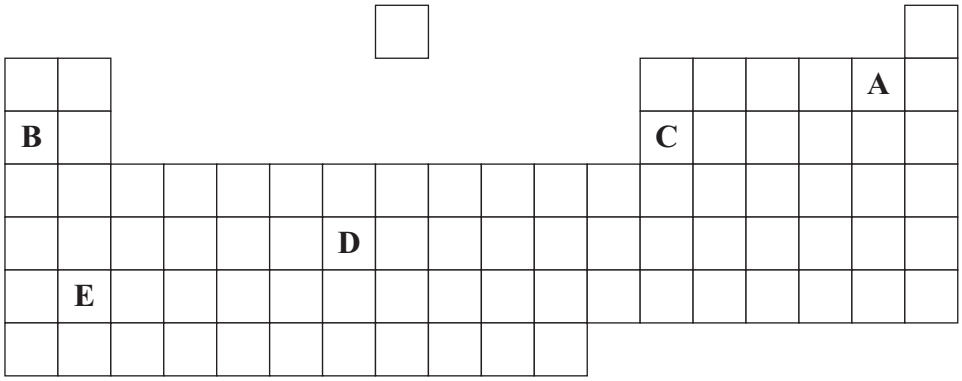
4.4.1.2 The reactivity series

Question 06

January 2008 | CHY3F | Original Q1 | Legacy

1 (a) The periodic table on the Data Sheet may help you to answer this question.

Part of the periodic table is shown below.



Choose your answers **only** from the letters shown in the periodic table above.

Which letter, **A** to **E**, represents:

(i) sodium Letter .....

(1 mark)

(ii) a non-metal Letter .....

(1 mark)

(iii) a Group 2 element Letter .....

(1 mark)

(iv) a transition element? Letter .....

(1 mark)

4.4.1.2 The reactivity series

Question 06 · continued

BLANK

(b) Complete these sentences by drawing a ring around the correct answer.

(i) Attempts to classify the elements into a periodic table were made

by [Arrhenius and Dalton / Brønsted and Lowry / Mendeleev and Newlands] .

(1 mark)

(ii) They arranged the elements in order of their [atomic weight / melting point / reactivity] .

(1 mark)

(iii) They put elements in the same Group if they had similar [boiling points / chemical reactions / electrical conductivities] .

(1 mark)

(iv) We now know that elements in the same Group have the same number of

[electrons / neutrons / protons] in their outer shell (energy level).

(1 mark)

8

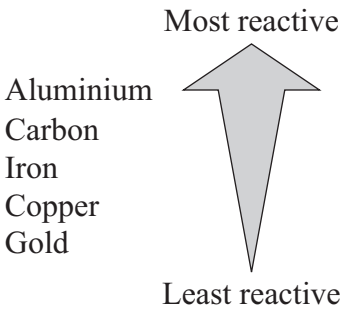
4.4.1.2 The reactivity series

Question 07

March 2008 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

This is the order of reactivity for five elements.



Match metals, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A iron

B aluminium

C copper

D gold

	What we can say about the metal
1	It will **not** react with oxygen or water even at high temperatures.
2	It is made in the blast furnace by the reduction of its oxide with carbon.
3	It can be extracted from its molten ore with electricity but **not** with carbon.
4	It can be extracted from its ore with carbon and is purified by electrolysis.

4.4.1.2 The reactivity series

Question 08

June 2008 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

- Iron is obtained by reducing its oxide ore with carbon.
- Aluminium **cannot** be obtained by reducing its oxide ore with carbon.
- Gold occurs as the metal itself.

8A From the information above, which row in the table shows the order of reactivity of the four elements?

	most reactive →			**least reactive**
1	aluminium	carbon	iron	gold
2	iron	aluminium	carbon	gold
3	iron	aluminium	gold	carbon
4	aluminium	iron	gold	carbon

8B Iron obtained directly from the blast furnace was used to build the Iron Bridge in Shropshire.

This bridge is unsuitable for use by modern lorries because . . .

1 it **cannot** be stopped from rusting.

2 it will easily bend out of shape.

3 it is too heavy to support its own weight.

4 it is too brittle and so it will break.

4.4.1.2 The reactivity series

Question 08 · continued June 2008 | CHY1AP | Original Q8 | Legacy

- Aluminium waste of high purity can be recycled.
- Any iron and other impurities are removed.
- The aluminium is then melted and processed in the same way as aluminium that has been extracted from its ore.
- Recycling aluminium in this way creates only 5% of the carbon dioxide produced by extracting aluminium from its ore.

8C Which of the following benefits an aluminium recycling company financially?

1 a fall in the price of aluminium

2 the high melting point of aluminium

3 the high purity of the aluminium waste arriving at the recycling plant

4 the metal can be purified by electrolysis

8D An environmental disadvantage of recycling aluminium is that . . .

1 the aluminium waste has to be transported for recycling.

2 land fill sites would **not** be filled so quickly.

3 the process creates only 5% of the carbon dioxide produced by extracting aluminium from its ore.

4 the price of aluminium will fall.

4.4.1.2 The reactivity series

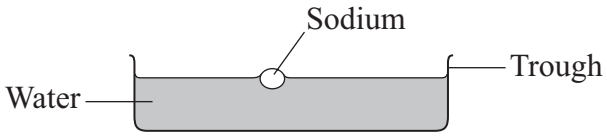
Question 09

June 2008 | CHY3F | Original Q2 | Legacy

2 (a) Read a student's report about the reaction between sodium and water.

The reaction between sodium and water

A small piece of sodium was added to some water in a trough.



The sodium floated and started to react.

The sodium moved along the surface of the water and melted to give a ball of molten metal.

The ball became smaller and smaller until it had all gone.

A gas was given off and a colourless solution was left.

The word equation for this reaction is:

sodium + water → sodium hydroxide + hydrogen

Use the information from the student's report to answer these questions.

2 (a) (i) Which information shows that sodium has a low density?

.....

(1 mark)

2 (a) (ii) Which information shows that the reaction is exothermic?

.....

(1 mark)

2 (a) (iii) Name the gas given off.

.....

(1 mark)

2 (b) The periodic table on the Data Sheet may help you to answer these questions.

2 (b) (i) Sodium is in Group 1.

Name a Group 1 element that is more reactive than sodium.

.....

(1 mark)

4.4.1.2 The reactivity series

Question 09 · continued

for mark

2 (b) (ii) Here are some statements about Group 1 elements.
Only **two** of these statements are correct.
Put a tick (✓) next to the **two** correct statements.

Statement	(✓)
They are halogens	
They are metals	
They form covalent compounds	
They form ions with a +1 charge	

(2 marks)

2 (c) Dimitri Mendeleev put forward his periodic table in 1869.

Complete these sentences by drawing a ring around the correct answer.

2 (c) (i) Mendeleev arranged the elements in order of their [atomic weight / density / reactivity] .

(1 mark)

2 (c) (ii) The table is called a periodic table because elements with [identical / the same / similar] properties occur at regular intervals.

(1 mark)

2 (c) (iii) The vertical columns are known as [groups / periods / rows] .

(1 mark)

2 (d) How did Mendeleev overcome the problem of undiscovered elements when he designed his table?

.....

(1 mark)

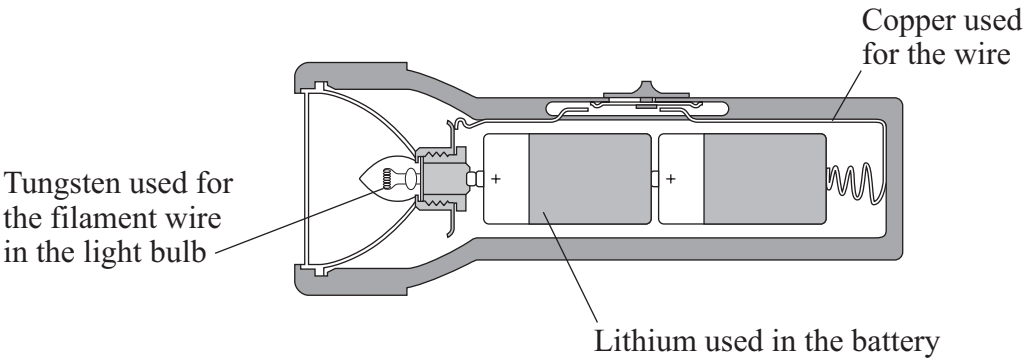
10

4.4.1.2 The reactivity series

Question 10

June 2009 | CHY1F | Original Q1 | Legacy

1 The diagram shows a circuit that is used in a torch. Electrons flow through this circuit.

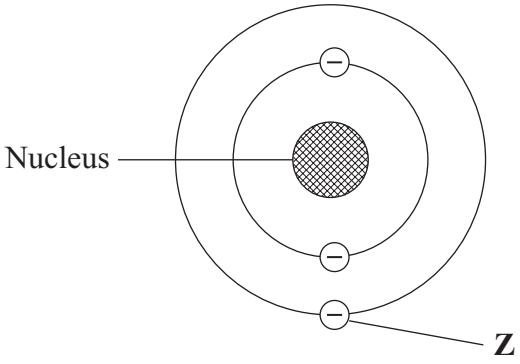


1 (a) Why is copper used for the wire?

.....

(1 mark)

1 (b) The diagram shows the structure of an atom of lithium.



Name the particle labelled **Z**.

.....

(1 mark)

4.4.1.2 The reactivity series

Question 10 · continued

for mark

1 (c) The table shows some properties of the metals used in the electrical circuit.

Metal	Melting point in °C	Boiling point in °C	Reaction with oxygen
Copper	1083	2582	Reacts **slowly** to form a thin oxide layer on surface
Lithium	179	1317	Reacts **rapidly** to form oxide
Tungsten	3370	5930	Reacts **only** when very hot to form oxide

1 (c) (i) Use information from the table to suggest the order of reactivity for copper, lithium and tungsten.

most reactive .....

.....

least reactive .....

(2 marks)

1 (c) (ii) The filament wire glows because it gets very hot.

Use information from the table to suggest **one** reason why tungsten is used for the filament wire in the light bulb.

.....

.....

(1 mark)

1 (d) The gas used in the light bulb is argon.

Draw a ring around the correct word in the box to complete the sentence.

Argon is used in the light bulb because it is

dense.
solid.
unreactive.

(1 mark)

6

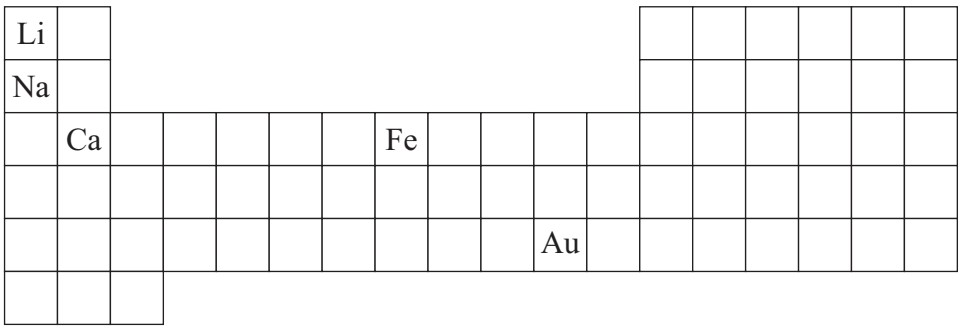
4.4.1.2 The reactivity series

Question 11

November 2009 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

The diagram shows part of the periodic table.



Match elements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table below.

A Calcium (Ca)

B Lithium (Li)

C Gold (Au)

D Iron (Fe)

1	It will not react with oxygen or water even at high temperatures.
2	It forms the oxide known as quicklime.
3	It has properties most similar to those of sodium (Na).
4	It is a transition element found in the Earth as an oxide.

4.4.1.2 The reactivity series

Question 12

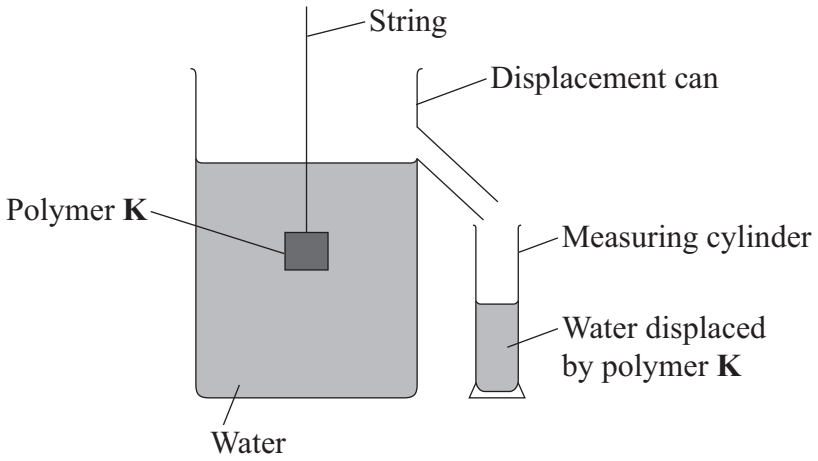
March 2010 | CHY1BP | Original Q6 | Legacy

QUESTION SIX

Some polymers can be used for tooth fillings. A good polymer should not shrink in the tooth cavity.

A scientist tested a polymer, **K**, to see how much it shrinks when it sets.

- He made a sample of the polymer in a container with a volume of 10 cm^3 exactly.
- He allowed the polymer to set hard.
- He removed the polymer from the container and measured its volume again, using the apparatus shown.
- He repeated the test three times.



The scientist then tested three different polymers, **L**, **M** and **N**, in exactly the same way.

The results are shown in the table.

Polymer	Volume of water displaced in cm^3			
	Test 1	Test 2	Test 3	Test 4
K	9.6	9.8	9.7	9.8
L	7.8	8.2	8.9	10.2
M	9.2	9.5	9.6	10.0
N	9.2	9.6	8.5	9.7

4.4.1.2 The reactivity series

Question 12 · continued March 2010 | CHY1BP | Original Q6 | Legacy

6A Which statement about the results is correct?

1 All four polymers would be equally good as dental fillings.

2 Polymer **K** shows the most consistent results.

3 Polymer **L** is the best for dental fillings because it gives the highest values.

4 If the third test is ignored, polymer **N** is the best polymer for dental fillings.

6B Which one of the following could be the reason for the reading of 10.2 cm^3 for polymer **L**, **Test 4**?

1 The piece of string was too long.

2 The polymer was dropped into the water in the displacement can.

3 At the start, the water was below the level of the spout.

4 Some water had evaporated.

6C One of the tests on polymer **M** gives a volume of 10.0 cm^3.

Does this mean it is the best polymer?

1 Yes, because it has given the volume needed.

2 No, because a single result should not be relied upon.

3 Yes, because it would be the highest value that could be obtained.

4 No, because the first test is always the most accurate.

6D Any polymer used for dental fillings should **not** be biodegradable because it would . . .

1 cost too much to make.

2 be poisonous.

3 shrink too much.

4 break down after it has been put in place.

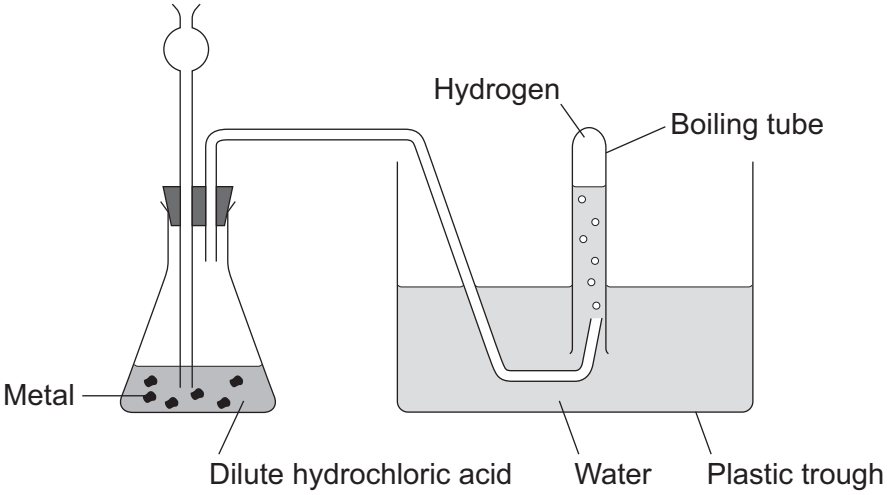
4.4.1.2 The reactivity series

Question 13

June 2010 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

Some students were trying to decide which one of the metals, **K**, **L**, **M** or **N**, was the most reactive. They set up the apparatus shown in the diagram.



Dilute hydrochloric acid was added to the metal **K**. Hydrogen was given off. The students recorded how long it took to fill the boiling tube with the hydrogen. They did the experiment twice more under exactly the same conditions.

They repeated the experiment, using equal-sized pieces of metals **L**, **M** and **N**.

The results are shown in the table.

	Time taken to fill the boiling tube with hydrogen in seconds		
Metal	**Experiment 1**	**Experiment 2**	**Experiment 3**
K	600	479	649
L	189	220	178
M	81	82	78
N	125	132	143

4.4.1.2 The reactivity series

Question 13 · continued

6A To make it a fair test, the students made sure that the boiling tube was always completely filled with hydrogen before they recorded the time.

What else should they do to make it a fair test?

1 use a different acid for each metal

2 use the same volume of the acid for each test

3 replace the water in the plastic trough for each test

4 use different temperatures for each metal

6B Which metal was the most reactive?

1 metal **K**

2 metal **L**

3 metal **M**

4 metal **N**

6C Why did the students take more than one reading for each metal?

1 to make an error less likely

2 so that they could plot a graph

3 to make it easier to see the relationship between the two variables

4 to make it a fair test

6D Some of their results were anomalous.

Which of the following experiments should the students repeat?

1 metal **K**, experiment 2

2 metal **L**, experiment 3

3 metal **M**, experiment 3

4 metal **N**, experiment 1

4.4.1.2 The reactivity series

Question 14

November 2010 | CHY1AP | Original Q1 | Legacy

QUESTION ONE

The table shows some information about four metals, **A**, **B**, **C** and **D**.

	Metal	Date of discovery	Boiling point in °C	Position in reactivity series
A	Iron	Before 1200	2900	Middle
B	Aluminium	1827	2640	High
C	Copper	Before 1200	2570	Low
D	Calcium	1808	1480	High

Match metals, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table below.

1	It is alloyed with carbon to make steel.
2	It was the last to be discovered.
3	It has the lowest boiling point.
4	It is the one most likely to be found as the metal itself.

4.4.1.2 The reactivity series

Question 15

November 2010 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

This question is about how we obtain some metals.

Match statements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A uses another metal

B does **not** use a chemical reaction

C could be done in a blast furnace

D is called electrolysis

1	Aluminium is made when an electric current passes through a molten aluminium compound.
2	Gold can be found at the bottom of some streams.
3	Titanium is made by reacting titanium chloride with magnesium.
4	Zinc is made when a mixture of zinc oxide and carbon is heated.

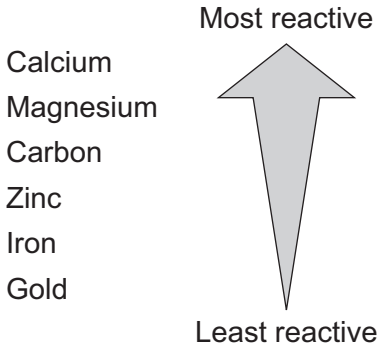
4.4.1.2 The reactivity series

Question 16

March 2011 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

This is the order of reactivity for some elements.



Match elements, **A**, **B**, **C** and **D**, with the numbers **1–4** in the table.

A Carbon

B Gold

C Magnesium

D Zinc

1	It is a non-metal element.
2	It does not react with oxygen or water even at high temperatures.
3	It is more reactive than iron but **can** be extracted from its oxide by mixing with carbon and heating the mixture.
4	It is less reactive than calcium but **cannot** be extracted from its oxide by mixing with carbon and heating the mixture.

4.4.1.2 The reactivity series

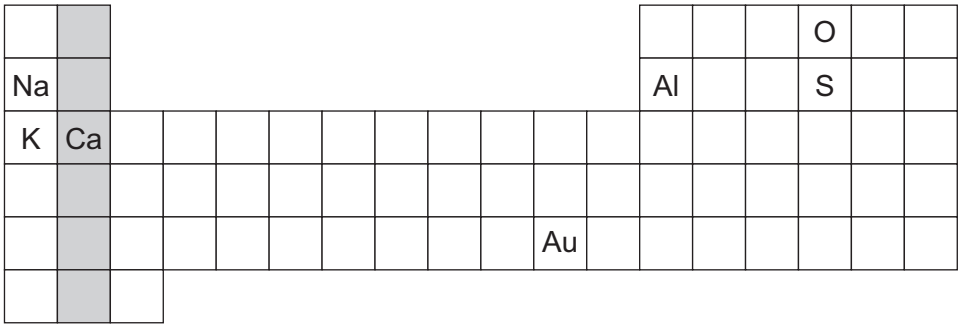
Question 17

June 2011 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

The diagram shows part of the periodic table.

One vertical column has been shaded.



Match words, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A compounds

B groups

C properties

D symbols

The elements in the periodic table are represented by . . . **1** . . . .

The vertical columns in the periodic table are called . . . **2** . . . .

Na (sodium) and K (potassium) have similar chemical . . . **3** . . . .

Some of the elements react together to form . . . **4** . . . .

4.4.1.2 The reactivity series

Question 18

November 2011 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

The table shows the abundance in the Earth's atmosphere of each of four noble gases.

Noble gas	Abundance (percentage in the atmosphere by volume)
Argon	0.9300
Neon	0.0018
Helium	0.0005
Krypton	0.0001

Match properties, **A**, **B**, **C** and **D**, with the numbers **1–4** in the sentences.

A abundance

B colour

C density

D reactivity

Argon is used in filament lamps because of its low chemical . . . **1** . . . .

Neon is used in electric discharge tubes for advertising signs because it produces a bright . . . **2** . . . .

Helium is used in balloons because it has a low . . . **3** . . . .

Krypton is the noble gas in the table with the lowest . . . **4** . . . .

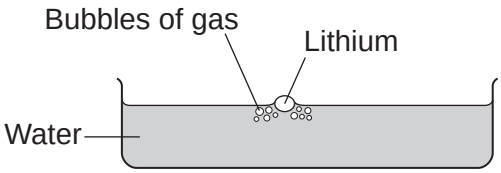
4.4.1.2 The reactivity series

Question 19

June 2013 | CH3FP | Original Q7 | Legacy

7 Lithium is in Group 1 of the periodic table.

Lithium reacts with water to produce a gas and an alkaline solution.



7 (a) (i) Name the gas produced.

.....

(1 mark)

7 (a) (ii) Which ion causes the solution to be alkaline?

.....

(1 mark)

7 (b) Potassium is also in Group 1 of the periodic table.
Potassium reacts with water in a similar way to lithium.

Write down **two** differences you would see between the reactions of potassium and lithium with water.

1 .....

.....

2 .....

.....

(2 marks)

4

4.4.1.2 The reactivity series

Question 20

June 2014 | CH1FP | Original Q5 | Legacy

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

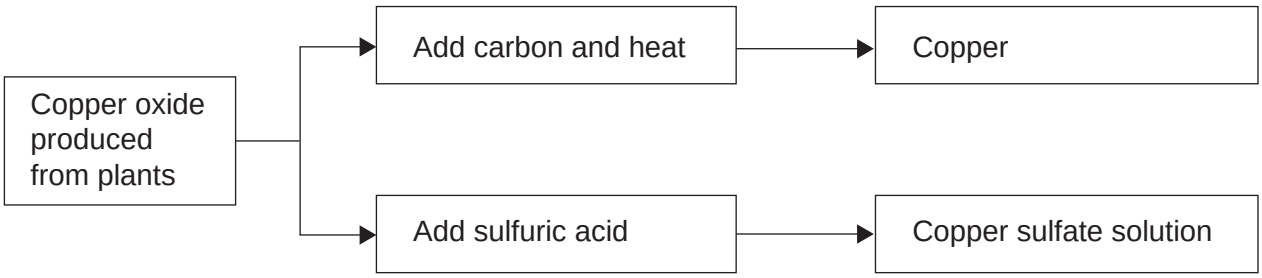
One way to extract the copper is to grow plants on the land.

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 6**.

Figure 6



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

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

carbon neutral.
economical.
reversible.

[1 mark]

5 (a) (ii) Using plants to extract metals is called

photosynthesis.
phytomining.
polymerisation.

[1 mark]

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

carbon dioxide.
oxygen.
sulfur dioxide.

[1 mark]

4.4.1.2 The reactivity series

Question 20 · continued

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

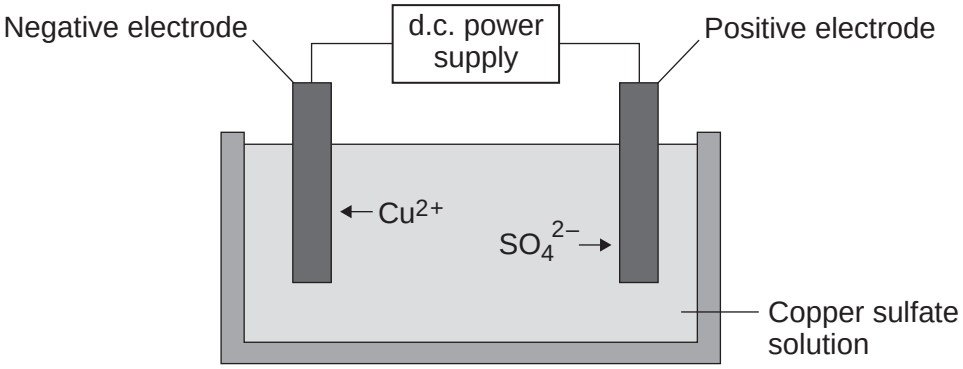
5 (b) (i) Complete the word equation.

[2 marks]

copper sulfate + iron ⟶ ..... + ...

5 (b) (ii) **Figure 7** shows the electrolysis of copper sulfate solution.

Figure 7



Why do copper ions go to the negative electrode?

[1 mark]

.....

.....

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

[2 marks]

.....

.....

.....

.....

8

4.4.1.2 The reactivity series

Question 21

June 2015 | CH3FP | Original Q9 | Legacy

9 This question is about the halogens (Group 7).

9 (a) How do the boiling points of the halogens change down the group from fluorine to iodine?

[1 mark]

.....

.....

9 (b) Sodium bromide is produced by reacting sodium with bromine.

Sodium bromide is an ionic compound.

9 (b) (i) Write down the symbols of the **two** ions in sodium bromide.

[1 mark]

.....

9 (b) (ii) Chlorine reacts with sodium bromide solution to produce bromine and one other product.

Complete the word equation for the reaction.

[1 mark]

chlorine + sodium bromide ⟶ bromine + ...

9 (b) (iii) Why does chlorine displace bromine from sodium bromide?

[1 mark]

.....

.....

9 (b) (iv) Use the Chemistry Data Sheet to help you to answer this question.

Suggest which halogen could react with sodium chloride solution to produce chlorine.

[1 mark]

.....

5

4.4.1.2 The reactivity series

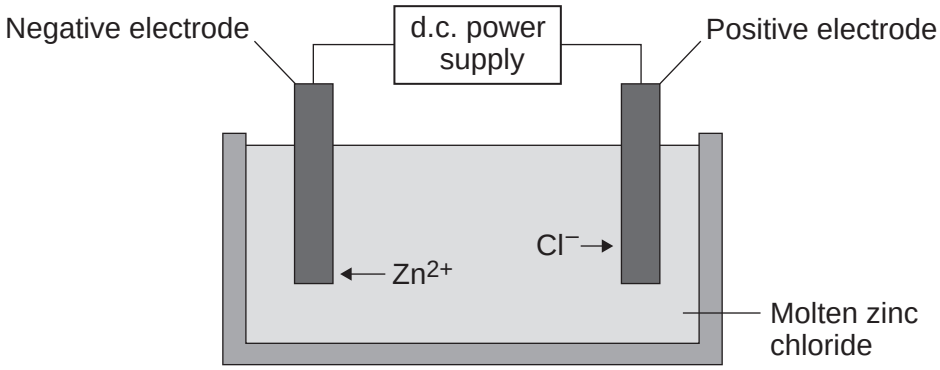
Question 22

June 2016 | CH2FP | Original Q3 | Legacy

3 This question is about zinc.

Figure 7 shows the electrolysis of molten zinc chloride.

Figure 7



3 (a) Zinc chloride is an ionic substance.
Complete the sentence.

[1 mark]

When zinc chloride is molten, it will conduct _____ .

3 (b) Zinc ions move towards the negative electrode where they gain electrons to produce zinc.

3 (b) (i) Name the product formed at the positive electrode.

[1 mark]

_____

3 (b) (ii) Explain why zinc ions move towards the negative electrode.

[2 marks]

_____

_____

_____

_____

4.4.1.2 The reactivity series

Question 22 · continued

3 (b) (iii) What type of reaction occurs when the zinc ions gain electrons?

[1 mark]

Tick (✓) **one** box.

Neutralisation ☐

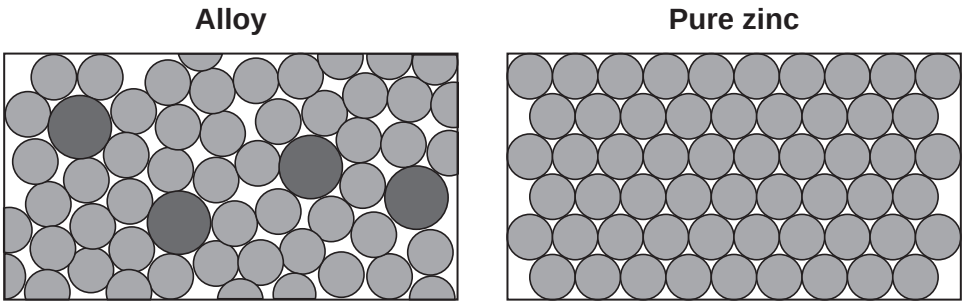
Oxidation ☐

Reduction ☐

3 (c) Zinc is mixed with copper to make an alloy.

3 (c) (i) **Figure 8** shows the particles in the alloy and in pure zinc.

Figure 8



Use **Figure 8** to explain why the alloy is harder than pure zinc.

[2 marks]

3 (c) (ii) Alloys can be bent. Some alloys return to their original shape when heated.

What name is used for these alloys?

[1 mark]

8

4.4.1.2 The reactivity series

Question 23

June 2016 | CH3FP | Original Q1 | Legacy

1 This question is about elements and the periodic table.

1 (a) Use the correct answers from the box to complete the sentences.

[3 marks]

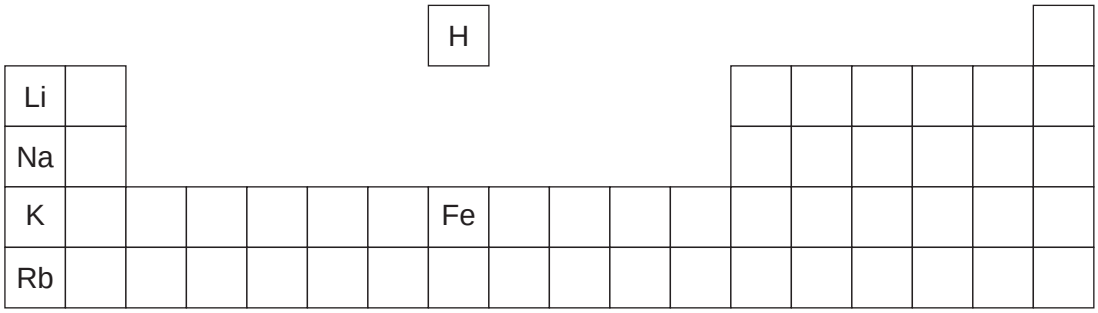
atoms	**atomic weights**	**electrons**	**proton numbers**

Newlands' and Mendeleev's periodic tables show the elements in order of their _____ .

Following the discovery of protons and _____, the modern periodic table shows the elements in order of their _____ .

1 (b) **Figure 1** shows the position of six elements in the modern periodic table.

Figure 1



1 (b) (i) Which **one** of these six elements has the lowest boiling point?

[1 mark]

_____

1 (b) (ii) Complete the sentence.

[1 mark]

In the periodic table, rubidium (Rb) is in Group _____ .

4.4.1.2 The reactivity series

Question 23 · continued

1 (b) (iii) Which of these three elements is the most reactive?

[1 mark]

Tick (✓) **one** box.

Lithium (Li) ☐

Sodium (Na) ☐

Potassium (K) ☐

1 (b) (iv) Which **two** statements are correct?

[2 marks]

Tick (✓) **two** boxes.

Iron has a higher density than potassium. ☐

Iron is softer than potassium. ☐

Iron reacts vigorously with water. ☐

Iron forms ions that have different charges. ☐

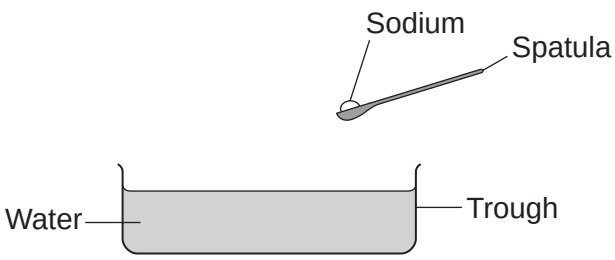
Question 1 continues on the next page

4.4.1.2 The reactivity series

Question 23 · continued

1 (c) **Figure 2** shows sodium being put into water.

Figure 2



Describe **three** observations that can be seen when sodium is put into water.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

11

4.4.1.2 The reactivity series

Question 24

June 2018 | 8462/1F | Original Q2

0 2 The halogens are elements in Group 7.

0 2 . 1 Bromine is in Group 7.

Give the number of electrons in the outer shell of a bromine atom.

[1 mark]

0 2 . 2 Bromine reacts with hydrogen. The gas hydrogen bromide is produced.

What is the structure of hydrogen bromide?

[1 mark]

Tick **one** box.

- Giant covalent ☐
- Ionic lattice ☐
- Metallic structure ☐
- Small molecule ☐

0 2 . 3 What is the formula for fluorine gas?

[1 mark]

Tick **one** box.

- F ☐
- F_2 ☐
- F^2 ☐
- 2F ☐

4.4.1.2 The reactivity series

Question 24 · continued

A student mixes solutions of halogens with solutions of their salts.

Table 1 shows the student's observations.

Table 1

	Potassium chloride (colourless)	Potassium bromide (colourless)	Potassium iodide (colourless)
Chlorine (colourless)		Solution turns orange	Solution turns brown
Bromine (orange)	No change		Solution turns brown
Iodine (brown)	No change	No change	

0 2 . 4 Explain how the reactivity of the halogens changes going down Group 7.

Use the results in **Table 1**.

[3 marks]

Question 2 continues on the next page

4.4.1.2 The reactivity series

Question 24 · continued

A company uses chlorine to produce titanium chloride from titanium dioxide.

0 2 . 5 What is the relative formula mass (M_r) of titanium dioxide, TiO_2?

Relative atomic masses (A_r): O = 16 Ti = 48

[1 mark]

Tick **one** box.

64 ☐

80 ☐

128 ☐

768 ☐

0 2 . 6 The company calculates that 500 g of titanium dioxide should produce 1.2 kg of titanium chloride.

However, the company finds that 500 g of titanium dioxide only produces 900 g of titanium chloride.

Calculate the percentage yield.

[2 marks]

Percentage yield = _____ %

9

4.4.1.2 The reactivity series

Question 25

June 2018 | 8462/1F | Original Q6

0 6 A student investigated the temperature change in displacement reactions between metals and copper sulfate solution.

This is the method used.

1. Measure 50 cm^3 of the copper sulfate solution into a polystyrene cup.
2. Record the starting temperature of the copper sulfate solution.
3. Add the metal and stir the solution.
4. Record the highest temperature the mixture reaches.
5. Calculate the temperature increase for the reaction.
6. Repeat steps 1-5 with different metals.

0 6 . 1 Draw **one** line from each type of variable to the name of the variable in the investigation.

[2 marks]

Type of variable	Name of variable in the investigation
	Concentration of solution
Dependent variable	Particle size of solid
	Temperature change
Independent variable	Type of metal
	Volume of solution

4.4.1.2 The reactivity series

Question 25 · continued

0 6 . 2 The student used a polystyrene cup and **not** a glass beaker.

Why did this make the investigation more accurate?

[1 mark]

Tick **one** box.

- Glass is breakable ☐
- Glass is transparent ☐
- Polystyrene is a better insulator ☐
- Polystyrene is less dense ☐

Question 6 continues on the next page

Question 25 · continued

Table 5 shows the student's results.

Table 5

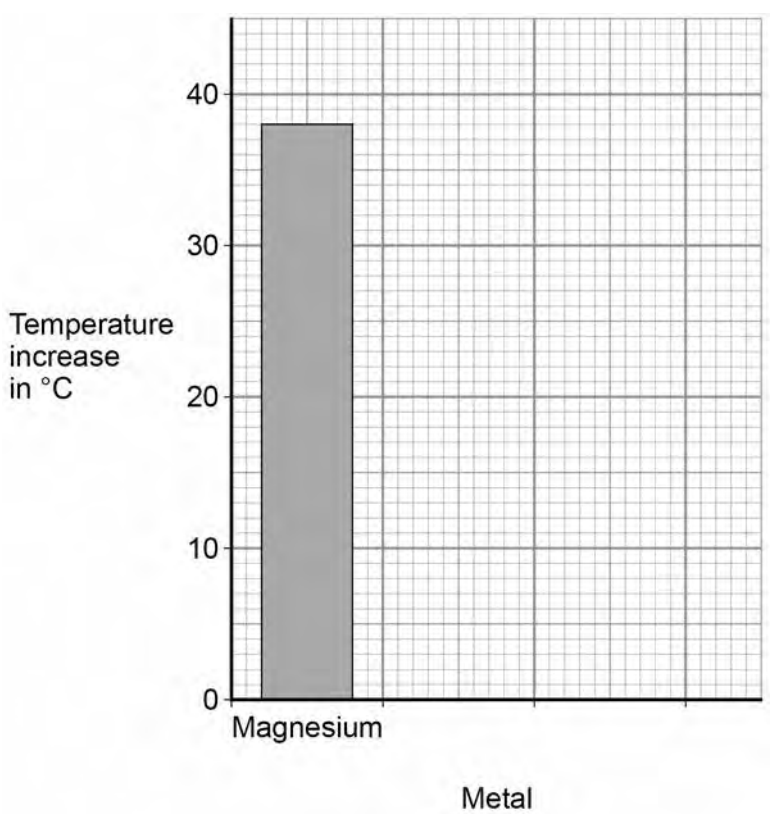
Metal	Temperature increase in °C
Magnesium	38
Nickel	8
Zinc	16

0 6 . 3 Complete **Figure 9**.

Use data from **Table 5**.

[2 marks]

Figure 9



4.4.1.2 The reactivity series

Question 25 · continued

0 6 . 4 The student concluded that the reactions between the metals and copper sulfate solution are endothermic.

Give **one** reason why this conclusion is **not** correct.

[1 mark]

0 6 . 5 The temperature increase depends on the reactivity of the metal.

Write the metals magnesium, nickel and zinc in order of reactivity.

Use **Table 5**.

[1 mark]

Most reactive _____

_____

Least reactive _____

0 6 . 6 **Y** is an unknown metal.

Describe a method to find the position of **Y** in the reactivity series in Question **06.5**

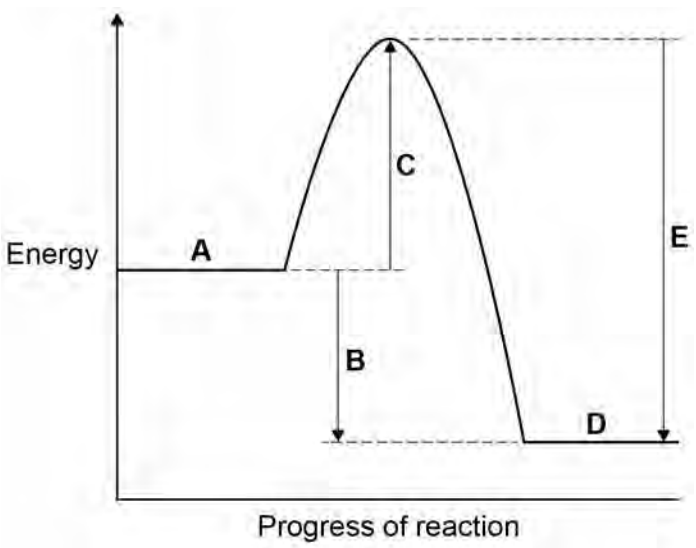
[3 marks]

4.4.1.2 The reactivity series

Question 25 · continued

Figure 10 shows the reaction profile for the reaction between zinc and copper sulfate solution.

Figure 10



0 6 . 7 Which letter represents the products of the reaction?

[1 mark]

Tick **one** box.

A		B		C		D		E	

0 6 . 8 Which letter represents the activation energy?

[1 mark]

Tick **one** box.

A		B		C		D		E	

12

4.4.1.2 The reactivity series

Question 26

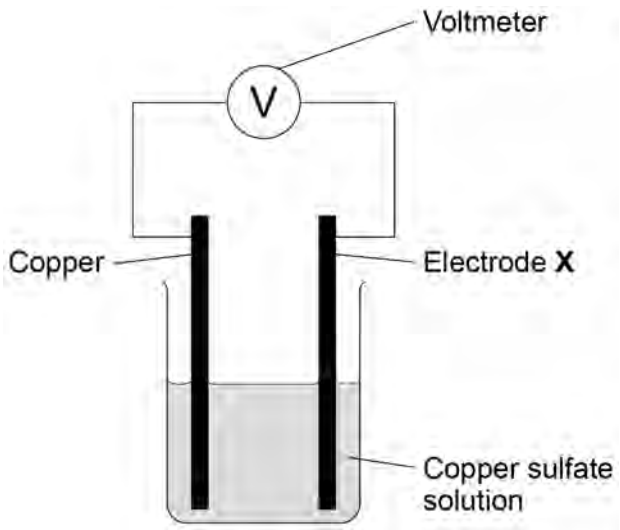
June 2019 | 8462/1F | Original Q4

0 4 This question is about chemical cells and batteries.

A student investigated the voltage produced by different chemical cells.

Figure 7 shows the apparatus.

Figure 7



This is the method used.

1. Use cobalt metal as electrode **X**.

2. Record the cell voltage.

3. Repeat steps 1 and 2 using different metals as electrode **X**.

0 4 . 1 Suggest **two** variables the student should keep the same to make the investigation valid.

[2 marks]

1 _____

_____

2 _____

_____

Question 26 · continued

Table 1 shows the student's results.

Table 1

Electrode X	Voltage of the cell in volts
cobalt	0.62
magnesium	2.71
zinc	1.10

0 4 . 2 Write the three metals used for electrode **X** in order of reactivity.

Use **Table 1**.

[1 mark]

Most reactive _____

_____

Least reactive _____

0 4 . 3 Copper is used as electrode **X** in **Figure 7**.

Predict the voltage of this cell.

Give **one** reason for your answer.

[2 marks]

Voltage = _____ volts

Reason _____

_____

4.4.1.2 The reactivity series

Question 26 · continued

0 4 . 4 Describe how to make a 12 V battery using 1.5 V cells.

[2 marks]

0 4 . 5 Which is the most suitable use for a non-rechargeable cell?

[1 mark]

Tick (✓) **one** box.

Electric toy ☐

Laptop computer ☐

Mobile phone ☐

0 4 . 6 Hydrogen fuel cells or rechargeable cells can be used to power electric vehicles.

Suggest **one** advantage and **one** disadvantage of using a hydrogen fuel cell compared with a rechargeable cell.

[2 marks]

Advantage of hydrogen fuel cell _____

Disadvantage of hydrogen fuel cell _____

10

4.4.1.2 The reactivity series

Question 27

November 2020 | 8462/1F | Original Q9

0 9 This question is about metals and the reactivity series.

0 9 . 1 Which **two** statements are properties of most transition metals?

[2 marks]

Tick (✓) **two** boxes.

- They are soft metals. ☐
- They form colourless compounds. ☐
- They form ions with different charges. ☐
- They have high melting points. ☐
- They have low densities. ☐

0 9 . 2 A student added copper metal to colourless silver nitrate solution.

The student observed:

- pale grey crystals forming
- the solution turning blue.

Explain how these observations show that silver is less reactive than copper.

[3 marks]

4.4.1.2 The reactivity series

Question 27 · continued

0 9 . 3 A student is given three metals, **X**, **Y** and **Z** to identify.

The metals are magnesium, iron and copper.

Plan an investigation to identify the three metals by comparing their reactions with dilute hydrochloric acid.

Your plan should give valid results.

[4 marks]

Question 9 continues on the next page

Question 27 · continued

0 9 . 4 Metal **M** has two isotopes.

Table 6 shows the mass numbers and percentage abundances of the isotopes.

Table 6

Mass number	Percentage abundance (%)
203	30
205	70

Calculate the relative atomic mass (A_r) of metal **M**.

Give your answer to 1 decimal place.

[2 marks]

Relative atomic mass (1 decimal place) = _____

11

4.4.1.2 The reactivity series

Question 28

November 2021 | 8462/1F | Original Q2

0 2 This question is about chemical cells and batteries.

0 2 . 1 Three different types of battery can be used to power a TV remote control.

Table 1 gives information about these batteries.

Table 1

	Zinc-carbon battery	Alkaline battery	Nickel-metal hydride battery
Cost of battery in £ (pounds)	0.17	0.50	1.50
Rechargeable?	No	No	Yes
Time before needing to replace or recharge in months	5	12	8

Give **one** advantage of each type of battery.

[3 marks]

Zinc-carbon _____

_____

Alkaline _____

_____

Nickel-metal hydride _____

_____

0 2 . 2 **Figure 3** shows a symbol printed on batteries.

Figure 3



This symbol shows that batteries should not be put in household waste.

Suggest why batteries should **not** be put in household waste.

[1 mark]

_____

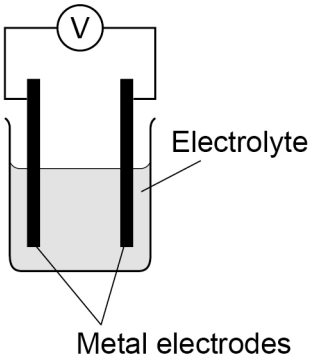
_____

4.4.1.2 The reactivity series

Question 28 · continued

Figure 4 shows a chemical cell.

Figure 4



0 2 . 3 The order of reactivity of three metals is shown below.

Iron	(Most reactive)
Tin	↑
Copper	(Least reactive)

Which combination of metal electrodes would give the highest voltage in the chemical cell in **Figure 4**?

[1 mark]

Tick (✓) **one** box.

Copper and iron ☐

Iron and tin ☐

Tin and copper ☐

0 2 . 4 The voltage produced by the cell in **Figure 4** depends on the type of electrodes and the type of electrolyte.

Suggest **one** other factor that could affect the voltage produced.

[1 mark]

4.4.1.2 The reactivity series

Question 28 · continued

0 2 . 5 Water is produced in a hydrogen fuel cell.

Complete the word equation to show the reaction that produces water in a hydrogen fuel cell.

[2 marks]

_____ + _____ → water

8

4.4.1.2 The reactivity series

Question 29

November 2021 | 8462/1F | Original Q3

0 3 This question is about Group 1 elements.

0 3 . 1 Complete **Table 2** to show the electronic structure of a potassium atom.

[1 mark]

Table 2

Atom	Number of electrons	Electronic structure
Sodium	11	2,8,1
Potassium	19	

0 3 . 2 Why do Group 1 elements have similar chemical properties?

[1 mark]

Tick (✓) **one** box.

They have the same number of electron shells. ☐

They have the same number of outer shell electrons. ☐

They have two electrons in the first shell. ☐

0 3 . 3 What is the type of bonding in sodium?

[1 mark]

Tick (✓) **one** box.

Covalent ☐

Ionic ☐

Metallic ☐

4.4.1.2 The reactivity series

Question 29 · continued

Table 3 shows observations made when lithium, potassium and rubidium react with water.

Table 3

Element	Observations
Lithium	Bubbles slowly Floats Moves slowly
Sodium	1 _____ 2 _____
Potassium	Bubbles very quickly Melts into a ball Floats Moves very quickly Flame
Rubidium	Sinks Melts into a ball Explodes with a flame

0 3 . 4 Give **two** observations you could make when sodium reacts with water.

Write your answers in **Table 3**.

[2 marks]

4.4.1.2 The reactivity series

Question 29 · continued

0 3 . 5 How does the reactivity of the elements change going down Group 1?

[1 mark]

0 3 . 6 Give **two** ways in which the observations in **Table 3** show the change in reactivity going down Group 1.

[2 marks]

1

2

0 3 . 7 Which gas is produced when Group 1 elements react with water?

[1 mark]

Tick (✓) **one** box.

- Carbon dioxide ☐
- Hydrogen ☐
- Nitrogen ☐
- Oxygen ☐

Question 29 · continued

0 3 . 8 Sodium fluoride is an ionic compound.

Figure 5 shows dot and cross diagrams for a sodium atom and a fluorine atom.

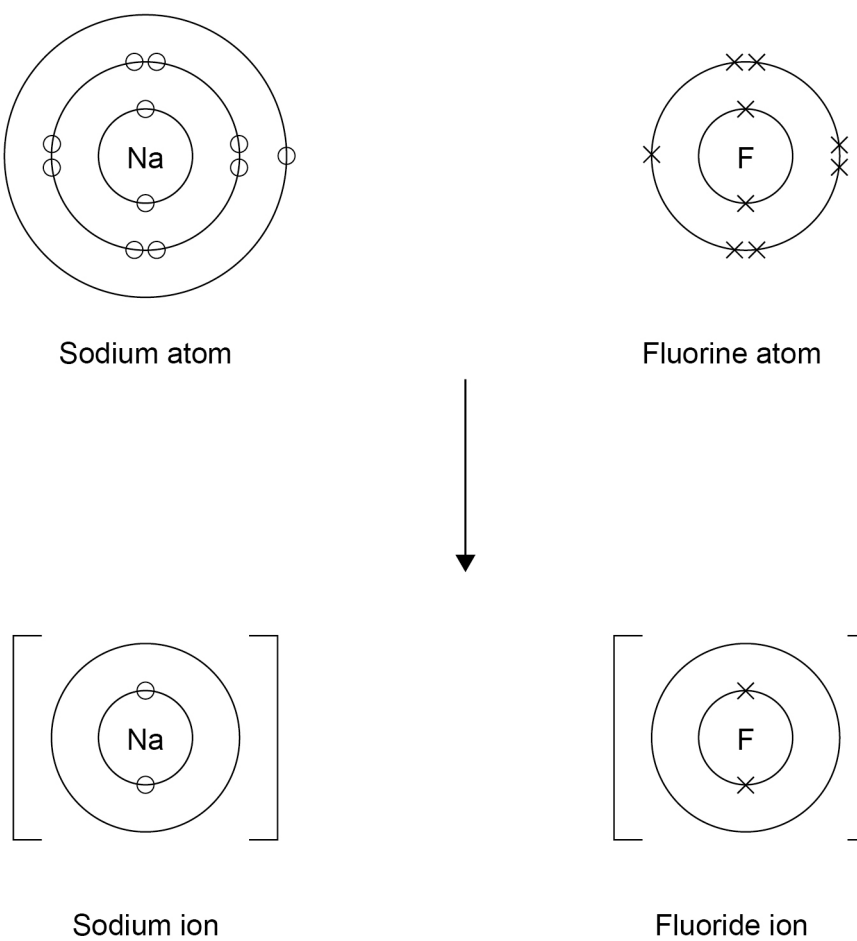
Complete **Figure 5** to show what happens when a sodium atom and a fluorine atom react to produce sodium fluoride.

You should:

- complete the electronic structures of the sodium ion and the fluoride ion
- give the charges on the sodium ion and the fluoride ion.

[3 marks]

Figure 5



12

4.4.1.2 The reactivity series

Question 30

November 2021 | 8462/1F | Original Q4

0 4 A student investigated the reactivity of metals with hydrochloric acid.

This is the method used.

1. Measure 50 cm^3 of hydrochloric acid into a polystyrene cup.
2. Measure the temperature of the hydrochloric acid.
3. Add one spatula of metal powder to the hydrochloric acid and stir.
4. Measure the highest temperature the mixture reaches.
5. Calculate the temperature increase for the reaction.
6. Repeat steps 1 to 5 three more times.
7. Repeat steps 1 to 6 with different metals.

Table 4 shows the student's results.

Table 4

Metal	Temperature increase in °C				Mean temperature increase in °C
	Trial 1	Trial 2	Trial 3	Trial 4	
Cobalt	6	7	5	9	7
Magnesium	54	50	37	55	**X**
Zinc	18	16	18	20	18

0 4 . 1 Calculate the mean temperature increase **X** for magnesium in **Table 4**.

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

[2 marks]

X = _____ °C

Question 30 · continued

0 4 . 2 Determine the order of reactivity for the metals cobalt, magnesium and zinc.

Use **Table 4**.

[1 mark]

Most reactive _____

_____

Least reactive _____

0 4 . 3 The range of measurements either side of the mean shows the uncertainty in the mean temperature increase.

Complete the sentence.

Use **Table 4**.

[1 mark]

The mean temperature increase for zinc is 18 ± _____ °C

0 4 . 4 What type of variable is the volume of hydrochloric acid in this investigation?

[1 mark]

Tick (✓) **one** box.

Control ☐

Dependent ☐

Independent ☐

0 4 . 5 Suggest **one** way of improving **step 3** in the method to give results which are more repeatable.

[1 mark]

_____

_____

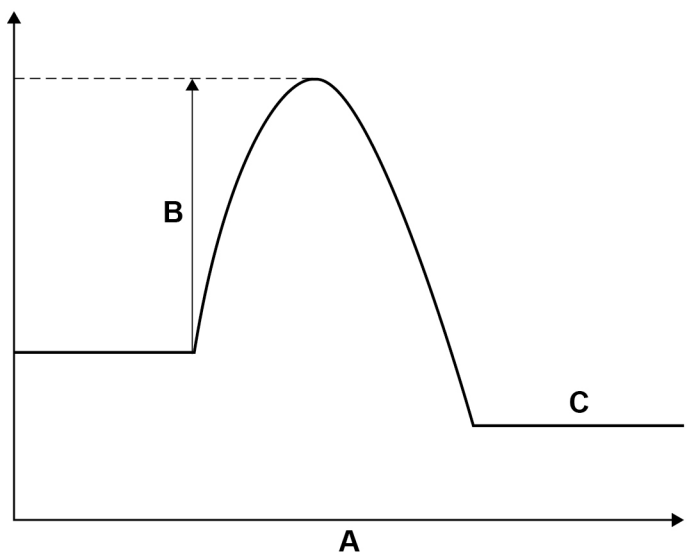
_____

4.4.1.2 The reactivity series

Question 30 · continued

0 4 . 6 **Figure 6** shows a reaction profile for the reaction of magnesium with hydrochloric acid.

Figure 6



What do labels **A**, **B** and **C** represent on **Figure 6**?

Choose answers from the box.

[3 marks]

activation energy	**energy**	**overall energy change**
products	**progress of reaction**	**reactants**

A _____

B _____

C _____

9

4.4.1.2 The reactivity series

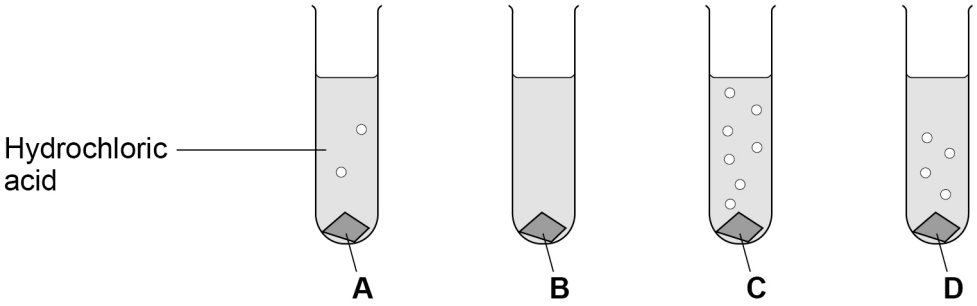
Question 31

0 3 This question is about acids.

A student added four metals, **A**, **B**, **C** and **D** to hydrochloric acid.

Figure 4 shows the rate of bubbling in each tube.

Figure 4



Use **Figure 4** to answer questions **03.1** and **03.2**.

0 3 . 1 Which metal is copper?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 3 . 2 Which metal is the most reactive?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 3 . 3 A metal oxide reacts with an acid to produce zinc sulfate and water.

Name the metal oxide and the acid used in this reaction.

[2 marks]

Name of metal oxide _____

Name of acid _____

4.4.1.2 The reactivity series

Question 31 · continued

0 3 . 4 Universal indicator is used to measure the pH of a solution.

Draw **one** line from each pH to the colour of universal indicator in a solution with that pH.

[2 marks]

pH	Colour of universal indicator
	Blue
1	Green
	Purple
7	Red
	Yellow

Question 3 continues on the next page

4.4.1.2 The reactivity series

Question 31 · continued

A student reacts an acid with an alkali in a titration.

0 3 . 5 What is the type of reaction when an acid reacts with an alkali?

[1 mark]

Tick (✓) **one** box.

Combustion ☐

Decomposition ☐

Neutralisation ☐

0 3 . 6 **Figure 5** shows a piece of equipment used to measure the volume of the acid in the titration.

Figure 5



What is the name of this piece of equipment?

[1 mark]

Tick (✓) **one** box.

Burette ☐

Pipette ☐

Syringe ☐

Tube ☐

8

4.4.1.2 The reactivity series

Question 32

June 2023 | 8462/1F | Original Q8

0 8 This question is about displacement reactions.

Iron is extracted from iron oxide by a displacement reaction with carbon.

0 8 . 1 Balance the equation for the reaction.

[2 marks]

$$Fe_2O_3 + 3\,C \rightarrow ____Fe + ____CO$$

0 8 . 2 Iron oxide is reduced in this reaction.

How does the equation show that iron oxide is reduced?

[1 mark]

_____

_____

0 8 . 3 Calculate the relative formula mass (M_r) of Fe_2O_3

Relative atomic masses (A_r): O = 16 Fe = 56

[2 marks]

_____

_____

_____

M_r = _____

Question 8 continues on the next page

Question 32 · continued

0 8 . 4 Copper oxide reacts with hydrogen to produce copper.

The equation for the reaction is:

$$CuO + H_2 \rightarrow Cu + H_2O$$

Calculate the percentage atom economy for obtaining copper from this reaction.

Use the equation:

$$\text{Percentage atom economy} = \frac{A_r \text{ of Cu}}{M_r \text{ of } H_2 + M_r \text{ of CuO}} \times 100$$

Relative atomic mass (A_r): Cu = 63.5
Relative formula masses (M_r): H_2 = 2 CuO = 79.5

[2 marks]

Percentage atom economy = _____ %

A student investigated the reactivity of four different metals, **A**, **B**, **C** and **D**.

The student:

- added each metal to aqueous solutions of each of the metal sulfates
- observed whether a reaction took place.

0 8 . 5 Give **one** observation that would show a reaction took place.

[1 mark]

4.4.1.2 The reactivity series

Question 32 · continued

0 8 . 6 **Table 4** shows the results.

Table 4

	Metal sulfate solution			
Metal	**A sulfate**	**B sulfate**	**C sulfate**	**D sulfate**
A	×	×	✓	×
B	✓	×	✓	×
C	×	×	×	×
D	✓	✓	✓	×

✓ shows that a displacement reaction took place.
× shows that a displacement reaction did not take place.

Write metals **A**, **B**, **C** and **D** in order of reactivity.

Give a reason for your order of reactivity.

[2 marks]

Most reactive _____

_____

_____

Least reactive _____

Reason _____

_____

10

4.4.1.2 The reactivity series

Question 33

June 2024 | 8462/1F | Original Q6

0 6 This question is about electrolysis and the extraction of metals.

0 6 . 1 Why can some molten substances be electrolysed?

[1 mark]

Tick (✓) **one** box.

Electrons can move through the molten substance to the electrodes. ☐

Ions can move through the molten substance to the electrodes. ☐

Protons can move through the molten substance to the electrodes. ☐

0 6 . 2 **Table 3** shows the products of the electrolysis of some molten compounds.

Complete **Table 3**.

[3 marks]

Table 3

Molten compound	Product at negative electrode	Product at positive electrode
Lead chloride	_____	Chlorine
Potassium iodide	Potassium	_____
_____	Zinc	Bromine

4.4.1.2 The reactivity series

Question 33 · continued

Aluminium is extracted by electrolysing molten aluminium oxide.

0 6 . 3 Balance the equation for the reaction.

Choose numbers from the box.

[2 marks]

2	**3**	**4**	**5**

$$2Al_2O_3 \rightarrow __ Al + __ O_2$$

0 6 . 4 Calculate the relative formula mass (M_r) of aluminium oxide (Al_2O_3).

Relative atomic masses (A_r): O = 16 Al = 27

[2 marks]

Relative formula mass (M_r) = _____

Question 6 continues on the next page

4.4.1.2 The reactivity series

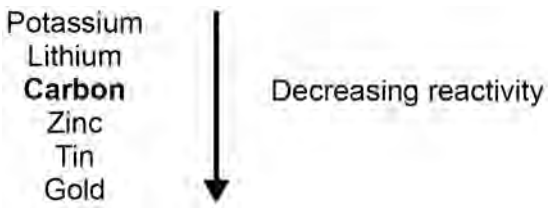
Question 33 · continued

June 2024 | 8462/1F | Original Q6

0 6 . 5 **Figure 13** shows part of the reactivity series of metals.

The non-metal carbon has been included.

Figure 13



Metals can be extracted from their compounds by:

- electrolysis
- reduction with carbon.

Electrolysis is more expensive than reduction with carbon.

Predict one metal that would be extracted by each method.

Use Figure 13.

[2 marks]

Extracted by electrolysis _____

Extracted by carbon reduction _____

10

4.4.1.2 The reactivity series

Question 34

June 2024 | 8462/1F | Original Q7

0 7 This question is about chemical cells.

0 7 . 1 A student connects four 1.5 V cells in series to make a battery.

What is the total voltage produced by the battery?

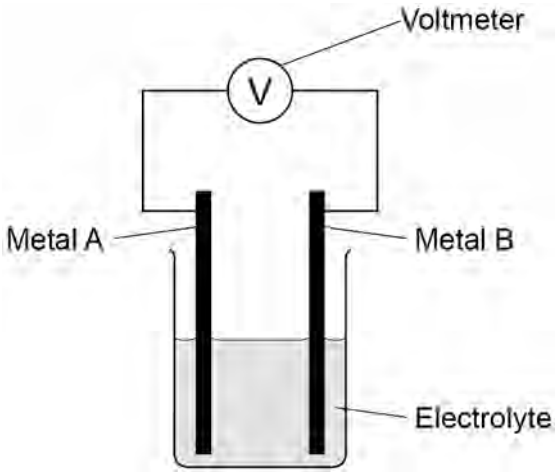
[1 mark]

Voltage = _____ V

A chemical cell can be made using two different metals in contact with an electrolyte.

Figure 14 shows a chemical cell.

Figure 14



0 7 . 2 Which is a suitable electrolyte for a chemical cell?

[1 mark]

Tick (✓) **one** box.

Pure water ☐

Solid lead bromide ☐

Sodium chloride solution ☐

4.4.1.2 The reactivity series

Question 34 · continued

0 7 . 3 A student made the hypothesis:

'The voltage produced by a cell depends on the difference in the reactivity of metal **A** and metal **B**.'

Plan an investigation to test this hypothesis.

Your plan should produce valid results.

Use **Figure 14**.

[6 marks]

8

4.4.1.2 The reactivity series

Question 35

June 2024 | 8462/1F | Original Q9

0 9 This question is about the periodic table.

Sodium and potassium are in Group 1 of the periodic table.

0 9 . 1 Give **one** similarity and **one** difference between the electronic structures of sodium and potassium.

[2 marks]

Similarity _____

_____

Difference _____

_____

Group 1 elements react with water.

0 9 . 2 Give **two** observations made when potassium reacts with water.

[2 marks]

1 _____

_____

2 _____

_____

0 9 . 3 Potassium hydroxide solution is produced when potassium reacts with water.

What is the colour of universal indicator when added to potassium hydroxide solution?

Give **one** reason for your answer.

[2 marks]

Colour of universal indicator _____

Reason _____

_____

Question 35 · continued

Table 4 shows the densities of some of the elements in Group 0 of the periodic table.

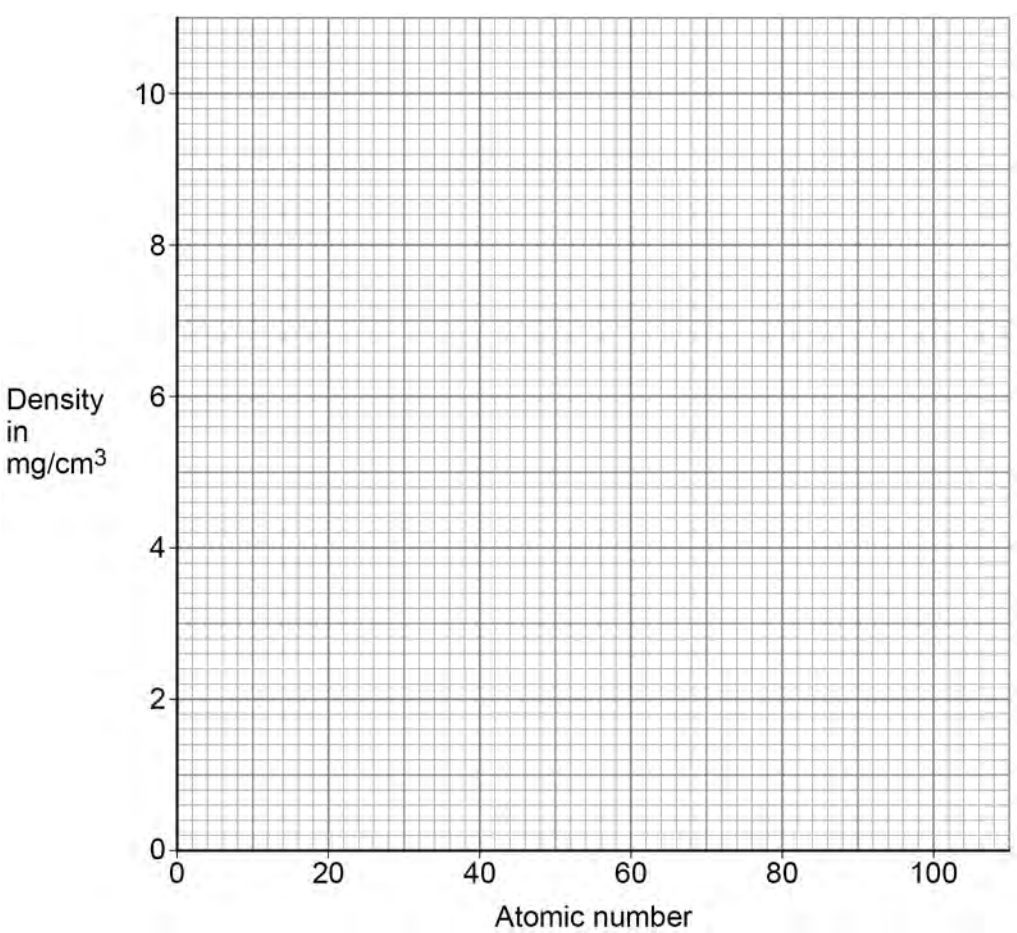
Table 4

Element	Atomic number	Density in mg/cm^3
Helium	2	0.2
Neon	10	0.8
Argon	18	1.6
Krypton	36	**X**
Xenon	54	5.4
Radon	86	9.1

0 9 . 4 Plot the data from **Table 4** on **Figure 15**.

[2 marks]

Figure 15



4.4.1.2 The reactivity series

Question 35 · continued

0 9 . 5 Estimate the density (**X**) of krypton.

Use **Figure 15** and **Table 4**.

[1 mark]

Density = _____ mg/cm^3

0 9 . 6 The elements in Group 7 are called the halogens.

A more reactive halogen can displace a less reactive halogen from a solution of its salt.

Which combination of solutions will produce a reaction when mixed?

[1 mark]

Tick (✓) **one** box.

Chlorine and potassium fluoride ☐

Chlorine and potassium bromide ☐

Bromine and potassium fluoride ☐

Bromine and potassium chloride ☐

0 9 . 7 Which of the following describes the trends going down Group 7?

[1 mark]

Tick (✓) **one** box.

Relative molecular mass decreases and boiling point decreases. ☐

Relative molecular mass decreases and boiling point increases. ☐

Relative molecular mass increases and boiling point decreases. ☐

Relative molecular mass increases and boiling point increases. ☐

11

4.4.1.2 The reactivity series

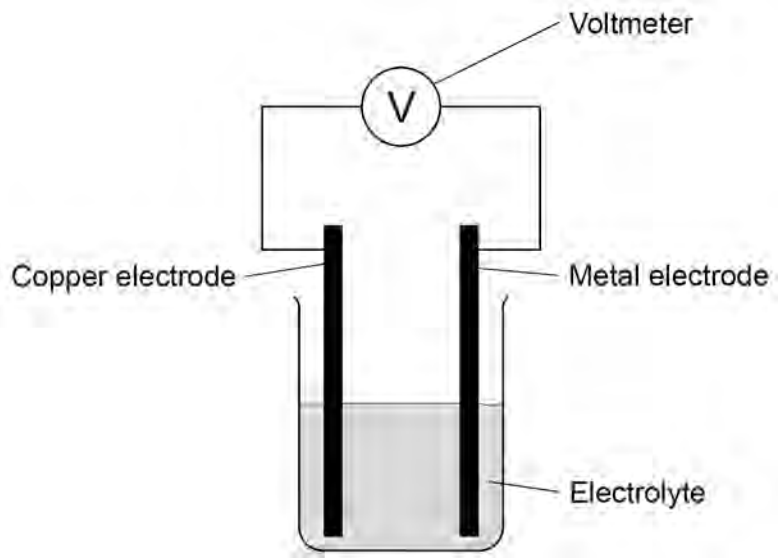
Question 36

0 3 Cells contain chemicals that react to produce electricity.

A student investigated the voltage produced by four different cells.

Figure 3 shows the apparatus.

Figure 3



This is the method used.

1. Measure the voltage produced by the cell using metal **A** as the metal electrode.
2. Repeat using different metals as the metal electrode.

Table 2 shows the results.

Table 2

Metal electrode	Voltage in volts
A	1.1
B	0.0
C	0.8
D	2.7

4.4.1.2 The reactivity series

Question 36 · continued

0 3 . 1 Which substance could be used as the electrolyte in the cell in **Figure 3**?

[1 mark]

Tick (✓) **one** box.

Pure water ☐

Sodium chloride solution ☐

Solid potassium bromide ☐

0 3 . 2 Which metal **A**, **B**, **C** or **D** was copper?

Give **one** reason for your answer.

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

[2 marks]

Metal _____

Reason _____

_____

0 3 . 3 Write the four metals **A**, **B**, **C** and **D** in order of reactivity.

Use **Table 2**.

[1 mark]

Most reactive _____

_____

_____

Least reactive _____

4.4.1.2 The reactivity series

Question 36 · continued

0 3 . 4 A battery consists of several cells connected together in series.

Each cell has a voltage of 3.6 V.

Calculate the number of cells needed to make a battery of voltage 14.4 V.

[2 marks]

Number of cells = _____

0 3 . 5 Fuel cells can be used to power electric cars.

Complete the sentence.

Choose the answer from the box.

[1 mark]

ammonia	**methane**	**water**

The overall reaction in a hydrogen fuel cell involves the oxidation of hydrogen to produce _____.

0 3 . 6 Rechargeable cells can be recharged when an external electrical current is supplied.

Complete the sentence.

[1 mark]

When an external electrical current is supplied to a rechargeable cell, the chemical reaction is _____.

8