AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.1.2.3

Metals and non-metals

Past-paper questions

Tier	**Foundation**
Question groups	**20**
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.

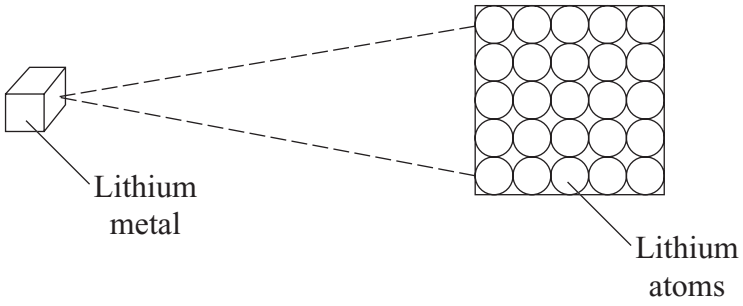
4.1.2.3 Metals and non-metals

Question 01

January 2007 | CHY1F | Original Q1 | Legacy

1 Lithium metal is used in alkaline batteries.

(a) The diagram shows the atoms in lithium metal.



Why is lithium metal described as an element?

.....

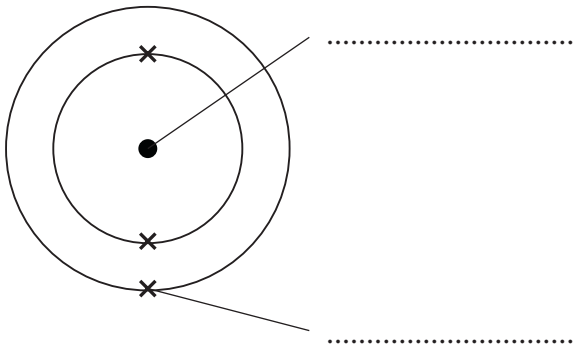
.....

(1 mark)

(b) The diagram below represents a lithium atom.

Choose words from the box to label parts of the atom.

bond	**electron**	**molecule**	**nucleus**



(2 marks)

3

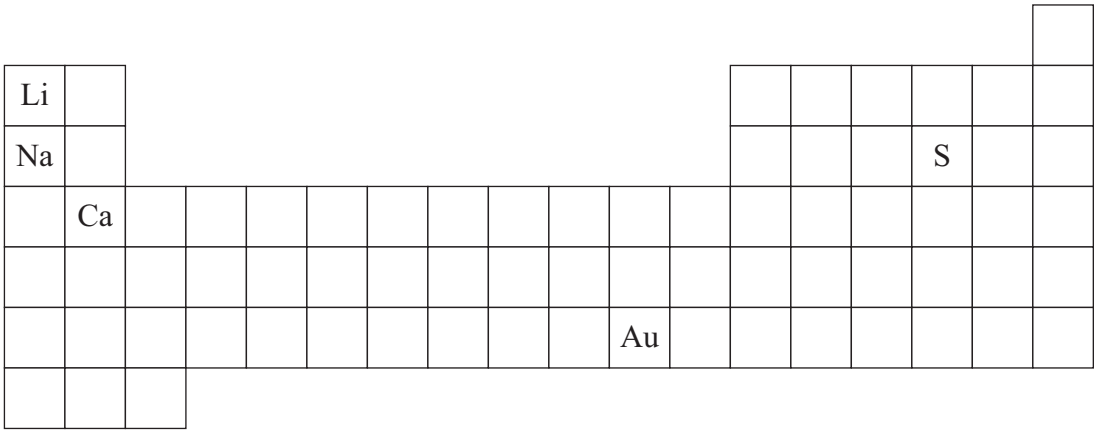
4.1.2.3 Metals and non-metals

Question 02

June 2007 | CHY1A | Original Q2 | Legacy

QUESTION TWO

The diagram shows the position of some elements in the periodic table.



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

A gold (Au)

B lithium (Li)

C calcium (Ca)

D sulfur (S)

	What we can say about the element
1	It is combined with the element oxygen in quicklime.
2	It is in a compound that produces acid rain.
3	It is an unreactive transition metal.
4	It has similar chemical properties to sodium.

4.1.2.3 Metals and non-metals

Question 03

November 2007 | CHY1A | Original Q4 | Legacy

QUESTION FOUR

This question is about four elements **A**, **B**, **C** and **D**.

	Melting point in °C	Boiling point in °C	Density in grams per cm^3	Electrical conductivity
Element A	115	444	2.10	very poor
Element B	–101	–35	0.003	very poor
Element C	1083	2600	8.90	very good
Element D	98	890	0.97	good

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

Element	Property of the element
1	It is the metal with the lowest density.
2	It is the non-metal that is a gas at 20 °C.
3	It is the metal with the highest melting point.
4	It is the non-metal with the highest boiling point.

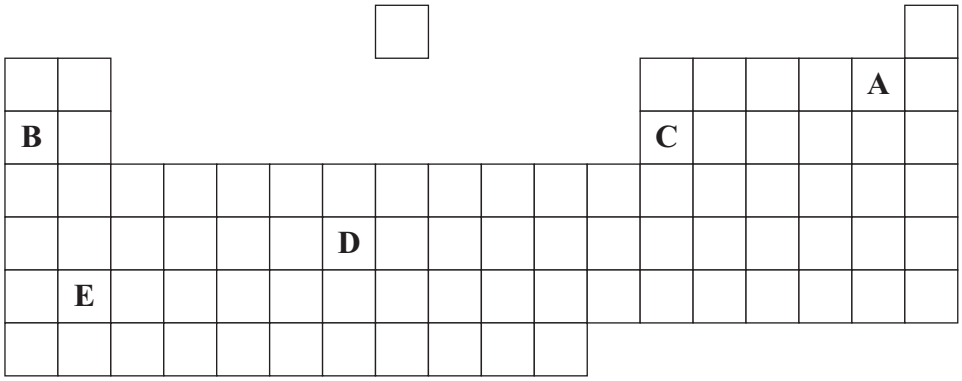
4.1.2.3 Metals and non-metals

Question 04

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)

4.1.2.3 Metals and non-metals

Question 04 · 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

4.1.2.3 Metals and non-metals

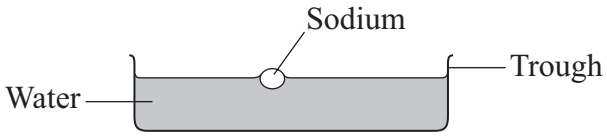
Question 05

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)

4.1.2.3 Metals and non-metals

Question 05 · 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

4.1.2.3 Metals and non-metals

Question 06

March 2009 | CHY1AP | Original Q3 | Legacy

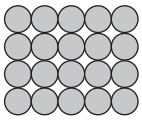
QUESTION THREE

The diagrams show the arrangement of atoms in each of four substances, **A**, **B**, **C** and **D**, at room temperature (20 °C).

Substance **A**



Substance **B**



Substance **C**



Substance **D**



Key

- An atom of oxygen
- An atom of carbon
- An atom of iron
- An atom of hydrogen

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

	Description of the substance
1	It is an element that is a gas.
2	It is an element that is a solid.
3	It is a compound that is a gas.
4	It is a compound that is a liquid.

4.1.2.3 Metals and non-metals

Question 07

March 2009 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

This question is about four elements, **A**, **B**, **C** and **D**.

	Melting point in °C	Boiling point in °C	Density in g per cm^3	Electrical conductivity
A	64	774	0.9	good
B	–218	–183	0.00014	very poor
C	–39	357	13.6	very good
D	115	444	2.1	very poor

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

	Property of the element
1	It is the element with the highest melting point.
2	It is a gas at room temperature (20 °C).
3	It is the metal with the lowest density.
4	It is the metal that is liquid at room temperature (20 °C).

4.1.2.3 Metals and non-metals

Question 08

June 2009 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

This question is about four metal ores.

	Name of ore	Formula	
A	Haematite	Fe_2O_3	Fe = iron; O = oxygen
B	Silver ore	Ag	Ag = silver
C	Chalcopyrite	$CuFeS_2$	Cu = copper; Fe = iron; S = sulfur
D	Bauxite	Al_2O_3	Al = aluminium; O = oxygen

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

1	It contains two metals.
2	It is an oxide of iron.
3	It contains the uncombined metal.
4	It cannot be reduced by mixing with carbon then heating.

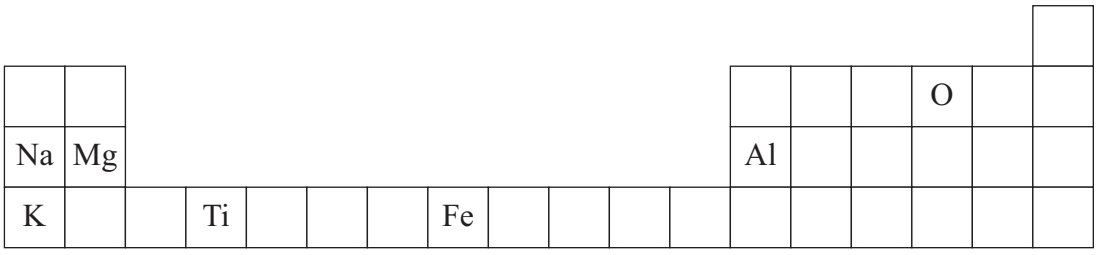
4.1.2.3 Metals and non-metals

Question 09

March 2010 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

This is part of the periodic table.



8A What do the metals Fe (iron) and Ti (titanium) have in common?

1 They belong to the same group in the periodic table.

2 They are transition metals.

3 They do **not** conduct electricity.

4 They are resistant to corrosion.

8B When Fe (iron) and O (oxygen) react, iron atoms join with oxygen atoms to form iron oxide, Fe_2O_3

When this happens, . . .

1 the nuclei from iron and oxygen atoms join together.

2 electrons are lost and new atoms form.

3 electrons are transferred and chemical bonds hold the atoms together.

4 the nuclei are transferred and new atoms form.

8C Fe (iron) and O (oxygen) are in the periodic table but Fe_2O_3 (iron oxide) is not.

This is because iron oxide is . . .

1 an alloy.

2 a compound.

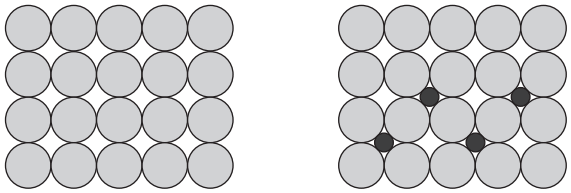
3 an ore.

4 a gas.

4.1.2.3 Metals and non-metals

Question 09 · continued

8D The diagram shows the arrangement of atoms in pure iron and in steel.



Pure iron **Steel**

Which row in the table shows the metal that is harder **and** correctly explains why it is harder?

	Harder metal	Explanation
1	Pure iron	It contains only one type of atom.
2	Steel	The atoms cannot easily slide over each other.
3	Pure iron	The atoms cannot easily slide over each other.
4	Steel	It contains only one type of atom.

4.1.2.3 Metals and non-metals

Question 10

7 Calamine lotion is used to treat itching. The main ingredients are two metal oxides.



7 (a) One of the metal oxides has a relative formula mass (M_r) of 81.

The formula of this metal oxide is MO.
(M is **not** the correct symbol for the metal.)

The relative atomic mass (A_r) of oxygen is 16.

7 (a) (i) Calculate the relative atomic mass (A_r) of metal M.

.....

.....

.....

Relative atomic mass (A_r) = ...

(2 marks)

7 (a) (ii) Use your answer to part (a)(i) and the periodic table on the Data Sheet to name metal M.

The name of metal M is ..... .

(1 mark)

4.1.2.3 Metals and non-metals

Question 10 · continued

7 (b) The other metal oxide is iron(III) oxide.

This contains iron(III) ions (Fe^{3+}) and oxide ions (O^{2-}).

7 (b) (i) Explain in terms of electrons how an iron atom (Fe) can change into an iron(III) ion (Fe^{3+}).

.....

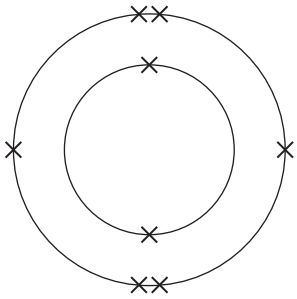
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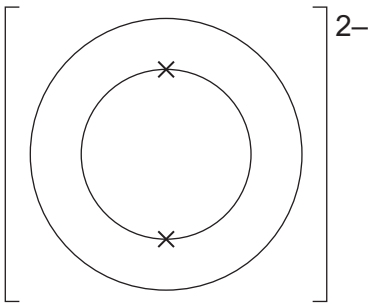
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(2 marks)

7 (b) (ii) The diagram below represents the electronic structure of an oxygen atom (O).



Complete the diagram below to show the electronic structure of an oxide ion (O^{2-}).



(1 mark)

6

4.1.2.3 Metals and non-metals

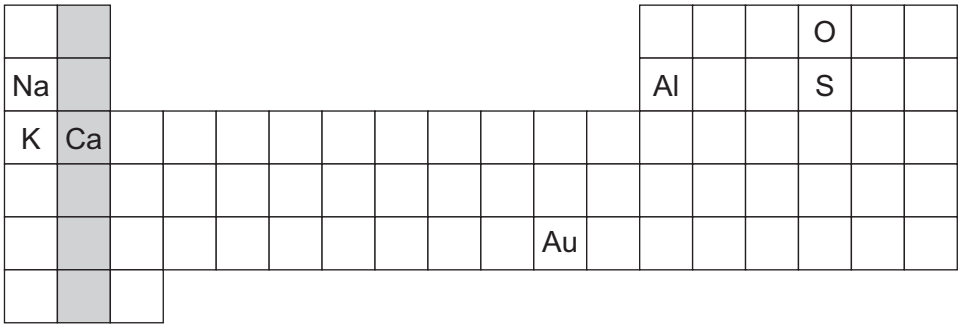
Question 11

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** . . . .

4.1.2.3 Metals and non-metals

Question 12

June 2013 | CH3FP | Original Q3 | Legacy

3 This question is about the periodic table.

Use the Chemistry Data Sheet to help you answer these questions.

3 (a) Complete the sentences.

Elements in the periodic table are arranged in order of atomic ..... .

The elements in Group ..... are called the noble gases.

(2 marks)

3 (b) Calcium (Ca) is in Group 2.

Name **one** other element in Group 2.

.....

(1 mark)

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

3 (c) (i) Sodium (Na) is

an alkali metal.

a non-metal.

a transition metal.

(1 mark)

3 (c) (ii) Nickel (Ni) is

an alkali metal.

a non-metal.

a transition metal.

(1 mark)

3 (d) In 1869 Mendeleev produced his periodic table.

Why did Mendeleev leave gaps in his periodic table?

.....

.....

(1 mark)

6

4.1.2.3 Metals and non-metals

Question 13

June 2015 | CH1FP | Original Q1 | Legacy

1 This question is about metals.

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

[1 mark]

Tick (✓) **one** box.

aluminium ☐

gold ☐

magnesium ☐

1 (b) Complete the sentence.

[1 mark]

Aluminium is an element because aluminium is made of

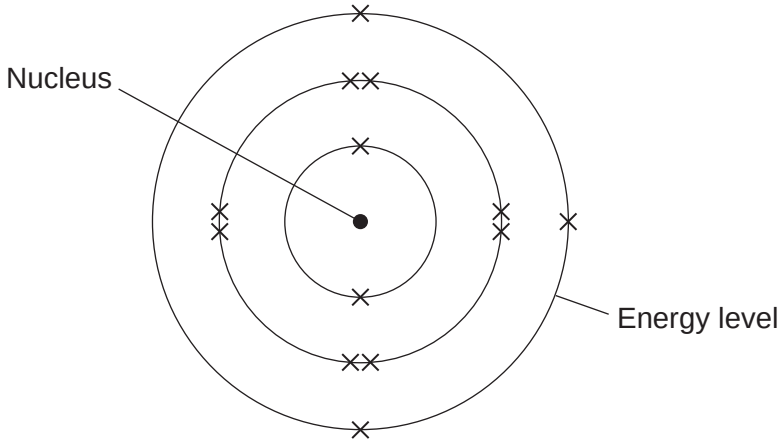
only one type of ..... .

4.1.2.3 Metals and non-metals

Question 13 · continued

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

Figure 1



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

[2 marks]

electrons	**ions**	**protons**	**neutrons**	**shells**

The nucleus of an aluminium atom contains ..... and ..... .

1 (c) (ii) Complete the sentence.

[1 mark]

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

Question 1 continues on the next page

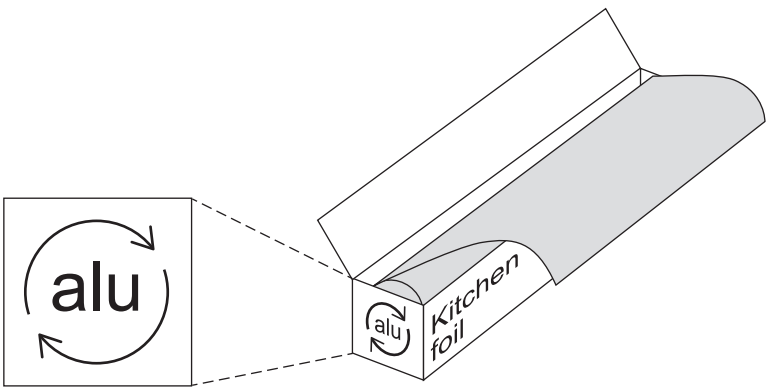
4.1.2.3 Metals and non-metals

Question 13 · continued

1 (d) Aluminium is used for kitchen foil.

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

Figure 2



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

1 (d) (i) What is the correct chemical symbol for aluminium? ..... .

[1 mark]

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

[2 marks]

.....

.....

.....

.....

1 (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.

[2 marks]

.....

.....

.....

.....

10

4.1.2.3 Metals and non-metals

Question 14

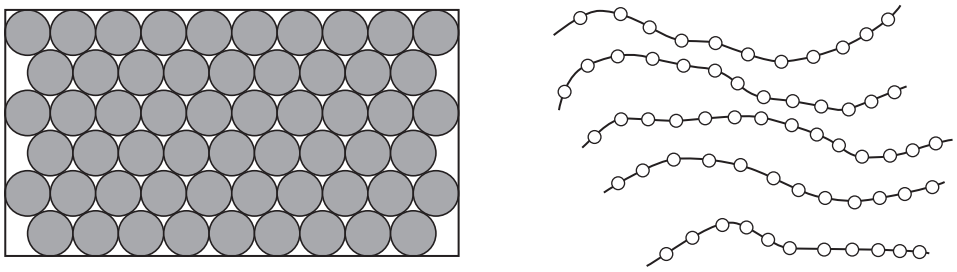
June 2017 | CH2FP | Original Q6 | Legacy

6 **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.**

Metals and thermosoftening polymers have different properties.

Figure 12 shows structures of a metal and a thermosoftening polymer.

Figure 12



Explain how the properties of a metal and a thermosoftening polymer relate to their structures.

In your answer you should describe the structures of a metal and a thermosoftening polymer.

[6 marks]

4.1.2.3 Metals and non-metals

Question 15

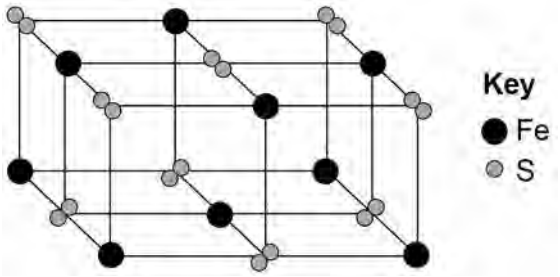
June 2018 | 8462/1F | Original Q9

0 9 This question is about metals and metal compounds.

0 9 . 1 Iron pyrites is an ionic compound.

Figure 12 shows a structure for iron pyrites.

Figure 12



Determine the formula of iron pyrites.

Use **Figure 12**.

[1 mark]

_____

0 9 . 2 An atom of iron is represented as $^{56}_{26}Fe$

Give the number of protons, neutrons and electrons in this atom of iron.

[3 marks]

Number of protons _____

Number of neutrons _____

Number of electrons _____

0 9 . 3 Iron is a transition metal.

Sodium is a Group 1 metal.

Give **two** differences between the properties of iron and sodium.

[2 marks]

1 _____

_____

2 _____

_____

4.1.2.3 Metals and non-metals

Question 15 · continued

Nickel is extracted from nickel oxide by reduction with carbon.

0 9 . 4 Explain why carbon can be used to extract nickel from nickel oxide.

[2 marks]

0 9 . 5 An equation for the reaction is:

$$NiO + C \rightarrow Ni + CO$$

Calculate the percentage atom economy for the reaction to produce nickel.

Relative atomic masses (A_r): C = 12 Ni = 59

Relative formula mass (M_r): NiO = 75

Give your answer to 3 significant figures.

[3 marks]

Percentage atom economy = _____ %

11

4.1.2.3 Metals and non-metals

Question 16

November 2021 | 8462/1F | Original Q1

0 1 This question is about elements, compounds and mixtures.

0 1 . 1 Substance **A** contains only one type of atom.

Substance **A** does **not** conduct electricity.

Which type of substance is **A**?

[1 mark]

Tick (✓) **one** box.

- Compound ☐
- Metallic element ☐
- Mixture ☐
- Non-metallic element ☐

0 1 . 2 Substance **B** contains two types of atoms.

The atoms are chemically combined together in fixed proportions.

Which type of substance is **B**?

[1 mark]

Tick (✓) **one** box.

- Compound ☐
- Metallic element ☐
- Mixture ☐
- Non-metallic element ☐

4.1.2.3 Metals and non-metals

Question 16 · continued

0 1 . 3 What is the name of the elements in Group 0 of the periodic table?

[1 mark]

Tick (✓) **one** box.

- Alkali metals ☐
- Halogens ☐
- Noble gases ☐
- Transition metals ☐

0 1 . 4 Which statement about the elements in Group 0 is correct?

[1 mark]

Tick (✓) **one** box.

- All elements in the group are very reactive. ☐
- All elements in the group form negative ions. ☐
- The boiling points increase down the group. ☐
- The relative atomic masses (A_r) decrease down the group. ☐

4.1.2.3 Metals and non-metals

Question 16 · continued

0 1 . 5 Neon is in Group 0.

What type of particles are in a sample of neon?

[1 mark]

Tick (✓) **one** box.

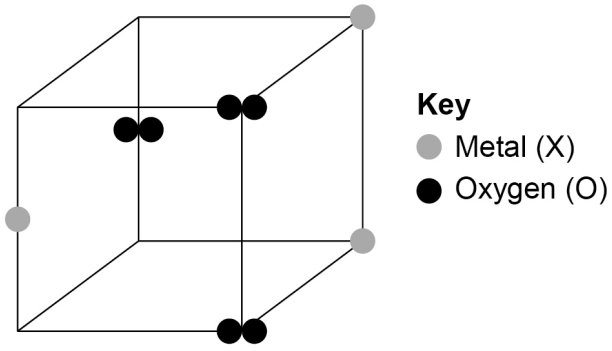
Atoms ☐

Ions ☐

Molecules ☐

0 1 . 6 **Figure 1** represents part of the structure of an oxide of a metal.

Figure 1



Determine the empirical formula of this oxide.

[1 mark]

Empirical formula = XO

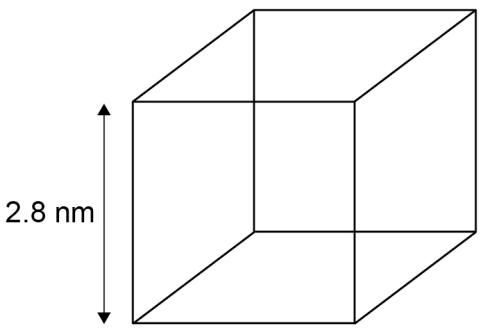
4.1.2.3 Metals and non-metals

Question 16 · continued

A nanoparticle of a metallic element is a cube.

Figure 2 shows a diagram of the nanoparticle.

Figure 2



0 1 . 7 The surface area of a cube is given by the equation:

surface area = (length of side)^2 × 6

Calculate the surface area of the cube in **Figure 2**.

Give your answer to 2 significant figures.

[3 marks]

Surface area (2 significant figures) = _____ nm^2

4.1.2.3 Metals and non-metals

Question 16 · continued

0 1 . 8 Fine and coarse particles of the metallic element are also cubes.

The length of a fine particle cube is 10 times smaller than the length of a coarse particle cube.

How does the surface area to volume ratio of the fine particle cube compare with that of the coarse particle cube?

[1 mark]

Tick (✓) **one** box.

Both surface area to volume ratios are the same. ☐

The surface area to volume ratio of the fine particle is 10 times greater. ☐

The surface area to volume ratio of the fine particle is 10 times smaller. ☐

10

Turn over for the next question

4.1.2.3 Metals and non-metals

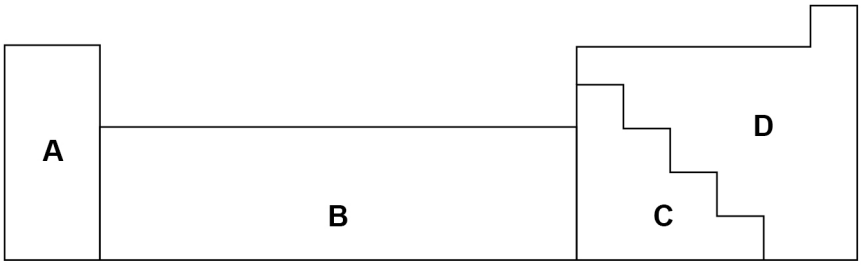
Question 17

June 2022 | 8462/1F | Original Q9

0 9 This question is about metals and non-metals.

Figure 15 shows an outline of part of the periodic table.

Figure 15



0 9 . 1 Element **Q** is a dull solid with a melting point of 44 °C.

Element **Q** does not conduct electricity.

Which section of the periodic table in **Figure 15** is most likely to contain element **Q**?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 9 . 2 Element **R** forms ions of formula R^{2+} and R^{3+}

Which section of the periodic table in **Figure 15** is most likely to contain element **R**?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 9 . 3 Give **two** differences between the physical properties of the elements in Group 1 and those of the transition elements.

[2 marks]

1 _____

_____

2 _____

_____

4.1.2.3 Metals and non-metals

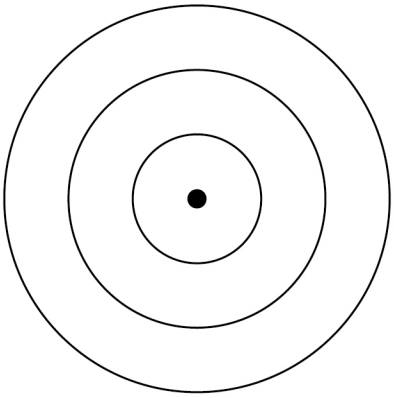
Question 17 · continued

0 9 . 4 Complete **Figure 16** to show the electronic structure of an aluminium atom.

Use the periodic table.

[1 mark]

Figure 16



0 9 . 5 Aluminium is a metal.

Describe how metals conduct electricity.

Answer in terms of electrons.

[3 marks]

0 9 . 6 Name the type of bonding in compounds formed between metals and non-metals.

[1 mark]

4.1.2.3 Metals and non-metals

Question 17 · continued

0 9 . 7 Magnesium oxide is a compound formed from the metal magnesium and the non-metal oxygen.

Describe what happens when a magnesium atom reacts with an oxygen atom.

You should refer to electrons in your answer.

[4 marks]

13

4.1.2.3 Metals and non-metals

Question 18

June 2023 | 8462/1F | Original Q6

0 6 This question is about metals.

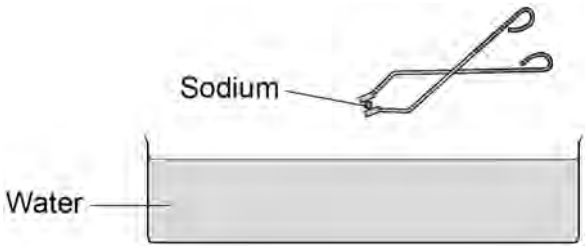
0 6 . 1 Platinum is used to make jewellery.

Suggest **one** reason why platinum is used to make jewellery.

[1 mark]

0 6 . 2 **Figure 7** shows a piece of sodium being added to water.

Figure 7



Give **two** observations that could be seen when sodium is added to water.

[2 marks]

1

2

Question 6 continues on the next page

4.1.2.3 Metals and non-metals

Question 18 · continued

0 6 . 3 Copper is a transition element.

Sodium is a Group 1 element.

What are **two** differences between copper and sodium?

[2 marks]

Tick (✓) **two** boxes.

- Copper has a lower melting point. ☐
- Copper is harder. ☐
- Copper is less dense. ☐
- Copper is less reactive. ☐
- Copper is less strong. ☐

4.1.2.3 Metals and non-metals

Question 18 · continued

0 6 . 4 The metals aluminium and copper can be used to make pans for cooking.

Table 2 shows information about the two metals.

The higher the value for thermal conductivity, the better the metal conducts thermal energy.

Table 2

	Aluminium	Copper
Thermal conductivity in arbitrary units	250	400
Density in g/cm^3	2.7	8.9
Cost of metal per kg in £	1.50	7.00

Evaluate the use of pans made of aluminium and of copper.

Use **Table 2**.

[4 marks]

9

4.1.2.3 Metals and non-metals

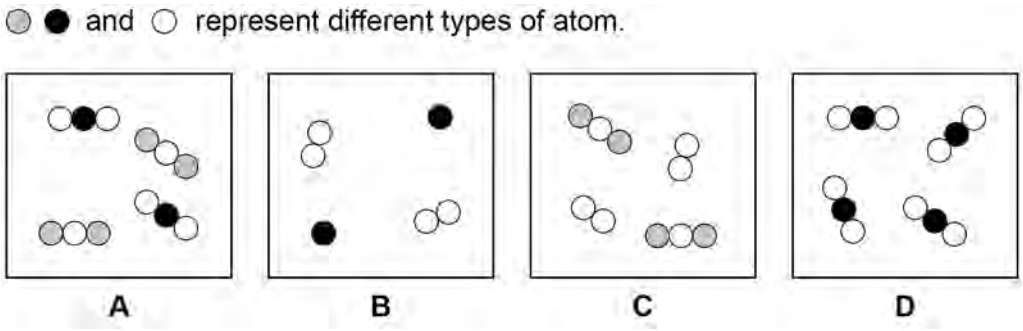
Question 19

June 2024 | 8462/1F | Original Q1

0 1 This question is about elements, compounds and mixtures.

Figure 1 shows diagrams which represent the atoms and molecules in different substances.

Figure 1



0 1 . 1 Which diagram in **Figure 1** represents a pure compound?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 2 Which diagram in **Figure 1** represents a mixture of an element and a compound?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Question 1 continues on the next page

4.1.2.3 Metals and non-metals

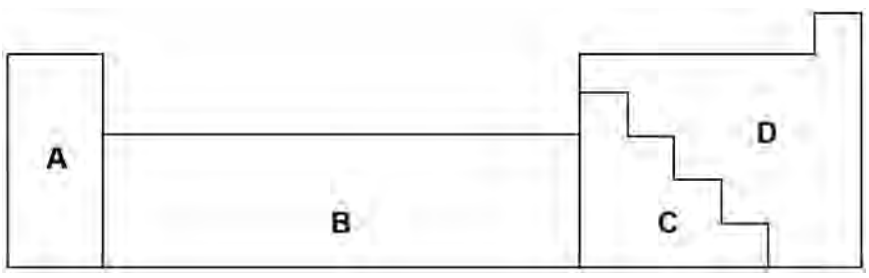
Question 19 · continued

0 1 . 3 Elements are metals or non-metals.

Figure 2 shows an outline of the periodic table.

The periodic table is divided into sections.

Figure 2



Where are metals found in the periodic table?

[1 mark]

Tick (✓) **one** box.

Section **A** only ☐

Sections **A**, **B** and **C** ☐

Sections **B**, **C** and **D** ☐

Section **D** only ☐

4.1.2.3 Metals and non-metals

Question 19 · continued

0 1 . 4 Which **two** of the following are typical properties of a transition metal?

[2 marks]

Tick (✓) **two** boxes.

- Can be bent and shaped ☐
- Good conductor of electricity ☐
- Low density ☐
- Low melting point ☐
- Poor conductor of heat ☐

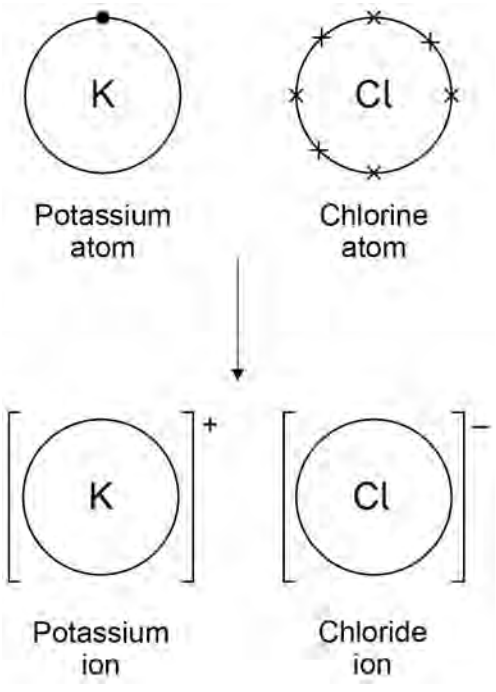
0 1 . 5 Potassium and chlorine react to produce potassium chloride.

An atom of potassium loses an electron to form a potassium ion.

An atom of chlorine gains an electron to form a chloride ion.

Complete the dot and cross diagram.

[2 marks]



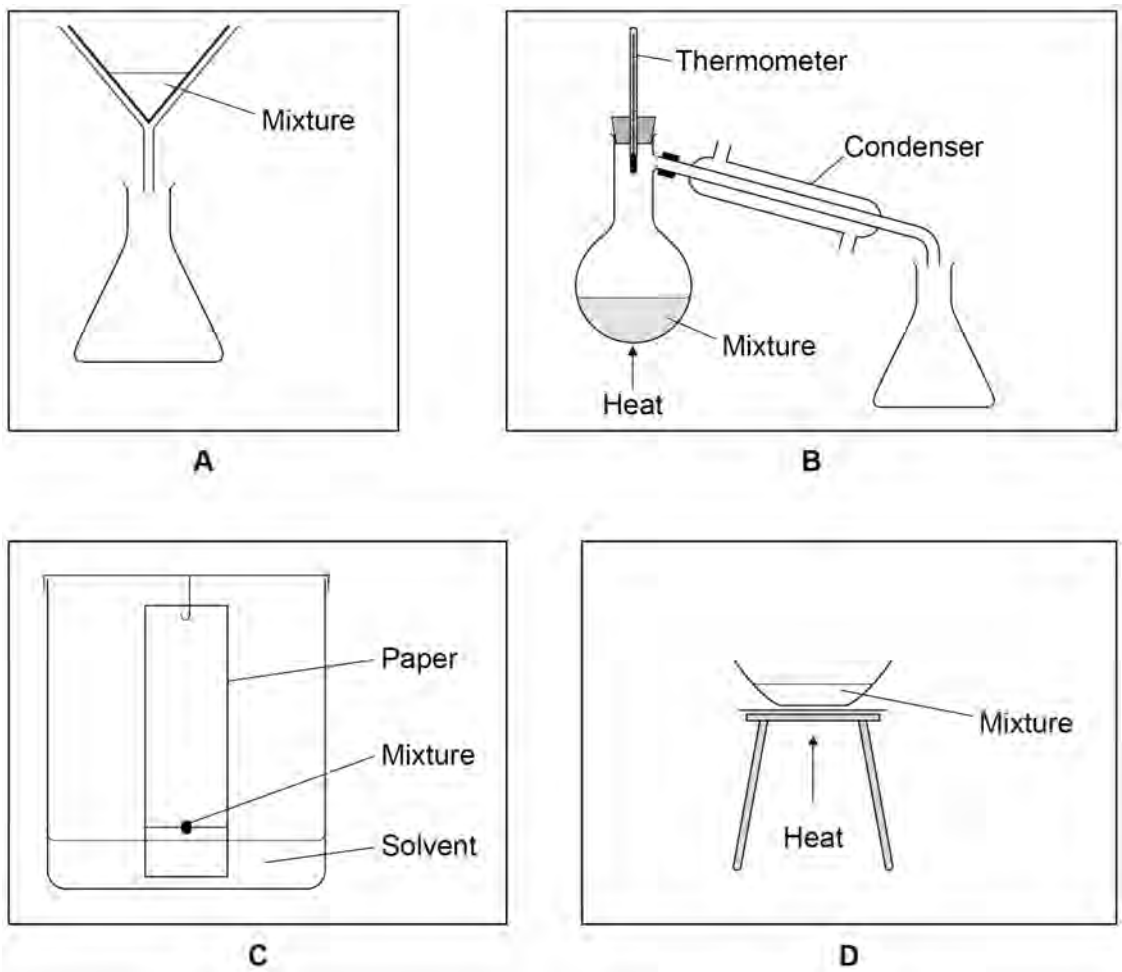
4.1.2.3 Metals and non-metals

Question 19 · continued

Mixtures are separated by different methods.

Figure 3 shows the apparatus for separating four different types of mixture.

Figure 3



4.1.2.3 Metals and non-metals

Question 19 · continued

0 1 . 6 Which apparatus could be used to collect water from sodium chloride solution?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 7 Which apparatus shows filtration?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

9

4.1.2.3 Metals and non-metals

Question 20

June 2025 | 8462/1F | Original Q8

0 8 This question is about elements in the periodic table.

0 8 . 1 Describe where the non-metallic elements are found in the periodic table.

[1 mark]

0 8 . 2 Gallium (Ga) is a metallic element in Group 3.

Which of these properties of gallium is **not** typical of most metals?

[1 mark]

Tick (✓) **one** box.

- A boiling point above 1000 °C ☐
- A melting point below 100 °C ☐
- Conducts electricity when solid ☐
- Forms positive ions ☐

4.1.2.3 Metals and non-metals

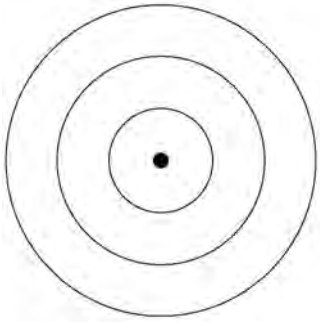
Question 20 · continued

0 8 . 3 A sodium atom can be represented as $^{23}_{11}Na$

Complete **Figure 12** to show the electronic structure of a sodium atom.

[1 mark]

Figure 12



0 8 . 4 Mendeleev created an early periodic table.

Mendeleev placed most of the elements in order of atomic weight.

Tellurium and iodine were not placed in order of atomic weight.

Why did Mendeleev **not** place tellurium and iodine in order of atomic weight?

[1 mark]

0 8 . 5 Argon is an element in Group 0 of the periodic table.

Explain why argon is unreactive.

[2 marks]

Question 20 · continued

An element **X** consists of two isotopes.

0 8 . 6 What is meant by 'isotopes'?

Answer in terms of subatomic particles.

[2 marks]

0 8 . 7 **Table 5** shows the mass numbers and percentage abundances of the isotopes of **X**.

Table 5

Mass number	Percentage abundance (%)
113	4
115	96

Which is the closest estimate to the relative atomic mass of **X**?

[1 mark]

Tick (✓) **one** box.

~113 ☐ ~114 ☐ ~115 ☐

9