AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.1.2.3

Metals and non-metals

Past-paper questions

Tier	**Higher**
Question groups	**14**
Available paper years	**2008–2025**

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.

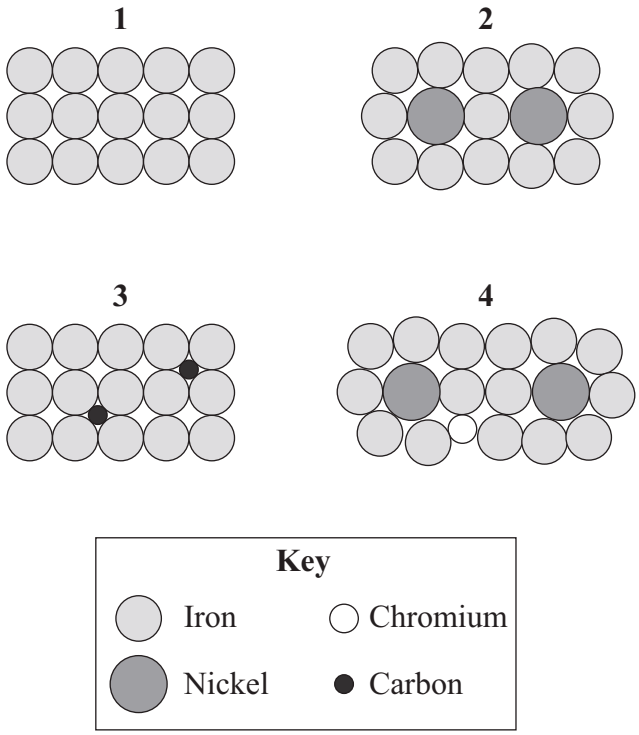
4.1.2.3 Metals and non-metals

Question 01

November 2008 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

The diagrams show the arrangement of atoms in a pure metal and in some alloys. The different circles represent atoms of different elements.



Match statements, **A**, **B**, **C** and **D**, with the diagrams **1–4**.

A It is a pure metal.

B It is the alloy that contains only two metals.

C It is a carbon steel alloy.

D It is the alloy that contains the largest number of different elements.

4.1.2.3 Metals and non-metals

Question 02

June 2009 | CHY1AP | Original Q7 | Legacy

QUESTION SEVEN

This question is about three metals, copper, lead and zinc.

7A Copper is found in the Earth's crust as the metal itself.

Lead and zinc are also found in the Earth's crust, but only as compounds such as oxides and sulfides.

These facts suggest that . . .

1 copper is a very reactive metal.

2 lead and zinc are transition metals, but copper is not.

3 lead and zinc react rapidly with oxygen and sulfur, but copper does not.

4 lead and zinc are more reactive than copper.

7B A naturally occurring compound of zinc is hydrozincite, $2ZnCO_3.3Zn(OH)_2$

Which row in the table correctly shows the number of elements, and the number of atoms of oxygen in the formula for hydrozincite?

	Number of elements	Number of atoms of oxygen
1	4	12
2	4	8
3	5	5
4	6	4

Question 02 · continued

7C Zinc is also found as zincite, ZnO.

The metal can be extracted from zincite by mixing it with carbon and heating strongly.

Which row in the table correctly shows the name for this process and the products?

	Name of process	Products
1	electrolysis	zinc and carbon dioxide
2	leaching	zinc and oxygen
3	reduction	zinc and oxygen
4	reduction	zinc and carbon dioxide

Lead and zinc compounds are often found together in the same ore.

The metals can be extracted by mixing the ore with carbon and heating strongly in a furnace. They can then be separated.

The table shows the melting points and boiling points of lead and zinc.

	Lead	Zinc
Melting point in °C	328	420
Boiling point in °C	1740	907

The furnace operates at a temperature of 1200 °C.

7D How will the lead and zinc be separated?

1 Molten lead remains in the furnace and the zinc evaporates.

2 Molten lead and molten zinc form two separate layers in the furnace.

3 Molten zinc remains in the furnace and the lead evaporates.

4 Zinc and lead vapours leave the furnace and are separated in a condenser.

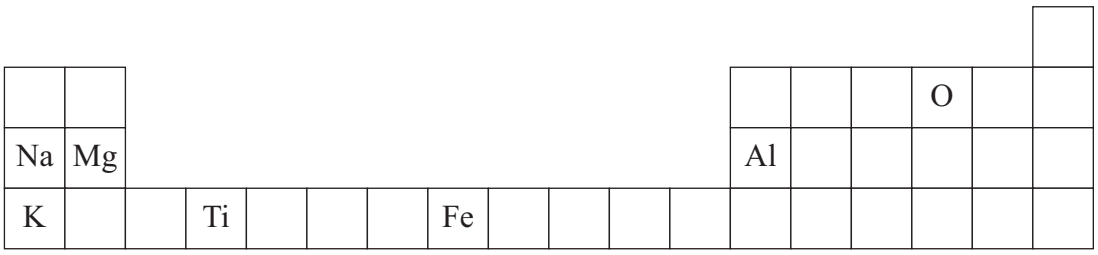
4.1.2.3 Metals and non-metals

Question 03

March 2010 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

This is part of the periodic table.



3A 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.

3B 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.

Question 03 · continued

3C Fe (iron) and O (oxygen) are in the periodic table but Fe_2O_3 (iron oxide) is not.

This is because iron oxide is . . .

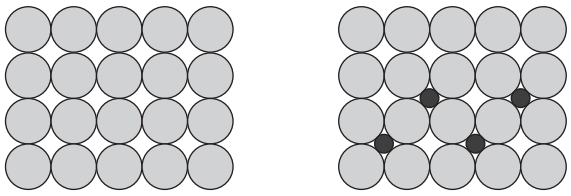
1 an alloy.

2 a compound.

3 an ore.

4 a gas.

3D 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 04

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



2 (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.

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

.....

.....

.....

Relative atomic mass (A_r) = ...

(2 marks)

2 (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 04 · continued

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

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

2 (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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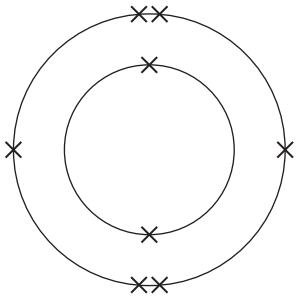
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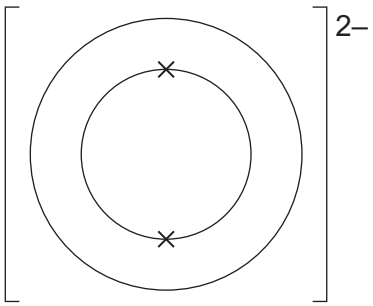
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(2 marks)

2 (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)

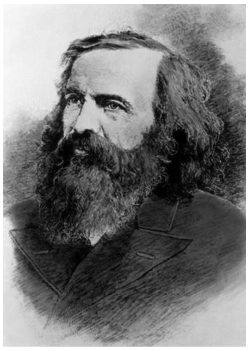
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4.1.2.3 Metals and non-metals

Question 05

June 2011 | CHY3H | Original Q3 | Legacy

3 Use the periodic table on the Data Sheet and the information below to help you answer these questions.



Mendeleev was one of the first chemists who classified elements in a systematic way based on atomic weight. He suggested his version of the periodic table in 1869.

He put the elements in order of their atomic weights but reversed the order for some pairs of elements. Then he arranged them in a table so that chemically similar elements were in columns known as Groups. He also left gaps and made predictions.

Part of Mendeleev's table is shown below.

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7
H						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca	#	Ti	V	Cr	Mn
Cu	Zn	#	#	As	Se	Br
Rb	Sr	Y	Zr	Nb	Mo	#
Ag	Cd	In	Sn	Sb	Te	I

The gaps Mendeleev left are shown by #.

3 (a) Which group of elements in the modern periodic table is missing from Mendeleev's table?

.....

(1 mark)

4.1.2.3 Metals and non-metals

Question 05 · continued

3 (b) Mendeleev reversed the order for some pairs of elements. For example, he put tellurium (Te, atomic weight 128) before iodine (I, atomic weight 127), as shown in his table.

Why did he do this?

.....

.....

(1 mark)

3 (c) In 1869 many chemists did **not** agree with Mendeleev's periodic table.

Suggest **three** reasons why.

.....

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(3 marks)

3 (d) In the 20th century, the arrangement of elements in the periodic table was explained in terms of atomic structure.

Describe the links between atomic structure and the periodic table.

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.....

.....

(2 marks)

7

4.1.2.3 Metals and non-metals

Question 06

June 2015 | CH1HP | Original Q1 | Legacy

1 This question is about atomic structure and elements.

1 (a) Complete the sentences.

1 (a) (i) The atomic number of an atom is the number of ..... .

[1 mark]

1 (a) (ii) The mass number of an atom is the number of .....

..... .

[1 mark]

1 (b) Explain why an atom has no overall charge.

Use the relative electrical charges of sub-atomic particles in your explanation.

[2 marks]

.....

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1 (c) Explain why fluorine and chlorine are in the same group of the periodic table.

Give the electronic structures of fluorine and chlorine in your explanation.

[2 marks]

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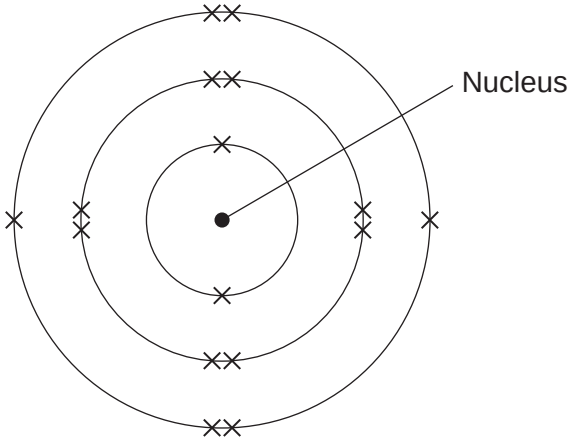
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4.1.2.3 Metals and non-metals

Question 06 · continued

1 (d) **Figure 1** shows the electronic structure of an atom of a non-metal.

Figure 1



What is the chemical symbol of this non-metal?

[1 mark]

Tick (✓) **one** box.

Ar ☐

O ☐

S ☐

Si ☐

1 (e) When elements react, their atoms join with other atoms to form compounds.

Complete the sentences.

1 (e) (i) Compounds formed when non-metals react with metals consist of

particles called ..... .

[1 mark]

1 (e) (ii) Compounds formed from only non-metals consist of

particles called ..... .

[1 mark]

9

4.1.2.3 Metals and non-metals

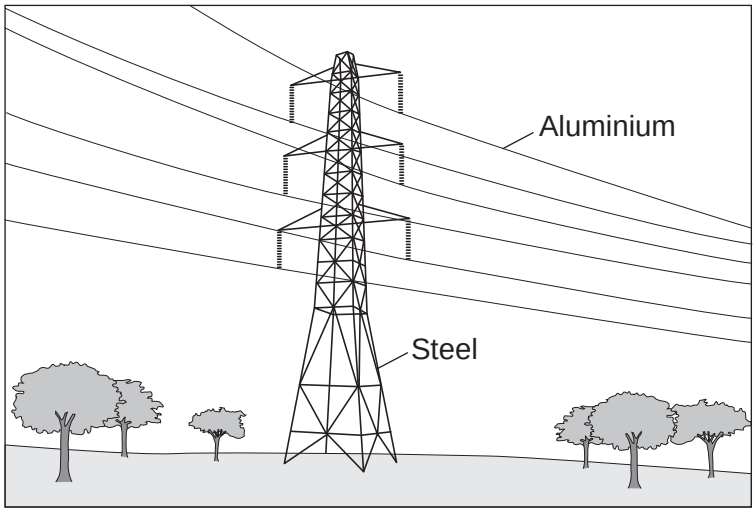
Question 07

June 2015 | CH1HP | Original Q4 | Legacy

4 This question is about metals.

Figure 4 shows the metals used to make pylons and the wires of overhead cables.

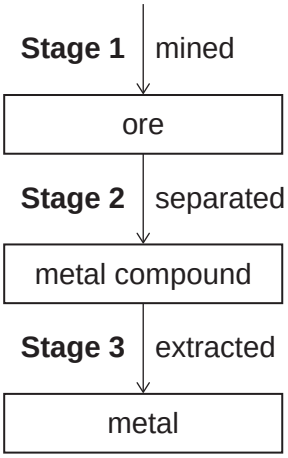
Figure 4



4 (a) An ore contains a metal compound.

A metal is extracted from its ore in three main stages, as shown in **Figure 5**.

Figure 5



Explain why **Stage 2** needs to be done.

[2 marks]

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.....

.....

.....

4.1.2.3 Metals and non-metals

Question 07 · continued

4 (b) Cast iron from a blast furnace contains 96% iron and 4% carbon.

4 (b) (i) Cast iron is not suitable for the manufacture of pylons.

Give **one** reason why.

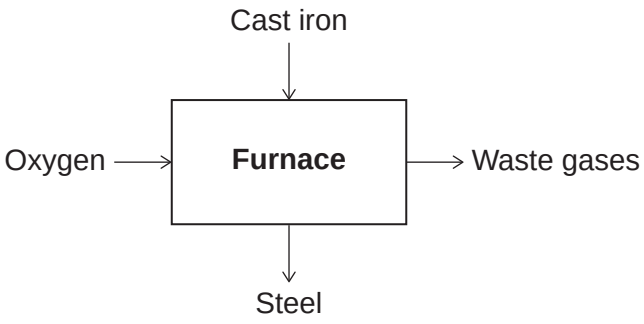
[1 mark]

.....

.....

4 (b) (ii) Most cast iron is converted into steel, as shown in **Figure 6**.

Figure 6



Describe how cast iron is converted into steel.

Use **Figure 6** to help you to answer this question.

[2 marks]

.....

.....

.....

.....

Question 4 continues on the next page

4.1.2.3 Metals and non-metals

Question 07 · continued

4 (c) Aluminium and copper are good conductors of electricity.

4 (c) (i) State **one** property that makes aluminium more suitable than copper for overhead cables.

[1 mark]

.....

.....

4 (c) (ii) How can you tell that copper is a transition metal and aluminium is **not** a transition metal from the position of each metal in the periodic table?

[2 marks]

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4 (c) (iii) Copper can be extracted from solutions of copper salts by adding iron.

Explain why.

[2 marks]

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10

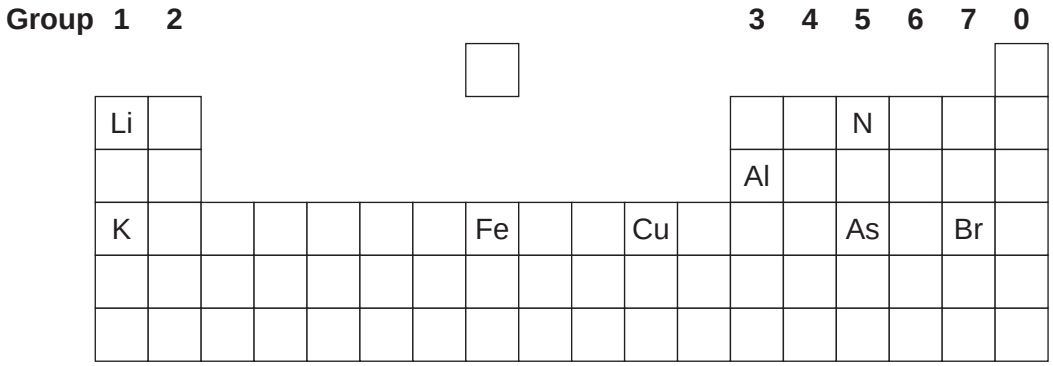
4.1.2.3 Metals and non-metals

Question 08

June 2015 | CH3HP | Original Q1 | Legacy

1 **Figure 1** shows the positions of eight elements in the modern periodic table.

Figure 1



Choose the correct chemical symbols from **Figure 1** to complete each sentence.

1 (a) The **two** metals that react vigorously with water are ..... and ..... .

[1 mark]

1 (b) The element used as a catalyst in the Haber process is ..... .

[1 mark]

1 (c) The **two** elements with five electrons in their outer shell (highest energy level) are

..... and ..... .

[1 mark]

1 (d) Iron has ions with different charges.

The other metal that has ions with different charges is ..... .

[1 mark]

4

4.1.2.3 Metals and non-metals

Question 09

June 2016 | CH3HP | Original Q3 | Legacy

3 This question is about elements and the periodic table.

3 (a) Newlands and Mendeleev both produced early versions of the periodic table.

3 (a) (i) Complete the sentence.

[1 mark]

In their periodic tables, Newlands and Mendeleev arranged the elements in order of

_____ .

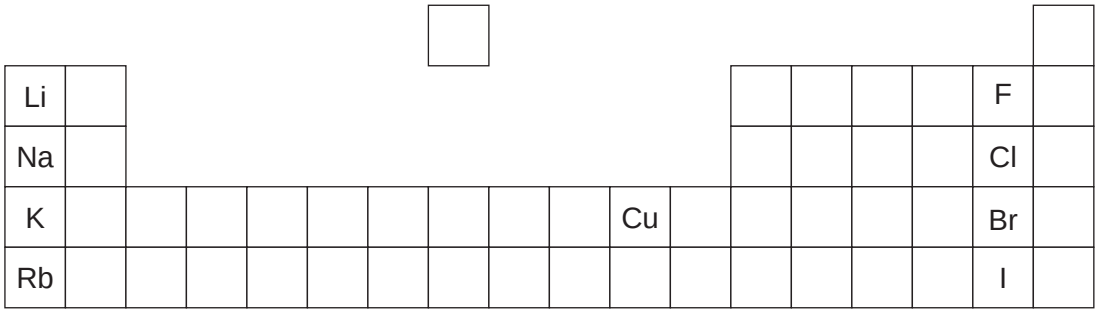
3 (a) (ii) Name the particle that allowed the elements to be arranged in order of their atomic number in the modern periodic table.

[1 mark]

_____

3 (b) **Figure 4** shows the position of nine elements in the modern periodic table.

Figure 4



3 (b) (i) Which **one** of the nine elements shown in **Figure 4** has the lowest boiling point?

[1 mark]

_____

3 (b) (ii) Copper and potassium have different melting points and boiling points.
Give **one other** difference between the properties of copper and potassium.

[1 mark]

_____

_____

4.1.2.3 Metals and non-metals

Question 09 · continued

3 (b) (iii) Explain why the reactivity of the elements increases going down Group 1 from lithium to rubidium but decreases going down Group 7 from fluorine to iodine.

[4 marks]

8

4.1.2.3 Metals and non-metals

Question 10

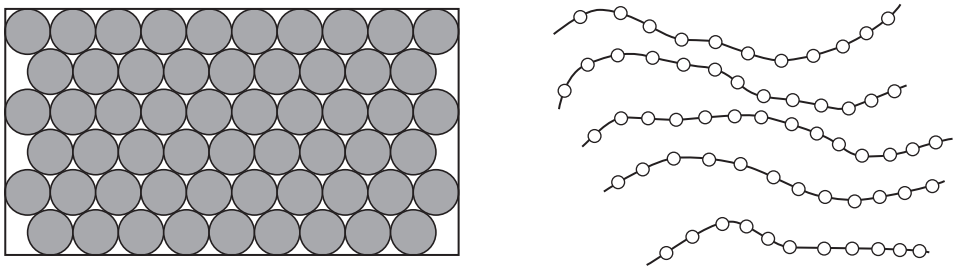
June 2017 | CH2HP | Original Q2 | Legacy

2 **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 3 shows structures of a metal and a thermosoftening polymer.

Figure 3



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

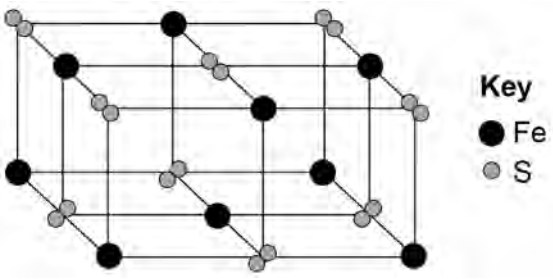
Question 11

0 2 This question is about metals and metal compounds.

0 2 . 1 Iron pyrites is an ionic compound.

Figure 1 shows a structure for iron pyrites.

Figure 1



Determine the formula of iron pyrites.

Use **Figure 1**.

[1 mark]

_____

0 2 . 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 2 . 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 11 · continued

Nickel is extracted from nickel oxide by reduction with carbon.

0 2 . 4 Explain why carbon can be used to extract nickel from nickel oxide.

[2 marks]

0 2 . 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

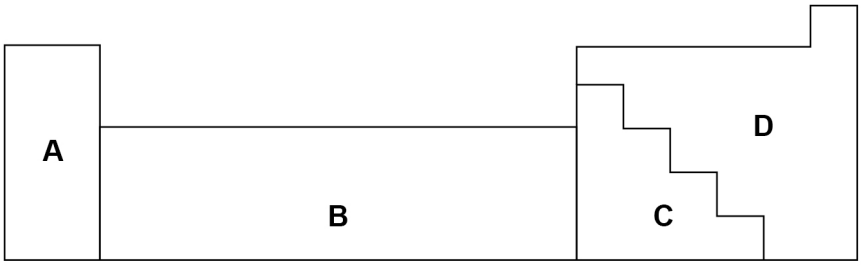
4.1.2.3 Metals and non-metals

Question 12

0 1 This question is about metals and non-metals.

Figure 1 shows an outline of part of the periodic table.

Figure 1



0 1 . 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 1** is most likely to contain element **Q**?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 2 Element **R** forms ions of formula R^{2+} and R^{3+}

Which section of the periodic table in **Figure 1** is most likely to contain element **R**?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 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

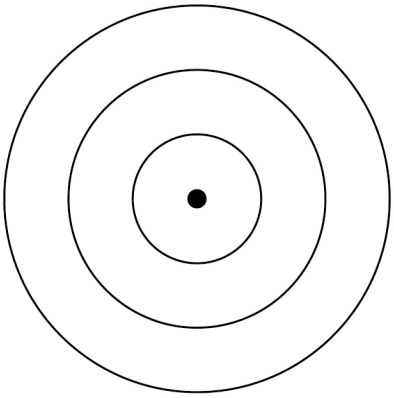
Question 12 · continued

0 1 . 4 Complete **Figure 2** to show the electronic structure of an aluminium atom.

Use the periodic table.

[1 mark]

Figure 2



0 1 . 5 Aluminium is a metal.

Describe how metals conduct electricity.

Answer in terms of electrons.

[3 marks]

0 1 . 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 12 · continued

0 1 . 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 13

June 2023 | 8462/1H | Original Q8

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

0 8 . 1 Argon has the atomic number 18

Explain why argon does **not** form compounds.

Answer in terms of electrons.

[2 marks]

0 8 . 2 Phosphorus (P) is the element below nitrogen in the periodic table.

Predict the formula of the compound formed between phosphorus and hydrogen.

[1 mark]

Formula = _____

0 8 . 3 Tellurium is the element with atomic number 52

Predict whether tellurium reacts with metals.

Explain your answer.

Answer in terms of the position of tellurium in the periodic table.

[2 marks]

4.1.2.3 Metals and non-metals

Question 13 · continued

Barium (Ba) is an element in Group 2 of the periodic table.

Barium reacts with hydrochloric acid.

0 8 . 4 Suggest **two** observations that could be made when barium reacts with hydrochloric acid.

[2 marks]

1 _____

_____

2 _____

_____

0 8 . 5 Write a balanced symbol equation for the reaction between barium and hydrochloric acid.

[3 marks]

_____ + _____ → _____ + _____

10

4.1.2.3 Metals and non-metals

Question 14

June 2025 | 8462/1H | Original Q1

0 1 This question is about elements in the periodic table.

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

[1 mark]

0 1 . 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

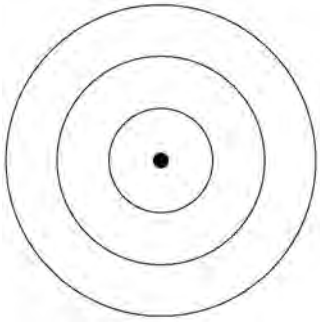
Question 14 · continued

0 1 . 3 A sodium atom can be represented as $^{23}_{11}Na$

Complete **Figure 1** to show the electronic structure of a sodium atom.

[1 mark]

Figure 1



0 1 . 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 1 . 5 Argon is an element in Group 0 of the periodic table.

Explain why argon is unreactive.

[2 marks]

4.1.2.3 Metals and non-metals

Question 14 · continued

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

0 1 . 6 What is meant by 'isotopes'?

Answer in terms of subatomic particles.

[2 marks]

0 1 . 7 **Table 1** shows the mass numbers and percentage abundances of the isotopes of **X**.

Table 1

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