AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.1.2.1

The periodic table

Past-paper questions

Tier	**Higher**
Question groups	**47**
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.

4.1.2.1 The periodic table

Question 01

November 2007 | CHY1A | Original Q6 | Legacy

QUESTION SIX

The diagram shows part of the periodic table.

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8
	Be						
Na	Mg	Al	Si	P	S	Cl	Ar
	Ca						
	Sr						

The row of substances from sodium (Na) to argon (Ar) is called a period.

6A Magnesium (Mg) and calcium (Ca) are placed in the same group of the periodic table because they . . .

1 have a similar colour.

2 have similar boiling points.

3 have similar chemical properties.

4 are next to each other in the reactivity series.

6B Magnesium (Mg) and sulfur (S) are in the same period.

Which row in the table below correctly shows one similarity and one difference between magnesium and sulfur?

	Similarity	Difference
1	Both are solids.	Magnesium is a non-metal; sulfur is a metal.
2	Both conduct electricity.	Magnesium is a solid; sulfur is a gas.
3	Both are solids.	Magnesium conducts electricity; sulfur does not.
4	Both conduct electricity.	Magnesium is a metal; sulfur is a non-metal.

4.1.2.1 The periodic table

Question 01 · continued November 2007 | CHY1A | Original Q6 | Legacy

6C Calcium (Ca) is in the periodic table but quicklime is not.

This is because . . .

1 calcium is a metal but quicklime is a non-metal.

2 calcium is an element but quicklime is a compound.

3 calcium is an element but quicklime is an alloy.

4 calcium is a metal but quicklime is a carbonate.

6D The balanced equation which shows the reaction between sodium and chlorine is . . .

1 $Na + Cl_2 \rightarrow NaCl_2$

2 $2Na + Cl_2 \rightarrow Na_2Cl_2$

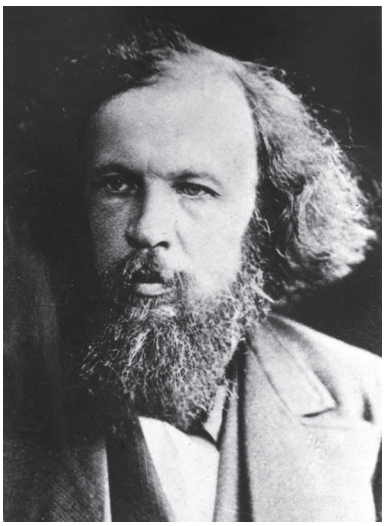
3 $2Na + Cl_2 \rightarrow 2NaCl$

4 $2Na + 2Cl_2 \rightarrow 2NaCl_2$

4.1.2.1 The periodic table

Question 02

4 Read the information about the periodic table.



When the Russian chemist Dimitri Mendeleev put forward his periodic table in 1869, the atomic structure of elements was unknown.

Mendeleev tried to arrange the elements in a meaningful way based on their chemical reactions. First he put the elements in order of their increasing atomic weight. He then put elements with similar properties in the same column.

However, he left gaps, and sometimes did not follow the order of increasing atomic weight – for example, he placed iodine (atomic weight 127) after tellurium (atomic weight 128).

Within a few years there was sufficient evidence to prove that Mendeleev was correct.

Our modern periodic table has evolved from Mendeleev's table.

The modern periodic table on the Data Sheet may help you to answer these questions.

(a) (i) State why Mendeleev left gaps.

.....

.....

(1 mark)

(ii) State why some elements were **not** placed in order of increasing atomic weight.

.....

.....

(1 mark)

4.1.2.1 The periodic table

Question 02 · continued

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(b) (i) The periodic table is now based on atomic structure.

Explain how.

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(3 marks)

(ii) Suggest why it is impossible to have an undiscovered element that would fit between sodium and magnesium.

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(1 mark)

(c) Explain, in terms of electrons, why fluorine is the most reactive element in Group 7.

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(3 marks)

9

4.1.2.1 The periodic table

Question 03

March 2008 | CHY1BP | Original Q5 | Legacy

QUESTION FIVE

The diagram shows part of the Periodic Table of the elements published in 1869.

Groups

1	2	3	4	5	6	7
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca					

About 30 years later, five noble gases were discovered.

5A How were the noble gases fitted into the Periodic Table?

1 They were put one each into the first five groups.

2 They were put into Groups 3 to 7.

3 A new group was created for them.

4 They were not included in the table.

5B Which one of the following explains why it took so long to discover the noble gases?

1 They have only very recently been found in high concentrations on Earth.

2 They are of very low density and are therefore found only in the upper atmosphere.

3 They are chemically unreactive and therefore difficult to detect.

4 They are so like the other gases in the atmosphere that they are difficult to separate.

4.1.2.1 The periodic table

Question 03 · continued March 2008 | CHY1BP | Original Q5 | Legacy

The Earth's atmosphere contains about 0.9% argon.

5C How much argon is there in a room with a volume of 50 cubic metres?

1 $0.018\,m^3$

2 $1.80\,m^3$

3 $0.45\,m^3$

4 $4.50\,m^3$

5D Which one of the following correctly describes the use of argon in discharge tubes for advertising signs?

1 It is radioactive, giving out a coloured glow.

2 It gives out a coloured glow under high voltage.

3 It is chemically unreactive and therefore harmless if it escapes.

4 It is of very low density and helps to support the weight of the tube.

4.1.2.1 The periodic table

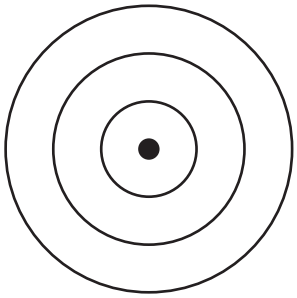
Question 04

June 2008 | CHY2H | Original Q7 | Legacy

7 Aluminium is a useful metal.

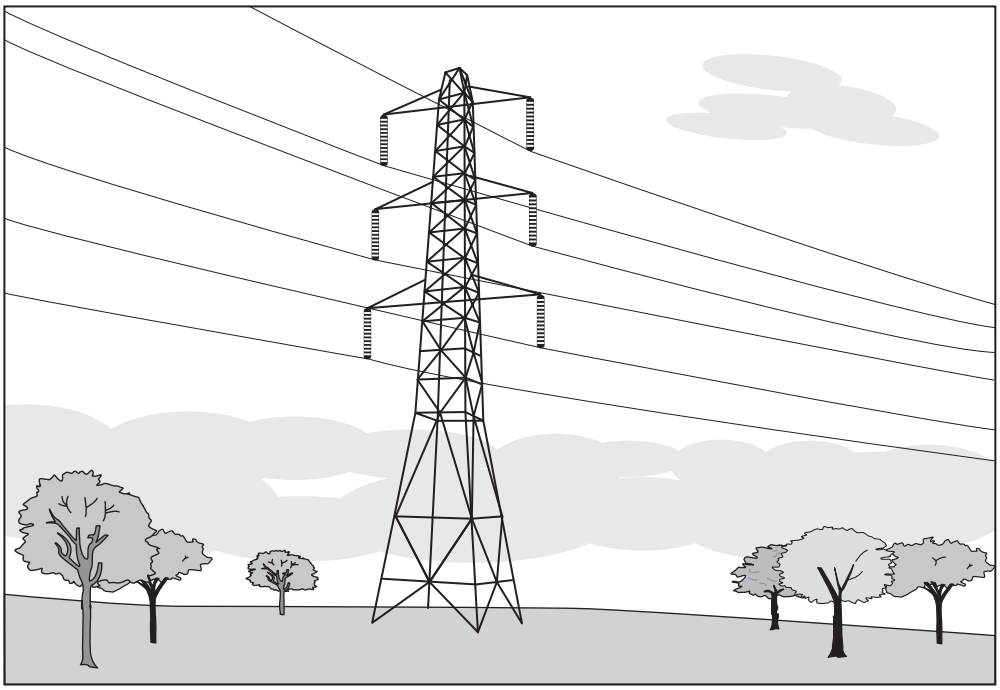
7 (a) The atomic number (proton number) of aluminium is 13.

Complete the diagram to show the electronic structure of an aluminium atom.
Use crosses (x) to represent the electrons.



(1 mark)

7 (b) Aluminium is used as the electrical conductor for overhead power cables.



Explain why metals are good conductors of electricity.

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.....

.....

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(2 marks)

3

4.1.2.1 The periodic table

Question 05

November 2008 | CHY1AP | Original Q7 | Legacy

QUESTION SEVEN

- Calcium reacts with water in this way:

$$Ca + 2H_2O \rightarrow Ca(OH)_2 + H_2$$

- Magnesium reacts in a similar way.
- Neither calcium nor magnesium can be obtained from their oxides by carbon reduction.

7A Look at the equation for the reaction between calcium and water.

On each side of the equation, there is a total of . . .

1 2 compounds.

2 4 elements.

3 6 atoms.

4 7 atoms.

7B The information given suggests that calcium is . . .

1 more reactive than both hydrogen and carbon.

2 more reactive than hydrogen but less reactive than carbon.

3 less reactive than hydrogen but more reactive than carbon.

4 less reactive than either hydrogen or carbon.

7C Which of the following is a correctly balanced equation for the reaction between calcium and nitric acid?

1 $2Ca + 2HNO_3 \rightarrow 2Ca(NO_3)_2 + H_2$

2 $Ca + 2HNO_3 \rightarrow Ca(NO_3)_2 + H_2$

3 $2Ca + HNO_3 \rightarrow 2Ca(NO_3)_2 + H_2$

4 $Ca + 2HNO_3 \rightarrow 2Ca(NO_3)_2 + 2H_2$

4.1.2.1 The periodic table

7D Calcium and magnesium are both in Group 2 of the periodic table.

This suggests that . . .

1 they are two of about 100 non-metallic elements.

2 their carbonates are likely to decompose differently on heating.

3 they are likely to be extracted from their ores by similar methods.

4 their carbonates will form the metal oxide and oxygen on heating.

Turn over for the next question

4.1.2.1 The periodic table

Question 06

November 2008 | CHY1BP | Original Q1 | Legacy

QUESTION ONE

This question is about some gases found in the Earth's atmosphere.

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

A carbon dioxide

B helium

C nitrogen

D oxygen

1	It is in Group 0 of the periodic table.
2	It makes up about 80 % of the atmosphere.
3	It is found in today's atmosphere in much smaller amounts than in Earth's early atmosphere.
4	It is used when fossil fuels burn.

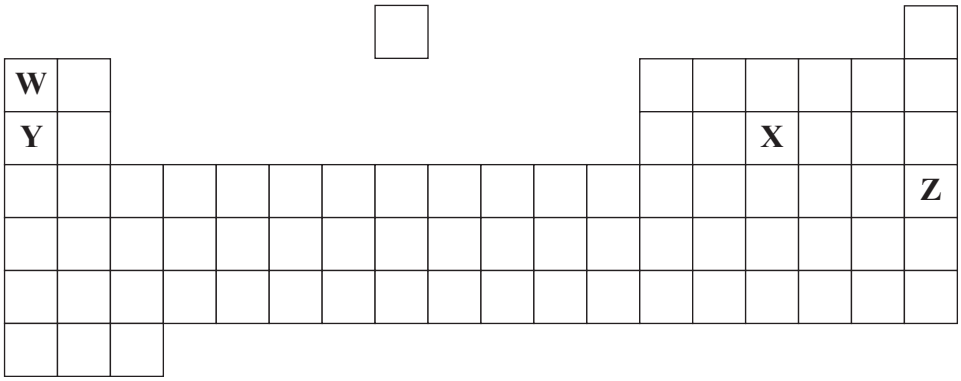
4.1.2.1 The periodic table

Question 07

March 2009 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The diagram represents the periodic table.



Four elements, **W**, **X**, **Y** and **Z**, are shown. The letters representing these elements are **not** their chemical symbols.

3A Which elements have chemical properties similar to element **W**?

1 both elements **X** and **Y**

2 only element **X**

3 only element **Y**

4 only element **Z**

3B What are the vertical columns called in the periodic table?

1 compounds

2 groups

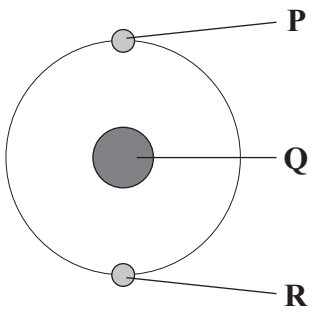
3 periods

4 tables

4.1.2.1 The periodic table

Question 07 · continued

3C The diagram shows an atom.



Which row in the table is correct?

	P	Q	R
1	electron	nucleus	electron
2	electron	nucleus	nucleus
3	nucleus	electron	electron
4	nucleus	nucleus	electron

3D In a chemical reaction, . . .

1 new types of atom are produced.

2 more atoms are produced.

3 the atoms rearrange themselves.

4 some atoms are lost.

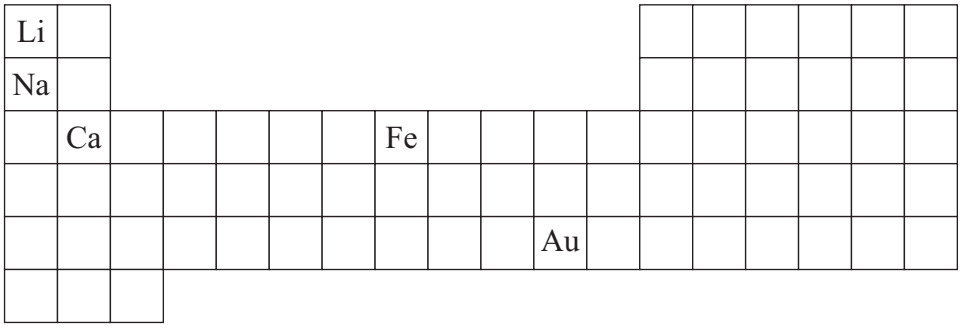
4.1.2.1 The periodic table

Question 08

November 2009 | CHY1AP | Original Q1 | Legacy

QUESTION ONE

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.

4.1.2.1 The periodic table

Question 09

January 2010 | CHY2H | Original Q3 | Legacy

3 (a) The table gives information about two isotopes of hydrogen, hydrogen-1 and hydrogen-2.

	Hydrogen-1	Hydrogen-2
Atomic number	1	1
Mass number	1	2

An atom of hydrogen-1 is represented as: $^{1}_{1}\mathbf{H}$

Show how an atom of hydrogen-2 is represented.

(1 mark)

3 (b) (i) Calculate the relative formula mass (M_r) of water, H_2O

Relative atomic masses: H = 1; O = 16.

.....

.....

Relative formula mass (M_r) = ...

(1 mark)

3 (b) (ii) Simple molecules like water have low boiling points.

Explain why, in terms of molecules.

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(2 marks)

4.1.2.1 The periodic table

Question 09 · continued

for mark

3 (c) Molecules of heavy water contain two atoms of hydrogen-2 instead of two atoms of hydrogen-1.

Explain why a molecule of heavy water has more mass than a normal water molecule. You should refer to the particles in the nucleus of the two different hydrogen atoms in your answer.

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(2 marks)

6

Turn over for the next question

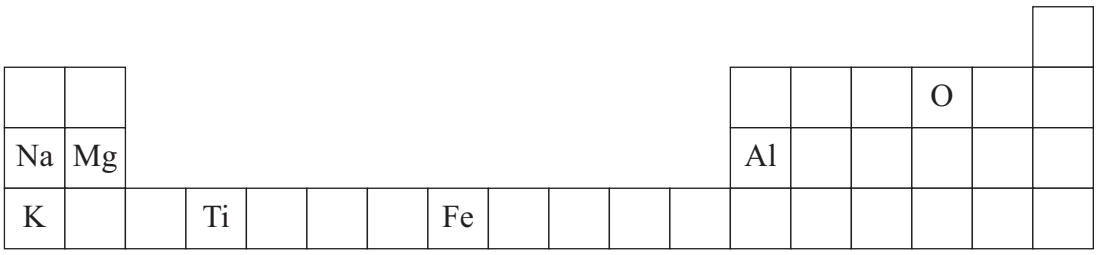
4.1.2.1 The periodic table

Question 10

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.

4.1.2.1 The periodic table

Question 10 · continued March 2010 | CHY1AP | Original Q3 | Legacy

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 . . .

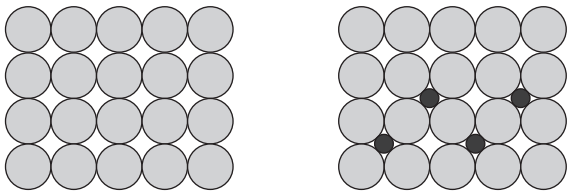
1 an alloy.

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.

4.1.2.1 The periodic table

Question 11

March 2010 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

The table below gives the temperatures at which some metal carbonates decompose.

Name of metal carbonate	Position of metal in periodic table	Temperature at which it decomposes
Sodium carbonate	Group 1	Decomposes only above its melting point of 851 °C
Calcium carbonate	Third in Group 2	825 °C
Magnesium carbonate	Second in Group 2	350 °C
Zinc carbonate	In the transition metal block	300 °C

8A Which of the following pairs of carbonates would decompose at 750 °C?

1 sodium carbonate and calcium carbonate

2 calcium carbonate and magnesium carbonate

3 sodium carbonate and zinc carbonate

4 magnesium carbonate and zinc carbonate

8B A valid conclusion that can be drawn from the temperatures in the table is that . . .

1 transition metal carbonates are the most thermally stable.

2 Group 2 metal carbonates become less thermally stable down the group.

3 zinc carbonate is the least thermally stable.

4 Group 1 metal carbonates melt before they decompose.

4.1.2.1 The periodic table

8C Extracting metal carbonates, such as limestone, from the ground can cause environmental damage.

A mining company issued this statement:

> Our research shows that our method of mining for limestone causes very little environmental damage.

This statement is . . .

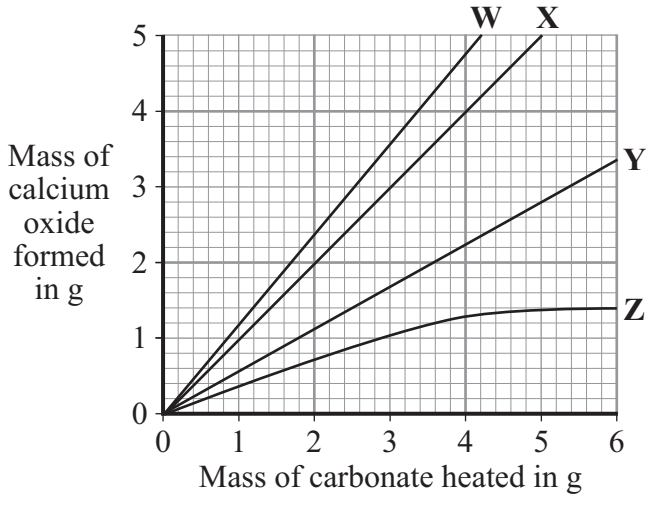
1 given on invalid evidence.

2 an invalid hypothesis.

3 a biased conclusion.

4 based on hearsay.

8D Assuming complete reaction, which of the following lines on the graph represents the mass of calcium oxide formed by heating different masses of calcium carbonate?



1 **W**

2 **X**

3 **Y**

4 **Z**

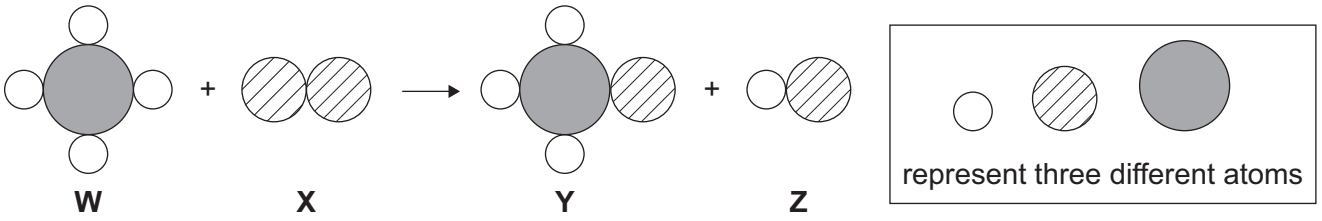
4.1.2.1 The periodic table

Question 12

November 2010 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The diagram shows the reaction between substances **W** and **X** to produce two new substances **Y** and **Z**.



3A Which statement about substance **Y** is correct?

1 It is a mixture of **W** and **X**.

2 It will have the same chemical properties as **W**.

3 It is a compound.

4 It has a total of 3 atoms.

3B In the formation of substances **Y** and **Z** from substances **W** and **X**, which statement is correct?

1 There is a decrease in mass.

2 There is an increase in mass.

3 No new chemical bonds are formed.

4 There is sharing or transfer of electrons.

4.1.2.1 The periodic table

3C Which substance would be found in the periodic table?

1 substance **W**

2 substance **X**

3 substance **Y**

4 substance **Z**

3D Which of the following statements is correct?

1 The total number of atoms stays the same during the reaction.

2 The reaction is an example of thermal decomposition.

3 Only atoms in substance **X** contain a nucleus.

4 Substance **W** contains five different elements.

Turn over for the next question

4.1.2.1 The periodic table

Question 13

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.

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.....

.....

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)

4.1.2.1 The periodic table

Question 13 · 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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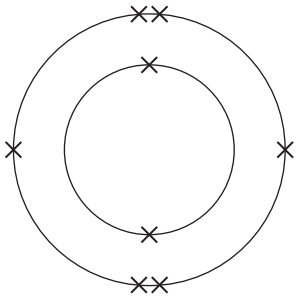
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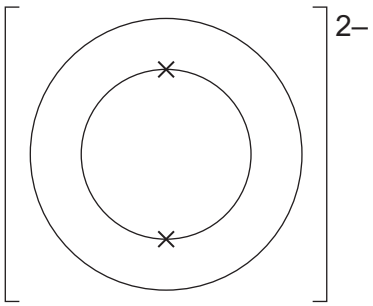
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(2 marks)

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)

6

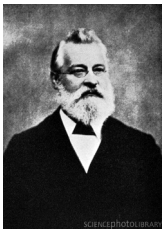
4.1.2.1 The periodic table

Question 14

January 2011 | CHY3H | Original Q4 | Legacy

4 The periodic table on the Data Sheet may help you answer these questions.

4 (a) Many chemists have contributed to the development of the periodic table.



John Newlands was one of the first chemists who attempted to classify elements in a systematic way based on atomic weight. In 1866 he suggested that there was a repeating pattern of elements with similar properties every eighth element.
Part of Newlands' periodic table is shown below.

H	Li	Be	B	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co, Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce, La	Zr	Di, Mo	Ro, Ru

Many chemists in 1866 did not accept Newlands' periodic table.

4 (a) (i) Give **one** piece of evidence which supports Newlands' ideas.

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(1 mark)

4 (a) (ii) Suggest **two** reasons why many chemists in 1866 did not accept Newlands' ideas.

1 .....

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2 .....

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(2 marks)

4.1.2.1 The periodic table

Question 14 · continued

4 (b) Chlorine, bromine and iodine are Group 7 elements.

A student investigated the reactivity of these elements.
The student added:

- aqueous chlorine to potassium bromide and potassium iodide solutions
- aqueous bromine to potassium chloride and potassium iodide solutions
- aqueous iodine to potassium chloride and potassium bromide solutions.

The student's results are shown below.

Solution	Potassium chloride	Potassium bromide	Potassium iodide
Chlorine		Solution turned orange-brown	Solution turned brown
Bromine	No reaction		Solution turned brown
Iodine	No reaction	No reaction	

4 (b) (i) Use these results to state **and** explain the trend in reactivity of these Group 7 elements.

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(2 marks)

4 (b) (ii) Complete the equation below, which represents the reaction between chlorine and potassium bromide.

Cl_2 + 2KBr ⟶ ..... + 2KCl

(1 mark)

4 (b) (iii) In terms of electronic structure, state why chlorine, bromine and iodine are in Group 7.

.....

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(1 mark)

4.1.2.1 The periodic table

Question 14 · continued

4 (c) Lithium, sodium and potassium are Group 1 elements.

Group 1 elements become **more** reactive down the group.

Explain why in terms of electronic structure.

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(3 marks)

10

Turn over for the next question

4.1.2.1 The periodic table

Question 15

March 2011 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

Haloalkanes are alkanes which have one or more hydrogen atoms replaced by halogen atoms.

The table shows properties of some haloalkanes.

Haloalkane	Formula	Density in g per cm^3	Boiling point in °C
Chloromethane	CH_3Cl	0.916	-24.1
Bromomethane	CH_3Br	1.676	3.7
Iodomethane	CH_3I	2.279	42.5
Chloroethane	CH_3CH_2Cl	0.898	12.4
Bromoethane	CH_3CH_2Br	1.461	38.5
Iodoethane	CH_3CH_2I	1.936	72.4
Dichloromethane	CH_2Cl_2	1.30	40.1
Trichloromethane	$CHCl_3$	1.50	61.8

9A From the information in the table, increasing the length of the carbon chain . . .

1 increases density but decreases boiling point.

2 increases density and boiling point.

3 decreases density but increases boiling point.

4 decreases density and boiling point.

9B From the information in the table, replacing more hydrogen atoms with halogen atoms causes . . .

1 no effect on the boiling point or the density.

2 an increase in boiling point and density.

3 an increase in boiling point only.

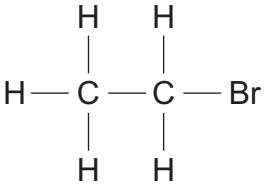
4 an increase in density only.

4.1.2.1 The periodic table

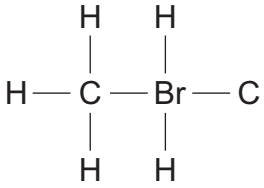
Question 15 · continued

9C Which is the correct structural formula for bromoethane?

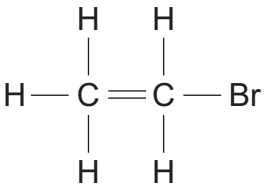
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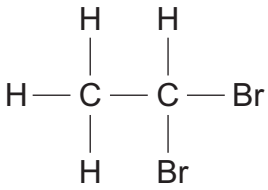
2



3



4



9D The order of the halogens in Group 7 of the periodic table is shown.

Group 7
Fluorine (F)
Chlorine (Cl)
Bromine (Br)
Iodine (I)

Which row in the table below shows the properties that fluoromethane might have?

	Density in g per cm^3	Boiling point in °C
1	0.6	15
2	1.8	−100
3	1.1	−30
4	0.6	−80

END OF TEST

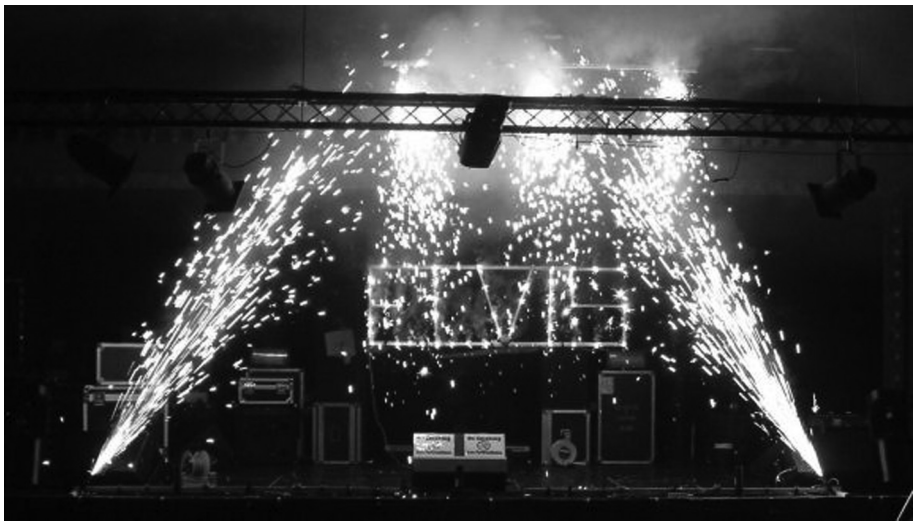
4.1.2.1 The periodic table

Question 16

June 2011 | CHY2H | Original Q4 | Legacy

4 Read the information in the box.

Flash powder is used to produce special effects at pop concerts.



Flash powder contains aluminium. The powder burns with a bright white flame and gives out lots of heat and light. It also produces white smoke.

The flash powder is placed on stage in a special container. At the bottom of the container there is a thin piece of wire. When the flash is needed, electricity is passed through the wire. The wire gets hot and starts the aluminium burning.

4 (a) When aluminium burns the reaction is *exothermic*.

What is the meaning of *exothermic?*

.....

.....

(1 mark)

4 (b) The hot wire provides energy to start the aluminium burning.

What is the name given to the heat energy needed to start a chemical reaction?

..... energy

(1 mark)

4.1.2.1 The periodic table

Question 16 · continued

4 (c) The white smoke produced is aluminium oxide.

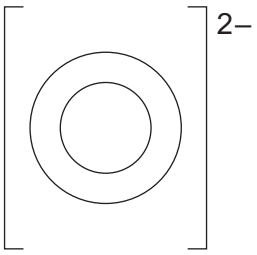
Aluminium oxide contains aluminium ions (Al^{3+}) and oxide ions (O^{2-}).

4 (c) (i) Complete the diagram to show the electronic structure of an oxide ion.

The atomic number of oxygen = 8

Use crosses (x) to represent the electrons.

oxide ion



(1 mark)

4 (c) (ii) The bonding in aluminium oxide is ionic.

What causes the aluminium ions and oxide ions to be held together strongly?

.....

.....

(1 mark)

4

4.1.2.1 The periodic table

Question 17

June 2011 | CHY2H | Original Q6 | Legacy

6 Lead compounds have been used for thousands of years as colours in paint.



6 (a) A sample of a red oxide used in paint was found to contain 6.21 g of lead and 0.64 g of oxygen.

Calculate the empirical (simplest) formula of this compound.

You **must** show all your working to gain full marks.

Relative atomic masses: O = 16; Pb = 207.

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(4 marks)

4.1.2.1 The periodic table

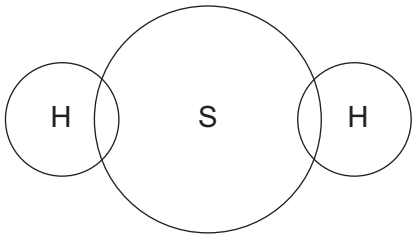
Question 17 · continued

6 (b) A problem with lead compounds is that they slowly react with hydrogen sulfide in the air. This produces lead sulfide which is black.

6 (b) (i) Hydrogen sulfide has the formula H_2S. The bonding in a molecule of hydrogen sulfide can be represented as:

H–S–H

Complete the diagram below to show the arrangement of the outer electrons of the hydrogen and sulfur atoms in hydrogen sulfide.
Use dots (•) and crosses (x) to represent the electrons.
You need only show the outer shell electrons.
(Atomic numbers: H = 1; S = 16.)



(1 mark)

6 (b) (ii) Hydrogen sulfide has a low boiling point.

Explain why.

.....

.....

.....

.....

(2 marks)

6 (b) (iii) Lead white is also used in paint. The white colour slowly darkens when lead sulfide is produced.

The painting can be restored with hydrogen peroxide. This converts the black lead sulfide into white lead sulfate.

Balance the equation for the reaction between lead sulfide and hydrogen peroxide (H_2O_2).

$$PbS(s) + ...H_2O_2(aq) \rightarrow PbSO_4(s) + 4H_2O(l)$$

(1 mark)

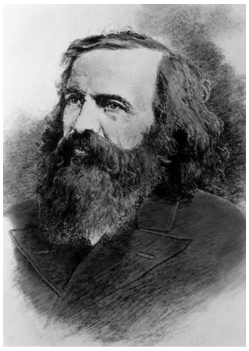
8

4.1.2.1 The periodic table

Question 18

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)

4.1.2.1 The periodic table

Question 18 · 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

4.1.2.1 The periodic table

Question 19

November 2011 | CHY1BP | Original Q6 | Legacy

QUESTION SIX

The atmosphere is made up of many different gases.

The abundance, melting points, and the boiling points of the noble gases are given in the table.

Noble gas	Abundance (percentage in the atmosphere by volume)	Melting point in °C	Boiling point in °C
Helium	0.0005	–272	–269
Neon	0.0018	–248	–229
Argon	0.93	–189	–186
Krypton	0.0001	–157	–153
Xenon	0.000009	–112	–108

6A Which of the following statements about the gases in the atmosphere is correct?

1 There is about 10 times as much argon as krypton.

2 There is about 20 times as much oxygen as argon.

3 There is about 4 times as much oxygen as nitrogen.

4 There is about 5 times as much nitrogen as oxygen.

6B Which noble gas is liquid over the largest temperature range?

1 neon

2 krypton

3 helium

4 argon

4.1.2.1 The periodic table

Question 19 · continued

6C Which row in the table below correctly describes the properties of the noble gases?

	Melting point/boiling point	Use	Position in the periodic table
1	Melting point above room temperature (20 °C)	Provides a reactive atmosphere	In group 0
2	Melting point below room temperature (20 °C)	Provides an unreactive atmosphere	In group 7
3	Boiling point below room temperature	Provides a reactive atmosphere	In group 1
4	Boiling point is higher than the melting point	Provides an unreactive atmosphere	In group 0

6D The average concentration of carbon dioxide in the atmosphere is about 390 parts per million (0.039 %).

Which row in the table below shows the best way to measure this amount?

	Instrument reading to . . .	How readings are taken and used
1	10 parts per million	In several locations in a small area and take an average
2	2 parts per million	Average the highest and lowest values obtained
3	10 parts per million	Take values from industrialised areas and take an average
4	2 parts per million	Average the values taken over a large number of randomly selected locations

4.1.2.1 The periodic table

Question 20

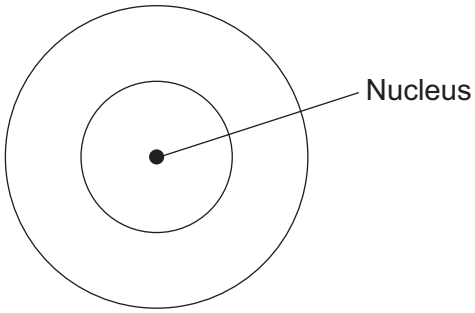
January 2012 | CH1HP | Original Q1 | Legacy

1 The picture shows a diamond ring.



1 (a) Diamond is a form of carbon. A carbon atom has six electrons.

Draw the electronic structure of a carbon atom.



(1 mark)

1 (b) A gold atom has an atomic number of 79 and a mass number of 197.

Complete the table to show the name and number of each sub-atomic particle in this gold atom.

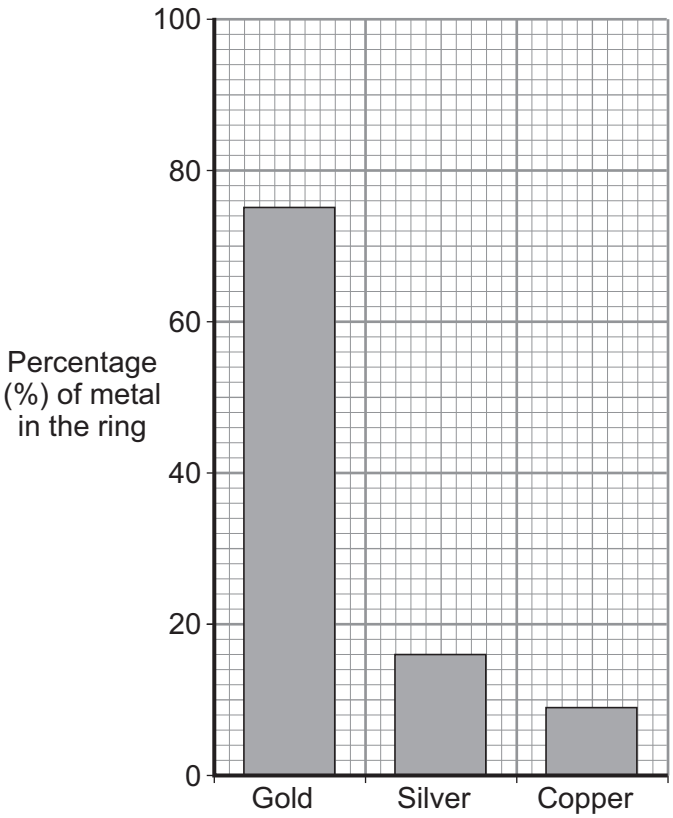
Name	Number
Proton	79
Electron	.....
.....	.....

(3 marks)

4.1.2.1 The periodic table

Question 20 · continued

1 (c) The bar chart shows the composition of this gold ring.



1 (c) (i) Give the percentage of the other two metals in this gold ring.

Silver is ..... % and copper is ..... %

(1 mark)

1 (c) (ii) This gold ring is not made from 100 % gold.

Give **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

(2 marks)

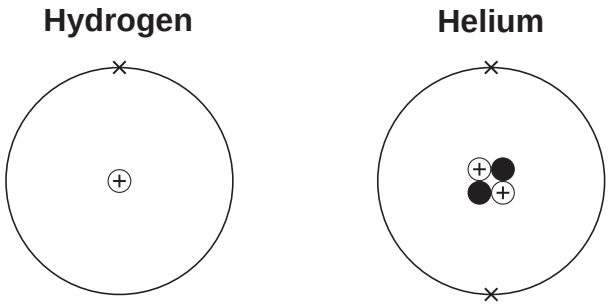
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4.1.2.1 The periodic table

Question 21

January 2013 | CH1HP | Original Q1 | Legacy

1 The Sun produces helium atoms from hydrogen atoms by nuclear fusion reactions.



1 (a) Describe the differences in the atomic structures of a hydrogen atom and a helium atom.

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(3 marks)

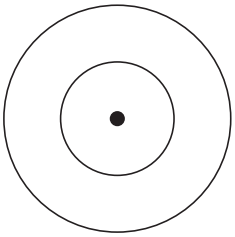
4.1.2.1 The periodic table

Question 21 · continued

1 (b) The Sun consists of 73% hydrogen and 25% helium.
The rest is other elements.
One of the other elements in the Sun is neon.

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

1 (b) (i) Complete the diagram to show the electronic structure of a neon atom.



(1 mark)

1 (b) (ii) Why is neon in the same group of the periodic table as helium?

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(1 mark)

5

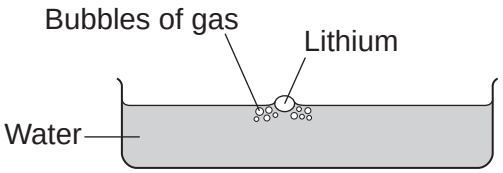
4.1.2.1 The periodic table

Question 22

June 2013 | CH3HP | Original Q1 | Legacy

1 Lithium is in Group 1 of the periodic table.

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



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

.....

(1 mark)

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

.....

(1 mark)

1 (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

4.1.2.1 The periodic table

Question 23

June 2014 | CH3HP | Original Q3 | Legacy

3 In 1869, Dmitri Mendeleev produced his periodic table of the elements.

Mendeleev placed the alkali metals in the same group.

3 (a) What evidence did Mendeleev use to decide that the alkali metals should be in the same group?

[1 mark]

.....

.....

3 (b) Describe how the elements in the modern periodic table are arranged:

3 (b) (i) in terms of protons

[1 mark]

.....

.....

3 (b) (ii) in terms of electrons.

[1 mark]

.....

.....

3 (c) State **two** properties of transition elements that make them more useful than alkali metals for making water pipes.

[2 marks]

.....

.....

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4.1.2.1 The periodic table

Question 23 · continued

3 (d) Describe and explain the trend in reactivity of the alkali metals (Group 1).

[4 marks]

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9

4.1.2.1 The periodic table

Question 24

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]

.....

.....

.....

.....

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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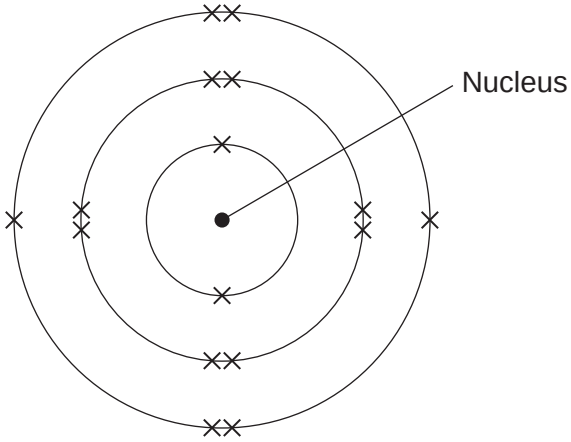
.....

4.1.2.1 The periodic table

Question 24 · 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

4.1.2.1 The periodic table

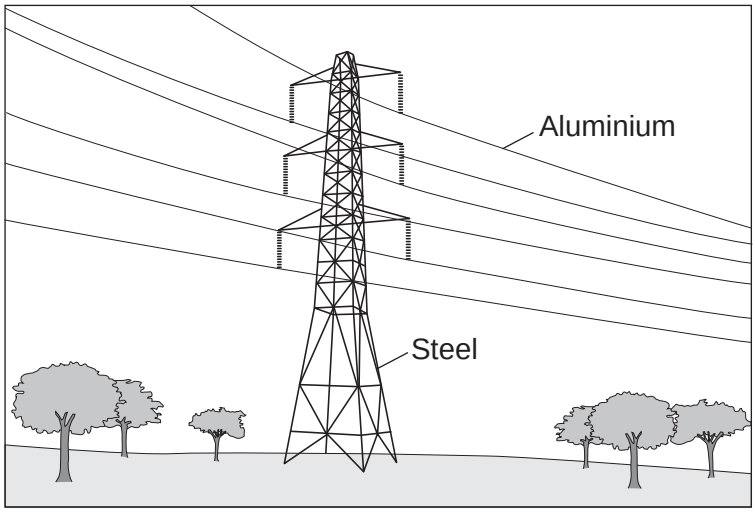
Question 25

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.

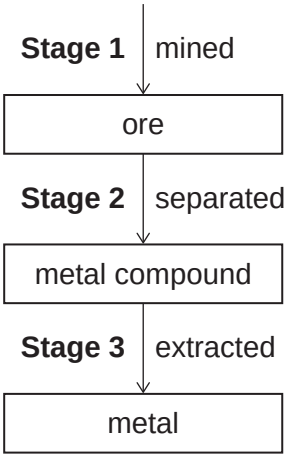
Figure 4



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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.....

4.1.2.1 The periodic table

Question 25 · 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.

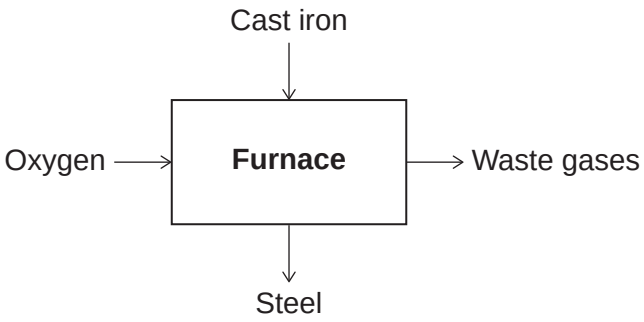
[1 mark]

.....

.....

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

4.1.2.1 The periodic table

Question 25 · 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

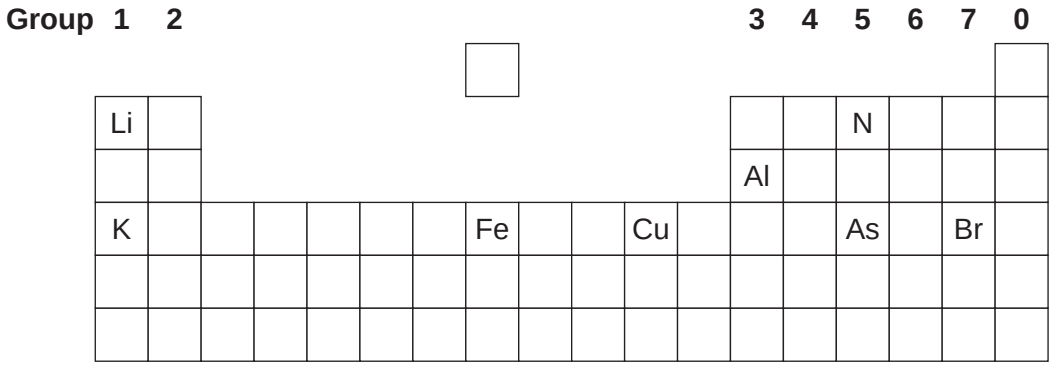
4.1.2.1 The periodic table

Question 26

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

4.1.2.1 The periodic table

Question 27

June 2015 | CH3HP | Original Q2 | Legacy

2 In 1866 John Newlands produced an early version of the periodic table.

Part of Newlands' periodic table is shown in **Figure 2**.

Figure 2

Column	1	2	3	4	5	6	7
	H	Li	Be	B	C	N	O
	F	Na	Mg	Al	Si	P	S
	Cl	K	Ca	Cr	Ti	Mn	Fe

Newlands' periodic table arranged all the known elements into columns in order of their atomic weight.

Newlands was trying to show a pattern by putting the elements into columns.

2 (a) Iron (Fe) does **not** fit the pattern in column 7.

Give a reason why.

[1 mark]

.....

.....

2 (b) In 1869 Dmitri Mendeleev produced his version of the periodic table.

Why did Mendeleev leave gaps for undiscovered elements in his periodic table?

[1 mark]

.....

.....

4.1.2.1 The periodic table

Question 27 · continued

2 (c) Newlands and Mendeleev placed the elements in order of atomic weight.

Complete the sentence.

[1 mark]

The modern periodic table places the elements in order of ..... .

2 (d) Lithium, sodium and potassium are all in Group 1 of the modern periodic table.

Explain why.

[2 marks]

.....

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.....

.....

5

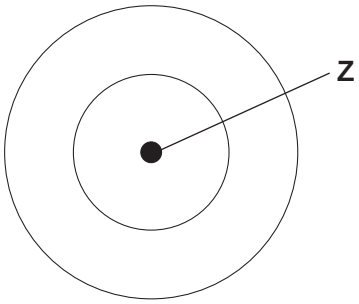
4.1.2.1 The periodic table

Question 28

1 There are eight elements in the second row (lithium to neon) of the periodic table.

1 (a) **Figure 1** shows an atom with two energy levels (shells).

Figure 1



1 (a) (i) Complete **Figure 1** to show the electronic structure of a boron atom.

[1 mark]

1 (a) (ii) What does the central part labelled **Z** represent in **Figure 1**?

[1 mark]

_____

1 (a) (iii) Name the sub-atomic particles in part **Z** of a boron atom.

Give the relative charges of these sub-atomic particles.

[3 marks]

_____

_____

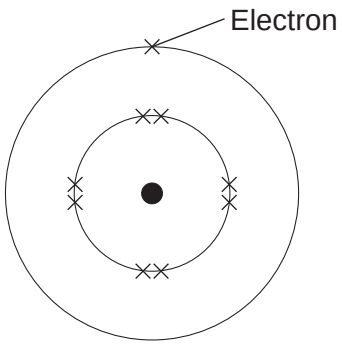
_____

4.1.2.1 The periodic table

Question 28 · continued

1 (b) The electronic structure of a neon atom shown in **Figure 2** is **not** correct.

Figure 2



Explain what is wrong with the electronic structure shown in **Figure 2**.

[3 marks]

8

4.1.2.1 The periodic table

Question 29

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

_____ .

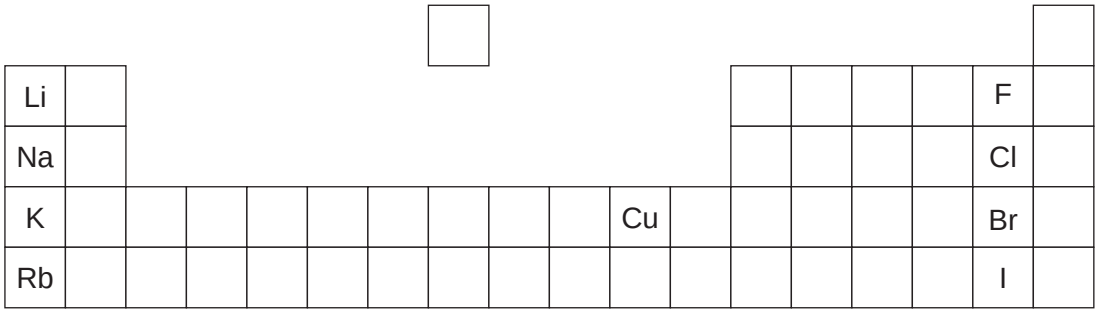
3 (a) (ii) Name the particle that allowed the elements to be arranged in order of their atomic number in the modern periodic table.

[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]

_____

_____

4.1.2.1 The periodic table

Question 29 · 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

4.1.2.1 The periodic table

Question 30

June 2017 | CH1HP | Original Q1 | Legacy

1 Elements are made of atoms.

1 (a) **Table 1** shows the atomic numbers and mass numbers of three atoms.

Table 1

Atom	Atomic number	Mass number
1	12	24
2	12	25
3	12	26

1 (a) (i) Suggest, in terms of the number of subatomic particles, why the atomic numbers of the three atoms are the same.

[1 mark]

_____

_____

1 (a) (ii) Explain, in terms of the number of subatomic particles, why the mass numbers of the three atoms are different.

[2 marks]

_____

_____

_____

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

Sulfuric acid, H_2SO_4, is a compound.

1 (b) (i) How many elements are in the formula H_2SO_4?

[1 mark]

_____

1 (b) (ii) How many atoms are in the formula H_2SO_4?

[1 mark]

_____

4.1.2.1 The periodic table

Question 30 · continued

1 (c) Sulfuric acid reacts with metal oxides.

$$\underset{\text{copper oxide}}{CuO} + \underset{\text{sulfuric acid}}{H_2SO_4} \longrightarrow \underset{\text{copper sulfate}}{CuSO_4} + \underset{\text{water}}{H_2O}$$

In a reaction, 159 g of copper oxide reacts with 196 g of sulfuric acid.

What is the mass of the products?

[1 mark]

Tick (✓) **one** box.

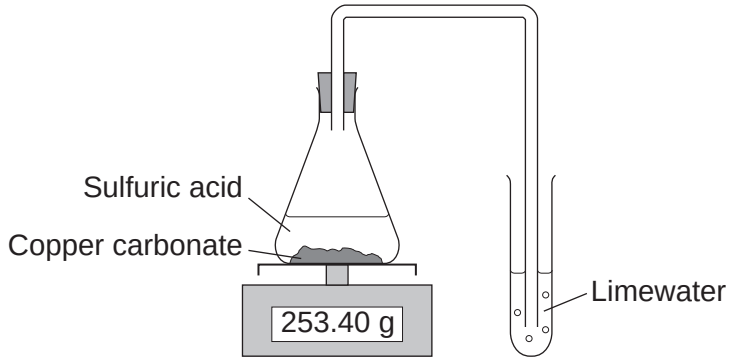
Mass of copper sulfate in g	Mass of water in g	Tick (✓)
30	7	
159	36	
196	18	
319	36	

4.1.2.1 The periodic table

Question 30 · continued

1 (d) **Figure 1** shows apparatus used to investigate the reaction of sulfuric acid with copper carbonate.

Figure 1



Describe and explain the changes seen during the reaction.

[3 marks]

9

4.1.2.1 The periodic table

Question 31

June 2017 | CH3HP | Original Q3 | Legacy

3 This question is about elements and compounds.

3 (a) In 1869 Mendeleev produced an early version of the periodic table.

Figure 4 shows part of Mendeleev's periodic table.

Figure 4

H						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl
K	Ca		Ti	V	Cr	Mn

3 (a) (i) Why did Mendeleev leave gaps in his periodic table?

[1 mark]

3 (a) (ii) Give **one** reason why the elements Ti, V, Cr and Mn should **not** be where Mendeleev placed them.

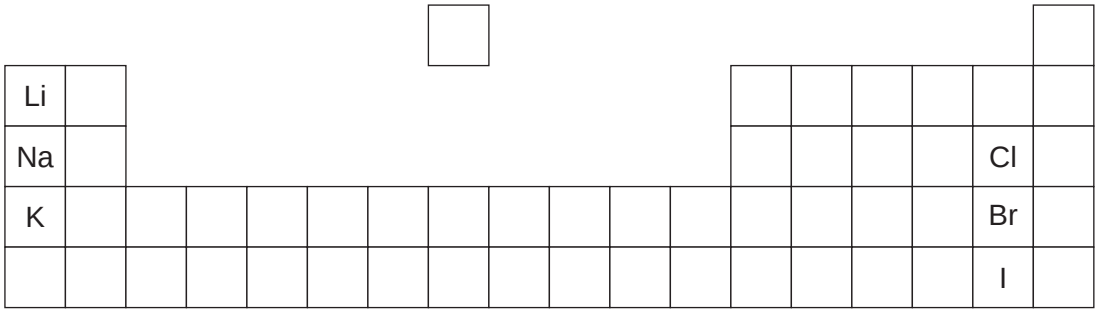
[1 mark]

4.1.2.1 The periodic table

Question 31 · continued

3 (b) **Figure 5** shows an outline of the modern periodic table.

Figure 5



3 (b) (i) Why, in terms of electrons, is bromine in Group 7?

[1 mark]

3 (b) (ii) Bromine reacts with sodium iodide.

The word equation for the reaction is:

bromine + sodium iodide ⟶ sodium bromide + iodine

This reaction shows that bromine is more reactive than iodine.

Explain why, in terms of electrons.

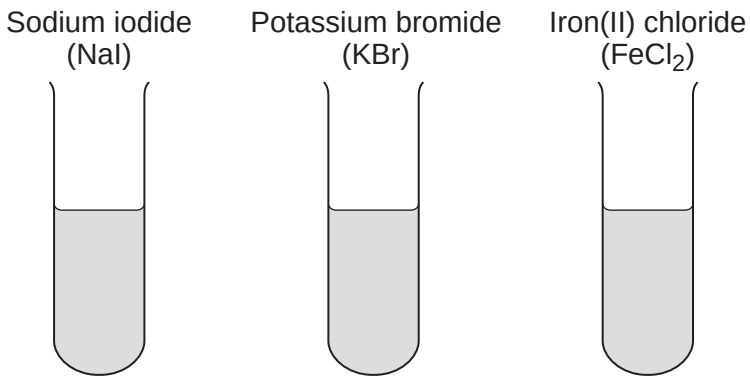
[3 marks]

Question 3 continues on the next page

Question 31 · continued

3 (c) **Figure 6** shows test tubes containing solutions of sodium iodide, potassium bromide and iron(II) chloride.

Figure 6



3 (c) (i) A student tested each solution with silver nitrate in the presence of dilute nitric acid.

Write the result for sodium iodide solution in **Table 1**.

[1 mark]

Table 1

	Sodium iodide solution	**Potassium bromide solution**	**Iron(II) chloride solution**
Result of adding silver nitrate		Cream precipitate	White precipitate

3 (c) (ii) The student tested new samples of each solution with sodium hydroxide solution.

Write the result for iron(II) chloride solution in **Table 2**.

[1 mark]

Table 2

	Sodium iodide solution	**Potassium bromide solution**	**Iron(II) chloride solution**
Result of adding sodium hydroxide solution	No precipitate	No precipitate	

4.1.2.1 The periodic table

Question 31 · continued

3 (d) A flame test is done on a mixture of sodium iodide and potassium bromide.

Why would a flame test **not** show the presence of both sodium ions and potassium ions in the mixture?

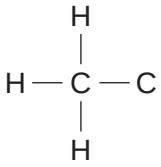
[1 mark]

3 (e) Carboxylic acids are compounds containing carbon.

3 (e) (i) Complete **Figure 7** to show the displayed structure of ethanoic acid.

[1 mark]

Figure 7



3 (e) (ii) Explain why ethanoic acid has a higher pH value than hydrochloric acid of the same concentration.

[2 marks]

12

4.1.2.1 The periodic table

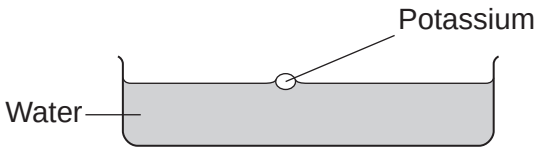
Question 32

4 This question is about potassium and its compounds.

4 (a) (i) Potassium reacts with water to produce potassium hydroxide solution and a gas.

Figure 8 shows the apparatus used for the reaction.

Figure 8



Complete and balance the equation for the reaction.

[2 marks]

____ K + ____ H_2O ⟶ ____ KOH + _____

4 (a) (ii) Potassium and lithium are in Group 1 of the periodic table.

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

[2 marks]

_____

_____

_____

_____

4.1.2.1 The periodic table

Question 32 · continued

4 (b) Describe how a student could do titrations to find the mean volume of potassium hydroxide solution which would neutralise 25.00 cm^3 of nitric acid.

[5 marks]

4 (c) The student found that 26.25 cm^3 of potassium hydroxide solution with a concentration of 0.20 moles per dm^3 neutralises 25.00 cm^3 of nitric acid.

The equation for the reaction is:

$$KOH + HNO_3 \longrightarrow KNO_3 + H_2O$$

Calculate the concentration of the nitric acid.

[3 marks]

Concentration of nitric acid = _____ moles per dm^3

12

4.1.2.1 The periodic table

Question 33

June 2018 | 8462/2H | Original Q7

0 7 Older cars are tested each year to measure the amount of pollutants contained in exhaust fumes.

Table 4 shows the maximum allowed percentages of exhaust pollutants for petrol cars.

Table 4

Age of car in years	Maximum allowed percentage (%) of exhaust pollutant	
	Carbon monoxide	Unburned hydrocarbons
16–24	0.30	0.02
3–16	0.20	0.02

0 7 . 1 Explain how carbon monoxide is produced when petrol is burned in car engines.

[2 marks]

0 7 . 2 Suggest **two** reasons why the maximum allowed percentage of carbon monoxide has been decreased for newer cars.

[2 marks]

1

2

4.1.2.1 The periodic table

Question 33 · continued

0 7 . 3 Give **one** reason for having a maximum allowed percentage of unburned hydrocarbons in exhaust fumes.

[1 mark]

Oxides of nitrogen are also pollutants contained in exhaust fumes.

0 7 . 4 Describe how oxides of nitrogen are produced when petrol is burned in car engines.

[2 marks]

Catalytic converters are fitted to car exhausts to reduce the amount of pollutants released into the atmosphere.

0 7 . 5 Nitrogen dioxide is an oxide of nitrogen.

Nitrogen dioxide reacts to produce nitrogen and oxygen in catalytic converters.

Complete the equation for this reaction.

The equation should be balanced.

[2 marks]

$$___\ NO_2\ (g) \rightarrow _____ + ___\ O_2\ (g)$$

4.1.2.1 The periodic table

Question 33 · continued

0 7 . 6 Give **two** effects of atmospheric pollution which are reduced by using catalytic converters.

[2 marks]

1 _____

_____

2 _____

_____

0 7 . 7 The catalyst in catalytic converters is a mixture of three elements.

Where in the periodic table are these elements most likely to be found?

[1 mark]

Tick **one** box.

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

12

4.1.2.1 The periodic table

Question 34

June 2019 | 8462/1H | Original Q1

0 1 This question is about the periodic table.

In the 19th century, some scientists tried to classify the elements by arranging them in order of their atomic weights.

Figure 1 shows the periodic table Mendeleev produced in 1869.

His periodic table was more widely accepted than previous versions.

Figure 1

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

0 1 . 1 The atomic weight of tellurium (Te) is 128 and that of iodine (I) is 127

Why did Mendeleev reverse the order of these two elements?

[1 mark]

4.1.2.1 The periodic table

Question 34 · continued

0 1 . 2 Mendeleev left spaces marked with an asterisk *

He left these spaces because he thought missing elements belonged there.

Why did Mendeleev's periodic table become more widely accepted than previous versions?

[3 marks]

0 1 . 3 Mendeleev arranged the elements in order of their atomic weight.

What is the modern name for atomic weight?

[1 mark]

Tick (✓) **one** box.

- Atomic number ☐
- Mass number ☐
- Relative atomic mass ☐
- Relative formula mass ☐

0 1 . 4 Complete the sentence.

[1 mark]

In the modern periodic table, the elements are arranged in order of

_____.

4.1.2.1 The periodic table

Question 34 · continued

Chlorine, iodine and astatine are in Group 7 of the modern periodic table.

0 1 . 5 Astatine (At) is below iodine in Group 7.

Predict:

- the formula of an astatine molecule
- the state of astatine at room temperature.

[2 marks]

Formula of astatine molecule _____

State at room temperature _____

0 1 . 6 Sodium is in Group 1 of the modern periodic table.

Describe what you would see when sodium reacts with chlorine.

[2 marks]

_____

_____

_____

_____

10

4.1.2.1 The periodic table

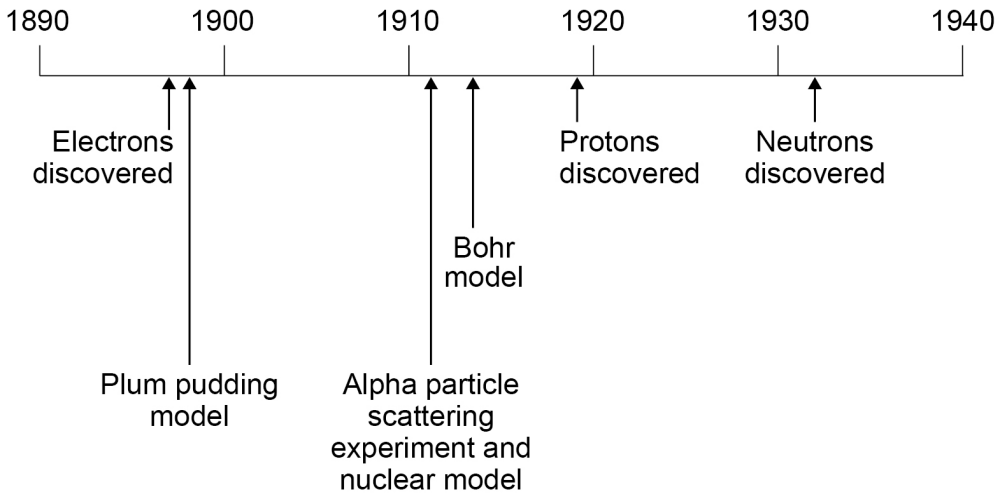
Question 35

November 2020 | 8462/1H | Original Q5

0 5 This question is about the development of scientific theories.

Figure 2 shows a timeline of some important steps in the development of the model of the atom.

Figure 2



0 5 . 1 The plum pudding model did not have a nucleus.

Describe **three** other differences between the nuclear model of the atom and the plum pudding model.

[3 marks]

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

_____

4.1.2.1 The periodic table

Question 35 · continued

0 5 . 2 Niels Bohr adapted the nuclear model.

Describe the change that Bohr made to the nuclear model.

[2 marks]

0 5 . 3 Mendeleev published his periodic table in 1869.

Mendeleev arranged the elements in order of atomic weight.

Mendeleev then reversed the order of some pairs of elements.

A student suggested Mendeleev's reason for reversing the order was to arrange the elements in order of atomic number.

Explain why the student's suggestion **cannot** be correct.

Use **Figure 2**.

[2 marks]

0 5 . 4 Give the correct reason why Mendeleev reversed the order of some pairs of elements.

[1 mark]

8

4.1.2.1 The periodic table

Question 36

0 2 This question is about atomic structure and the periodic table.

Gallium (Ga) is an element that has two isotopes.

0 2 . 1 Give the meaning of 'isotopes'.

You should answer in terms of subatomic particles.

[2 marks]

0 2 . 2 **Table 1** shows the mass numbers and percentage abundances of the isotopes of gallium.

Table 1

Mass number	Percentage abundance (%)
69	60
71	40

Calculate the relative atomic mass (A_r) of gallium.

Give your answer to 1 decimal place.

[2 marks]

Relative atomic mass (1 decimal place) = _____

4.1.2.1 The periodic table

Question 36 · continued

Gallium (Ga) is in Group 3 of the modern periodic table.

0 2 . 3 Give the numbers of electrons and neutrons in an atom of the isotope $^{69}_{31}Ga$

[2 marks]

Number of electrons _____

Number of neutrons _____

0 2 . 4 What is the most likely formula of a gallium ion?

[1 mark]

Tick (✓) **one** box.

Ga^{+} ☐

Ga^{-} ☐

Ga^{3+} ☐

Ga^{3-} ☐

0 2 . 5 Gallium was discovered six years after Mendeleev published his periodic table.

Give **two** reasons why the discovery of gallium helped Mendeleev's periodic table to become accepted.

[2 marks]

1 _____

_____

2 _____

_____

9

4.1.2.1 The periodic table

Question 37

November 2021 | 8462/1H | Original Q3

0 3 This question is about the extraction of metals.

Element **R** is extracted from its oxide by reduction with hydrogen.

The equation for the reaction is:

$$3\,H_2 + \mathbf{R}O_3 \rightarrow \mathbf{R} + 3\,H_2O$$

0 3 . 1 The sum of the relative formula masses (M_r) of the reactants ($3\,H_2$ + $\mathbf{R}O_3$) is 150

Calculate the relative atomic mass (A_r) of **R**.

Relative atomic masses (A_r): H = 1 O = 16

[2 marks]

Relative atomic mass (A_r) of **R** = _____

0 3 . 2 Identify element **R**.

You should use:

- your answer to **question 03.1**
- the periodic table.

[1 mark]

Identity of **R** = _____

4.1.2.1 The periodic table

Question 37 · continued

0 3 . 3 Carbon is used to extract tin (Sn) from tin oxide (SnO_2).

The equation for the reaction is:

$$SnO_2 + C \rightarrow Sn + CO_2$$

Calculate the percentage atom economy for extracting tin in this reaction.

Relative atomic masses (A_r): C = 12 O = 16 Sn = 119

[3 marks]

Percentage atom economy = _____ %

Question 3 continues on the next page

4.1.2.1 The periodic table

Question 37 · continued

0 3 . 4 Tungsten (W) is a metal.

Tungsten is extracted from tungsten oxide (WO_3).

All other solid products from the extraction method must be separated from the tungsten.

Table 2 shows information about three possible methods to extract tungsten from tungsten oxide.

Table 2

Method	Reactant	Relative cost of reactant	Products
1	Carbon	Low	Tungsten solid Carbon dioxide gas Tungsten carbide solid
2	Hydrogen	High	Tungsten solid Water vapour
3	Iron	Low	Tungsten solid Iron oxide solid

Evaluate the three possible methods for extracting tungsten from tungsten oxide.

[4 marks]

10

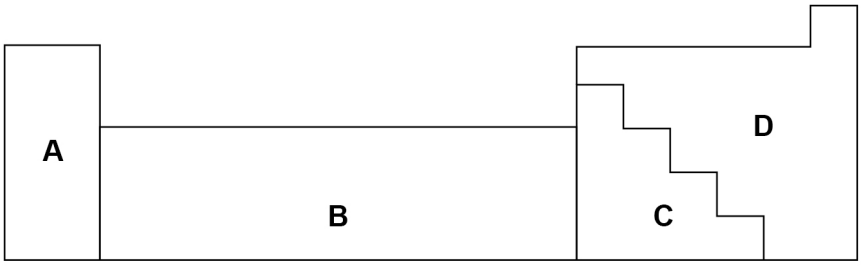
4.1.2.1 The periodic table

Question 38

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 _____

_____

4.1.2.1 The periodic table

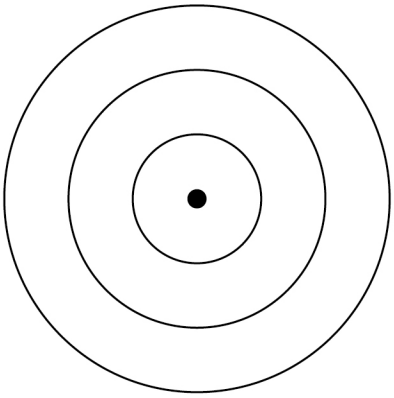
Question 38 · continued

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]

4.1.2.1 The periodic table

Question 38 · 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

4.1.2.1 The periodic table

Question 39

June 2022 | 8462/1H | Original Q5

0 5 This question is about groups in the periodic table.

The elements in Group 1 become more reactive going down the group.

Rubidium is below potassium in Group 1.

0 5 . 1 Rubidium and potassium are added to water.

Predict **one** observation you would see that shows that rubidium is more reactive than potassium.

[1 mark]

0 5 . 2 Explain why rubidium is more reactive than potassium.

[3 marks]

0 5 . 3 Complete the equation for the reaction of rubidium with water.

You should balance the equation.

[3 marks]

$$Rb + H_2O \rightarrow \quad +$$

4.1.2.1 The periodic table

Question 39 · continued

The noble gases are in Group 0.

0 5 . 4 Which is a correct statement about the noble gases?

[1 mark]

Tick (✓) **one** box.

- The noble gases all have atoms with eight electrons in the outer shell. ☐
- The noble gases have boiling points that increase going down the group. ☐
- The noble gases have molecules with two atoms. ☐
- The noble gases react with metals to form ionic compounds. ☐

0 5 . 5 **Table 1** shows information about the three isotopes of neon.

Table 1

Mass number	Percentage abundance (%)
20	90.48
21	0.27
22	9.25

Calculate the relative atomic mass (A_r) of neon.

Give your answer to 3 significant figures.

[3 marks]

Relative atomic mass (3 significant figures) = _____

11

4.1.2.1 The periodic table

Question 40

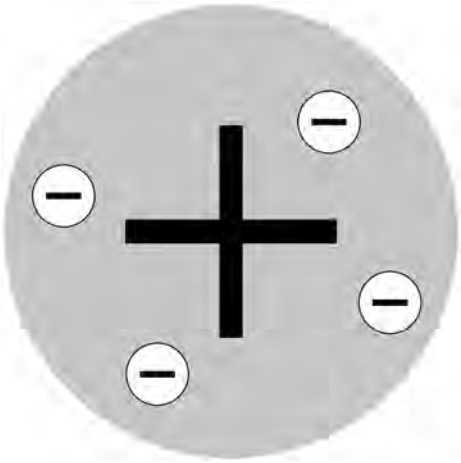
0 1 Discoveries in chemistry led to a better understanding of atomic structure.

0 1 . 1 Atoms were originally thought to be tiny spheres that could not be divided.

The plum pudding model of the atom was then developed.

Figure 1 represents the plum pudding model of the atom.

Figure 1



Describe the plum pudding model of the atom.

[2 marks]

0 1 . 2 Atoms contain electrons, neutrons and protons.

Write these three particles in order of their discovery.

[1 mark]

Earliest _____

_____

Latest _____

4.1.2.1 The periodic table

Question 40 · continued

Very few atoms of the element tennessine (Ts) have ever been identified.

The atomic number of tennessine is 117

0 1 . 3 Predict the number of outer shell electrons in an atom of tennessine.

Give **one** reason for your answer.

Use the periodic table.

[2 marks]

Number of outer shell electrons _____

Reason _____

_____

0 1 . 4 Tennessine was first identified by a small group of scientists in 2010.

Suggest **one** reason why tennessine was **not** accepted as a new element by other scientists until 2015.

[1 mark]

_____

_____

Question 1 continues on the next page

4.1.2.1 The periodic table

Question 40 · continued

0 1 . 5 The discovery of isotopes explained why some relative atomic masses are not whole numbers.

Element **R** has two isotopes.

Table 1 shows the mass numbers and percentage abundances of the isotopes of element **R**.

Table 1

Mass number	Percentage abundance (%)
6	7.6
7	92.4

Calculate the relative atomic mass (A_r) of element **R**.

Give your answer to 1 decimal place.

[3 marks]

Relative atomic mass (1 decimal place) = _____

9

4.1.2.1 The periodic table

Question 41

June 2023 | 8462/1H | Original Q5

0 5 This question is about acids and alkalis.

0 5 . 1 Ethanoic acid is a weak acid.

What is meant by 'weak acid'?

Answer in terms of ionisation.

[1 mark]

_____

_____

0 5 . 2 The concentration of an acid can be measured in mol/dm^3.

Which combination of changes **increases** the concentration of an acid?

[1 mark]

Tick (✓) **one** box.

- The mass of acid dissolved is halved and the volume of the solution is halved. ☐
- The mass of acid dissolved is halved and the volume of the solution is doubled. ☐
- The mass of acid dissolved is doubled and the volume of the solution is halved. ☐
- The mass of acid dissolved is doubled and the volume of the solution is doubled. ☐

0 5 . 3 The concentration of an acid can be determined by titration.

An indicator is added to an alkali in a flask.

Name an indicator that can be used in this titration.

Give the colour change of the indicator when acid from a burette is added to the alkali in the flask.

[2 marks]

Name of indicator _____

Colour change from _____ to _____

4.1.2.1 The periodic table

Question 41 · continued

0 5 . 4 Sodium carbonate dissolves in water to produce an alkaline solution.

Give the formula of the ion that makes a solution alkaline.

[1 mark]

_____

0 5 . 5 A student does a titration using sodium carbonate solution and nitric acid.

The equation for the reaction is:

$$Na_2CO_3 + 2\,HNO_3 \rightarrow 2\,NaNO_3 + CO_2 + H_2O$$

25.0 cm^3 of 0.124 mol/dm^3 sodium carbonate solution is neutralised by 23.6 cm^3 of nitric acid.

Calculate the concentration of the nitric acid.

Give your answer to 3 significant figures.

You should calculate:

- the number of moles of sodium carbonate in 25.0 cm^3 of the solution
- the number of moles of nitric acid in 23.6 cm^3 of the nitric acid
- the concentration of the nitric acid in mol/dm^3.

[5 marks]

Concentration (3 significant figures) = _____ mol/dm^3

4.1.2.1 The periodic table

Question 41 · continued

When hydrochloric acid dissolves in water, hydrogen ions (H^+) and chloride ions (Cl^-) are produced.

0 5 . 6 A solution of hydrochloric acid with pH 4.5 has a concentration of H^+ ions of 3.16×10^{-5} mol/dm^3.

What is the concentration of H^+ ions in a solution of hydrochloric acid with pH 2.5?

[1 mark]

Concentration of H^+ ions = _____ mol/dm^3

0 5 . 7 Which element has atoms that have the same electronic structure as the chloride ion?

Use the periodic table.

[1 mark]

_____

12

4.1.2.1 The periodic table

Question 42

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]

4.1.2.1 The periodic table

Question 42 · 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

4.1.2.1 The periodic table

Question 43

June 2024 | 8462/1H | Original Q2

0 2 This question is about the periodic table.

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

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

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 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 _____

_____

4.1.2.1 The periodic table

Question 43 · continued

Table 1 shows the densities of some of the elements in Group 0 of the periodic table.

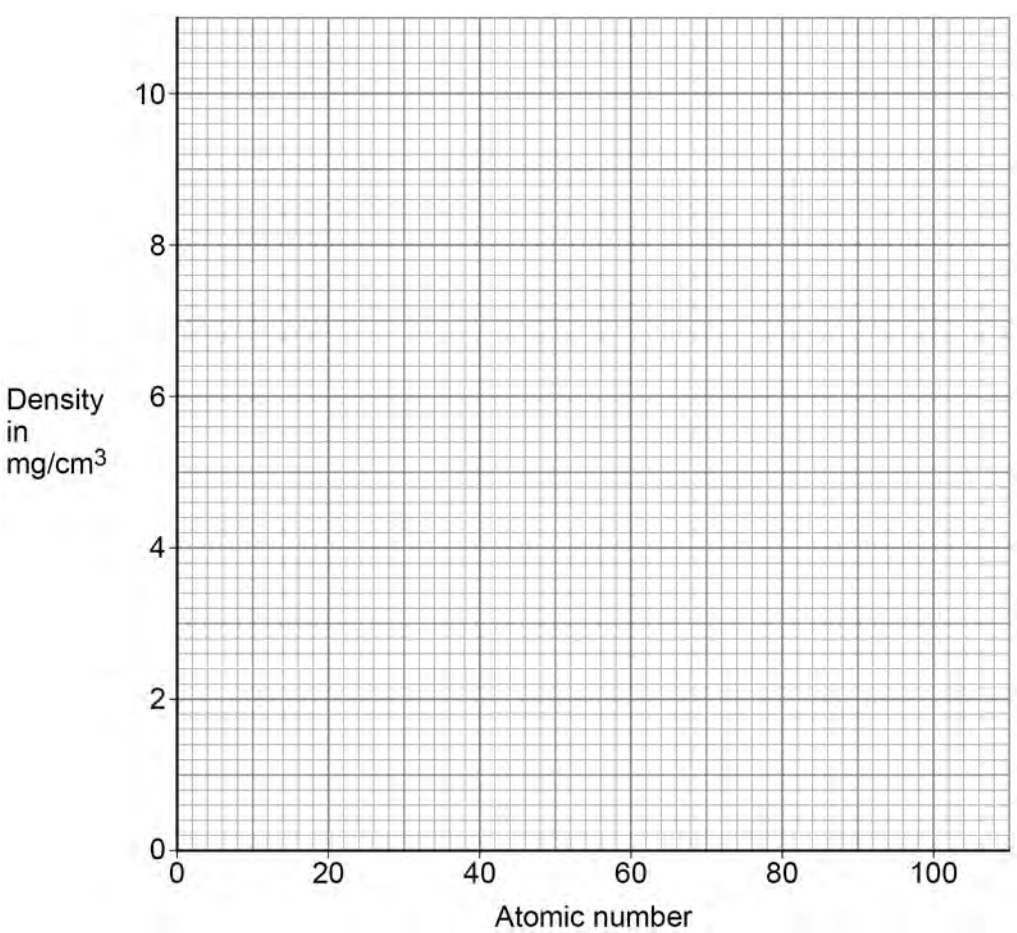
Table 1

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 2 . 4 Plot the data from **Table 1** on **Figure 1**.

[2 marks]

Figure 1



4.1.2.1 The periodic table

Question 43 · continued

0 2 . 5 Estimate the density (**X**) of krypton.

Use **Figure 1** and **Table 1**.

[1 mark]

Density = _____ mg/cm^3

0 2 . 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 2 . 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

4.1.2.1 The periodic table

Question 44

0 7 This question is about sulfuric acid.

0 7 . 1 Sulfuric acid contains sulfate ions.

Describe the test for the presence of sulfate ions in sulfuric acid.

Give the result of the test.

[2 marks]

Test _____

_____

Result _____

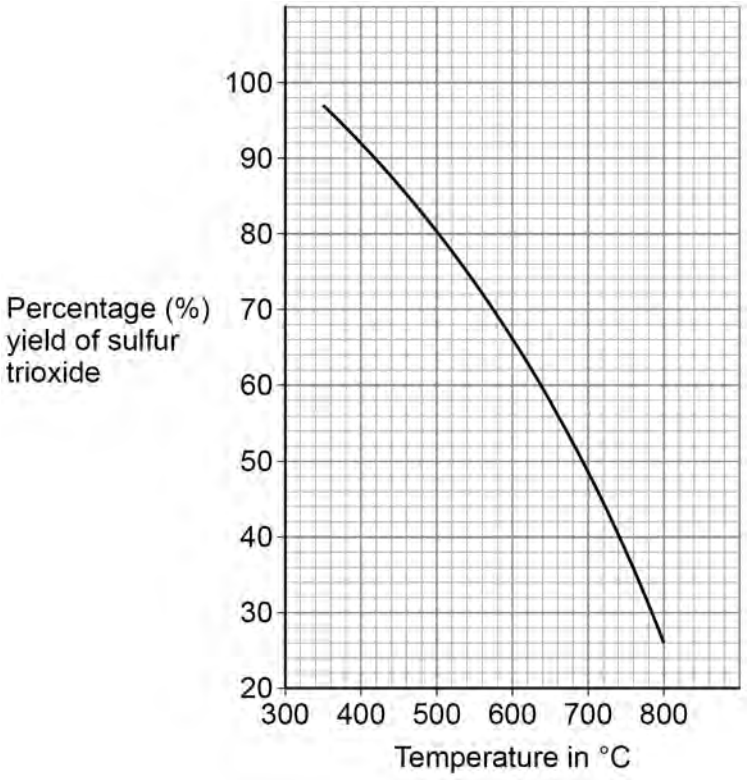
_____

One stage in the industrial production of sulfuric acid is the reaction of sulfur dioxide with oxygen to produce sulfur trioxide.

This reversible reaction reaches dynamic equilibrium.

Figure 7 shows the percentage yield of sulfur trioxide in this reaction at different temperatures.

Figure 7



4.1.2.1 The periodic table

Question 44 · continued

0 7 . 2 Which statement about the forward reaction is correct?

Use **Figure 7**.

[1 mark]

Tick (✓) **one** box.

- The yield is greater at higher temperatures because the reaction is exothermic. ☐
- The yield is greater at higher temperatures because the reaction is endothermic. ☐
- The yield is smaller at higher temperatures because the reaction is exothermic. ☐
- The yield is smaller at higher temperatures because the reaction is endothermic. ☐

The equation for the reaction is:

$$2\ SO_2(g) + O_2(g) \rightleftharpoons 2\ SO_3(g)$$

0 7 . 3 Explain why the percentage yield of sulfur trioxide in this reaction is greater if the pressure is higher.

[2 marks]

0 7 . 4 In industry, the reaction is done at 450 °C and atmospheric pressure.

Under these conditions the yield of sulfur trioxide is 86%.

Suggest **two** reasons why a higher pressure is **not** used.

[2 marks]

1

2

4.1.2.1 The periodic table

Question 44 · continued

0 7 . 5 This reaction uses a catalyst to increase the rate of the reaction.

The catalyst is a metal oxide.

Which is the most likely metal in the metal oxide catalyst?

Use the periodic table.

[1 mark]

Tick (✓) **one** box.

- Aluminium (Al) ☐
- Barium (Ba) ☐
- Potassium (K) ☐
- Vanadium (V) ☐

8

4.1.2.1 The periodic table

Question 45

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 ☐

4.1.2.1 The periodic table

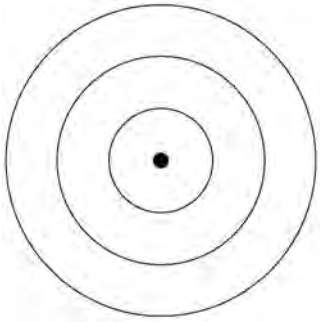
Question 45 · continued

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]

4.1.2.1 The periodic table

Question 45 · 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

4.1.2.1 The periodic table

Question 46

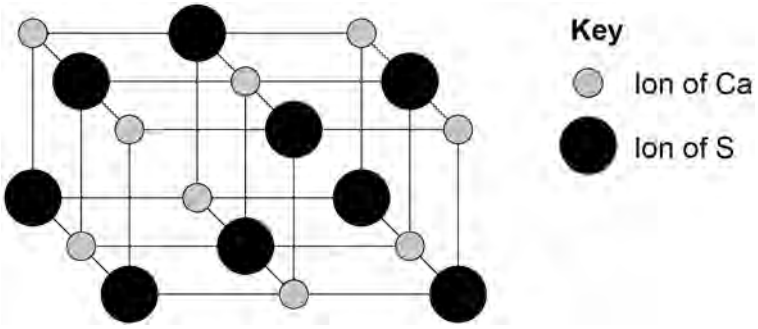
June 2025 | 8462/1H | Original Q2

0 2 This question is about structure and bonding.

Calcium sulfide is an ionic compound.

Figure 2 represents the structure of calcium sulfide.

Figure 2



0 2 . 1 Determine the empirical formula of calcium sulfide.

[1 mark]

Empirical formula _____

Question 2 continues on the next page

4.1.2.1 The periodic table

Question 46 · continued

0 2 . 2 Calcium is in Group 2 of the periodic table.

Sulfur is in Group 6 of the periodic table.

Describe what happens when a calcium atom reacts with a sulfur atom.

Answer in terms of electrons and ions.

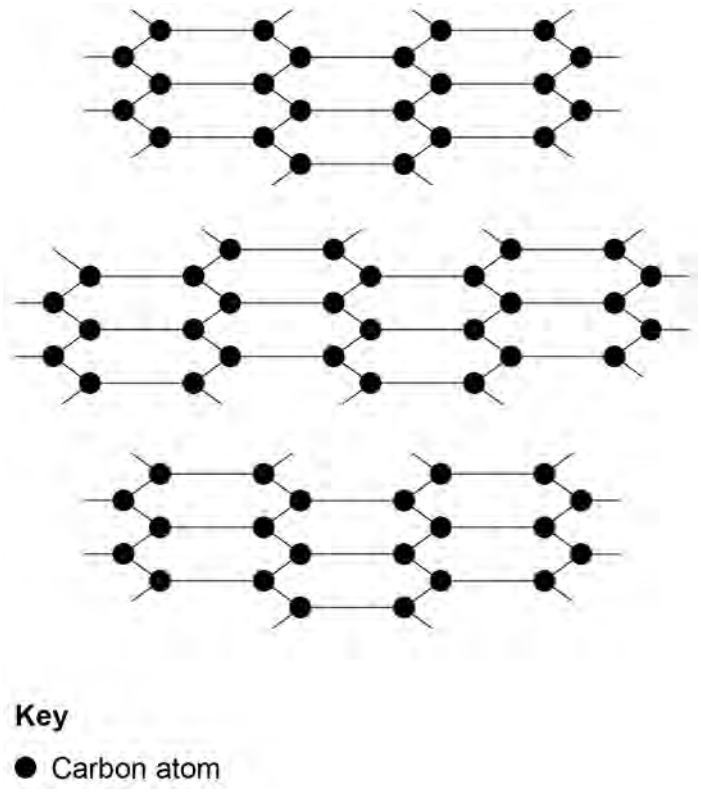
[4 marks]

4.1.2.1 The periodic table

Question 46 · continued

Figure 3 shows the structure of graphite.

Figure 3



0 2 . 3 Describe the structure and bonding of graphite.

[4 marks]

Extra space

4.1.2.1 The periodic table

Question 46 · continued

0 2 . 4 Substances that consist of small molecules do **not** conduct electricity.

Give **one** reason why.

[1 mark]

0 2 . 5 Methane consists of small molecules.

Poly(ethene) is a polymer.

Why does poly(ethene) have a higher melting point than methane?

[1 mark]

Tick (✓) **one** box.

- Poly(ethene) has more covalent bonds to break than methane. ☐
- Poly(ethene) has no intermolecular forces to overcome. ☐
- Poly(ethene) has stronger covalent bonds to break than methane. ☐
- Poly(ethene) has stronger intermolecular forces to overcome than methane. ☐

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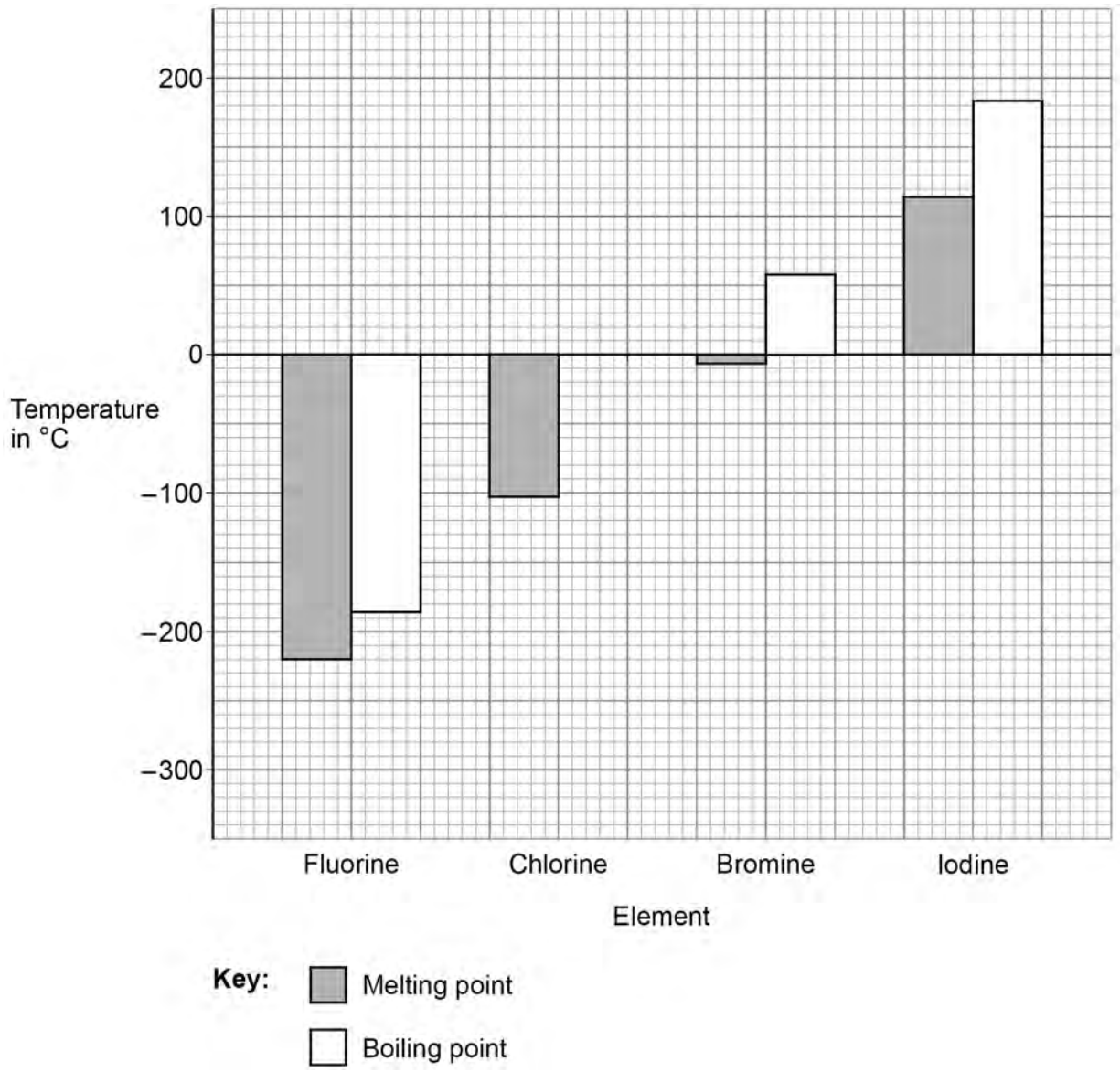
4.1.2.1 The periodic table

Question 47

0 4 The elements in Group 7 of the periodic table are known as the halogens.

Figure 4 shows information about some of the elements in Group 7.

Figure 4



4.1.2.1 The periodic table

Question 47 · continued

0 4 . 1 Predict the boiling point of chlorine.

Use **Figure 4**.

[1 mark]

_____ °C

0 4 . 2 What is the state of fluorine at –250 °C?

Use **Figure 4**.

[1 mark]

_____

Astatine (At) is an element in Group 7.

0 4 . 3 What is the number of electrons in the outer shell of an astatine atom?

[1 mark]

_____

0 4 . 4 Hydrogen reacts with astatine to produce hydrogen astatide.

Predict the formula of hydrogen astatide.

[1 mark]

_____

Question 4 continues on the next page

4.1.2.1 The periodic table

Question 47 · continued

0 4 . 5 Explain the trend in reactivity of the elements going down Group 7.

[4 marks]

Extra space

0 4 . 6 A more reactive halogen can displace a less reactive halogen from a solution of its salt.

Write a balanced equation for the reaction between bromine and potassium iodide.

[3 marks]

_____ + _____ ⟶ _____ + _____

11