AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.1.1.1

Atoms, elements and compounds

Past-paper questions

Tier	**Higher**
Question groups	**24**
Available paper years	**2007–2023**

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.

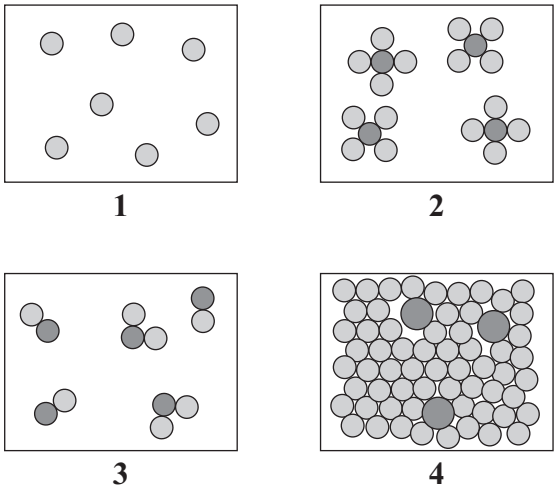
4.1.1.1 Atoms, elements and compounds

Question 01

June 2007 | CHY1A | Original Q2 | Legacy

QUESTION TWO

The diagrams show the atoms in four different substances.



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

A an alloy

B an element

C a hydrocarbon

D a mixture of compounds

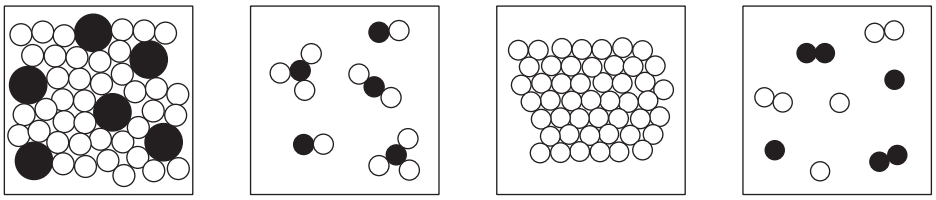
4.1.1.1 Atoms, elements and compounds

Question 02

November 2007 | CHY1A | Original Q2 | Legacy

QUESTION TWO

The diagrams show the atoms in four substances.



1 2 3 4

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

A pure iron

B an alloy

C a mixture of compounds

D a mixture of elements

4.1.1.1 Atoms, elements and compounds

Question 03

2 Soda-lime glass is made by heating, to above 1500 °C, a mixture of:

soda (sodium carbonate), Na_2CO_3
limestone (calcium carbonate), $CaCO_3$
sand (silicon dioxide), SiO_2

(a) (i) Which element do all of these compounds contain?

.....

(1 mark)

(ii) Explain what the formula Na_2CO_3 shows about the compound.

.....

.....

.....

.....

(2 marks)

(b) Calcium carbonate breaks down when heated to above 1500 °C.

(i) Write a word equation to show what happens.

..... → ..... + ...

(2 marks)

(ii) What is the name of this type of chemical reaction?

.....

(1 mark)

4.1.1.1 Atoms, elements and compounds

Question 03 · continued

BLANK

(c) The melting point of soda-lime glass is about 750 °C.
The raw materials for making soda are limestone and common salt (sodium chloride).
There are almost unlimited amounts of the raw materials available to manufacture soda-lime glass.

From the information given, what is the most important reason for recycling soda-lime glass?

.....

.....

(1 mark)

7

Turn over for the next question

4.1.1.1 Atoms, elements and compounds

Question 04

June 2008 | CHY1AP | Original Q1 | Legacy

QUESTION ONE

This question is about hydrocarbons and fuels.

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

A C_2H_5OH

B C_3H_8

C C_2H_4

D S

1	a hydrocarbon that is **not** an alkane
2	an alkane
3	a compound that is **not** a hydrocarbon
4	an element that may be found in a fuel

4.1.1.1 Atoms, elements and compounds

Question 05

June 2008 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

Crude oil contains a large number of alkanes, which have the general formula C_nH_{2n+2}

Crude oil can be separated into a number of fractions by fractional distillation.

6A Crude oil can be separated into fractions in this way because . . .

1 the alkanes it contains have different boiling points.

2 the alkanes it contains have different densities.

3 alkanes are compounds which are made up of more than one element.

4 all alkanes vaporise easily when they are heated.

6B Each fraction from the crude oil will contain . . .

1 a single alkane.

2 a mixture of several alkanes.

3 alkanes that have the same boiling point.

4 alkanes that have the same density.

The alkanes are a series of compounds.

The first ten alkanes in the series range from methane, CH_4 to decane, $C_{10}H_{22}$

6C The difference between the formulae of successive alkanes is . . .

1 C

2 H_2

3 CH

4 CH_2

4.1.1.1 Atoms, elements and compounds

6D Which of the following changes in the alkane series, from methane to decane?

1 the general formula

2 the number of bonds on each carbon atom

3 the ratio of carbon atoms to hydrogen atoms

4 the number of elements present

Turn over for the next question

4.1.1.1 Atoms, elements and compounds

Question 06

June 2008 | CHY1AP | Original Q7 | Legacy

QUESTION SEVEN

Copper is found in the Earth's crust, both as the metal itself and as a variety of compounds.

7A This suggests that copper . . .

1 is a very reactive metal.

2 reacts with only a small number of other elements.

3 is **not** very reactive but more reactive than gold.

4 reacts rapidly with oxygen and sulfur at low temperatures.

A naturally occurring compound of copper is malachite, $CuCO_3.Cu(OH)_2$

7B Which row in the table shows the number of elements and the number of atoms of oxygen in the formula for malachite?

	Elements	Atoms of oxygen
1	4	5
2	4	4
3	5	3
4	6	2

Copper is extracted from high grade ores by first smelting the mined ore, then purification by electrolysis.

Copper salts can be extracted from some low grade ores by leaching. Sulfuric acid runs through the ore to produce a solution of copper sulfate. The copper can then be obtained from the solution by electrolysis.

7C An advantage of leaching over smelting is that . . .

1 leaching produces large amounts of copper sulfate.

2 there is no chance of environmental damage during leaching.

3 leaching does **not** require large quantities of energy.

4 there are no waste products left after leaching.

4.1.1.1 Atoms, elements and compounds

Question 06 · continued

7D There is plenty of scrap copper and copper alloys that could be recycled.

One factor that could bring an increase in the amount that is recycled would be . . .

1 the opening of new large mines with high grade ores.

2 a reduction in the price of copper on the world markets.

3 that recycling became much more economic than extraction from the ore.

4 other metals being used instead of copper.

Turn over for the next question

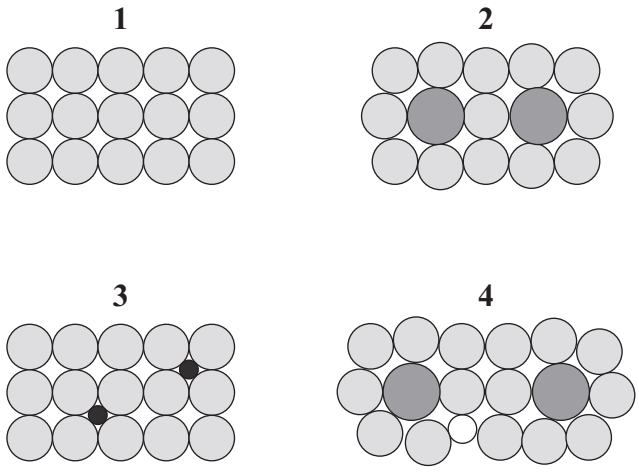
4.1.1.1 Atoms, elements and compounds

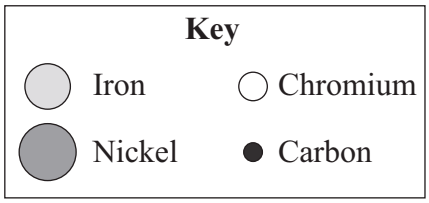
Question 07

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.

4.1.1.1 Atoms, elements and compounds

Question 08

June 2009 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

Methane gas (CH_4) burns in oxygen.

This is the chemical equation for the reaction:

$$CH_4 + 2O_2 \rightarrow CO_2 + 2H_2O$$

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

A compounds

B bonds

C products

D elements

Methane and oxygen are the reactants but carbon dioxide and water are the . . . **1** . . . of the reaction.

The atoms in carbon dioxide and water are held together by . . . **2** . . . .

Methane, carbon dioxide and water are . . . **3** . . . .

The equation is balanced because in the reaction there is no change in the total number of atoms of each of the . . . **4** . . . .

4.1.1.1 Atoms, elements and compounds

Question 09

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 09 · 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.

4.1.1.1 Atoms, elements and compounds

Question 10

November 2009 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

This question is about four chemical substances involved in the two chemical reactions below.

$$ZnCO_3 \rightarrow ZnO + \text{Substance } \mathbf{X}$$

$$2ZnO + C \rightarrow 2Zn + \text{Substance } \mathbf{X}$$

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

A $ZnCO_3$

B C

C CO_2

D ZnO

1	It is the metal oxide produced by thermal decomposition.
2	It has a formula made up of five atoms of three different elements.
3	It is the compound produced in both reactions.
4	It will burn in a limited supply of air to produce carbon monoxide and carbon dioxide.

4.1.1.1 Atoms, elements and compounds

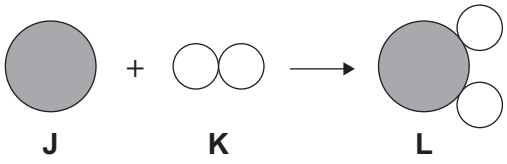
Question 11

June 2010 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

The diagram represents the reaction between substance **J** and substance **K** to create a new substance, **L**.

In the diagram, each circle represents an atom.



4A Which substance or substances are elements?

1 **J** only

2 both **K** and **L**

3 both **J** and **K**

4 **L** only

4B Substance **L** . . .

1 is an impure substance.

2 is a mixture.

3 will have the same chemical properties as substances **J** and **K**.

4 is a compound of **J** and **K**.

4C When substance **L** is formed from substances **J** and **K** . . .

1 there is an overall increase in mass.

2 there is an overall decrease in mass.

3 there is no overall change in mass.

4 the total number of atoms changes.

4D A molecule of substance **K** will . . .

1 have two separate nuclei.

2 share a nucleus.

3 not have any chemical bonds.

4 not contain any electrons.

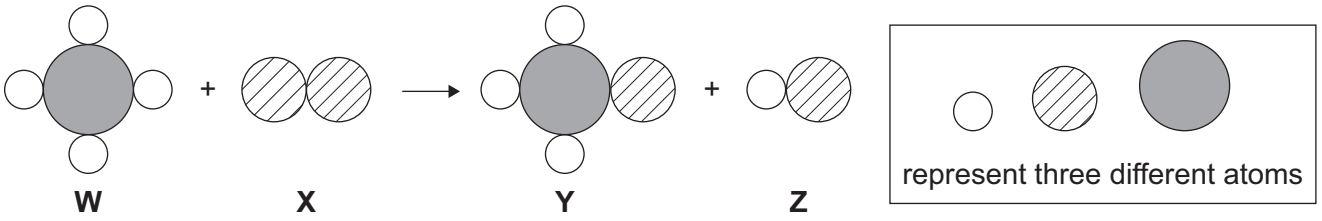
4.1.1.1 Atoms, elements and compounds

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.

4.1.1.1 Atoms, elements and compounds

Question 12 · continued

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.

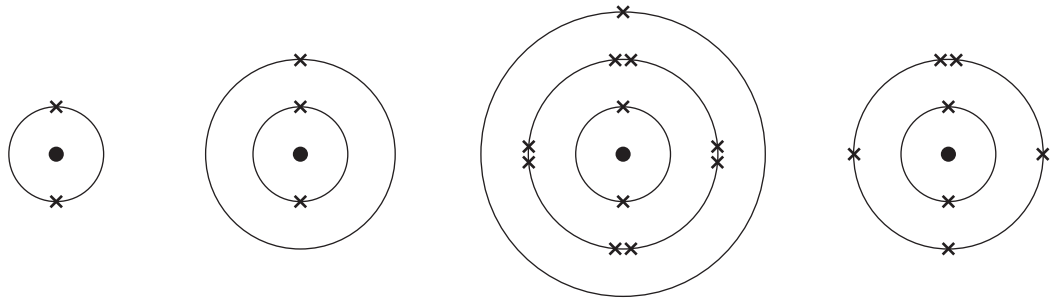
Turn over for the next question

4.1.1.1 Atoms, elements and compounds

Question 13

June 2012 | CH1HP | Original Q1 | Legacy

1 The diagrams show the electronic structure of four different atoms.



Atom A **Atom B** **Atom C** **Atom D**

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

1 (a) Name the two sub-atomic particles in the nucleus of an atom.

.....

(1 mark)

1 (b) Why is there no overall electrical charge on each atom?

.....

.....

(1 mark)

1 (c) Why is **Atom A** unreactive?

.....

(1 mark)

1 (d) Which **two** of these atoms have similar chemical properties?
Give a reason for your answer.

.....

.....

.....

.....

(2 marks)

5

4.1.1.1 Atoms, elements and compounds

Question 14

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]

.....

.....

.....

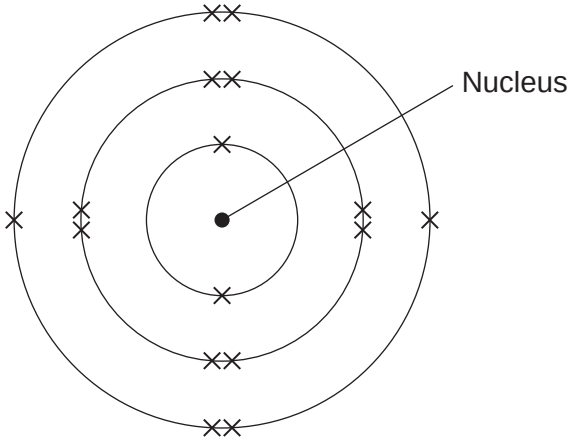
.....

4.1.1.1 Atoms, elements and compounds

Question 14 · 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

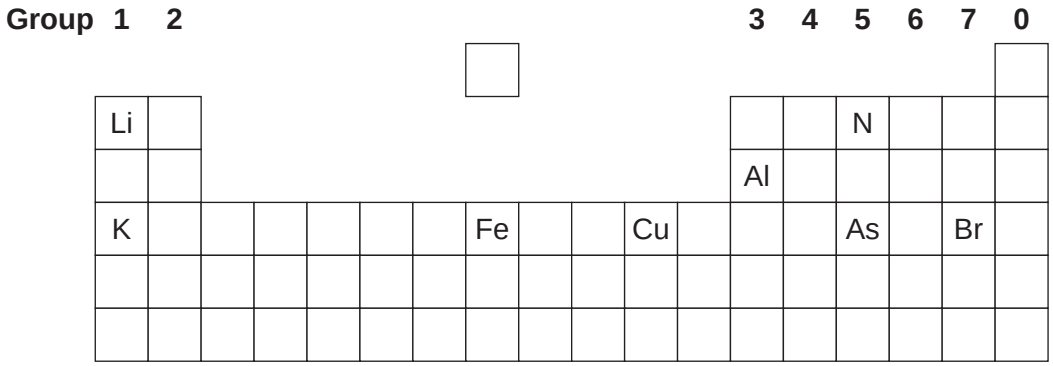
4.1.1.1 Atoms, elements and compounds

Question 15

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

4.1.1.1 Atoms, elements and compounds

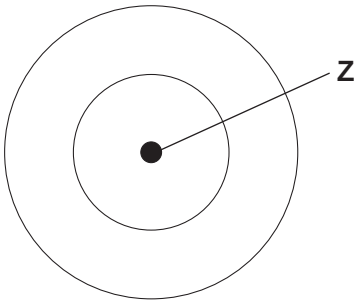
Question 16

June 2016 | CH1HP | Original Q1 | Legacy

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]

_____

_____

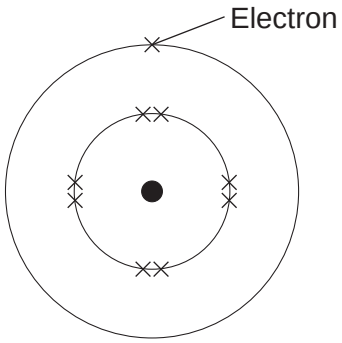
_____

4.1.1.1 Atoms, elements and compounds

Question 16 · 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

4.1.1.1 Atoms, elements and compounds

Question 17

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]

_____

4.1.1.1 Atoms, elements and compounds

Question 17 · 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.

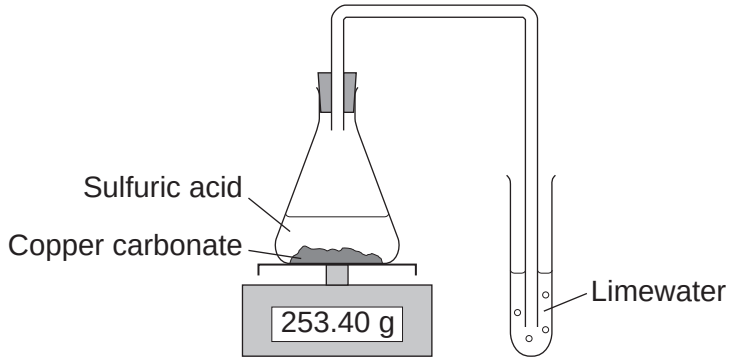
Mass of copper sulfate in g	Mass of water in g	Tick (✓)
30	7	
159	36	
196	18	
319	36	

4.1.1.1 Atoms, elements and compounds

Question 17 · 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

4.1.1.1 Atoms, elements and compounds

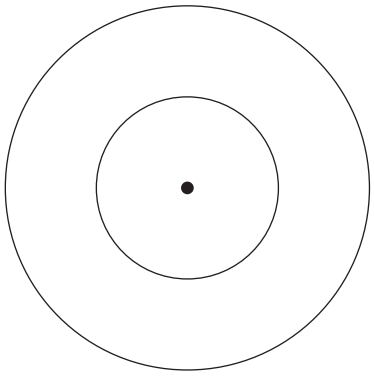
Question 18

June 2017 | CH1HP | Original Q2 | Legacy

2 This question is about compounds of carbon.

2 (a) **Figure 2** shows an atom with two energy levels (shells).

Figure 2



2 (a) (i) A carbon atom has six electrons.

Complete **Figure 2** to show the electronic structure of a carbon atom.

Use **x** to represent an electron.

[1 mark]

2 (a) (ii) Complete the following description about the central part of this carbon atom.

[3 marks]

The central part is made up of six neutrons that have no electrical charge and _____

_____

_____

_____

_____

2 (b) Crude oil is a mixture of compounds. These compounds are mainly hydrocarbons.

What does the term hydrocarbon mean?

[1 mark]

_____

_____

Question 18 · continued

2 (c) Alkanes and alkenes are hydrocarbons.

Table 2 shows the boiling points of some alkanes and alkenes.

Table 2

Alkanes

Name	Formula	Boiling point in °C
Ethane	C_2H_6	−88
Propane	C_3H_8	−42
Butane	C_4H_{10}	0
Pentane	C_5H_{12}	+36
Hexane	C_6H_{14}	+69

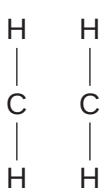
Alkenes

Name	Formula	Boiling point in °C
Ethene	C_2H_4	−104
Propene	C_3H_6	−48
Butene	C_4H_8	−6
Pentene	C_5H_{10}	+30
Hexene	C_6H_{12}	+64

2 (c) (i) Complete the displayed structure of ethane and the displayed structure of ethene.

[2 marks]

Ethane



Ethene



2 (c) (ii) Describe the relationship between the number of carbon atoms in an alkane molecule and the boiling point of the alkane molecule.

[1 mark]

_____

_____

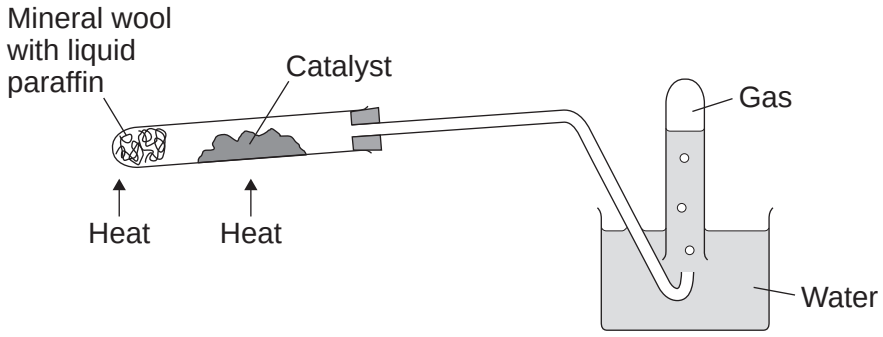
Question 18 · continued

2 (c) (iii) Use the information in **Table 2** to compare the boiling points of alkanes with the boiling points of alkenes.

[2 marks]

2 (d) A student used the apparatus in **Figure 3** to investigate what happens when liquid paraffin is heated to a high temperature.

Figure 3



Liquid paraffin contains alkanes.

Describe what happens to the alkane molecules in this investigation.

[3 marks]

13

4.1.1.1 Atoms, elements and compounds

Question 19

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]

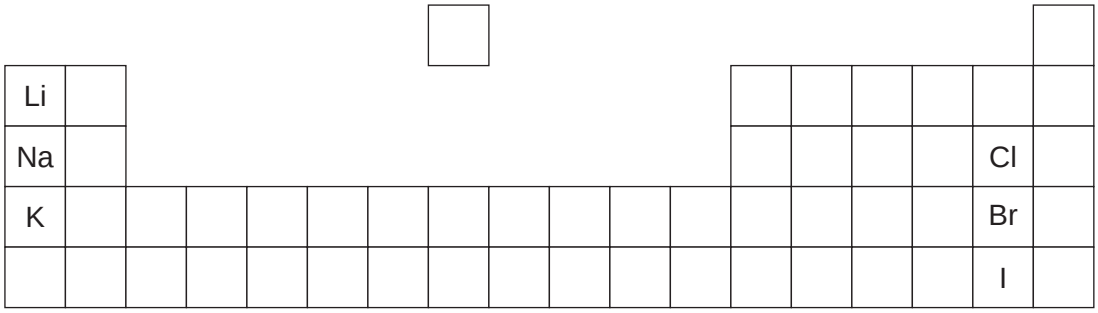
3 (a) (ii) Give **one** reason why the elements Ti, V, Cr and Mn should **not** be where Mendeleev placed them.

[1 mark]

Question 19 · 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.

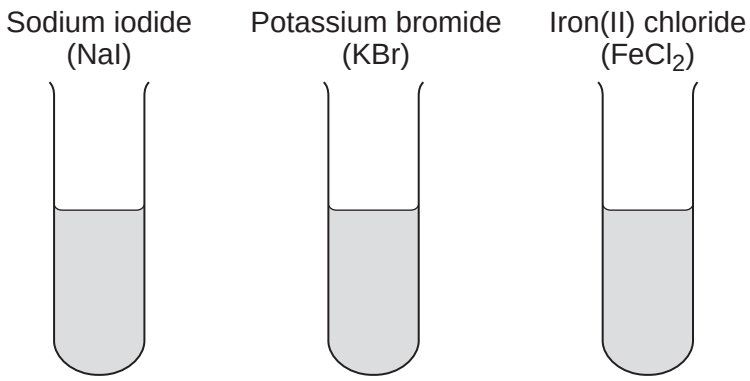
[3 marks]

Question 3 continues on the next page

Question 19 · 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	

4.1.1.1 Atoms, elements and compounds

Question 19 · 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?

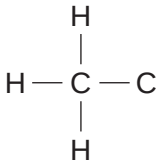
[1 mark]

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

4.1.1.1 Atoms, elements and compounds

Question 20

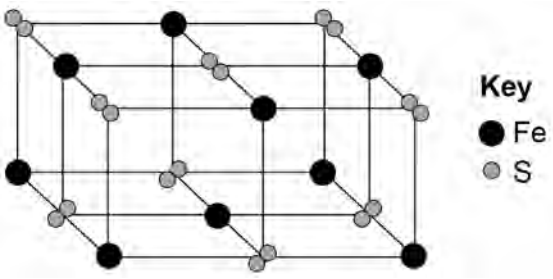
June 2018 | 8462/1H | Original Q2

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 _____

_____

4.1.1.1 Atoms, elements and compounds

Question 20 · 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

4.1.1.1 Atoms, elements and compounds

Question 21

November 2021 | 8462/1H | Original Q4

0 4 This question is about Group 1 elements.

0 4 . 1 Give **two** observations you could make when a small piece of potassium is added to water.

[2 marks]

1 _____

_____

2 _____

_____

0 4 . 2 Complete the equation for the reaction of potassium with water.

You should balance the equation.

[2 marks]

$$K + \qquad H_2O \rightarrow \qquad +$$

0 4 . 3 Explain why the reactivity of elements changes going down Group 1.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

4.1.1.1 Atoms, elements and compounds

Question 21 · continued

Sodium reacts with oxygen to produce the ionic compound sodium oxide.

Oxygen is a Group 6 element.

0 4 . 4 Draw a dot and cross diagram to show what happens when atoms of sodium and oxygen react to produce sodium oxide.

[4 marks]

Diagram

4.1.1.1 Atoms, elements and compounds

Question 21 · continued

0 4 . 5 Why is oxygen described as being reduced in the reaction between sodium and oxygen?

[1 mark]

0 4 . 6 Explain why sodium oxide has a high melting point.

[3 marks]

16

4.1.1.1 Atoms, elements and compounds

Question 22

November 2021 | 8462/2H | Original Q5

0 5 This question is about fertilisers.

Some fertilisers are described as NPK fertilisers because they contain three elements needed for healthy plant growth.

0 5 . 1 Which **two** compounds each contain **two** of these elements?

[2 marks]

Tick (✓) **two** boxes.

- Ammonium nitrate ☐
- Ammonium phosphate ☐
- Calcium chloride ☐
- Calcium phosphate ☐
- Potassium chloride ☐
- Potassium nitrate ☐

0 5 . 2 Rocks containing calcium phosphate are treated with acid to produce soluble salts that can be used as fertilisers.

Name the soluble salts produced when calcium phosphate reacts with:

- nitric acid
- phosphoric acid.

[2 marks]

Nitric acid _____

Phosphoric acid _____

4.1.1.1 Atoms, elements and compounds

Question 22 · continued

0 5 . 3 Ammonium sulfate is a compound in fertilisers.

Ammonium sulfate can be made using an industrial process or in the laboratory.

In the industrial process, the following steps are used.

1. React streams of ammonia solution and sulfuric acid together.
2. Evaporate the water by passing the solution down a warm column.
3. Collect dry crystals continuously at the bottom of the column.

In the laboratory, the following steps are used.

1. React ammonia solution and sulfuric acid in a conical flask.
2. Evaporate water from the solution until crystals start to form.
3. Leave to cool and crystallise further.
4. Separate the crystals using filtration.
5. Dry the crystals between pieces of filter paper.

Evaluate the two methods for producing a large mass of ammonium sulfate.

[4 marks]

8

4.1.1.1 Atoms, elements and compounds

Question 23

June 2023 | 8462/1H | Original Q1

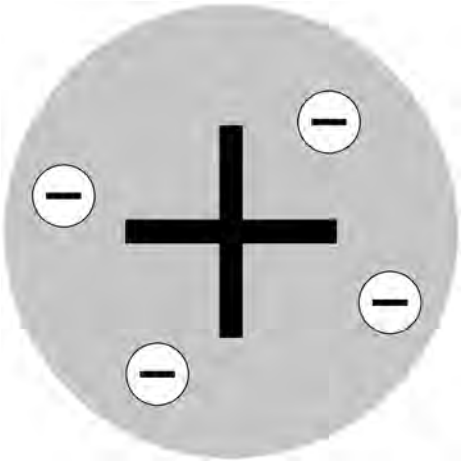
0 1 Discoveries in chemistry led to a better understanding of atomic structure.

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 _____

4.1.1.1 Atoms, elements and compounds

Question 23 · 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

Question 23 · 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

4.1.1.1 Atoms, elements and compounds

Question 24

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]

4.1.1.1 Atoms, elements and compounds

Question 24 · continued

June 2023 | 8462/1H | Original Q8

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