AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.1.1.1

Atoms, elements and compounds

Past-paper questions

Tier	**Foundation**
Question groups	**65**
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.

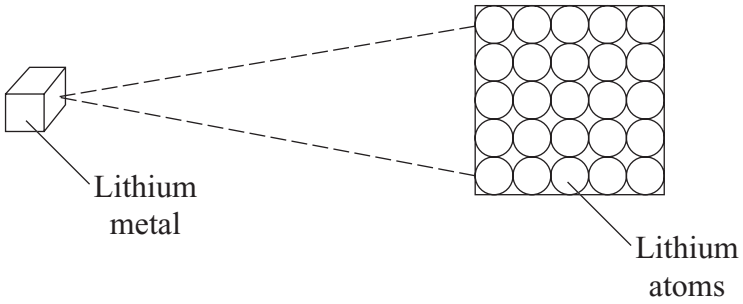
4.1.1.1 Atoms, elements and compounds

Question 01

January 2007 | CHY1F | Original Q1 | Legacy

1 Lithium metal is used in alkaline batteries.

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



Why is lithium metal described as an element?

.....

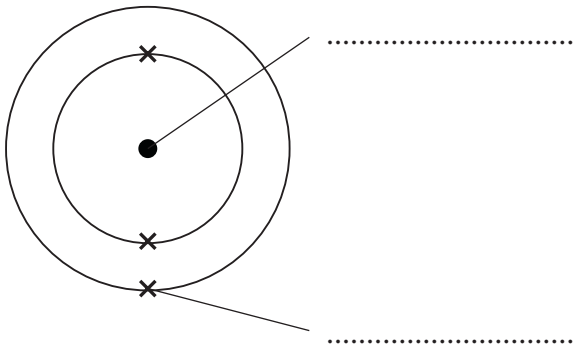
.....

(1 mark)

(b) The diagram below represents a lithium atom.

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

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



(2 marks)

3

4.1.1.1 Atoms, elements and compounds

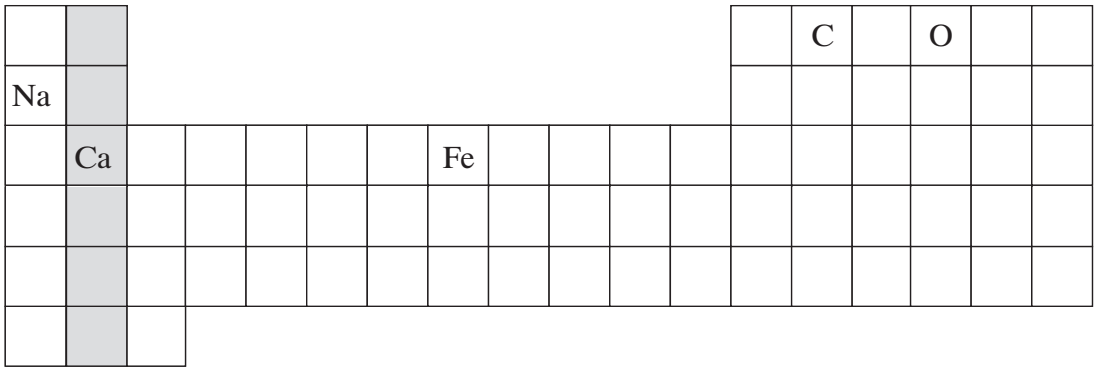
Question 02

March 2007 | CHY1A | Original Q4 | Legacy

QUESTION FOUR

The diagram shows part of the periodic table.

One vertical column has been shaded in.



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

A compounds

B elements

C groups

D properties

Some of the substances shown in the periodic table can react together to form . . . **1** . . . .

The substances in the periodic table are . . . **2** . . . .

Substances in the same vertical column have similar chemical . . . **3** . . . .

The vertical columns are called . . . **4** . . . .

4.1.1.1 Atoms, elements and compounds

Question 03

June 2007 | CHY1A | Original Q1 | Legacy

QUESTION ONE

The balanced, symbol equation shows the atoms involved in a chemical reaction.

$Fe_2O_3(s)$	+	$3CO(g)$	→	$2Fe(s)$	+	$3CO_2(g)$
iron oxide		carbon monoxide		iron		carbon dioxide

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

A atom

B compound

C element

D symbol

O is the . . . **1** . . . for oxygen.

Fe_2O_3 is the formula for the . . . **2** . . . , iron oxide.

Fe represents one . . . **3** . . . of iron.

Carbon is a soft, black, non-metal . . . **4** . . . .

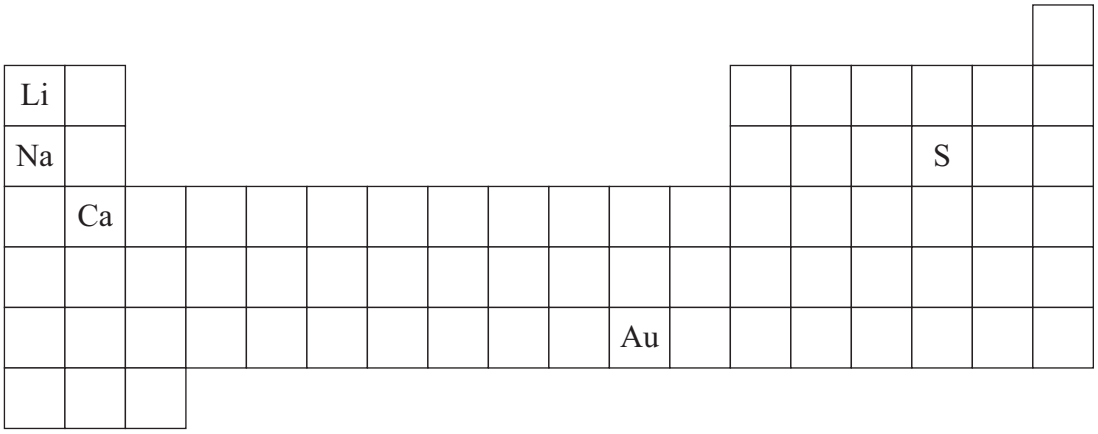
4.1.1.1 Atoms, elements and compounds

Question 04

June 2007 | CHY1A | Original Q2 | Legacy

QUESTION TWO

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



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

A gold (Au)

B lithium (Li)

C calcium (Ca)

D sulfur (S)

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

4.1.1.1 Atoms, elements and compounds

Question 05

November 2007 | CHY1A | Original Q1 | Legacy

QUESTION ONE

The equation shows how sodium reacts with water.

2Na sodium	+	$2H_2O$ water	→	2NaOH sodium hydroxide	+	H_2 hydrogen

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

A atoms

B compounds

C elements

D molecules

In the equation:

2Na represents two . . . **1** . . . of sodium.

$2H_2O$ represents two . . . **2** . . . of water.

Water and sodium hydroxide are . . . **3** . . . .

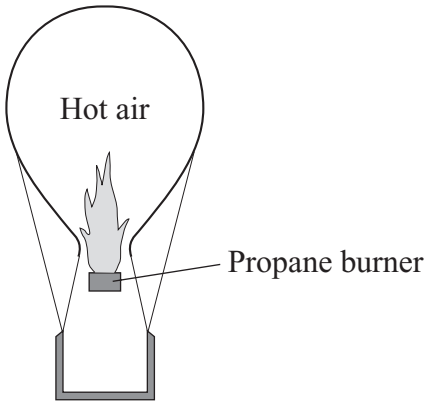
Sodium and hydrogen are . . . **4** . . . .

4.1.1.1 Atoms, elements and compounds

Question 06

January 2008 | CHY1F | Original Q1 | Legacy

1 Hot air balloons burn hydrocarbons to heat the air.



(a) The hot air contains these gases:

nitrogen, N_2
oxygen, O_2
argon, Ar
carbon dioxide, CO_2
water vapour, H_2O

(i) Argon is an *element*.

What is an *element*?

.....

.....

(1 mark)

(ii) Name **one** other gas in the hot air that is also an element.

.....

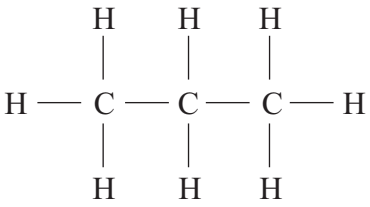
(1 mark)

4.1.1.1 Atoms, elements and compounds

Question 06 · continued

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(b) Propane, C_3H_8, can be represented as:



Use the correct words from the box to complete the sentences.

bond	**carbon**	**compound**	**element**	**mixture**

(i) Propane is a ..... and is made up of atoms of hydrogen and ..... .

(2 marks)

(ii) Each line between the atoms in propane represents a chemical ..... .

(1 mark)

5

4.1.1.1 Atoms, elements and compounds

Question 07

8 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)

(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

4.1.1.1 Atoms, elements and compounds

Question 08

January 2008 | CHY2F | Original Q4 | Legacy

4 The electrolysis of sodium chloride solution produces useful substances.

(a) (i) Choose a word from the box to complete the sentence.

covalent	**ionic**	**non-metallic**

Electrolysis takes place when electricity passes through ..... compounds when they are molten or in solution.

(1 mark)

(ii) Choose a word from the box to complete the sentence.

alkenes	**elements**	**salts**

During electrolysis the compound is broken down to form ..... .

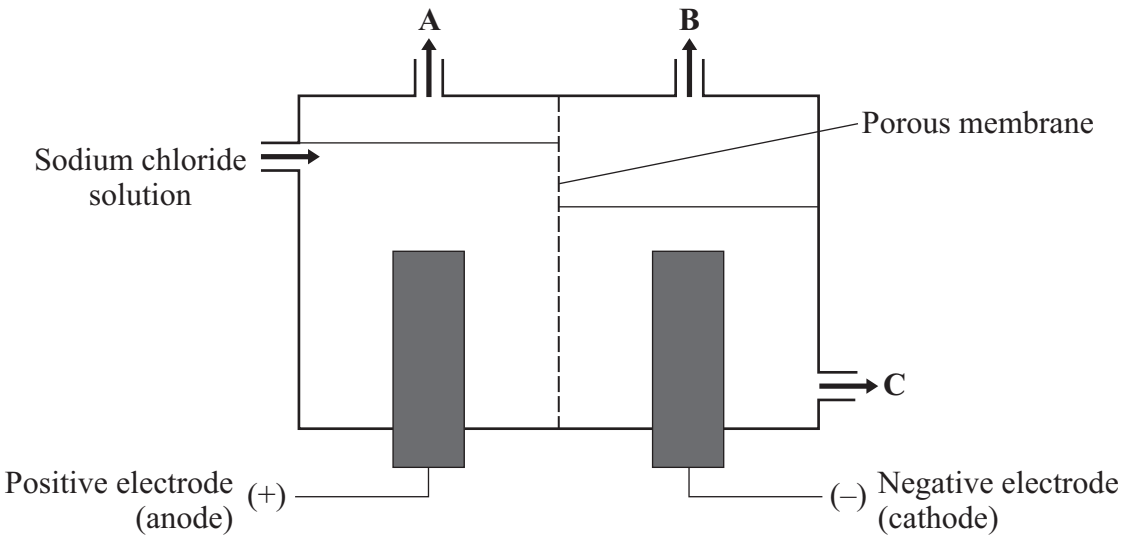
(1 mark)

Question 08 · continued

BLANK

(b) The table of ions on the Data Sheet may help you to answer this question.

The diagram shows an apparatus used for the electrolysis of sodium chloride solution.



Identify the products **A**, **B** and **C** on the diagram using substances from the box.

chlorine gas	**hydrogen gas**	**oxygen gas**
sodium hydroxide solution		**sodium metal**

(i) **A** is ..... .
(1 mark)

(ii) **B** is ..... .
(1 mark)

(iii) **C** is ..... .
(1 mark)

5

4.1.1.1 Atoms, elements and compounds

Question 09

March 2008 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

This question is about formulae of chemical compounds.

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

A this compound contains hydrogen

B this compound is a carbonate

C this formula has only two atoms

D this formula has only two oxygen atoms

	Formula
1	$CaCO_3$
2	CaO
3	CO_2
4	H_2O

4.1.1.1 Atoms, elements and compounds

Question 10

June 2008 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The engine of a car is made of aluminium, to which other metals have been added to make it stronger. In the engine, petrol vapour burns as it reacts with oxygen. Petrol is made up of several alkanes.

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

A alkane

B engine

C oxygen

D petrol vapour

	Type of substance
1	mixture of metals
2	element
3	compound
4	mixture of gases

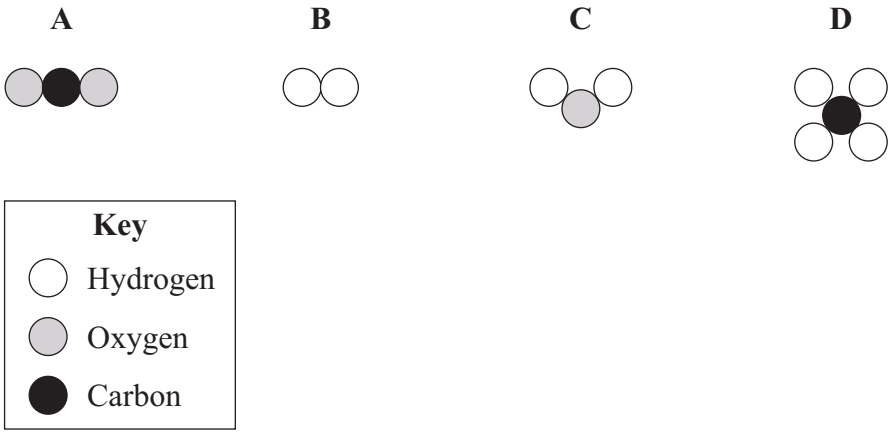
4.1.1.1 Atoms, elements and compounds

Question 11

June 2008 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

The diagrams show the numbers and different types of atoms in four substances, **A**, **B**, **C** and **D**.



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

	Formula for the substance
1	CO_2
2	H_2
3	H_2O
4	CH_4

4.1.1.1 Atoms, elements and compounds

Question 12

June 2008 | CHY1AP | Original Q6 | Legacy

QUESTION SIX

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

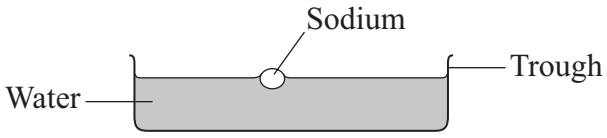
Question 13

June 2008 | CHY3F | Original Q2 | Legacy

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

The reaction between sodium and water

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



The sodium floated and started to react.

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

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

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

The word equation for this reaction is:

sodium + water → sodium hydroxide + hydrogen

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

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

.....

(1 mark)

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

.....

(1 mark)

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

.....

(1 mark)

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

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

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

.....

(1 mark)

4.1.1.1 Atoms, elements and compounds

Question 13 · continued

for mark

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

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

(2 marks)

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

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

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

(1 mark)

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

(1 mark)

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

(1 mark)

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

.....

(1 mark)

10

4.1.1.1 Atoms, elements and compounds

Question 14

November 2008 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

This question is about elements.

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

A a nucleus

B a compound

C a group

D an element

An atom consists of electrons orbiting . . . **1** . . . .

A substance that is made up of only one kind of atom is called . . . **2** . . . .

In the periodic table, a vertical column is called . . . **3** . . . .

When two or more elements combine together, they form . . . **4** . . . .

4.1.1.1 Atoms, elements and compounds

Question 15

March 2009 | CHY1AP | Original Q3 | Legacy

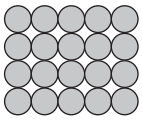
QUESTION THREE

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

Substance **A**



Substance **B**



Substance **C**



Substance **D**



Key

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

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

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

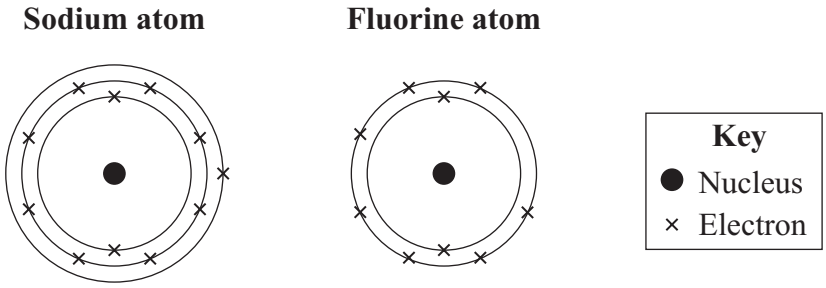
4.1.1.1 Atoms, elements and compounds

Question 16

June 2009 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The diagram shows a sodium atom and a fluorine atom.



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

A a compound

B an electron

C a bond

D an element

Fluorine is made of only one sort of atom. This means that it is . . . **1** . . . .

When sodium and fluorine react, the fluorine atom takes . . . **2** . . . from the sodium atom.

The atoms are then held together by . . . **3** . . . .

Sodium and fluorine combine together to form sodium fluoride, which is . . . **4** . . . .

4.1.1.1 Atoms, elements and compounds

Question 17

November 2009 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

The formula of hydrogen sulfide is H_2S.

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

A atoms

B electrons

C compounds

D elements

Hydrogen and sulfur are in the periodic table because they are . . . **1** . . . .

Hydrogen and sulfur are combined together in hydrogen sulfide, which is one of many known . . . **2** . . . .

The bonds in hydrogen sulfide are formed by shared pairs of . . . **3** . . . .

The formula of hydrogen sulfide contains a total of three . . . **4** . . . .

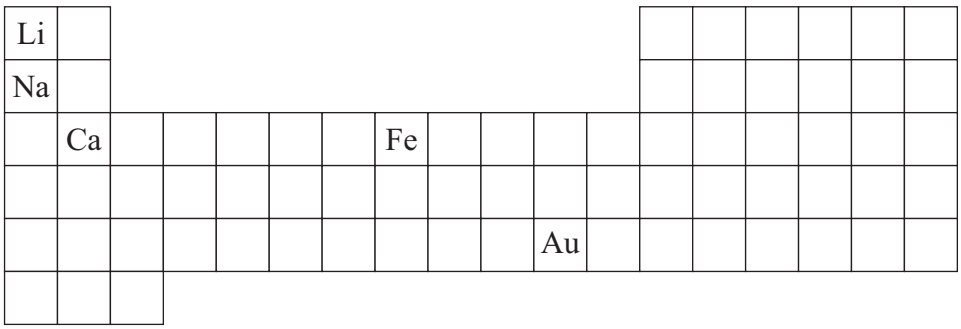
4.1.1.1 Atoms, elements and compounds

Question 18

November 2009 | CHY1AP | Original Q5 | Legacy

QUESTION FIVE

The diagram shows part of the periodic table.



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

A Calcium (Ca)

B Lithium (Li)

C Gold (Au)

D Iron (Fe)

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

4.1.1.1 Atoms, elements and compounds

Question 19

January 2019 | CHY1F | Original Q4 | Legacy

4 Natural gas is mainly a hydrocarbon called methane.

4 (a) Use **one** word from the box to complete the sentence.

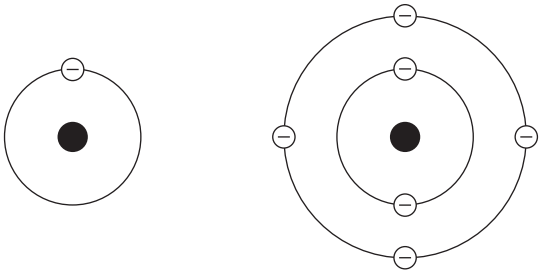
compounds	**elements**	**molecules**

Hydrocarbons contain hydrogen and carbon only.

Hydrogen and carbon are ..... .

(1 mark)

4 (b) The diagrams represent atoms of hydrogen and carbon.



Hydrogen Carbon

Draw a ring around the correct answer to complete the sentences.

4 (b) (i) The centre of each atom is called the

bond.
nucleus.
symbol.

(1 mark)

4 (b) (ii) The hydrogen atom has one electron and the carbon atom has

three
four
six

electrons.

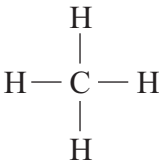
(1 mark)

4.1.1.1 Atoms, elements and compounds

Question 19 · continued

for mark

4 (c) A molecule of methane can be represented as



Draw a ring around the correct answer to complete the sentences.

4 (c) (i) The formula of methane is

CH

CH_4

C_4H_4

(1 mark)

4 (c) (ii) The line between C—H is called a

bond.

molecule.

nucleus.

(1 mark)

4 (d) Methane burns to produce carbon dioxide (CO_2) and water (H_2O).

4 (d) (i) Draw a ring around the correct answer to complete the sentence.

When methane burns it reacts with

carbon.

nitrogen.

oxygen.

(1 mark)

4 (d) (ii) Hydrogen (H_2) can be used as a fuel.

Suggest why burning hydrogen would be less harmful to the environment than burning methane.

.....

.....

(1 mark)

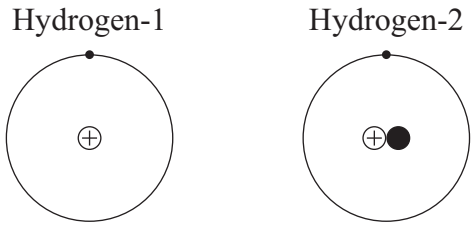
7

4.1.1.1 Atoms, elements and compounds

Question 20

3 Two isotopes of hydrogen are hydrogen-1 ($^{1}_{1}H$) and hydrogen-2 ($^{2}_{1}H$).

The diagrams represent atoms of hydrogen-1 and hydrogen-2.



3 (a) Use the correct words from the box to complete the sentences.

electrons	**neutrons**	**protons**

3 (a) (i) The positive particles , ⊕ , in the nucleus of atoms are called

..... .

(1 mark)

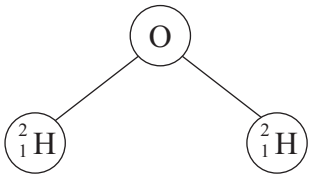
3 (a) (ii) The particles with no charge, ● , in the nucleus of atoms are called

..... .

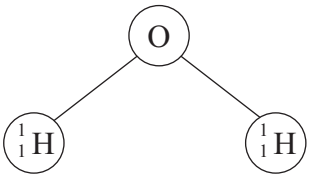
(1 mark)

3 (b) The diagrams show two different types of water molecule.

Molecule A



Molecule B



Draw a ring around the correct answer to complete the sentence.

Molecule **A** is [heavier than / lighter than / the same mass as] molecule **B**.

Explain your answer.

.....

.....

(2 marks)

4

4.1.1.1 Atoms, elements and compounds

Question 21

March 2010 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

This question is about the substances involved in the thermal decomposition of calcium carbonate, $CaCO_3$

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

A atoms

B compounds

C non-metal elements

D elements

Calcium carbonate contains three . . . **1** . . . .

The formula for calcium carbonate contains a total of five . . . **2** . . . .

Calcium carbonate contains two . . . **3** . . . .

On heating, calcium carbonate decomposes into two new . . . **4** . . . .

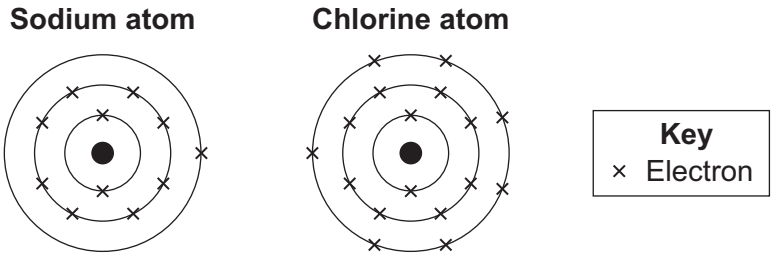
4.1.1.1 Atoms, elements and compounds

Question 22

June 2010 | CHY1AP | Original Q3 | Legacy

QUESTION THREE

This question is about a sodium atom and a chlorine atom.



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

A bonds

B electrons

C elements

D nuclei

In the diagrams, ● represents . . . **1** . . . .

Sodium and chlorine are . . . **2** . . . .

When sodium and chlorine react, the chlorine atoms take . . . **3** . . . from the sodium atoms.

The sodium and chlorine atoms are then held together by . . . **4** . . . .

4.1.1.1 Atoms, elements and compounds

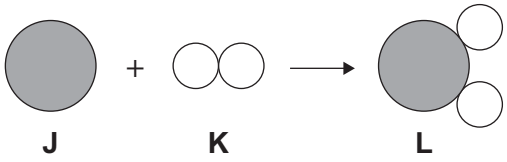
Question 23

June 2010 | CHY1AP | Original Q9 | Legacy

QUESTION NINE

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.



9A Which substance or substances are elements?

1 **J** only

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

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

4 **L** only

9B 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**.

9C 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.

9D 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.

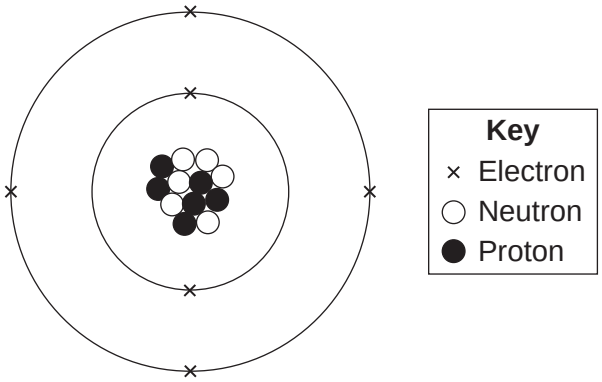
END OF TEST

4.1.1.1 Atoms, elements and compounds

Question 24

June 2010 | CHY2F | Original Q2 | Legacy

2 The diagram represents a carbon atom.



2 (a) Use words from the box to answer the questions.

electron	**neutron**	**nucleus**	**proton**

2 (a) (i) What is the name of the central part of the atom?

.....

(1 mark)

2 (a) (ii) What is the name of the particle with no charge?

.....

(1 mark)

2 (a) (iii) What is the name of the particle with a negative charge?

.....

(1 mark)

2 (b) Use the diagram above to help you to answer these questions.

2 (b) (i) Draw a ring around the atomic (proton) number of this carbon atom.

6 **12** **18**

(1 mark)

2 (b) (ii) Draw a ring around the mass number of this carbon atom.

6 **12** **18**

(1 mark)

4.1.1.1 Atoms, elements and compounds

Question 24 · continued

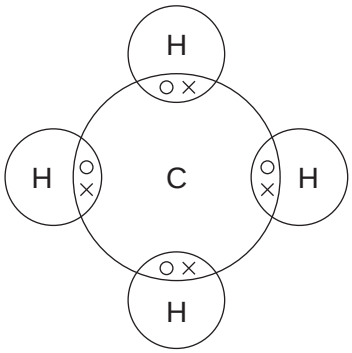
2 (c) A different carbon atom has 6 protons and 8 neutrons.

Draw a ring around the symbol that represents this atom.

$^{8}_{6}C$ $^{14}_{6}C$ $^{14}_{8}C$

(1 mark)

2 (d) The diagram shows the bonding in a methane molecule.



2 (d) (i) Draw a ring around the chemical formula of a methane molecule.

CH_4 **CH^4** **C_4H**

(1 mark)

2 (d) (ii) Draw a ring around the word that describes methane.

compound **element** **mixture**

(1 mark)

2 (d) (iii) Draw a ring around the type of bonding in a methane molecule.

covalent **ionic** **metallic**

(1 mark)

9

4.1.1.1 Atoms, elements and compounds

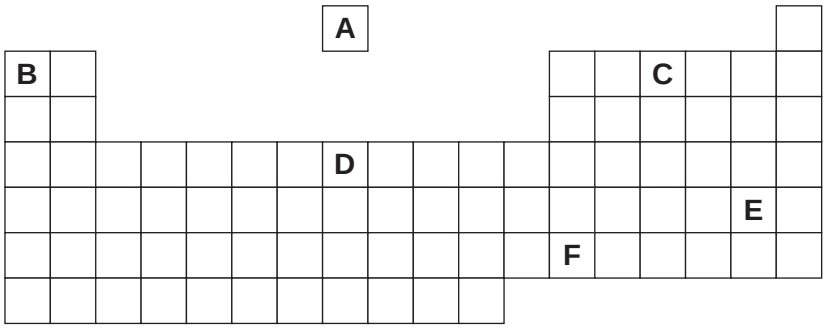
Question 25

June 2010 | CHY3F | Original Q3 | Legacy

3 (a) Use the periodic table on the Data Sheet to help you answer these questions.

Part of the periodic table is shown below.

The letters are **not** the symbols of the elements.



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

Which letter, **A**, **B**, **C**, **D**, **E** or **F**, represents

3 (a) (i) hydrogen Letter ☐

(1 mark)

3 (a) (ii) a Group 3 element Letter ☐

(1 mark)

3 (a) (iii) a halogen Letter ☐

(1 mark)

3 (a) (iv) the element with atomic (proton) number of 7 Letter ☐

(1 mark)

3 (a) (v) an element with one electron in its outer shell? Letter ☐

(1 mark)

4.1.1.1 Atoms, elements and compounds

Question 25 · continued

3 (b) The table shows the melting points of the Group 1 metals arranged in alphabetical order.

Group 1 metal		
Name	**Symbol**	**Melting point in °C**
Caesium	Cs	29
Francium	Fr	27
Lithium	Li	180
Potassium	K	64
Rubidium	Rb	39
Sodium	Na	98

3 (b) (i) Arrange these metals in order of increasing melting point. Three have been done for you.

Fr Cs Li

Lowest ⟶ Highest

(1 mark)

3 (b) (ii) Use the periodic table on the Data Sheet **and** your answer in part (b)(i) above to complete this sentence about how the melting points change.

Going down Group 1, the melting points ..... .

(1 mark)

3 (c) The transition metals are a block of elements between Groups 2 and 3 of the periodic table. Transition metals have different properties to Group 1 metals.

Put ticks (✓) next to the **three** correct statements about transition metals in the table below.

Statement	(✓)
They are harder than Group 1 metals	
They have lower densities than Group 1 metals	
They have higher melting points than Group 1 metals	
They are more reactive with water than Group 1 metals	
They often form coloured compounds but Group 1 compounds are usually white	

(3 marks)

10

4.1.1.1 Atoms, elements and compounds

Question 26

June 2010 | CHY3F | Original Q4 | Legacy

4 Chemical tests can be used to detect and identify elements and compounds.

A jar of a chemical from 1870 is shown.



Copperas was a name used for iron(II) sulfate, $FeSO_4$. It does not contain any copper!

4 (a) A student tested solutions of copperas to show which ions it contained.

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

4 (a) (i) The student tested for iron(II) ions, Fe^{2+}

The student added a solution of

barium chloride.

silver nitrate.

sodium hydroxide.

The colour of the precipitate formed was

green.

red.

white.

The precipitate was a

liquid.

gas.

solid.

(3 marks)

4.1.1.1 Atoms, elements and compounds

Question 26 · continued

4 (a) (ii) The student tested for sulfate ions, SO_4^{2-}

The student added dilute hydrochloric acid and [barium chloride / silver nitrate / sodium hydroxide] solution.

The colour of the precipitate formed was [green. / red. / white.]

Sulfuric acid (H_2SO_4) should **not** be used instead of hydrochloric acid (HCl) when testing for sulfate ions. This is because sulfuric acid contains [chloride ions, Cl^- / nitrate ions, NO_3^- / sulfate ions, SO_4^{2-}]

(3 marks)

4 (b) A flame test can be used to identify the metal ions in a compound.

How do you carry out a flame test?

.....

.....

(1 mark)

4 (c) The elements in a compound can also be detected and identified using instrumental methods of analysis.

State **one** advantage of using instrumental methods compared with chemical tests.

.....

.....

(1 mark)

8

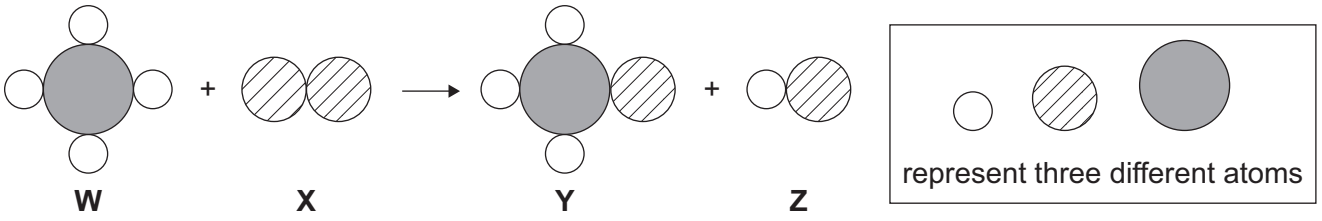
4.1.1.1 Atoms, elements and compounds

Question 27

November 2010 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

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



W X Y Z

8A 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.

8B 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.

8C Which substance would be found in the periodic table?

1 substance **W**

2 substance **X**

3 substance **Y**

4 substance **Z**

8D 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.

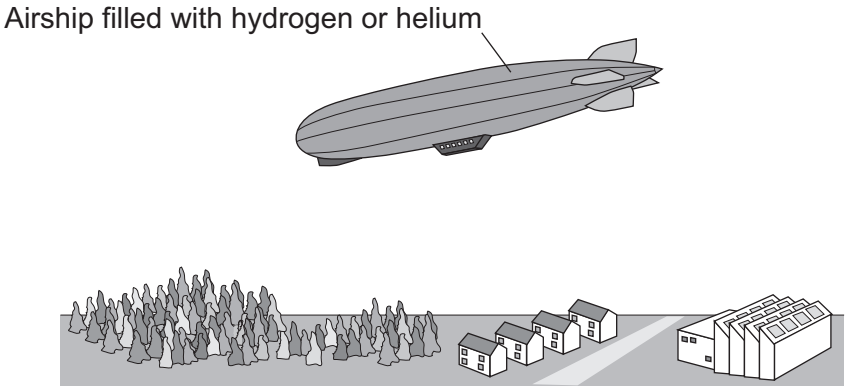
4 Substance **W** contains five different elements.

4.1.1.1 Atoms, elements and compounds

Question 28

January 2011 | CHY1F | Original Q1 | Legacy

1 Hydrogen and helium have both been used in airships.



1 (a) Tick (✓) the property which both hydrogen and helium have that makes an airship float in air.

Property	Tick (✓)
Colourless	
Less dense than air	
More dense than air	

(1 mark)

1 (b) (i) Hydrogen is no longer used in airships because it burns in oxygen.

The chemical equation for this reaction is shown.

$$2H_2 + O_2 \rightarrow 2H_2O$$

Complete the word equation for this reaction.

hydrogen + oxygen → .....

(1 mark)

4.1.1.1 Atoms, elements and compounds

Question 28 · continued

1 (b) (ii) Helium is safer than hydrogen because it does **not** burn in oxygen.

Draw a ring around the correct answer to complete the sentence.

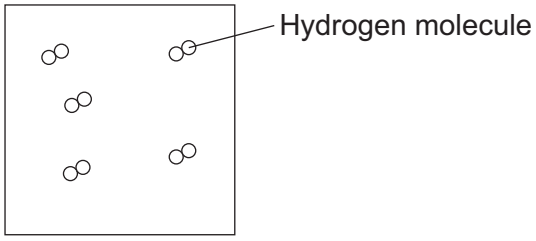
Helium is now used in airships because it is

- a fuel.
- already in the air.
- unreactive.

(1 mark)

1 (c) **Diagram 1** represents hydrogen molecules.

Diagram 1



Draw a ring around the correct answer to complete the sentence.

Each hydrogen molecule is made up of two hydrogen

- atoms.
- compounds.
- elements.

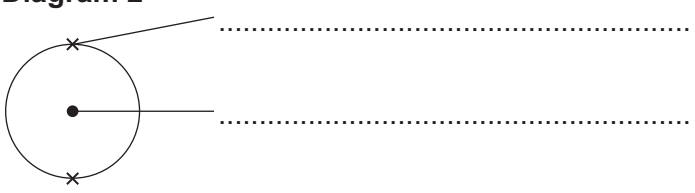
(1 mark)

1 (d) **Diagram 2** shows the parts of a helium atom.

Use words from the box to label **diagram 2**.

bond	**electron**	**nucleus**

Diagram 2



(2 marks)

6

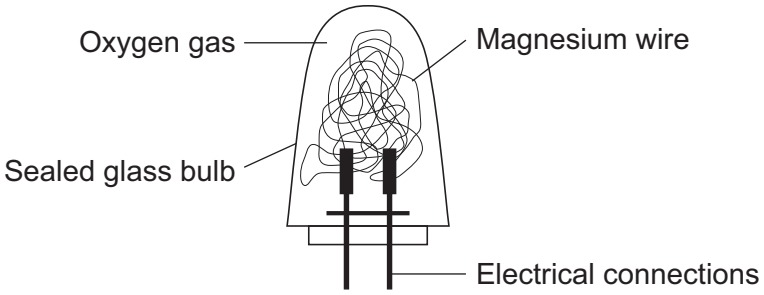
4.1.1.1 Atoms, elements and compounds

Question 29

March 2011 | CHY1AP | Original Q8 | Legacy

QUESTION EIGHT

The diagram shows a flash bulb that was used in photography.



When a photograph is taken, an electric current flows through the magnesium. The magnesium burns very brightly and very quickly. A white powder called magnesium oxide (MgO) is formed.

A student wanted to find out if the mass of the flash bulb changed when it was used.

- The mass of a new flash bulb was measured.
- It was made to flash and then allowed to cool.
- The glass bulb was unbroken.
- The mass of the used flash bulb was then measured.

8A Which of the following statements is correct?

The mass of the flash bulb . . .

1 did not change.

2 changed because a chemical reaction had taken place.

3 increased because a new substance had been made.

4 decreased because the magnesium and oxygen had been used up.

8B Which statement correctly describes what happens inside the flash bulb?

1 Magnesium and oxygen atoms make magnesium oxide when they mix together.

2 Magnesium and oxygen atoms combine and are held together by chemical bonds.

3 Many new magnesium and oxygen atoms are formed when there is a flash inside the flash bulb.

4 Magnesium and oxygen atoms combine to make atoms of magnesium oxide.

4.1.1.1 Atoms, elements and compounds

Question 29 · continued

8C Which row in the table gives a correct description of each substance involved in the reaction in the flash bulb?

	Substance		
	Magnesium	**Oxygen**	**Magnesium oxide**
1	element	element	compound
2	element	compound	element
3	compound	compound	element
4	element	compound	compound

8D The magnesium oxide made in this reaction can be used to produce magnesium nitrate. The formula for magnesium nitrate is $Mg(NO_3)_2$

Which row in the table below shows the numbers of each type of atom in the formula $Mg(NO_3)_2$?

	Magnesium	**Nitrogen**	**Oxygen**
1	1	1	3
2	2	1	6
3	1	2	3
4	1	2	6

4.1.1.1 Atoms, elements and compounds

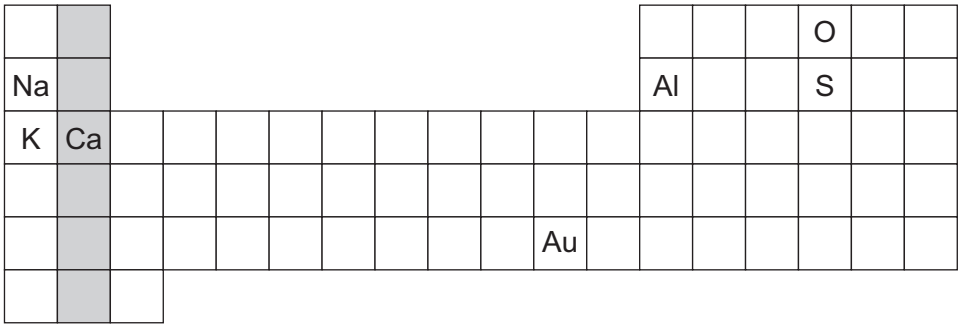
Question 30

June 2011 | CHY1AP | Original Q2 | Legacy

QUESTION TWO

The diagram shows part of the periodic table.

One vertical column has been shaded.



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

A compounds

B groups

C properties

D symbols

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

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

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

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

4.1.1.1 Atoms, elements and compounds

Question 31

June 2011 | CHY1F | Original Q4 | Legacy

4 An ore contains zinc carbonate ($ZnCO_3$).

4 (a) Complete the table to show the number of atoms of each element in the formula of zinc carbonate.

Zinc has been done for you.

Element	Number of atoms in the formula $ZnCO_3$
Zinc, Zn	1
Carbon, C	
Oxygen, O	

(2 marks)

4 (b) Draw a ring around the correct answer to complete the sentence and the word equation.

4 (b) (i) Zinc carbonate decomposes in a similar way to calcium carbonate

when [water is added. / cooled. / heated.]

(1 mark)

4 (b) (ii) zinc carbonate ⟶ zinc oxide + [carbon dioxide / hydrogen / oxygen]

(1 mark)

Question 4 continues on the next page

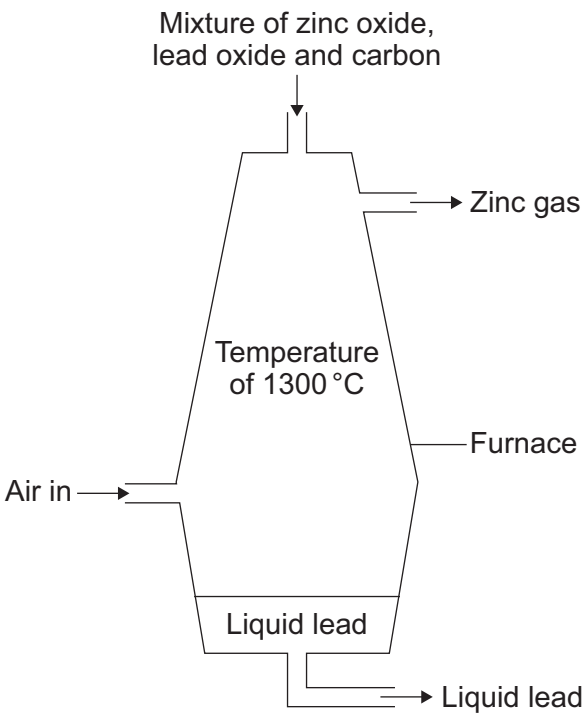
Question 31 · continued

4 (c) Another ore contains a mixture of zinc carbonate and lead carbonate.

The metals zinc and lead are produced from this ore in two stages:

Stage 1 decomposing the carbonates to produce a mixture of zinc oxide and lead oxide.

Stage 2 mixing the oxides with carbon and heating in a furnace.



Some of the reactions in the furnace are:

zinc oxide + carbon → zinc + carbon dioxide

lead oxide + carbon → lead + carbon dioxide

carbon + oxygen → carbon dioxide

4.1.1.1 Atoms, elements and compounds

Question 31 · continued

Use the information given to help you to answer these questions.

4 (c) (i) Draw a ring around the correct answer to complete the sentence.

The reaction between carbon and oxygen that heats the furnace is called

combustion.

decomposition.

evaporation.

(1 mark)

4 (c) (ii) Tick (✓) **one** reason why carbon reacts with zinc oxide to produce zinc.

Reason	Tick (✓)
carbon is less reactive than zinc	
carbon is more reactive than zinc	
carbon is similar in reactivity to zinc	

(1 mark)

4 (c) (iii) In the furnace zinc is a gas but lead is a liquid.

Suggest why.

.....

.....

.....

.....

(2 marks)

8

4.1.1.1 Atoms, elements and compounds

Question 32

June 2011 | CHY3F | Original Q1 | Legacy

1 Use the periodic table on the Data Sheet to help you to answer these questions.

1 (a) The following is a list of symbols of some elements.

Sb	**Se**	**Si**	**Sn**	**Sr**

Choose your answers **only** from the symbols shown in the box above.

Which symbol represents

1 (a) (i) a Group 5 element ☐

(1 mark)

1 (a) (ii) the element in the same group as oxygen (O) ☐

(1 mark)

1 (a) (iii) the element with atomic (proton) number of 50 ☐

(1 mark)

1 (a) (iv) silicon? ☐

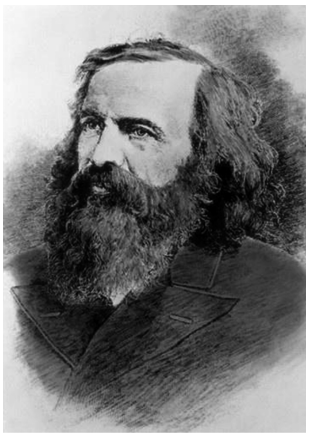
(1 mark)

Question 1 continues on the next page

4.1.1.1 Atoms, elements and compounds

Question 32 · continued

1 (b)



Mendeleev suggested his version of the periodic table in 1869.

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

4.1.1.1 Atoms, elements and compounds

Question 32 · continued

There are differences between Mendeleev's table and the periodic table on the Data Sheet.

Draw a ring around the correct answer to complete the sentences.

1 (b) (i) Mendeleev left gaps (shown by #) in his table.

Mendeleev left gaps for [compounds / elements / mixtures] that had not been discovered.

(1 mark)

1 (b) (ii) Mendeleev put copper (Cu) in the same box as [bromine (Br). / chromium (Cr). / potassium (K).]

(1 mark)

1 (b) (iii) Mendeleev did **not** have a Group [0. / 3. / 5.]

(1 mark)

7

4.1.1.1 Atoms, elements and compounds

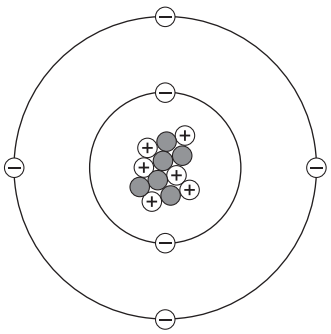
Question 33

January 2012 | CH1FP | Original Q1 | Legacy

1 The picture shows a diamond ring.



1 (a) Diamond is a form of carbon. The diagram represents a carbon atom.



Complete the table to show the name and charge of each type of particle in the carbon atom.

Name of particle	Charge
proton	
neutron	0
	–1

(2 marks)

4.1.1.1 Atoms, elements and compounds

Question 33 · continued

1 (b) Use the Chemistry Data Sheet to help you to answer these questions.

1 (b) (i) Draw a ring around the correct answer to complete the sentence.

Gold and carbon are

- compounds.
- elements.
- mixtures.

(1 mark)

1 (b) (ii) Complete the sentence.

Gold and carbon have different properties because gold is a metal and carbon is a ..... .

(1 mark)

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

Pure gold is not used to make the ring because pure gold is too

- hard.
- reactive.
- soft.

The gold ring is made by mixing pure gold with other metals to form

- a compound.
- an atom.
- an alloy.

(2 marks)

Question 1 continues on the next page

4.1.1.1 Atoms, elements and compounds

Question 33 · continued

1 (d) The data in the table shows some information about the three metals in the gold ring.

Name of metal	Atomic number	Percentage (%) of metal
gold	79	
silver	47	16
copper	29	9

Draw **one** line from each question to its correct answer.

Question	Answer
What is the percentage of gold in this ring?	29
How many electrons are there in a copper atom?	61
How many neutrons are in an atom of silver with a mass number of 108?	75
	79

(3 marks)

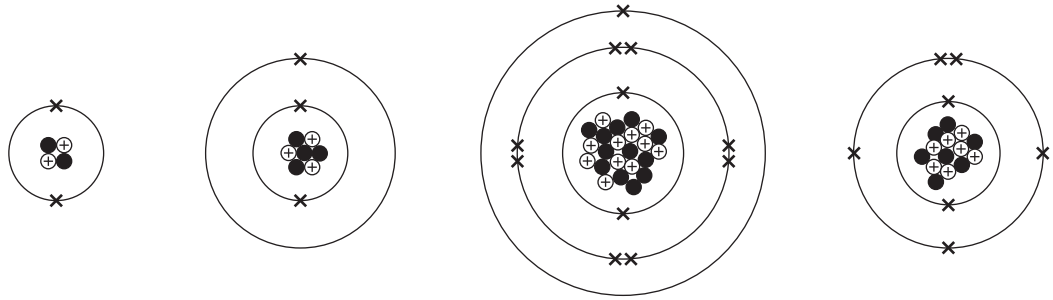
9

4.1.1.1 Atoms, elements and compounds

Question 34

June 2012 | CH1FP | Original Q1 | Legacy

1 The diagrams show the sub-atomic particles in 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) Draw a ring around the correct answer to complete each sentence.

1 (a) (i) The centre of each atom is called the

energy level.
molecule.
nucleus.

(1 mark)

1 (a) (ii) The centre of each atom contains neutrons and

bonds.
electrons.
protons.

(1 mark)

1 (b) Complete the sentence.

There is no overall electrical charge on each atom because the

number of ..... is equal to the number of ..... .

(1 mark)

4.1.1.1 Atoms, elements and compounds

Question 34 · continued

1 (c) What is the name of the element represented by atom **D**? .....
(1 mark)

1 (d) Which **two** of the atoms, **A**, **B**, **C** and **D**, are in the same group of the periodic table?

Give a reason for your answer.

Atom ☐ and atom ☐

Reason .....

.....
(2 marks)

6

Turn over for the next question

4.1.1.1 Atoms, elements and compounds

Question 35

June 2012 | CH1FP | Original Q6 | Legacy

6 Ethanol (C_2H_5OH) can be made from ethene or from sugar.

6 (a) Complete the table which shows the number of atoms of each element in the formula of ethanol.

Use the Chemistry Data Sheet to help you to complete the table.

Element	Symbol	Number of atoms in the formula C_2H_5OH
Carbon	C	2
Hydrogen	H	.....
.....	O	1

(2 marks)

6 (b) Ethene (C_2H_4) is produced when hydrocarbons are cracked.

6 (b) (i) Tick (✓) **two** conditions needed to crack a hydrocarbon.

Condition	Tick (✓)
The presence of an emulsifier.	
Heating the hydrocarbon to a high temperature.	
Adding oxygen to the hydrocarbon.	
The presence of a catalyst.	

(2 marks)

6 (b) (ii) Draw the missing bonds to complete the displayed structure of ethene.

H H

C C

H H

(1 mark)

6 (b) (iii) Name the substance added to ethene (C_2H_4) to produce ethanol (C_2H_5OH).

.....

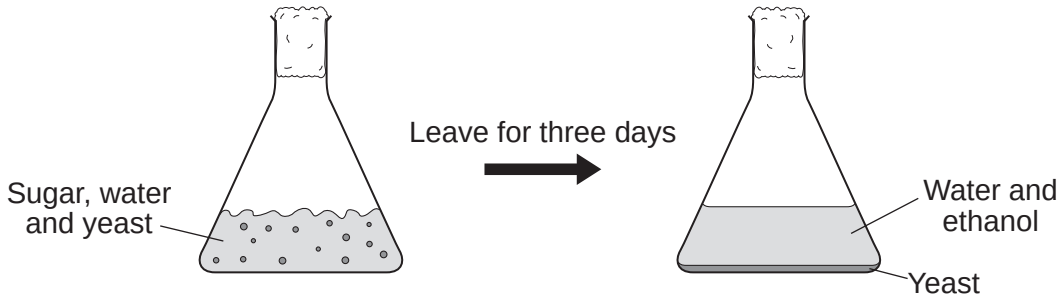
(1 mark)

4.1.1.1 Atoms, elements and compounds

Question 35 · continued

6 (c) The diagram shows how a solution of ethanol is made from sugar dissolved in water.

The boiling point of ethanol is 78°C and the boiling point of water is 100°C.



6 (c) (i) Name the gas produced during this reaction.

.....

(1 mark)

6 (c) (ii) What are the main steps needed to obtain pure ethanol from the mixture produced after three days?

.....

.....

.....

.....

(2 marks)

9

4.1.1.1 Atoms, elements and compounds

Question 36

January 2013 | CH2FP | Original Q1 | Legacy

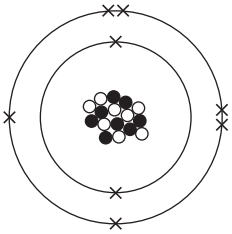
1 This question is about atoms and molecules.

1 (a) Complete the table to show the relative masses of the particles in atoms.

Name of particle	Relative mass
Proton	.....
Neutron	1
Electron	.....

(2 marks)

1 (b) The diagram shows an oxygen atom.



Key
- ● Proton
- ○ Neutron
- × Electron

Use the correct number to complete each sentence.

8	**16**	**18**	**24**

The atomic (proton) number of the oxygen atom shown above is ..... .

The mass number of the oxygen atom shown above is ..... .

(2 marks)

1 (c) (i) Draw a ring around the correct answer to complete the sentence.

Oxygen atoms with different numbers of neutrons are called

isotopes.

molecules.

polymers.

(1 mark)

4.1.1.1 Atoms, elements and compounds

Question 36 · continued

1 (c) (ii) An oxygen atom with a different number of neutrons has 10 neutrons.

Draw a ring around the symbol which represents this atom.

$^{16}_{8}O$ $^{18}_{10}O$ $^{18}_{8}O$

(1 mark)

1 (d) A water molecule contains hydrogen and oxygen atoms.

1 (d) (i) Use the correct answer to complete the sentence.

a compound	an element	a mixture

Water is ..... .

(1 mark)

1 (d) (ii) Draw a ring around the correct structure of a water molecule.

H — O — H **O — H — H** **O — H — O**

(1 mark)

1 (d) (iii) Draw a ring around the type of bonding in a water molecule.

covalent **ionic** **metallic**

(1 mark)

1 (d) (iv) Draw a ring around the correct answer to complete the sentence.

The bonds in a water molecule are formed by [gaining / losing / sharing] electrons.

(1 mark)

10

4.1.1.1 Atoms, elements and compounds

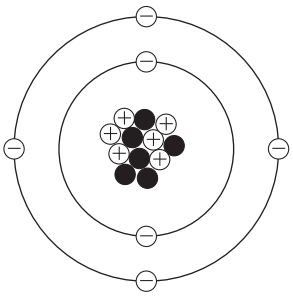
Question 37

June 2014 | CH1FP | Original Q1 | Legacy

1 Fossil fuels contain carbon.

1 (a) **Figure 1** represents a carbon atom.

Figure 1



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

1 (a) (i) The name of the particle with a positive charge is

an electron.

a neutron.

a proton.

[1 mark]

1 (a) (ii) The centre of the atom is called the

energy level.

molecule.

nucleus.

[1 mark]

1 (a) (iii) Use the Chemistry Data Sheet to help you to answer this question.

Use the correct number from the box to complete each sentence.

[2 marks]

4	6	8	10	12

The mass number of this carbon atom is ☐

In the periodic table, carbon is in Group ☐

4.1.1.1 Atoms, elements and compounds

Question 37 · continued

1 (b) Coal is a fossil fuel.

A piece of coal contains:

- 80% carbon
- 9% oxygen
- 1% sulfur
- 5% hydrogen.

The rest of the coal is other elements.

1 (b) (i) What is the percentage of other elements in this piece of coal?

[1 mark]

..... %

1 (b) (ii) Coal burns in air to produce carbon dioxide, sulfur dioxide and water.

Draw **one** line from each product to the type of pollution caused by each product.

[3 marks]

Product	Type of pollution
Carbon dioxide	Acid rain
Sulfur dioxide	Global dimming
Water	Global warming
	No pollution

8

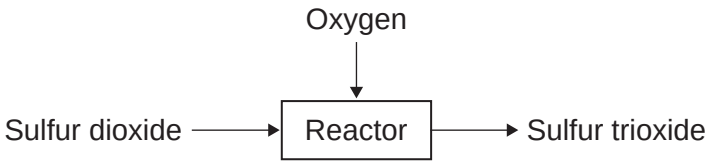
4.1.1.1 Atoms, elements and compounds

Question 38

June 2014 | CH2FP | Original Q3 | Legacy

3 **Figure 4** represents the reaction of sulfur dioxide with oxygen.

Figure 4



3 (a) (i) Complete the word equation for the reaction of sulfur dioxide with oxygen.

[1 mark]

sulfur dioxide + ... → .....

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

[1 mark]

Sulfur dioxide (SO_2) is

- a compound.
- an element.
- a mixture.

3 (b) The reactants are gases.

When the pressure of the gases is increased, the reaction gets faster.

Complete the sentence.

[1 mark]

When the pressure of the gases is increased,

the frequency of the collisions ..... .

4.1.1.1 Atoms, elements and compounds

Question 38 · continued

3 (c) The particles need energy to react.

Complete the sentence.

[1 mark]

The minimum amount of energy that particles need to react is called

the ..... energy.

3 (d) Give **one** way of increasing the rate of the reaction other than changing the pressure.

[1 mark]

.....

.....

5

Turn over for the next question

4.1.1.1 Atoms, elements and compounds

Question 39

June 2015 | CH1FP | Original Q1 | Legacy

1 This question is about metals.

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

[1 mark]

Tick (✓) **one** box.

aluminium ☐

gold ☐

magnesium ☐

1 (b) Complete the sentence.

[1 mark]

Aluminium is an element because aluminium is made of

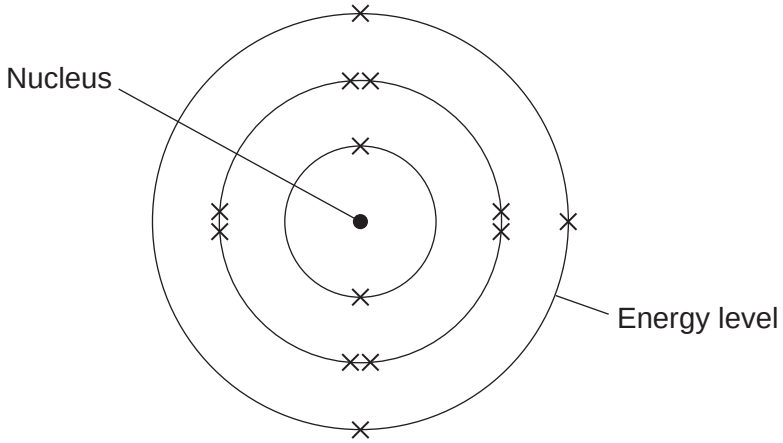
only one type of ..... .

4.1.1.1 Atoms, elements and compounds

Question 39 · continued

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

Figure 1



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

[2 marks]

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

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

1 (c) (ii) Complete the sentence.

[1 mark]

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

Question 1 continues on the next page

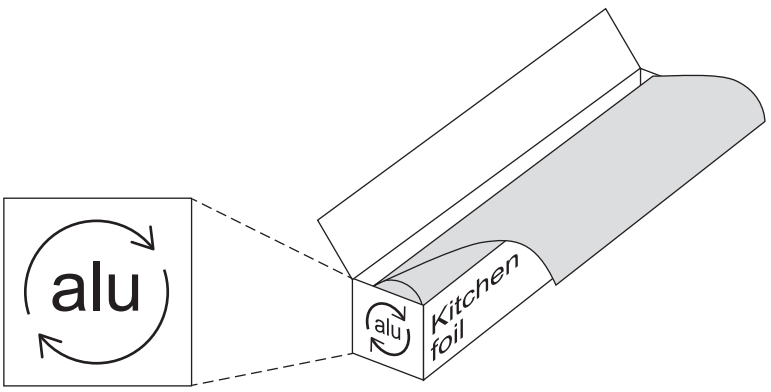
4.1.1.1 Atoms, elements and compounds

Question 39 · continued

1 (d) Aluminium is used for kitchen foil.

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

Figure 2



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

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

[1 mark]

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

[2 marks]

.....

.....

.....

.....

1 (e) Aluminium has a low density, conducts electricity and is resistant to corrosion.

Which **one** of these properties makes aluminium suitable to use as kitchen foil? Give a reason for your answer.

[2 marks]

.....

.....

.....

.....

10

4.1.1.1 Atoms, elements and compounds

Question 40

June 2015 | CH2FP | Original Q1 | Legacy

1 This question is about carbon and gases in the air.

1 (a) Carbon atoms have protons, neutrons and electrons.

Complete **Table 1** by writing the relative mass of a neutron and an electron.

[2 marks]

Table 1

Name of particle	Relative mass
proton	1
neutron	
electron	

1 (b) What is the total number of protons and neutrons in an atom called?

[1 mark]

Tick (✓) **one** box.

The atomic number ☐

The mass number ☐

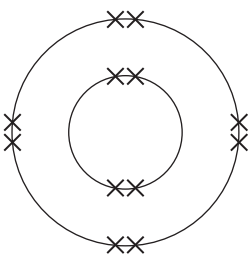
One mole of the atom ☐

1 (c) An atom of carbon has six electrons.

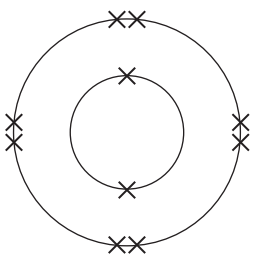
Which structure, **A**, **B** or **C**, represents the electronic structure of the carbon atom?

[1 mark]

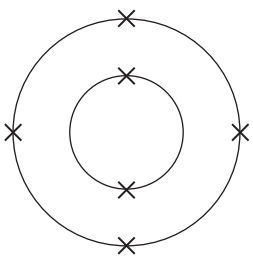
Structure A



Structure B



Structure C



The carbon atom is structure ☐.

4.1.1.1 Atoms, elements and compounds

Question 40 · continued

1 (d) Carbon reacts with oxygen to produce carbon dioxide (CO_2).

1 (d) (i) How many different elements are in one molecule of carbon dioxide?

[1 mark]

.....

1 (d) (ii) What is the total number of atoms in one molecule of carbon dioxide?

[1 mark]

.....

1 (e) Sometimes carbon reacts with oxygen to produce carbon monoxide (CO).

1 (e) (i) Calculate the relative formula mass (M_r) of carbon monoxide.

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

[1 mark]

.....

.....

M_r of carbon monoxide = ...

1 (e) (ii) Calculate the percentage by mass of carbon in carbon monoxide.

[1 mark]

.....

.....

Percentage by mass of carbon in carbon monoxide = ...%

Question 1 continues on the next page

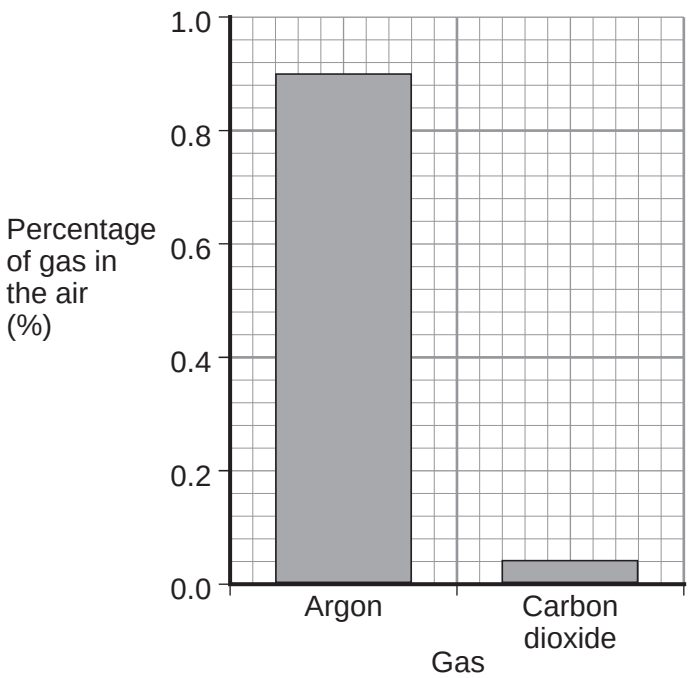
4.1.1.1 Atoms, elements and compounds

Question 40 · continued

1 (f) Carbon dioxide is one of the gases in the air.

1 (f) (i) **Figure 1** shows the percentage of argon and the percentage of carbon dioxide in the air.

Figure 1



What is the percentage of argon in the air?

[1 mark]

Percentage of argon = ... %

1 (f) (ii) An instrumental method is used to measure the amount of carbon dioxide in the air.

Give **one** reason for using an instrumental method.

[1 mark]

.....

.....

10

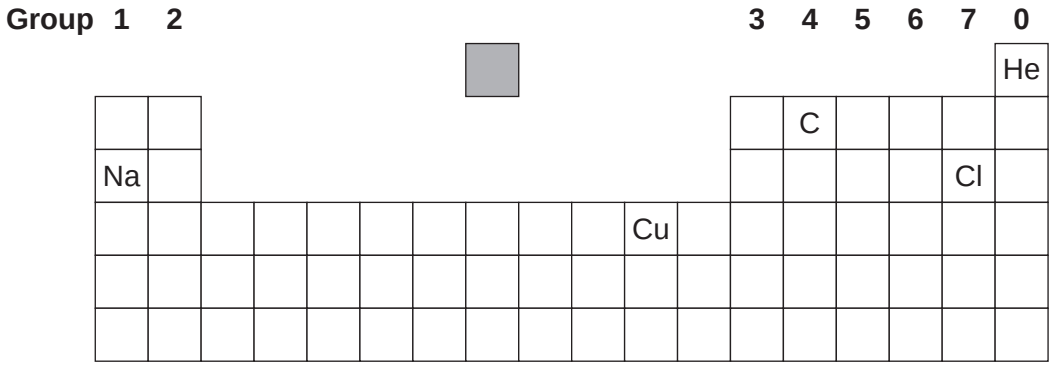
4.1.1.1 Atoms, elements and compounds

Question 41

June 2015 | CH3FP | Original Q2 | Legacy

2 **Figure 2** shows the chemical symbols of five elements in the periodic table.

Figure 2



2 (a) Choose the correct chemical symbol from **Figure 2** to complete each sentence.

2 (a) (i) The element that is an alkali metal is ..... .

[1 mark]

2 (a) (ii) The element that is a transition metal is ..... .

[1 mark]

2 (a) (iii) The element in Group 4 is ..... .

[1 mark]

2 (a) (iv) The element with a full outer energy level (shell) of electrons is ..... .

[1 mark]

2 (b) Which other element goes in the shaded box in **Figure 2**? .....

[1 mark]

5

4.1.1.1 Atoms, elements and compounds

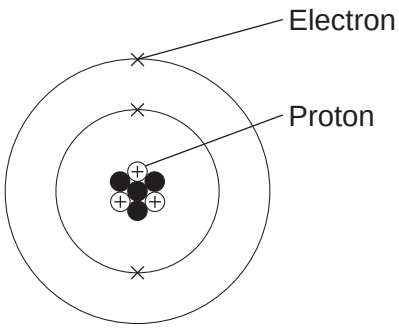
Question 42

June 2016 | CH1FP | Original Q1 | Legacy

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

1 (a) **Figure 1** shows a lithium atom.

Figure 1



1 (a) (i) What is the mass number of the lithium atom in **Figure 1**?

[1 mark]

Tick (✓) **one** box.

3 ☐

4 ☐

7 ☐

1 (a) (ii) What is the charge of an electron?

[1 mark]

Tick (✓) **one** box.

–1 ☐

0 ☐

+1 ☐

4.1.1.1 Atoms, elements and compounds

Question 42 · continued

June 2016 | CH1FP | Original Q1 | Legacy

1 (a) (iii) Protons are in the nucleus.

Which other sub-atomic particles are in the nucleus?

[1 mark]

Tick (✓) **one** box.

ions ☐

molecules ☐

neutrons ☐

1 (b) What is **always** different for atoms of different elements?

[1 mark]

Tick (✓) **one** box.

number of neutrons ☐

number of protons ☐

number of shells ☐

Question 1 continues on the next page

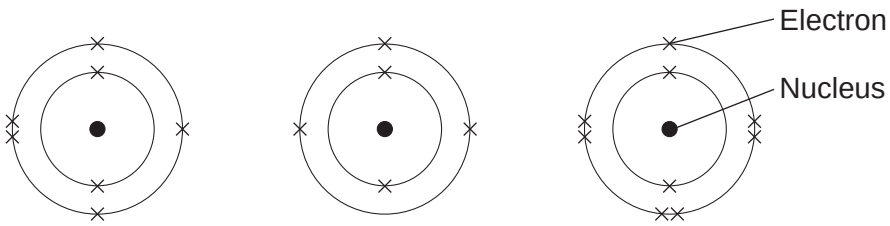
4.1.1.1 Atoms, elements and compounds

Question 42 · continued

1 (c) **Figure 2** shows the electron arrangements of three different atoms, **X**, **Y** and **Z**.

These atoms are from elements in the second row (lithium to neon) of the periodic table.

Figure 2



Atom X **Atom Y** **Atom Z**

Which atom is from an element in Group 3 of the periodic table?

[1 mark]

Tick (✓) **one** box.

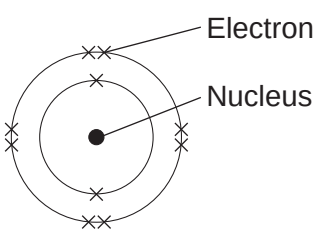
Atom X ☐

Atom Y ☐

Atom Z ☐

1 (d) **Figure 3** shows the electron arrangement of a different atom from an element in the second row of the periodic table.

Figure 3



1 (d) (i) Give the chemical symbol of this element.

[1 mark]

_____

1 (d) (ii) Why is this element unreactive?

[1 mark]

_____

_____

7

4.1.1.1 Atoms, elements and compounds

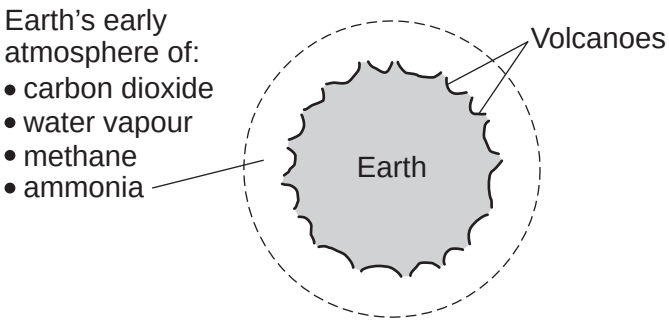
Question 43

June 2016 | CH1FP | Original Q2 | Legacy

2 This question is about the Earth and its atmosphere.

2 (a) **Figure 4** shows the Earth and its atmosphere billions of years ago.

Figure 4



2 (a) (i) The boiling point of water is 100 °C.

Suggest **one** reason why there was no liquid water on the Earth's surface billions of years ago.

[1 mark]

_____

_____

2 (a) (ii) Complete the sentence.

[1 mark]

On the Earth today, volcanic eruptions happen at the boundaries between

tectonic _____ .

Question 2 continues on the next page

4.1.1.1 Atoms, elements and compounds

Question 43 · continued

2 (b) The Earth's atmosphere today contains nitrogen, oxygen, argon, carbon dioxide and other gases.

2 (b) (i) Draw **one** line from each substance to a description of the substance.

[3 marks]

Substance	Description of the substance
air	compound
carbon dioxide	element
argon	hydrocarbon
	metal
	mixture

2 (b) (ii) Which gas in the Earth's atmosphere is used when hydrocarbons burn?

[1 mark]

Tick (✓) **one** box.

- carbon dioxide ☐
- nitrogen ☐
- oxygen ☐

2 (b) (iii) What percentage of the Earth's atmosphere is nitrogen?

[1 mark]

Tick (✓) **one** box.

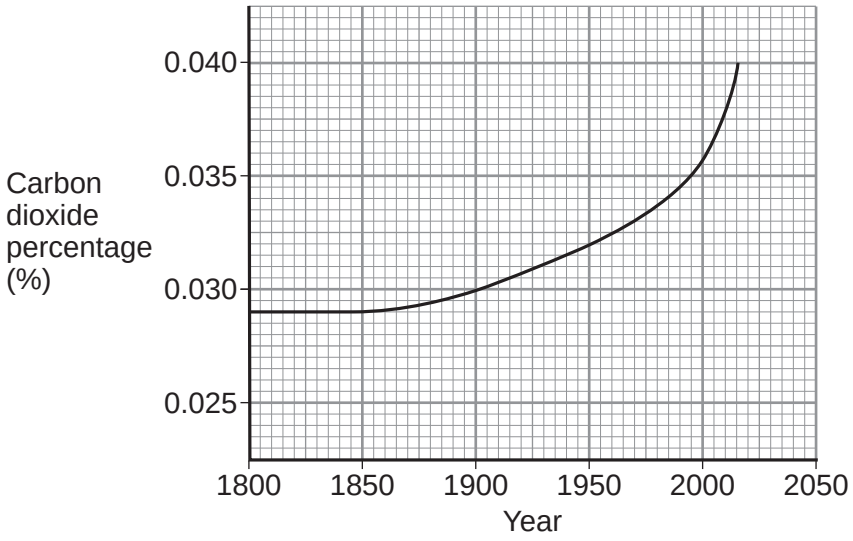
- about 40% ☐
- about 60% ☐
- about 80% ☐

4.1.1.1 Atoms, elements and compounds

Question 43 · continued

2 (c) **Figure 5** shows the carbon dioxide percentage (%) in the Earth's atmosphere since the year 1800.

Figure 5



2 (c) (i) What was the carbon dioxide percentage in 1900?

[1 mark]

_____ %

2 (c) (ii) Describe, in detail, how the carbon dioxide percentage changed from 1900 to 2015.

[2 marks]

_____

_____

_____

_____

2 (c) (iii) Suggest **two** reasons for the change in the carbon dioxide percentage from 1900 to 2015.

[2 marks]

1 _____

_____

2 _____

_____

12

4.1.1.1 Atoms, elements and compounds

Question 44

June 2016 | CH1FP | Original Q3 | Legacy

3 Metals are extracted from ores in the Earth's crust.

3 (a) Why is copper used in the manufacture of computers?

[1 mark]

Tick (✓) **one** box.

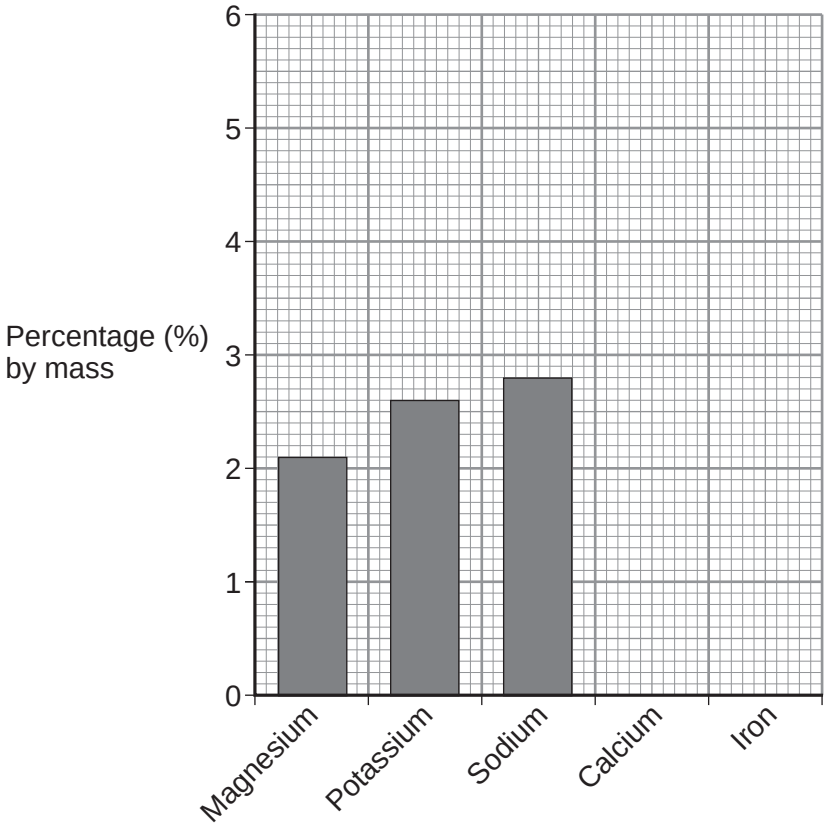
Because it has a high density. ☐

Because it does not react with water. ☐

Because it is a good conductor of electricity. ☐

3 (b) **Figure 6** shows the percentage (%) by mass of some metals in the Earth's crust.

Figure 6



4.1.1.1 Atoms, elements and compounds

Question 44 · continued

3 (b) (i) What is the percentage by mass of magnesium in the Earth's crust?

[1 mark]

_____ %

3 (b) (ii) On **Figure 6** draw the bars for:

- calcium at 3.6% by mass
- iron at 5.0% by mass.

[2 marks]

3 (c) An ore of zinc contains zinc carbonate.

The equation for the reaction when zinc carbonate is heated is:

$$\underset{\text{zinc carbonate}}{ZnCO_3} \longrightarrow \underset{\text{zinc oxide}}{ZnO} + \underset{\text{carbon dioxide}}{CO_2}$$

3 (c) (i) What is the name of this type of reaction?

[1 mark]

Tick (✓) **one** box.

corrosion ☐

decomposition ☐

electrolysis ☐

3 (c) (ii) Which substance in the equation is a gas at room temperature (20 °C)?

[1 mark]

Tick (✓) **one** box.

zinc carbonate ☐

zinc oxide ☐

carbon dioxide ☐

Question 3 continues on the next page

4.1.1.1 Atoms, elements and compounds

Question 44 · continued

3 (c) (iii) Complete **Table 1** to show the number of atoms of carbon and oxygen in the formula of zinc carbonate.

[2 marks]

Table 1

Element	Number of atoms in the formula $ZnCO_3$
zinc, Zn	1
carbon, C	
oxygen, O	

3 (c) (iv) When 125 g zinc carbonate is heated, 81 g zinc oxide is produced.

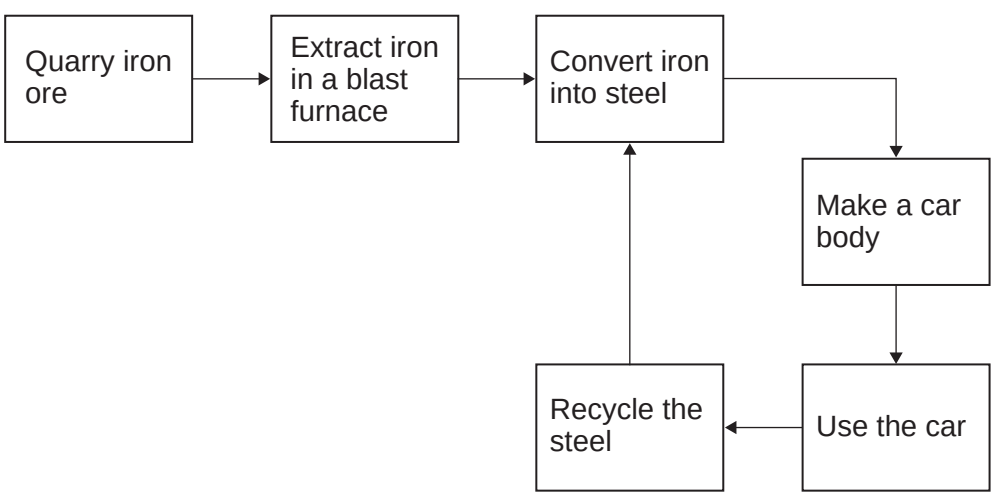
Calculate the mass of carbon dioxide produced.

[1 mark]

Mass of carbon dioxide = _____ g

3 (d) **Figure 7** shows a simple life cycle of a car body.

Figure 7



4.1.1.1 Atoms, elements and compounds

Question 44 · continued

3 (d) (i) What is **one** reason why iron from the blast furnace is converted into steel?

[1 mark]

Tick (✓) **one** box.

To make the iron pure. ☐

To make the iron more brittle. ☐

To make alloys for specific uses. ☐

3 (d) (ii) Apart from cost, give **three different** reasons why steel should be recycled.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

13

4.1.1.1 Atoms, elements and compounds

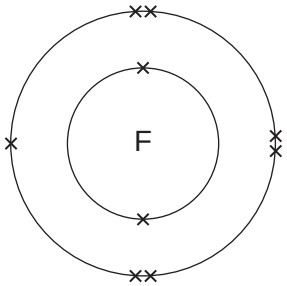
Question 45

June 2016 | CH2FP | Original Q1 | Legacy

1 This question is about fluorine.

1 (a) **Figure 1** shows the arrangement of electrons in a fluorine atom.

Figure 1



1 (a) (i) In which group of the periodic table is fluorine?

[1 mark]

Group _____

1 (a) (ii) Complete **Table 1** to show the particles in an atom and their relative masses.

[2 marks]

Table 1

Name of particle	Relative mass
Proton	
Neutron	1
	Very small

1 (a) (iii) Use the correct answer from the box to complete the sentence.

[1 mark]

alkalis	**alloys**	**isotopes**

Atoms of fluorine with different numbers of neutrons are called _____ .

4.1.1.1 Atoms, elements and compounds

Question 45 · continued

1 (b) Sodium reacts with fluorine to produce sodium fluoride.

1 (b) (i) Complete the word equation for this reaction.

[1 mark]

sodium + _____ ⟶ _____

1 (b) (ii) Complete the sentence.

[1 mark]

Substances in which atoms of two or more different elements are chemically combined are called _____ .

1 (b) (iii) The relative formula mass (M_r) of sodium fluoride is 42.

Use the correct answer from the box to complete the sentence.

[1 mark]

ion	mole	molecule

The relative formula mass (M_r), in grams, of sodium fluoride is one _____ of the substance.

Question 1 continues on the next page

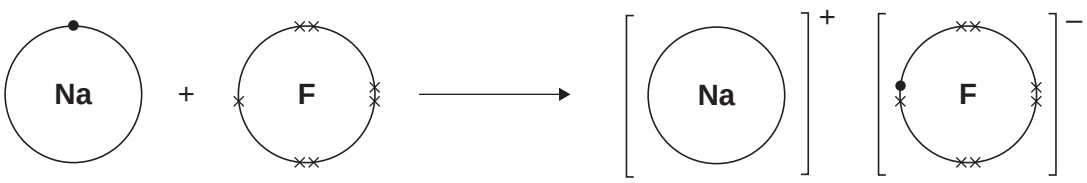
4.1.1.1 Atoms, elements and compounds

Question 45 · continued

1 (b) (iv) **Figure 2** shows what happens to the electrons in the outer shells when a sodium atom reacts with a fluorine atom.

The dots (•) and crosses (×) represent electrons.

Figure 2



Use **Figure 2** to help you answer this question.

Describe, as fully as you can, what happens when sodium reacts with fluorine to produce sodium fluoride.

[4 marks]

4.1.1.1 Atoms, elements and compounds

Question 45 · continued

1 (b) (v) Sodium fluoride is an ionic substance.

What are **two** properties of ionic substances?

[2 marks]

Tick (✓) **two** boxes.

- Dissolve in water ☐
- Gas at room temperature ☐
- High melting point ☐
- Low boiling point ☐

13

Turn over for the next question

4.1.1.1 Atoms, elements and compounds

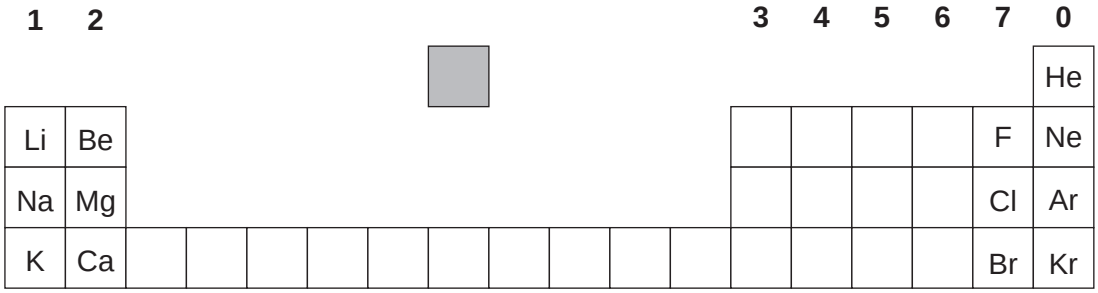
Question 46

June 2017 | CH1FP | Original Q2 | Legacy

2 Use the Chemistry Data Sheet to help you answer this question.

Figure 2 shows part of the periodic table.

Figure 2



2 (a) Give the name of the element that should be in the shaded box.

[1 mark]

_____

2 (b) How many different elements are there in the complete periodic table?

[1 mark]

Tick (✓) **one** box.

About 36 ☐

About 100 ☐

About 500 ☐

4.1.1.1 Atoms, elements and compounds

Question 46 · continued

2 (c) What are **two** reasons why lithium, sodium and potassium are in the same group of the periodic table?

[2 marks]

Tick (✓) **two** boxes.

- Low melting points ☐
- Same number of electrons in the outer shell ☐
- Similar atomic (proton) numbers ☐
- Similar chemical reactions ☐
- Two electrons in the innermost shell ☐

2 (d) Complete each sentence.

[2 marks]

The elements in Group 0 are called _____ gases.

The elements in the central block are known as _____ metals.

2 (e) Use the correct word from the box to complete each sentence.

[2 marks]

alloys	ions	molecules	polymers	protons

Atoms of fluorine gain electrons to form fluoride _____ .

Atoms of fluorine share electrons to form fluorine _____ .

8

4.1.1.1 Atoms, elements and compounds

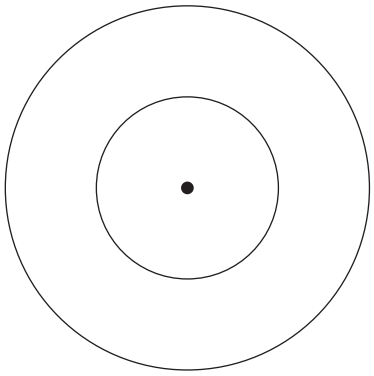
Question 47

June 2017 | CH1FP | Original Q6 | Legacy

6 This question is about compounds of carbon.

6 (a) **Figure 7** shows an atom with two energy levels (shells).

Figure 7



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

Complete **Figure 7** to show the electronic structure of a carbon atom.

Use **x** to represent an electron.

[1 mark]

6 (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 _____

_____

_____

_____

_____

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

What does the term hydrocarbon mean?

[1 mark]

_____

_____

Question 47 · continued

6 (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

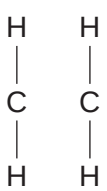
Alkenes

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

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

[2 marks]

Ethane



Ethene



6 (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]

4.1.1.1 Atoms, elements and compounds

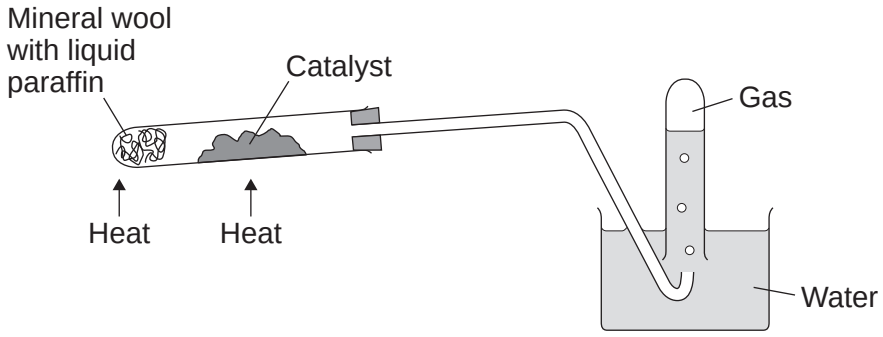
Question 47 · continued

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

[2 marks]

6 (d) A student used the apparatus in **Figure 8** to investigate what happens when liquid paraffin is heated to a high temperature.

Figure 8



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 48

June 2017 | CH3FP | Original Q1 | Legacy

1 This question is about elements and compounds.

1 (a) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

densities	numbers	weights

The elements in the modern periodic table are arranged in order of their atomic _____ .

1 (a) (ii) Use the correct answer from the box to complete the sentence.

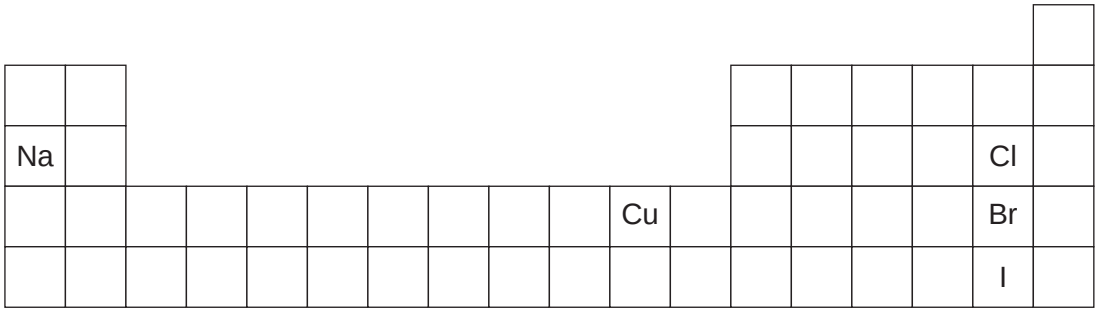
[1 mark]

electrons	neutrons	protons

The outer shells of atoms of elements in the same group have the same number of _____ .

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

Figure 1



1 (b) (i) Which **one** of the elements in **Figure 1** is a gas at room temperature?

[1 mark]

_____

4.1.1.1 Atoms, elements and compounds

Question 48 · continued

1 (b) (ii) Which **one** of the elements in **Figure 1** is a transition metal?

[1 mark]

_____

1 (b) (iii) Complete the sentence.

[1 mark]

In the modern periodic table, bromine (Br) is in Group _____ .

1 (c) Bromine reacts with sodium iodide to produce iodine.

The word equation for the reaction is:

bromine + sodium iodide ⟶ iodine + sodium bromide

1 (c) (i) What type of reaction is this?

[1 mark]

Tick (✓) **one** box.

Combustion ☐

Displacement ☐

Neutralisation ☐

1 (c) (ii) Use the Chemistry Data Sheet to help you answer this question.

Which halogen would react with sodium chloride solution to produce chlorine?

[1 mark]

Tick (✓) **one** box.

Bromine ☐

Fluorine ☐

Iodine ☐

Question 1 continues on the next page

4.1.1.1 Atoms, elements and compounds

Question 48 · continued

1 (d) Silver nitrate in the presence of dilute nitric acid is used to test for iodide ions.

What colour precipitate is produced?

[1 mark]

Tick (✓) **one** box.

Cream ☐

White ☐

Yellow ☐

4.1.1.1 Atoms, elements and compounds

Question 48 · continued

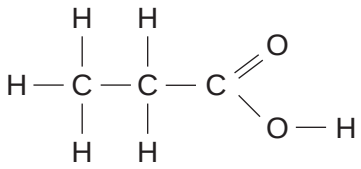
1 (e) Propanoic acid is a compound containing carbon atoms.

1 (e) (i) **Figure 2** shows the displayed structure of propanoic acid.

Draw a ring around the functional group of propanoic acid in **Figure 2**.

[1 mark]

Figure 2



1 (e) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

carbon dioxide	hydrogen	oxygen

Propanoic acid reacts with carbonates to produce _____ .

1 (e) (iii) Use the correct answer from the box to complete the sentence.

[1 mark]

alkalis	esters	fuels

Propanoic acid reacts with alcohols to produce pleasant smelling compounds called _____ .

11

4.1.1.1 Atoms, elements and compounds

Question 49

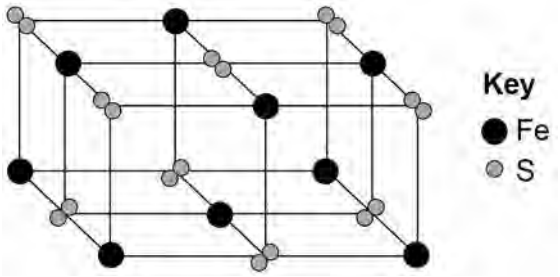
June 2018 | 8462/1F | Original Q9

0 9 This question is about metals and metal compounds.

0 9 . 1 Iron pyrites is an ionic compound.

Figure 12 shows a structure for iron pyrites.

Figure 12



Determine the formula of iron pyrites.

Use **Figure 12**.

[1 mark]

_____

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

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

[3 marks]

Number of protons _____

Number of neutrons _____

Number of electrons _____

0 9 . 3 Iron is a transition metal.

Sodium is a Group 1 metal.

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

[2 marks]

1 _____

_____

2 _____

_____

4.1.1.1 Atoms, elements and compounds

Question 49 · continued

Nickel is extracted from nickel oxide by reduction with carbon.

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

[2 marks]

0 9 . 5 An equation for the reaction is:

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

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

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

Relative formula mass (M_r): NiO = 75

Give your answer to 3 significant figures.

[3 marks]

Percentage atom economy = _____ %

11

4.1.1.1 Atoms, elements and compounds

Question 50

June 2018 | 8462/2F | Original Q1

0 1 This question is about copper sulfate.

Blue copper sulfate turns white when it is heated.

The word equation for the reaction is:

hydrated copper sulfate ⇌ anhydrous copper sulfate + water

blue white

0 1 . 1 What name is given to hydrated copper sulfate in this reaction?

[1 mark]

Tick **one** box.

- Catalyst ☐
- Element ☐
- Product ☐
- Reactant ☐

0 1 . 2 What does the symbol ⇌ mean?

[1 mark]

Tick **one** box.

- Endothermic ☐
- Exothermic ☐
- Reversible ☐
- Polymerisation ☐

4.1.1.1 Atoms, elements and compounds

Question 50 · continued

0 1 . 3 Complete the sentence.

[1 mark]

The colour change when water is added to anhydrous copper sulfate

is white to _____ .

A student heats 2.5 g of hydrated copper sulfate in a test tube.

0.9 g of water is given off.

The remaining solid is anhydrous copper sulfate.

0 1 . 4 Calculate the mass of anhydrous copper sulfate produced.

[1 mark]

_____

_____

Mass of anhydrous copper sulfate = _____ g

0 1 . 5 Calculate the percentage of water contained in 2.5 g of hydrated copper sulfate.

[2 marks]

_____

_____

_____

Percentage of water = _____ %

Question 1 continues on the next page

4.1.1.1 Atoms, elements and compounds

Question 50 · continued

0 1 . 6 Draw **one** line from each compound to the formula for the compound.

[2 marks]

Compound	Formula for the compound
Copper sulfate	CuO
	CuS
	$CuSO_4$
Water	H_2O
	H_2SO_4

4.1.1.1 Atoms, elements and compounds

Question 51

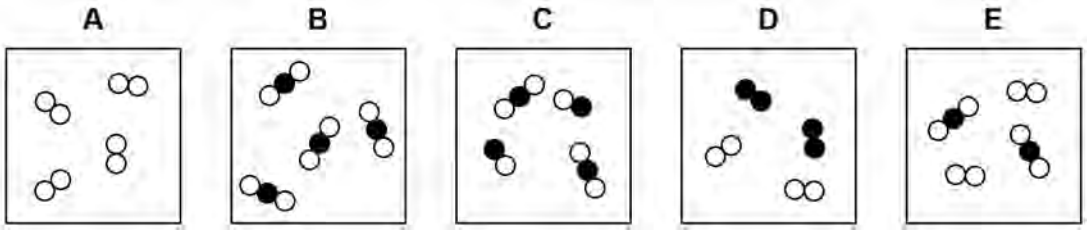
June 2019 | 8462/1F | Original Q3

0 3 This question is about elements, compounds and mixtures.

Figure 5 shows five different substances, **A**, **B**, **C**, **D** and **E**.

○ and ● represent atoms of different elements.

Figure 5



Use **Figure 5** to answer Questions **03.1** to **03.3**

0 3 . 1 Which substance is only one compound?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 3 . 2 Which substance is a mixture of elements?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

0 3 . 3 Which substance is a mixture of an element and a compound?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐ **E** ☐

4.1.1.1 Atoms, elements and compounds

Question 51 · continued

Substances are separated from a mixture using different methods.

0 3 . 4 Draw **one** line from each method of separation to the substance and mixture it would separate.

[2 marks]

Method of separation	Substance and mixture
	blue food colour from a mixture of food colours
chromatography	
	copper from an alloy of copper and zinc
	copper sulfate from copper sulfate solution
crystallisation	
	ethanol from a mixture of ethanol and water

4.1.1.1 Atoms, elements and compounds

Question 51 · continued

June 2019 | 8462/1F | Original Q3

0 3 . 5 Sand does not dissolve in water. A student separates a mixture of sand and water by filtration.

Draw a diagram of the apparatus the student could use.

You should label:

- where the sand is collected
- where the water is collected.

[3 marks]

Diagram

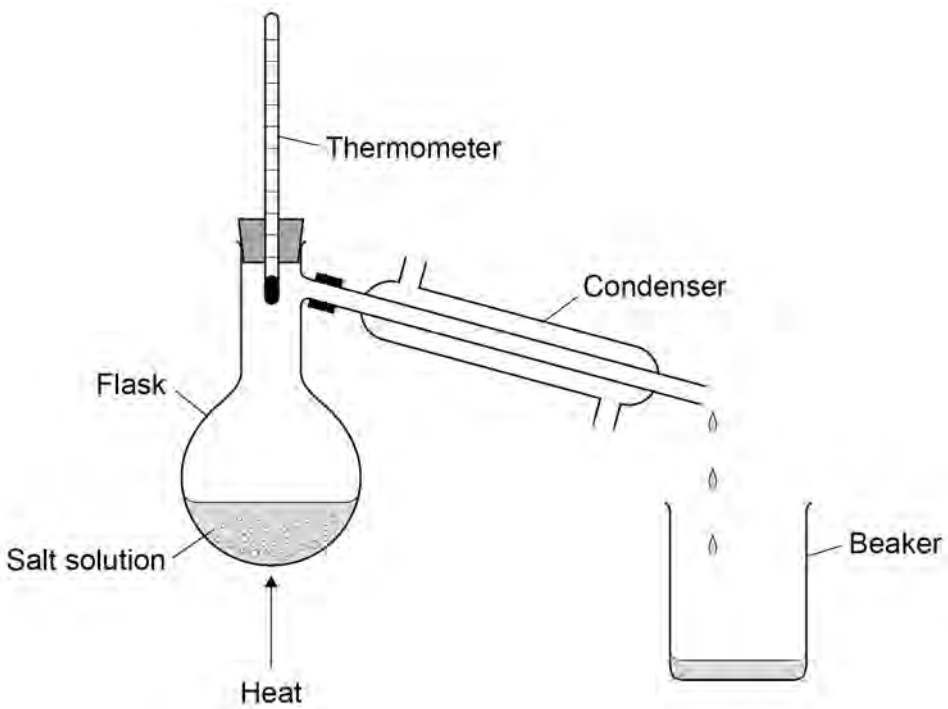
Question 3 continues on the next page

Question 51 · continued

0 3 . 6 A student distils a sample of salt solution to produce pure water.

Figure 6 shows the apparatus.

Figure 6



What temperature would you expect the thermometer to show?

[1 mark]

Tick (✓) **one** box.

0 °C ☐

10 °C ☐

50 °C ☐

100 °C ☐

4.1.1.1 Atoms, elements and compounds

Question 51 · continued

0 3 . 7 Describe how the process of distillation shown in **Figure 6** produces pure water from salt solution.

[4 marks]

13

Turn over for the next question

4.1.1.1 Atoms, elements and compounds

Question 52

November 2020 | 8462/1F | Original Q2

0 2 This question is about models of the atom.

0 2 . 1 Atoms were first thought to be tiny spheres that could not be divided.

Which particle was discovered to change this model of the atom?

[1 mark]

Tick (✓) **one** box.

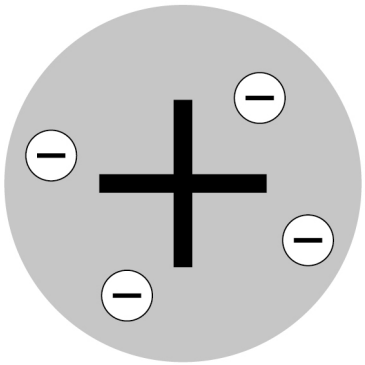
Electron ☐

Neutron ☐

Proton ☐

0 2 . 2 **Figure 2** shows another model of the atom.

Figure 2



What is the name of this model of the atom?

[1 mark]

4.1.1.1 Atoms, elements and compounds

Question 52 · continued

0 2 . 3 A scientist fired particles at gold atoms.

Some of these particles were scattered.

The results led to a different model of the atom.

Which type of particle was fired at the gold atoms?

[1 mark]

Tick (✓) **one** box.

- Alpha ☐
- Electron ☐
- Neutron ☐
- Proton ☐

0 2 . 4 Which scientist first suggested that electrons orbit the nucleus at specific distances?

[1 mark]

Tick (✓) **one** box.

- Bohr ☐
- Chadwick ☐
- Mendeleev ☐

Question 52 · continued

0 2 . 5 The model of the atom used today has three subatomic particles:

- electrons
- neutrons
- protons.

Complete the sentences.

[3 marks]

Atoms of the same element have the same atomic number because they have the same number of _____.

Atoms of the same element can have different mass numbers because they have different numbers of _____.

Atoms have no overall charge because they have the same number of _____ and _____.

0 2 . 6 The radius of a nucleus is approximately 1×10^{-14} m

The radius of an atom is approximately 1×10^{-10} m

A teacher uses a ball of radius 1 cm to represent the nucleus.

What could represent the atom on the same scale?

[1 mark]

Tick (✓) **one** box.

- A ball of radius 10 cm ☐
- A sports arena of radius 100 m ☐
- An island of radius 10 km ☐
- A planet of radius 1000 km ☐

8

4.1.1.1 Atoms, elements and compounds

Question 53

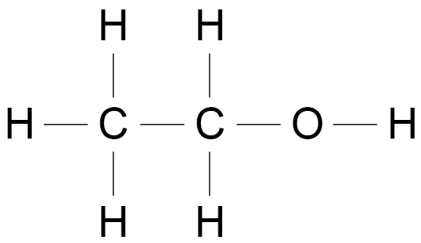
November 2020 | 8462/2F | Original Q7

0 7 This question is about ethanol and ethanoic acid.

Ethanol is an alcohol.

0 7 . 1 **Figure 7** shows the displayed structural formula of ethanol.

Figure 7



Draw a circle on **Figure 7** around the alcohol functional group.

[1 mark]

0 7 . 2 An ethanol molecule contains atoms of three different elements.

Complete **Table 5** to show:

- the name of each element
- the symbol for each element
- the number of atoms of each element in one molecule of ethanol.

Use **Figure 7**.

[3 marks]

Table 5

Name of element	Symbol for element	Number of atoms in one molecule of ethanol
Carbon	C	
Hydrogen		6
	O	1

4.1.1.1 Atoms, elements and compounds

Question 53 · continued

0 7 . 3 Ethanol removes grass stains from clothes.

What type of substance is ethanol when used to remove grass stains?

[1 mark]

Tick (✓) **one** box.

A solute ☐

A solution ☐

A solvent ☐

Wine contains ethanol.

Wine is produced from grape juice by fermentation.

0 7 . 4 Complete the sentence.

[1 mark]

Grape juice can be fermented to produce wine because

grape juice contains _____.

0 7 . 5 What is added to grape juice to cause fermentation?

[1 mark]

_____

4.1.1.1 Atoms, elements and compounds

Question 53 · continued

0 7 . 6 Ethanol reacts with ethanoic acid to produce an ester.

What is the name of the ester produced when ethanol reacts with ethanoic acid?

[1 mark]

Tick (✓) **one** box.

Ethane ☐

Ethene ☐

Ethyl ethanoate ☐

0 7 . 7 Ethanoic acid reacts with sodium carbonate.

The equation for the reaction is:

$$2\,CH_3COOH(aq) + Na_2CO_3(s) \rightarrow 2\,CH_3COONa(aq) + H_2O(l) + CO_2(g)$$

What is the name of the liquid produced by this reaction?

[1 mark]

_____

0 7 . 8 Vinegar is a solution that contains ethanoic acid.

400 cm^3 of vinegar contains 20 g of ethanoic acid.

Calculate the mass of ethanoic acid in 1.0 dm^3 of vinegar.

[3 marks]

_____

_____

_____

_____

_____

_____

Mass = _____ g

12

4.1.1.1 Atoms, elements and compounds

Question 54

November 2021 | 8462/1F | Original Q1

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

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

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

Which type of substance is **A**?

[1 mark]

Tick (✓) **one** box.

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

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

The atoms are chemically combined together in fixed proportions.

Which type of substance is **B**?

[1 mark]

Tick (✓) **one** box.

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

4.1.1.1 Atoms, elements and compounds

Question 54 · continued

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

[1 mark]

Tick (✓) **one** box.

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

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

[1 mark]

Tick (✓) **one** box.

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

4.1.1.1 Atoms, elements and compounds

Question 54 · continued

0 1 . 5 Neon is in Group 0.

What type of particles are in a sample of neon?

[1 mark]

Tick (✓) **one** box.

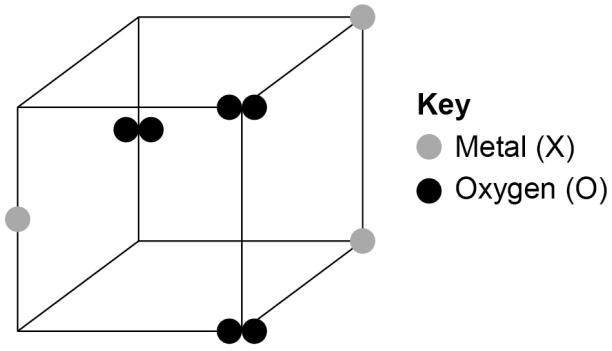
Atoms ☐

Ions ☐

Molecules ☐

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

Figure 1



Determine the empirical formula of this oxide.

[1 mark]

Empirical formula = XO

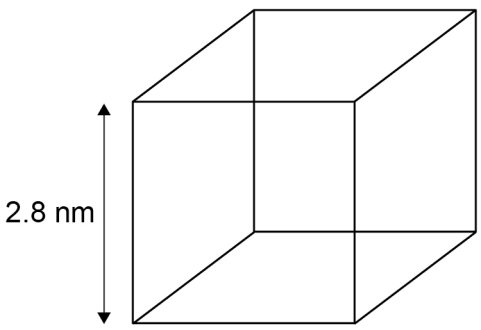
4.1.1.1 Atoms, elements and compounds

Question 54 · continued

A nanoparticle of a metallic element is a cube.

Figure 2 shows a diagram of the nanoparticle.

Figure 2



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

surface area = (length of side)^2 × 6

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

Give your answer to 2 significant figures.

[3 marks]

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

4.1.1.1 Atoms, elements and compounds

Question 54 · continued

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

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

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

[1 mark]

Tick (✓) **one** box.

Both surface area to volume ratios are the same. ☐

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

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

10

Turn over for the next question

4.1.1.1 Atoms, elements and compounds

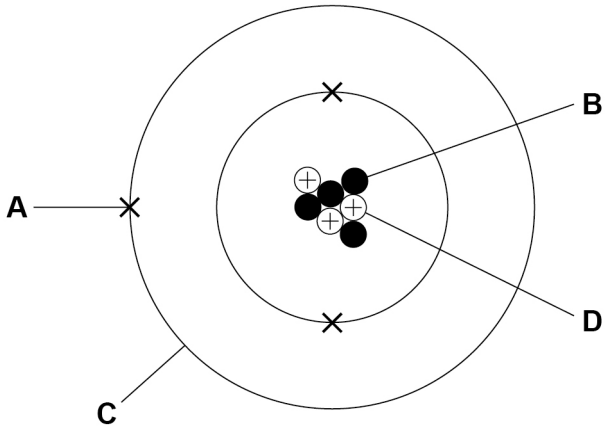
Question 55

June 2022 | 8462/1F | Original Q1

0 1 This question is about atoms.

0 1 . 1 **Figure 1** represents an atom of an element.

Figure 1



Draw **one** line from each name to the correct label.

[2 marks]

Name	Label
	A
Neutron	B
Proton	C
	D

4.1.1.1 Atoms, elements and compounds

Question 55 · continued

0 1 . 2 An atom of element **Y** has:

- an atomic number of 9
- a mass number of 19.

Give the number of electrons and the number of neutrons in this atom.

Choose answers from the box.

[2 marks]

1	**9**	**10**	**19**	**28**

Number of electrons _____

Number of neutrons _____

Question 1 continues on the next page

4.1.1.1 Atoms, elements and compounds

Question 55 · continued

Table 1 shows information about two isotopes of element **Z**.

Table 1

	Mass number	Percentage abundance (%)
Isotope **A**	39	93.3
Isotope **B**	41	6.7

0 1 . 3 Calculate the relative atomic mass (A_r) of element **Z**.

Use **Table 1** and the equation:

$$A_r = \frac{\text{(mass number} \times \text{percentage) of isotope } \mathbf{A} + \text{(mass number} \times \text{percentage) of isotope } \mathbf{B}}{100}$$

Give your answer to 3 significant figures.

[3 marks]

A_r (3 significant figures) = _____

4.1.1.1 Atoms, elements and compounds

Question 55 · continued

0 1 . 4 Suggest the identity of element **Z**.

Use the periodic table.

[1 mark]

Element **Z** _____

0 1 . 5 Complete the sentence.

Choose the answer from the box.

[1 mark]

electrons	**neutrons**	**protons**

Isotopes of the same element have different mass numbers because the isotopes have different numbers of _____.

9

4.1.1.1 Atoms, elements and compounds

Question 56

June 2022 | 8462/1F | Original Q2

0 2 This question is about elements, compounds and mixtures.

0 2 . 1 Which type of substance is hydrogen?

[1 mark]

Tick (✓) **one** box.

Element ☐

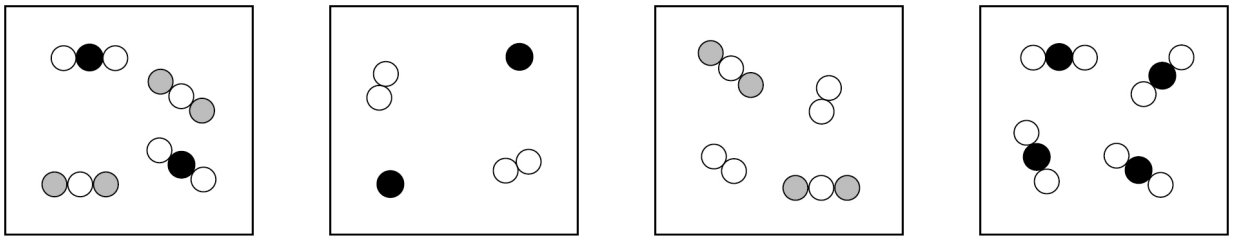
Compound ☐

Mixture ☐

The diagrams in **Figure 2** represent different substances.

○ ● and ○ represent atoms of three different elements.

Figure 2



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

Use **Figure 2** to answer questions **02.2** and **02.3**.

0 2 . 2 Which diagram represents a mixture of compounds?

[1 mark]

A ☐ **B** ☐ **C** ☐ **D** ☐

0 2 . 3 Which diagram represents a mixture of elements?

[1 mark]

A ☐ **B** ☐ **C** ☐ **D** ☐

Question 56 · continued

Substances can be separated from mixtures by using different methods.

0 2 . 4 Complete the sentence.

[1 mark]

Sand can be separated from a mixture of sand and water by

_____.

A mixture of four liquids was fractionally distilled.

Figure 3 shows the apparatus used.

Figure 3

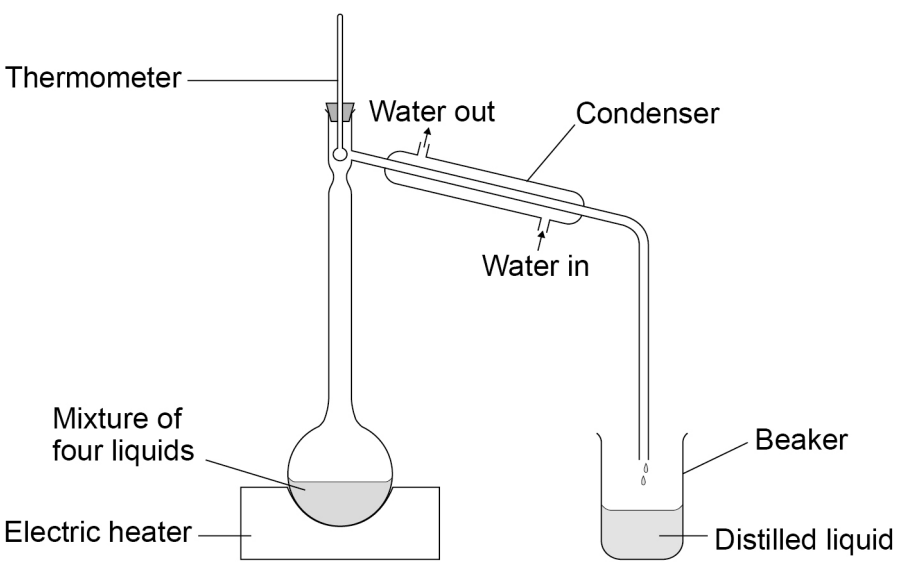


Table 2 shows the boiling points of the four liquids in the mixture.

Table 2

Liquid	Boiling point in °C
A	97
B	138
C	78
D	118

4.1.1.1 Atoms, elements and compounds

Question 56 · continued

0 2 . 5 Which liquid in **Table 2** would distil and be collected in the beaker first?

[1 mark]

Liquid _____

0 2 . 6 Suggest what would happen to the temperature of the water as the water flows through the condenser.

[1 mark]

_____

_____

0 2 . 7 Describe how to obtain sodium chloride crystals from sodium chloride solution by crystallisation.

[2 marks]

_____

_____

_____

_____

8

4.1.1.1 Atoms, elements and compounds

Question 57

0 4 This question is about the periodic table.

Figure 6 shows an early version of the periodic table published by a scientist.

Figure 6

H							
Li	Be	B	C	N	O	F	
Na	Mg	Al	Si	P	S	Cl	
K Cu	Ca Zn	? ?	Ti ?	V As	Cr Se	Mn Br	Fe Co Ni
Rb Ag	Sr Cd	Y In	Zr Sn	Nb Sb	Mo Te	? I	Ru Rh Pd

0 4 . 1 The scientist left gaps in the periodic table in **Figure 6**.

Each gap is represented by a question mark (**?**).

Give **one** reason why the scientist left gaps in this periodic table.

[1 mark]

0 4 . 2 Which scientist published the periodic table in **Figure 6**?

[1 mark]

Tick (✓) **one** box.

Bohr ☐

Chadwick ☐

Mendeleev ☐

4.1.1.1 Atoms, elements and compounds

Question 57 · continued

0 4 . 3 The modern periodic table is different from the periodic table in **Figure 6**.

One extra group of elements has been added.

What is the name of the extra group of elements in the modern periodic table?

[1 mark]

Tick (✓) **one** box.

- Alkali metals ☐
- Halogens ☐
- Noble gases ☐

0 4 . 4 Why do the elements in Group 1 of the modern periodic table have similar chemical properties?

[1 mark]

Tick (✓) **one** box.

- The elements all form negative ions. ☐
- The elements all have one electron in the outer shell. ☐
- The elements all have the same number of shells. ☐

Question 4 continues on the next page

4.1.1.1 Atoms, elements and compounds

Question 57 · continued

0 4 . 5 **Table 3** shows the melting points of the first five elements going down Group 1.

Table 3

Element	Melting point in °C
Lithium	181
Sodium	98
Potassium	**X**
Rubidium	39
Caesium	29

Predict value **X**.

[1 mark]

X = _____ °C

0 4 . 6 Give **one** observation you would see when a small piece of potassium is added to water.

[1 mark]

_____

_____

4.1.1.1 Atoms, elements and compounds

Question 57 · continued

0 4 . 7 **Table 4** shows information about the first five elements going down Group 7.

Table 4

Element	State at 150 °C	Symbol	Formula of the compound with hydrogen
Fluorine	gas	F	HF
Chlorine	_____	Cl	HCl
Bromine	gas	Br	HBr
Iodine	liquid	I	HI
Astatine	solid	At	_____

Complete **Table 4**.

[2 marks]

0 4 . 8 The elements in Group 7 consist of molecules.

What is the formula of a molecule of bromine?

[1 mark]

Tick (✓) **one** box.

Br ☐

Br_2 ☐

Br^2 ☐

2Br ☐

9

4.1.1.1 Atoms, elements and compounds

Question 58

June 2023 | 8462/1F | Original Q1

0 1 This question is about atoms.

Atoms contain three types of particle:

- electrons
- neutrons
- protons.

0 1 . 1 Which particle has no electrical charge?

[1 mark]

Tick (✓) **one** box.

Electron ☐

Neutron ☐

Proton ☐

0 1 . 2 Which particles have the same relative mass?

[1 mark]

Tick (✓) **one** box.

An electron and a neutron ☐

An electron and a proton ☐

A neutron and a proton ☐

0 1 . 3 The formula of a compound is N_2O

How many of each type of atom are in one molecule of N_2O?

[2 marks]

Nitrogen _____

Oxygen _____

4.1.1.1 Atoms, elements and compounds

Question 58 · continued

An atom of element **Z** contains:

- 3 electrons
- 4 neutrons
- 3 protons.

0 1 . 4 Give the name of element **Z**.

Use the periodic table.

[1 mark]

_____

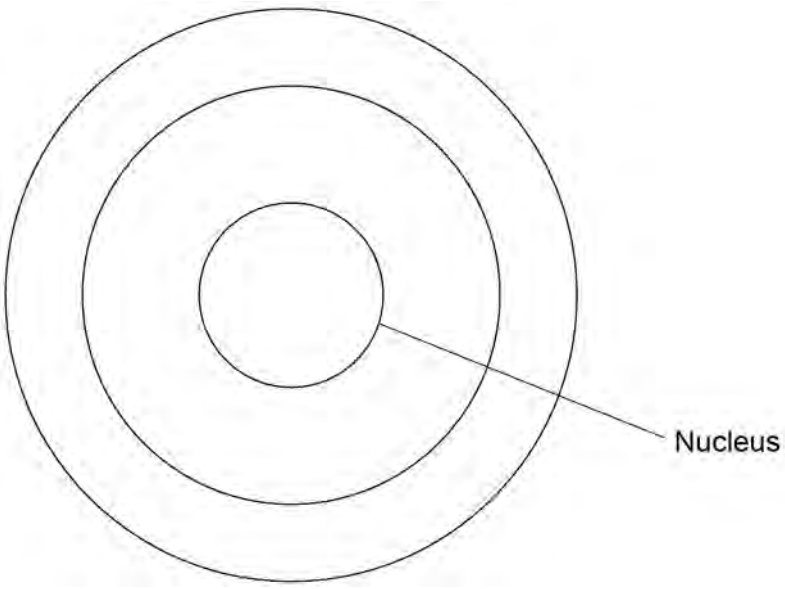
0 1 . 5 Complete **Figure 1** to show the position of the particles in an atom of element **Z**.

Use the symbols:

× = electron
● = neutron
○ = proton

[4 marks]

Figure 1



9

4.1.1.1 Atoms, elements and compounds

Question 59

June 2023 | 8462/1F | Original Q3

0 3 This question is about carbon.

0 3 . 1 Which type of substance is carbon?

[1 mark]

Tick (✓) **one** box.

Compound ☐

Element ☐

Mixture ☐

0 3 . 2 Carbon has isotopes with mass numbers 12, 13 and 14.

Complete the sentences.

Choose answers from the box.

[2 marks]

electrons	**ions**	**molecules**	**neutrons**	**protons**

The isotopes of carbon have the same number of _____.

The isotopes of carbon have a different number of _____.

4.1.1.1 Atoms, elements and compounds

Question 59 · continued

0 3 . 3 12 g of carbon contains 6.02×10^{23} atoms.

Which expression is used to calculate the mass of one atom of carbon?

[1 mark]

Tick (✓) **one** box.

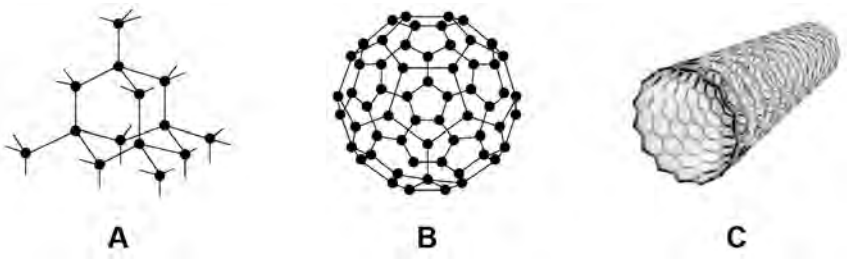
$\frac{12}{6.02 \times 10^{23}}$ ☐

$\frac{6.02 \times 10^{23}}{12}$ ☐

$12 \times 6.02 \times 10^{23}$ ☐

0 3 . 4 **Figure 2** shows diagrams that represent different forms of carbon.

Figure 2



Which diagram in **Figure 2** represents Buckminsterfullerene?

[1 mark]

Tick (✓) **one** box.

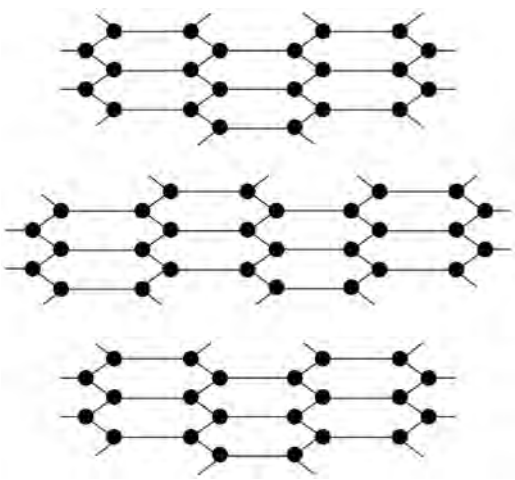
A ☐ **B** ☐ **C** ☐

Question 3 continues on the next page

Question 59 · continued

0 3 . 5 **Figure 3** represents part of the structure of graphite.

Figure 3



Draw **one** line from each property of graphite to the structural feature that is the reason for that property.

[2 marks]

Property	Structural feature
	Graphite has hexagonal rings of carbon atoms.
Graphite conducts electricity.	The bonds between carbon atoms in the layers are strong.
Graphite is soft.	There are no covalent bonds between layers of atoms.
	There are delocalised electrons in graphite.

7

4.1.1.1 Atoms, elements and compounds

Question 60

June 2023 | 8462/1F | Original Q9

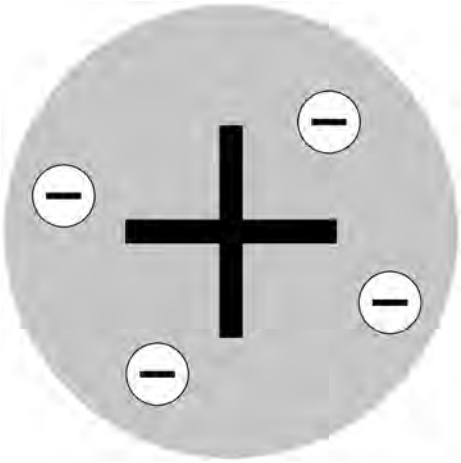
0 9 Discoveries in chemistry led to a better understanding of atomic structure.

0 9 . 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 10 represents the plum pudding model of the atom.

Figure 10



Describe the plum pudding model of the atom.

[2 marks]

0 9 . 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 60 · continued

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

The atomic number of tennessine is 117

0 9 . 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 9 . 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 9 continues on the next page

0 9 . 5 The discovery of isotopes explained why some relative atomic masses are not whole numbers.

Element **R** has two isotopes.

Table 5 shows the mass numbers and percentage abundances of the isotopes of element **R**.

Table 5

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 61

0 2 This question is about glass and polymers.

Beakers can be made from borosilicate glass or poly(propene).

Table 1 shows information about materials used to make beakers.

Table 1

	Material used to make beakers	
	borosilicate glass	**poly(propene)**
Temperature at which melting begins in °C	850	160
Flammability	does not burn	burns
Resistance to impact	shatters	tough
Cost of 100 cm^3 beaker in £	1.50	2.00

0 2 . 1 Suggest **two** reasons why a Bunsen burner should **not** be used to heat a liquid in a poly(propene) beaker.

Use **Table 1**.

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 2 Poly(propene) beakers are more expensive than borosilicate glass beakers.

Suggest **one** reason why using poly(propene) beakers instead of borosilicate glass beakers could save money.

Use **Table 1**.

[1 mark]

_____

_____

Question 61 · continued

0 2 . 3 Which is a raw material used to make borosilicate glass?

[1 mark]

Tick (✓) **one** box.

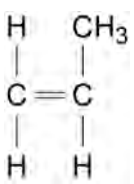
Boron trioxide ☐

Clay ☐

Limestone ☐

Poly(propene) is produced from propene.

The displayed structural formula of propene is:



0 2 . 4 **Table 2** shows some information about the elements in one molecule of propene.

Table 2

Symbol for element	Name of element	Number of atoms of element in one molecule of propene
C		
H		

Complete **Table 2**.

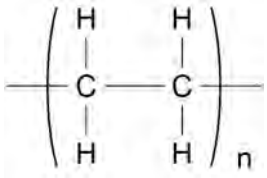
[2 marks]

Question 61 · continued

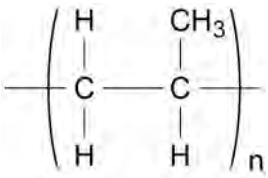
0 2 . 5 Which structure is the repeating unit of poly(propene)?

[1 mark]

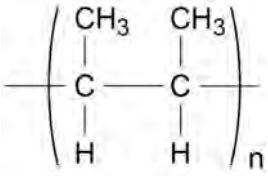
Tick (✓) **one** box.



☐



☐



☐

0 2 . 6 Poly(propene) is produced in three stages:

- **Stage 1:** separating large alkane molecules from crude oil
- **Stage 2:** producing propene molecules from large alkane molecules
- **Stage 3:** joining many propene molecules together.

Name **Stage 1**, **Stage 2** and **Stage 3**.

Choose answers from the box.

[3 marks]

cracking	**fermentation**	**fractional distillation**
polymerisation	**reverse osmosis**	

Stage 1 is _____.

Stage 2 is _____.

Stage 3 is _____.

4.1.1.1 Atoms, elements and compounds

Question 61 · continued

0 2 . 7 A molecule of hexene contains a double carbon–carbon bond.

Many hexene molecules join together to form poly(hexene).

Which **two** words describe a hexene molecule in this process?

[2 marks]

Tick (✓) **two** boxes.

- Alkene ☐
- Catalyst ☐
- Composite ☐
- Element ☐
- Monomer ☐

12

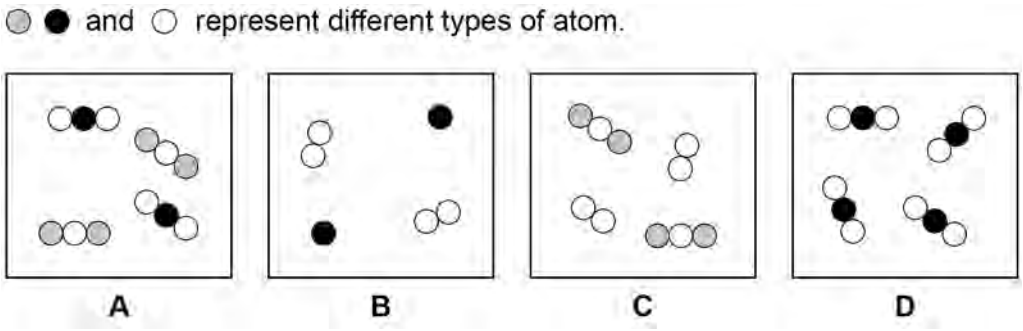
4.1.1.1 Atoms, elements and compounds

Question 62

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

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

Figure 1



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

[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

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

[1 mark]

Tick (✓) **one** box.

A ☐ B ☐ C ☐ D ☐

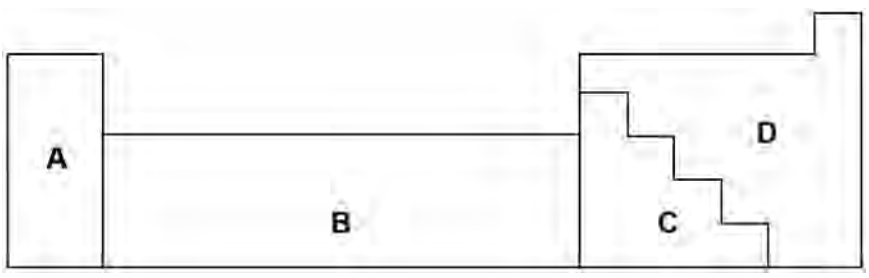
Question 1 continues on the next page

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

Figure 2 shows an outline of the periodic table.

The periodic table is divided into sections.

Figure 2



Where are metals found in the periodic table?

[1 mark]

Tick (✓) **one** box.

Section **A** only ☐

Sections **A**, **B** and **C** ☐

Sections **B**, **C** and **D** ☐

Section **D** only ☐

Question 62 · continued

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

[2 marks]

Tick (✓) **two** boxes.

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

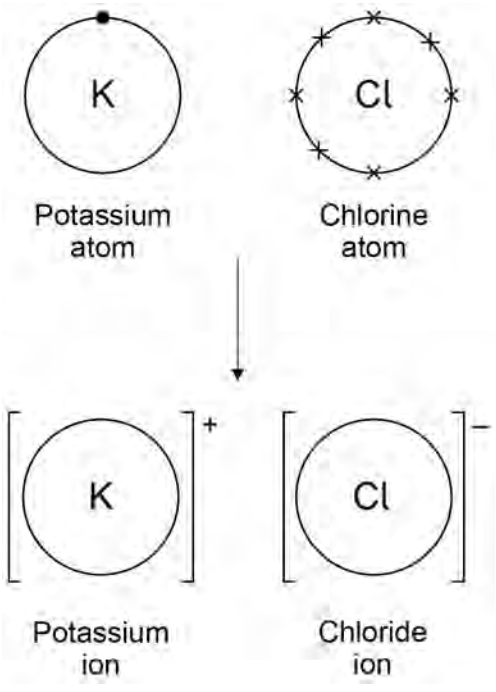
0 1 . 5 Potassium and chlorine react to produce potassium chloride.

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

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

Complete the dot and cross diagram.

[2 marks]

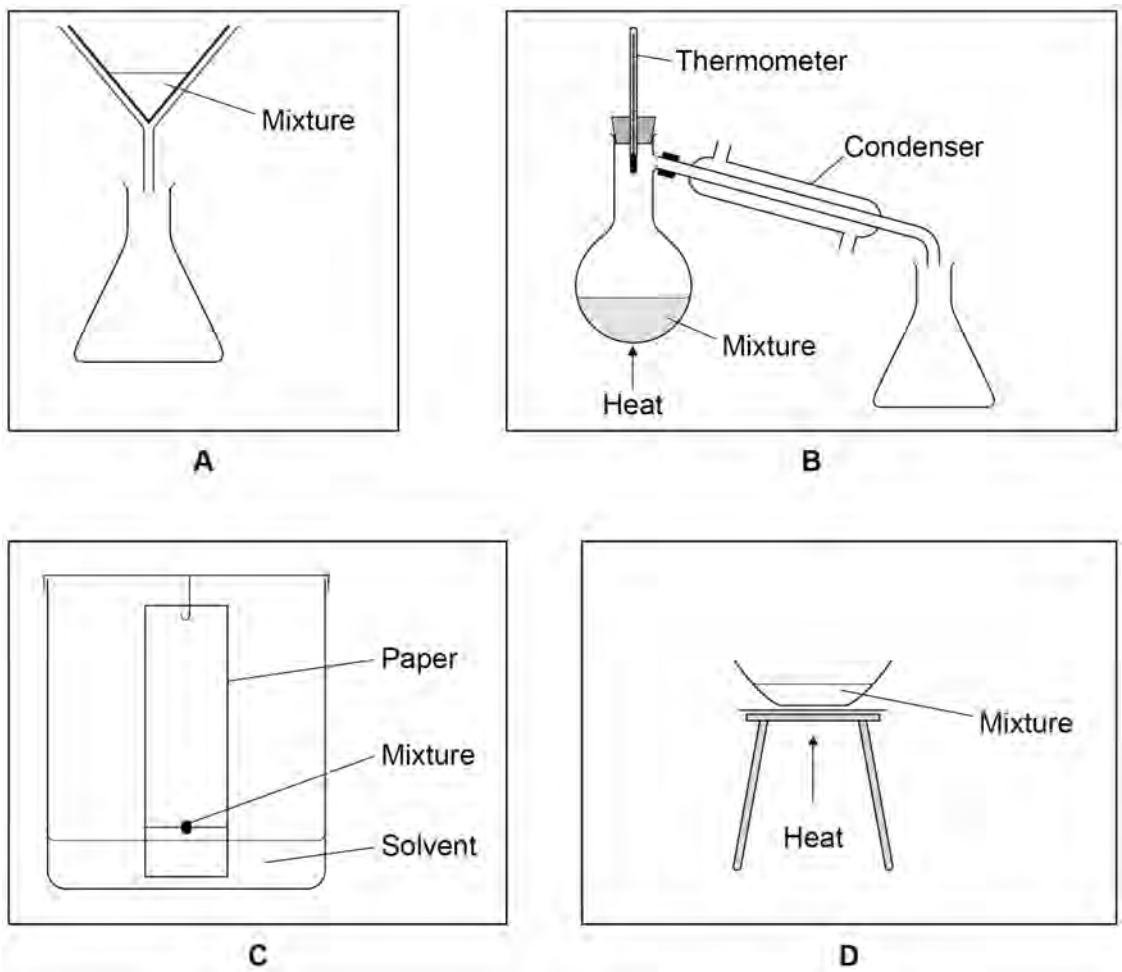


Question 62 · continued

Mixtures are separated by different methods.

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

Figure 3



4.1.1.1 Atoms, elements and compounds

Question 62 · continued

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

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 7 Which apparatus shows filtration?

Use **Figure 3**.

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

9

4.1.1.1 Atoms, elements and compounds

Question 63

June 2024 | 8462/1F | Original Q4

0 4 This question is about small particles.

0 4 . 1 What is the approximate number of atoms in a nanoparticle?

[1 mark]

Tick (✓) **one** box.

- A few hundred atoms ☐
- A few thousand atoms ☐
- A few million atoms ☐
- A few billion atoms ☐

0 4 . 2 Nanoparticles of some elements can be used as catalysts.

Which element is most likely to be used as a catalyst?

Use the periodic table.

[1 mark]

Tick (✓) **one** box.

- Aluminium ☐
- Iron ☐
- Magnesium ☐

Question 4 continues on the next page

Question 63 · continued

0 4 . 3 Nanoparticles are used in sun creams and in wound dressings.

A wound dressing is placed next to the skin to prevent infection.

Figure 8 shows a wound dressing.

Figure 8



Table 2 shows some information about substances used in the form of nanoparticles.

Table 2

Substance	Property
Carbon	Strong
Silicon dioxide	Hard
Silver	Kills bacteria
Titanium dioxide	Blocks light

4.1.1.1 Atoms, elements and compounds

Question 63 · continued

Draw **one** line from each use to the best substance for that use.

[2 marks]

Use	Substance
	Carbon
Sun creams	Silicon dioxide
Wound dressings	Silver
	Titanium dioxide

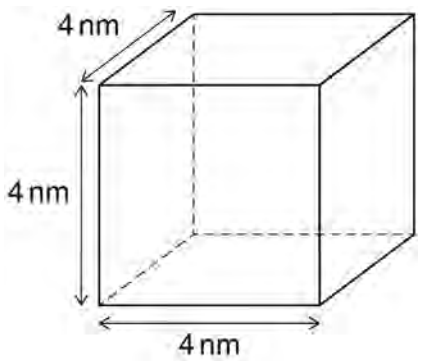
Question 4 continues on the next page

4.1.1.1 Atoms, elements and compounds

Question 63 · continued

0 4 . 4 **Figure 9** shows a cubic nanoparticle.

Figure 9



Calculate:

- the surface area of the cubic nanoparticle
- the volume of the cubic nanoparticle
- the simplest whole number ratio of surface area : volume for the cubic nanoparticle.

Use the equation:

surface area of cubic nanoparticle = 6 × surface area of one face

[6 marks]

Surface area of cubic nanoparticle = _____ nm^2

Volume of cubic nanoparticle = _____ nm^3

Simplest whole number ratio of surface area: volume = _____ : _____

10

4.1.1.1 Atoms, elements and compounds

Question 64

June 2025 | 8462/1F | Original Q1

0 1 This question is about elements and compounds.

0 1 . 1 What is the name of the compound with the formula $ZnBr_2$?

Use the periodic table.

[1 mark]

Tick (✓) **one** box.

Zinc bromide ☐

Zinc chloride ☐

Zinc iodide ☐

0 1 . 2 A compound has the formula C_2H_6O

Table 1 shows information about a molecule of C_2H_6O

Table 1

Symbol of element	Name of element	Number of atoms of the element in a molecule of C_2H_6O
C		2
H	Hydrogen	
	Oxygen	1

Complete **Table 1**.

Use the periodic table.

[3 marks]

4.1.1.1 Atoms, elements and compounds

Question 64 · continued

0 1 . 3 Potassium and sulfur react to produce potassium sulfide.

Write the word equation for this reaction.

[1 mark]

_____ + _____ → _____

0 1 . 4 Aluminium reacts with fluorine to produce aluminium fluoride.

Balance the equation for this reaction.

[2 marks]

_____ Al + _____ F_2 → 2 AlF_3

7

4.1.1.1 Atoms, elements and compounds

Question 65

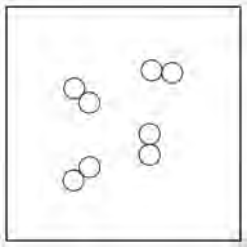
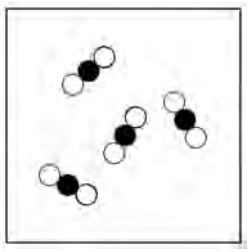
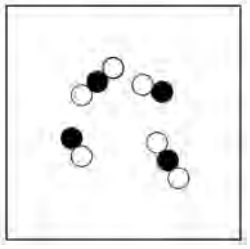
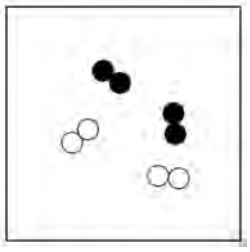
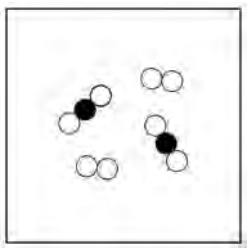
June 2025 | 8462/1F | Original Q7

0 7 This question is about mixtures.

0 7 . 1 Draw **one** line from each type of mixture to the representation of that mixture.

○ and ● represent atoms of different elements.

[2 marks]

Type of mixture	Representation
Mixture of compounds	
Mixture of a compound and an element	
	
	
	

Question 65 · continued

0 7 . 2 A student had a mixture of salt and sand.

Salt is soluble in water.

Sand is insoluble in water.

Plan a method to obtain pure dry samples of salt and of sand from the mixture.

Figure 11 shows the chemicals and equipment that can be used.

[6 marks]

Figure 11



4.1.1.1 Atoms, elements and compounds

Question 65 · continued

Extra space

0 7 . 3 A mixture of salt and sand contained 16.0 g of salt.

The student obtained 13.6 g of salt after separation from the mixture.

Calculate the percentage yield of the salt.

Use the equation

$$\% \text{ yield} = \frac{\text{mass of salt obtained}}{\text{mass of salt in mixture}} \times 100$$

[2 marks]

% yield = _____ %

10