AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.1.1.5

Size and mass of atoms

Past-paper questions

Tier	**Higher**
Question groups	**24**
Available paper years	**2008–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.1.1.5 Size and mass of atoms

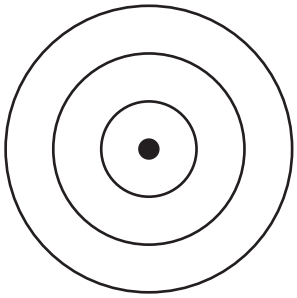
Question 01

June 2008 | CHY2H | Original Q7 | Legacy

7 Aluminium is a useful metal.

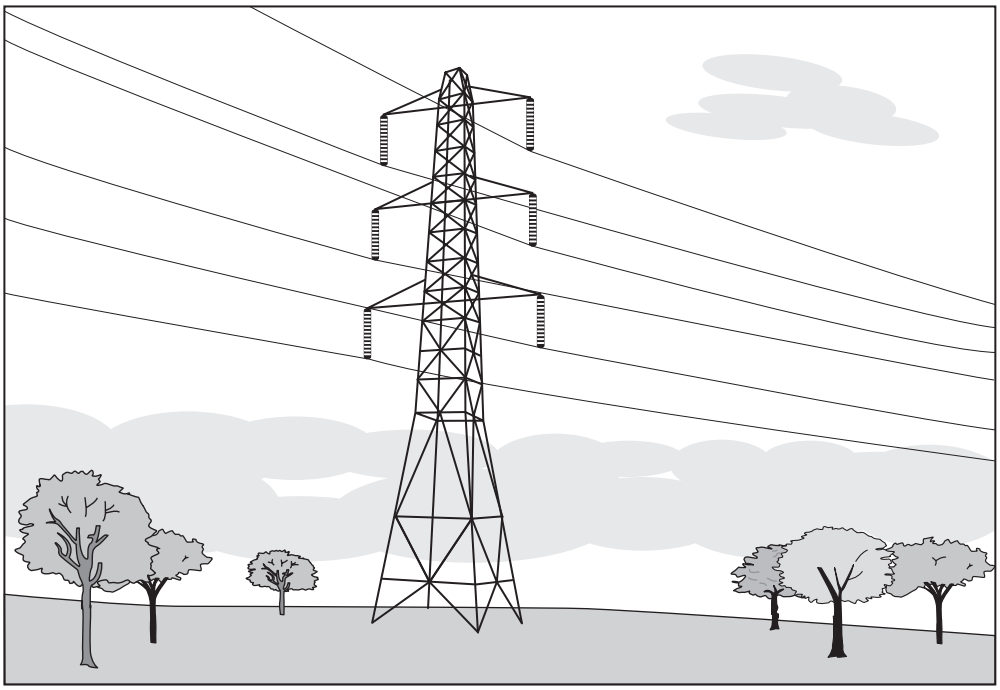
7 (a) The atomic number (proton number) of aluminium is 13.

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



(1 mark)

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



Explain why metals are good conductors of electricity.

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(2 marks)

3

4.1.1.5 Size and mass of atoms

Question 02

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

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

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

Show how an atom of hydrogen-2 is represented.

(1 mark)

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

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

.....

.....

Relative formula mass (M_r) = ...

(1 mark)

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

Explain why, in terms of molecules.

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.....

(2 marks)

4.1.1.5 Size and mass of atoms

Question 02 · continued

for mark

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

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

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(2 marks)

6

Turn over for the next question

4.1.1.5 Size and mass of atoms

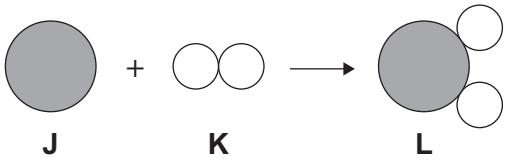
Question 03

June 2010 | CHY1AP | Original Q4 | Legacy

QUESTION FOUR

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

In the diagram, each circle represents an atom.



4A Which substance or substances are elements?

1 **J** only

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

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

4 **L** only

4B Substance **L** . . .

1 is an impure substance.

2 is a mixture.

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

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

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

1 there is an overall increase in mass.

2 there is an overall decrease in mass.

3 there is no overall change in mass.

4 the total number of atoms changes.

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

1 have two separate nuclei.

2 share a nucleus.

3 not have any chemical bonds.

4 not contain any electrons.

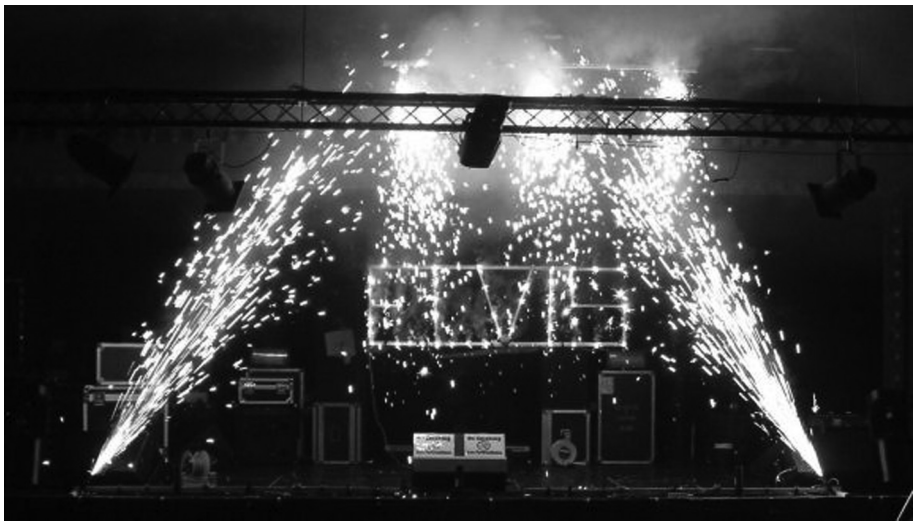
4.1.1.5 Size and mass of atoms

Question 04

June 2011 | CHY2H | Original Q4 | Legacy

4 Read the information in the box.

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



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

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

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

What is the meaning of *exothermic?*

.....

.....

(1 mark)

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

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

..... energy

(1 mark)

4.1.1.5 Size and mass of atoms

Question 04 · continued

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

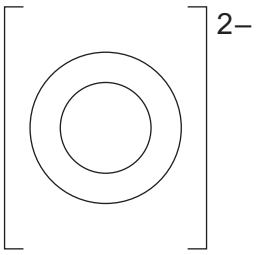
Aluminium oxide contains aluminium ions (Al^{3+}) and oxide ions (O^{2-}).

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

The atomic number of oxygen = 8

Use crosses (x) to represent the electrons.

oxide ion



(1 mark)

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

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

.....

.....

(1 mark)

4

4.1.1.5 Size and mass of atoms

Question 05

June 2011 | CHY2H | Original Q6 | Legacy

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



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

Calculate the empirical (simplest) formula of this compound.

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

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

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(4 marks)

4.1.1.5 Size and mass of atoms

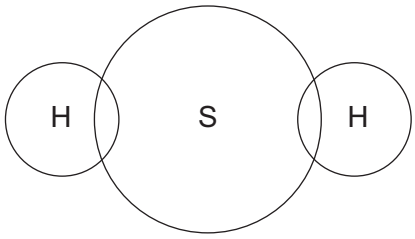
Question 05 · continued

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

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

H–S–H

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



(1 mark)

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

Explain why.

.....

.....

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(2 marks)

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

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

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

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

(1 mark)

8

4.1.1.5 Size and mass of atoms

Question 06

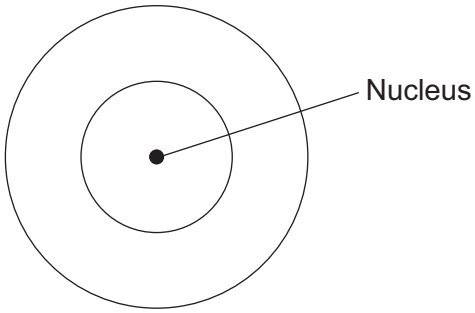
January 2012 | CH1HP | Original Q1 | Legacy

1 The picture shows a diamond ring.



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

Draw the electronic structure of a carbon atom.



(1 mark)

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

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

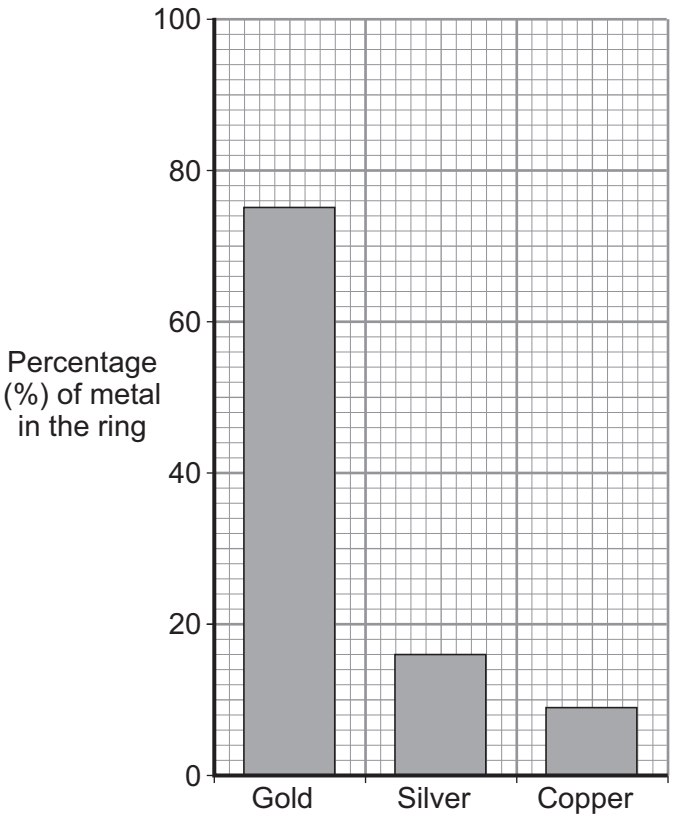
Name	Number
Proton	79
Electron	.....
.....	.....

(3 marks)

4.1.1.5 Size and mass of atoms

Question 06 · continued

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



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

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

(1 mark)

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

Give **two** reasons why.

1 .....

.....

.....

2 .....

.....

.....

(2 marks)

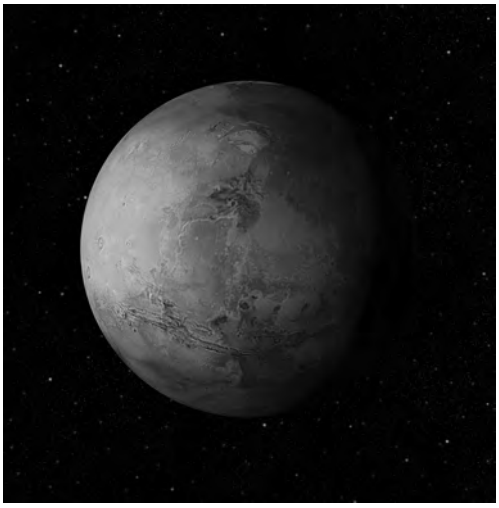
7

4.1.1.5 Size and mass of atoms

Question 07

June 2013 | CH2HP | Original Q6 | Legacy

6 Spacecraft have been to the planets Venus and Mars. The spacecraft have sent back information about the atmosphere of each planet.



6 (a) The main gas in the atmosphere of Mars is carbon dioxide.

Explain why, in terms of structure, carbon dioxide is a gas, even at low temperatures.

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(3 marks)

4.1.1.5 Size and mass of atoms

Question 07 · continued

6 (b) Gas chromatography linked to a mass spectrometer (GC-MS) is used to identify substances found on Mars.

6 (b) (i) What is the purpose of gas chromatography?

.....

.....

(1 mark)

6 (b) (ii) What information do the molecular ion peaks from the mass spectrometer give about the substances?

.....

(1 mark)

6 (c) The atmosphere on Venus contains droplets of sulfuric acid solution.

6 (c) (i) Suggest a pH value for sulfuric acid solution.

pH = ...

(1 mark)

6 (c) (ii) Name the ion which makes sulfuric acid solution acidic.

.....

(1 mark)

6 (d) The atmosphere of Venus contains the isotopes $^{2}_{1}H$ and $^{1}_{1}H$

Describe the similarities and the differences in the isotopes $^{2}_{1}H$ and $^{1}_{1}H$

You should refer to the sub-atomic particles in each isotope.

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(3 marks)

10

4.1.1.5 Size and mass of atoms

Question 08

June 2015 | CH1HP | Original Q1 | Legacy

1 This question is about atomic structure and elements.

1 (a) Complete the sentences.

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

[1 mark]

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

..... .

[1 mark]

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

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

[2 marks]

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

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

[2 marks]

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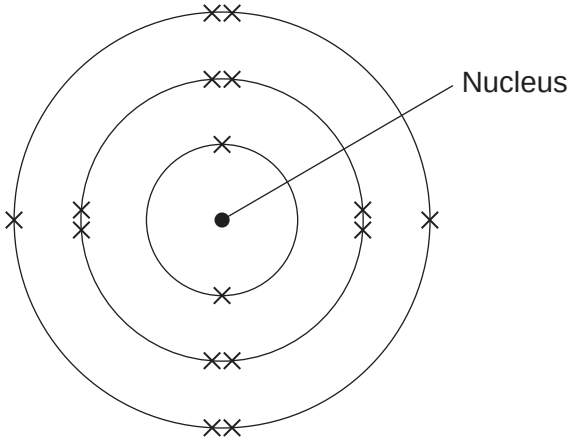
4.1.1.5 Size and mass of atoms

Question 08 · continued

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

Figure 1



What is the chemical symbol of this non-metal?

[1 mark]

Tick (✓) **one** box.

Ar ☐

O ☐

S ☐

Si ☐

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

Complete the sentences.

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

particles called ..... .

[1 mark]

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

particles called ..... .

[1 mark]

9

4.1.1.5 Size and mass of atoms

Question 09

June 2015 | CH2HP | Original Q4 | Legacy

4 This question is about atoms and isotopes.

4 (a) Atoms contain protons, neutrons and electrons.
A lithium atom has the symbol $^{7}_{3}\text{Li}$

Explain, in terms of sub-atomic particles, why the mass number of this lithium atom is 7.

[3 marks]

.....

.....

.....

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.....

.....

4 (b) Amounts of substances can be described in different ways.

Complete the sentences.

[2 marks]

One mole of a substance is the relative formula mass in ..... .

The relative atomic mass of an element compares the mass of an atom of an element with the mass of an atom of ..... .

4 (c) Two isotopes of oxygen are $^{18}_{8}\text{O}$ and $^{16}_{8}\text{O}$

Describe the similarities and differences between the isotopes $^{18}_{8}\text{O}$ and $^{16}_{8}\text{O}$
You should refer to the numbers of sub-atomic particles in each isotope.

[3 marks]

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8

4.1.1.5 Size and mass of atoms

Question 10

June 2016 | CH2HP | Original Q3 | Legacy

3 This question is about atoms, molecules and nanoparticles.

3 (a) Different atoms have different numbers of sub-atomic particles.

3 (a) (i) An oxygen atom can be represented as $^{16}_{8}O$

Explain why the mass number of this atom is 16.

You should refer to the numbers of sub-atomic particles in the nucleus of the atom.

[2 marks]

3 (a) (ii) Explain why $^{12}_{6}C$ and $^{14}_{6}C$ are isotopes of carbon.

You should refer to the numbers of sub-atomic particles in the nucleus of each isotope.

[3 marks]

4.1.1.5 Size and mass of atoms

Question 10 · continued

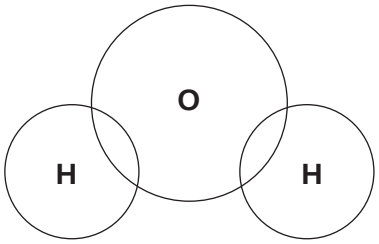
3 (b) Hydrogen atoms and oxygen atoms chemically combine to produce water molecules.

3 (b) (i) Complete **Figure 3** to show the arrangement of the outer shell electrons of the hydrogen and oxygen atoms in a molecule of water.

Use dots (•) or crosses (×) to represent the electrons.

[2 marks]

Figure 3



3 (b) (ii) Name the type of bonding in a molecule of water.

[1 mark]

_____

3 (b) (iii) Why does pure water **not** conduct electricity?

[1 mark]

_____

_____

3 (c) Nanoparticles of cobalt oxide can be used as catalysts in the production of hydrogen from water.

3 (c) (i) How does the size of a nanoparticle compare with the size of an atom?

[1 mark]

_____

_____

3 (c) (ii) Suggest **one** reason why 1 g of cobalt oxide nanoparticles is a better catalyst than 1 g of cobalt oxide powder.

[1 mark]

_____

_____

11

4.1.1.5 Size and mass of atoms

Question 11

June 2016 | CH3HP | Original Q3 | Legacy

3 This question is about elements and the periodic table.

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

3 (a) (i) Complete the sentence.

[1 mark]

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

_____ .

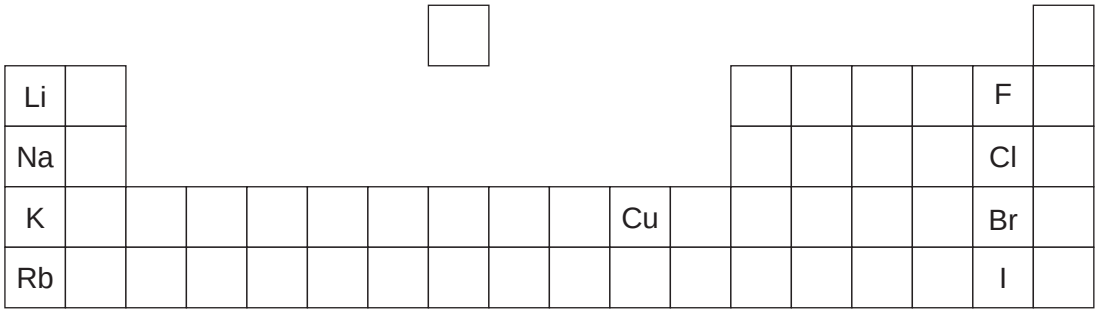
3 (a) (ii) Name the particle that allowed the elements to be arranged in order of their atomic number in the modern periodic table.

[1 mark]

_____

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

Figure 4



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

[1 mark]

_____

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

[1 mark]

_____

_____

4.1.1.5 Size and mass of atoms

Question 11 · continued

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

[4 marks]

8

4.1.1.5 Size and mass of atoms

Question 12

June 2017 | CH1HP | Original Q1 | Legacy

1 Elements are made of atoms.

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

Table 1

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

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

[1 mark]

_____

_____

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

[2 marks]

_____

_____

_____

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

Sulfuric acid, H_2SO_4, is a compound.

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

[1 mark]

_____

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

[1 mark]

_____

4.1.1.5 Size and mass of atoms

Question 12 · continued

1 (c) Sulfuric acid reacts with metal oxides.

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

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

What is the mass of the products?

[1 mark]

Tick (✓) **one** box.

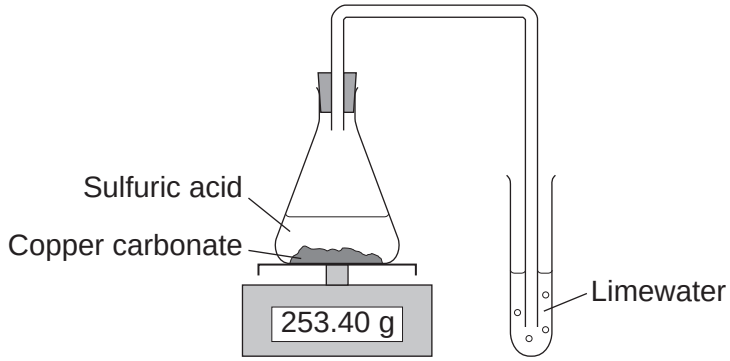
Mass of copper sulfate in g	Mass of water in g	Tick (✓)
30	7	
159	36	
196	18	
319	36	

4.1.1.5 Size and mass of atoms

Question 12 · continued

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

Figure 1



Describe and explain the changes seen during the reaction.

[3 marks]

9

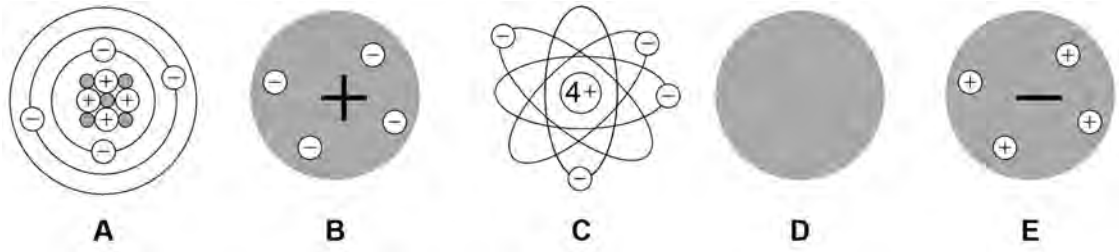
4.1.1.5 Size and mass of atoms

Question 13

June 2018 | 8462/1H | Original Q4

0 4 **Figure 3** represents different models of the atom.

Figure 3



0 4 . 1 Which diagram shows the plum pudding model of the atom?

[1 mark]

Tick **one** box.

A		B		C		D		E	

0 4 . 2 Which diagram shows the model of the atom developed from the alpha particle scattering experiment?

[1 mark]

Tick **one** box.

A		B		C		D		E	

0 4 . 3 Which diagram shows the model of the atom resulting from Bohr's work?

[1 mark]

Tick **one** box.

A		B		C		D		E	

4.1.1.5 Size and mass of atoms

Question 13 · continued

0 4 . 4 Define the mass number of an atom.

[1 mark]

0 4 . 5 Element **X** has two isotopes. Their mass numbers are 69 and 71

The percentage abundance of each isotope is:

- 60% of ^{69}**X**
- 40% of ^{71}**X**

Estimate the relative atomic mass of element **X**.

[1 mark]

Tick **one** box.

< 69.5 ☐

Between 69.5 and 70.0 ☐

Between 70.0 and 70.5 ☐

> 70.5 ☐

0 4 . 6 Chadwick's experimental work on the atom led to a better understanding of isotopes.

Explain how his work led to this understanding.

[3 marks]

8

4.1.1.5 Size and mass of atoms

Question 14

June 2019 | 8462/1H | Original Q4

0 4 This question is about atomic structure.

0 4 . 1 Atoms contain subatomic particles.

Table 2 shows properties of two subatomic particles.

Complete **Table 2**.

[2 marks]

Table 2

Name of particle	Relative mass	Relative charge
neutron		
		+1

An element **X** has two isotopes.

The isotopes have different mass numbers.

0 4 . 2 Define mass number.

[1 mark]

0 4 . 3 Why is the mass number different in the two isotopes?

[1 mark]

Question 4 continues on the next page

4.1.1.5 Size and mass of atoms

Question 14 · continued

0 4 . 4 The model of the atom changed as new evidence was discovered.

The plum pudding model suggested that the atom was a ball of positive charge with electrons embedded in it.

Evidence from the alpha particle scattering experiment led to a change in the model of the atom from the plum pudding model.

Explain how.

[4 marks]

8

4.1.1.5 Size and mass of atoms

Question 15

November 2020 | 8462/1H | Original Q2

0 2 This question is about metals and the reactivity series.

0 2 . 1 Which **two** statements are properties of most transition metals?

[2 marks]

Tick (✓) **two** boxes.

- They are soft metals. ☐
- They form colourless compounds. ☐
- They form ions with different charges. ☐
- They have high melting points. ☐
- They have low densities. ☐

0 2 . 2 A student added copper metal to colourless silver nitrate solution.

The student observed:

- pale grey crystals forming
- the solution turning blue.

Explain how these observations show that silver is less reactive than copper.

[3 marks]

4.1.1.5 Size and mass of atoms

Question 15 · continued

0 2 . 3 A student is given three metals, **X**, **Y** and **Z** to identify.

The metals are magnesium, iron and copper.

Plan an investigation to identify the three metals by comparing their reactions with dilute hydrochloric acid.

Your plan should give valid results.

[4 marks]

Question 2 continues on the next page

Question 15 · continued

0 2 . 4 Metal **M** has two isotopes.

Table 2 shows the mass numbers and percentage abundances of the isotopes.

Table 2

Mass number	Percentage abundance (%)
203	30
205	70

Calculate the relative atomic mass (A_r) of metal **M**.

Give your answer to 1 decimal place.

[2 marks]

Relative atomic mass (1 decimal place) = _____

11

4.1.1.5 Size and mass of atoms

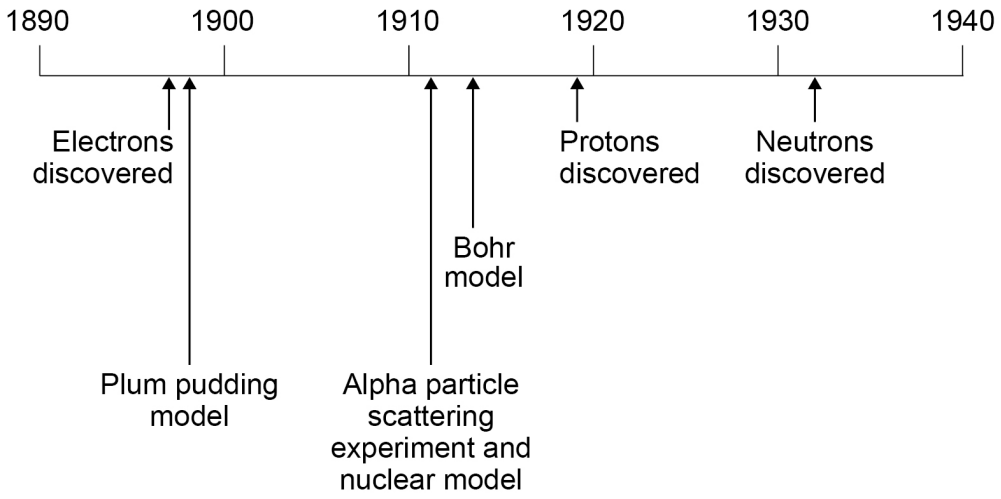
Question 16

November 2020 | 8462/1H | Original Q5

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

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

Figure 2



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

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

[3 marks]

1 _____

_____

_____

2 _____

_____

_____

3 _____

_____

_____

4.1.1.5 Size and mass of atoms

Question 16 · continued

0 5 . 2 Niels Bohr adapted the nuclear model.

Describe the change that Bohr made to the nuclear model.

[2 marks]

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

Mendeleev arranged the elements in order of atomic weight.

Mendeleev then reversed the order of some pairs of elements.

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

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

Use **Figure 2**.

[2 marks]

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

[1 mark]

8

4.1.1.5 Size and mass of atoms

Question 17

November 2021 | 8462/1H | Original Q2

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

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

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

You should answer in terms of subatomic particles.

[2 marks]

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

Table 1

Mass number	Percentage abundance (%)
69	60
71	40

Calculate the relative atomic mass (A_r) of gallium.

Give your answer to 1 decimal place.

[2 marks]

Relative atomic mass (1 decimal place) = _____

Question 17 · continued

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

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

[2 marks]

Number of electrons _____

Number of neutrons _____

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

[1 mark]

Tick (✓) **one** box.

Ga^{+} ☐

Ga^{-} ☐

Ga^{3+} ☐

Ga^{3-} ☐

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

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

[2 marks]

1 _____

_____

2 _____

_____

9

4.1.1.5 Size and mass of atoms

Question 18

June 2022 | 8462/1H | Original Q5

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

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

Rubidium is below potassium in Group 1.

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

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

[1 mark]

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

[3 marks]

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

You should balance the equation.

[3 marks]

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

Question 18 · continued

The noble gases are in Group 0.

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

[1 mark]

Tick (✓) **one** box.

The noble gases all have atoms with eight electrons in the outer shell. ☐

The noble gases have boiling points that increase going down the group. ☐

The noble gases have molecules with two atoms. ☐

The noble gases react with metals to form ionic compounds. ☐

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

Table 1

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

Calculate the relative atomic mass (A_r) of neon.

Give your answer to 3 significant figures.

[3 marks]

Relative atomic mass (3 significant figures) = _____

11

4.1.1.5 Size and mass of atoms

Question 19

June 2023 | 8462/1H | Original Q1

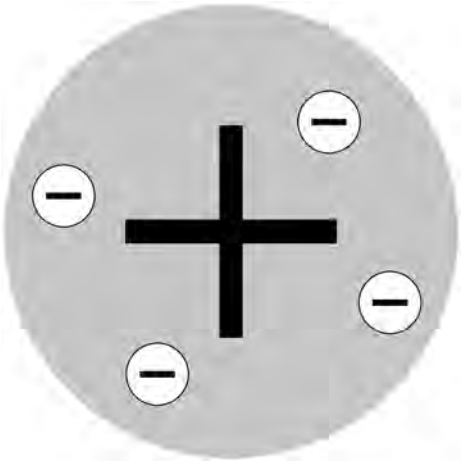
0 1 Discoveries in chemistry led to a better understanding of atomic structure.

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

The plum pudding model of the atom was then developed.

Figure 1 represents the plum pudding model of the atom.

Figure 1



Describe the plum pudding model of the atom.

[2 marks]

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

Write these three particles in order of their discovery.

[1 mark]

Earliest _____

_____

Latest _____

4.1.1.5 Size and mass of atoms

Question 19 · continued

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

The atomic number of tennessine is 117

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

Give **one** reason for your answer.

Use the periodic table.

[2 marks]

Number of outer shell electrons _____

Reason _____

_____

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

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

[1 mark]

_____

_____

Question 1 continues on the next page

Question 19 · continued

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

Element **R** has two isotopes.

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

Table 1

Mass number	Percentage abundance (%)
6	7.6
7	92.4

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

Give your answer to 1 decimal place.

[3 marks]

Relative atomic mass (1 decimal place) = _____

9

4.1.1.5 Size and mass of atoms

Question 20

June 2023 | 8462/1H | Original Q8

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

0 8 . 1 Argon has the atomic number 18

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

Answer in terms of electrons.

[2 marks]

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

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

[1 mark]

Formula = _____

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

Predict whether tellurium reacts with metals.

Explain your answer.

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

[2 marks]

4.1.1.5 Size and mass of atoms

Question 20 · continued

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

Barium reacts with hydrochloric acid.

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

[2 marks]

1 _____

_____

2 _____

_____

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

[3 marks]

_____ + _____ → _____ + _____

10

4.1.1.5 Size and mass of atoms

Question 21

June 2024 | 8462/1H | Original Q2

0 2 This question is about the periodic table.

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

0 2 . 1 Give **one** similarity and **one** difference between the electronic structures of sodium and potassium.

[2 marks]

Similarity _____

_____

Difference _____

_____

Group 1 elements react with water.

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

[2 marks]

1 _____

_____

2 _____

_____

0 2 . 3 Potassium hydroxide solution is produced when potassium reacts with water.

What is the colour of universal indicator when added to potassium hydroxide solution?

Give **one** reason for your answer.

[2 marks]

Colour of universal indicator _____

Reason _____

_____

Question 21 · continued

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

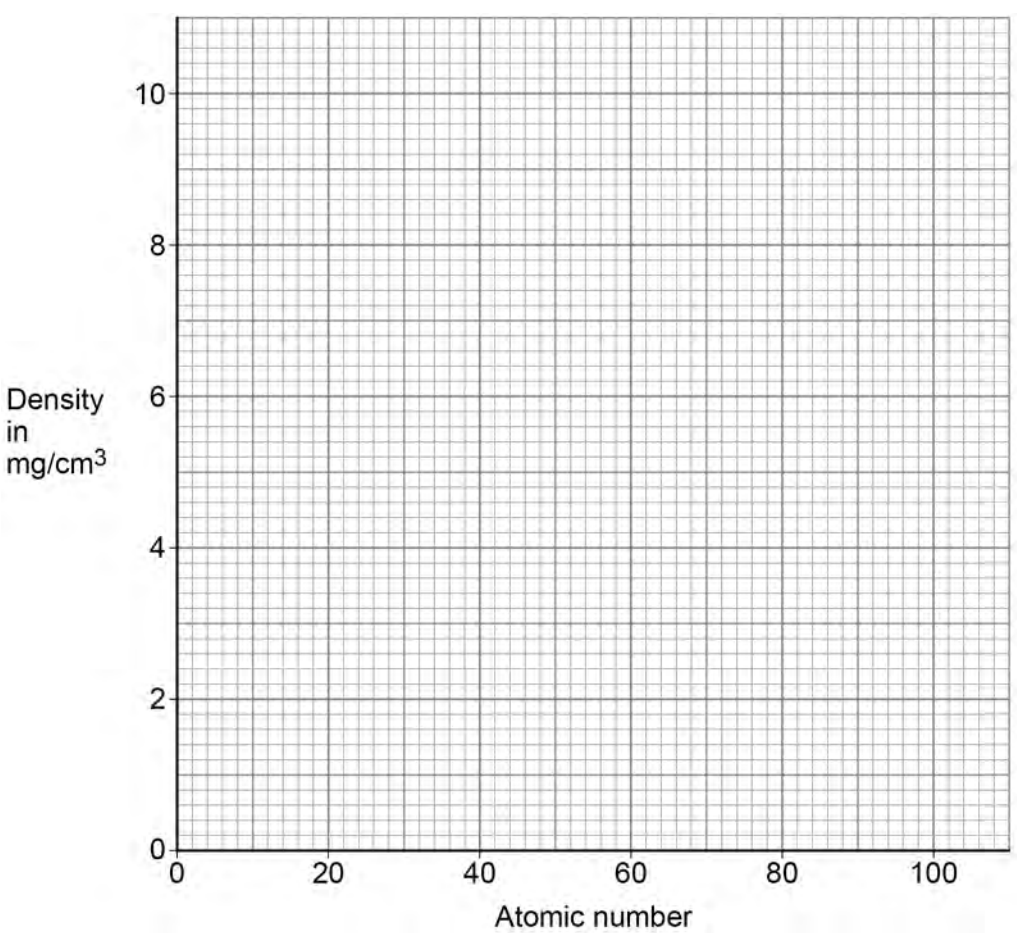
Table 1

Element	Atomic number	Density in mg/cm^3
Helium	2	0.2
Neon	10	0.8
Argon	18	1.6
Krypton	36	**X**
Xenon	54	5.4
Radon	86	9.1

0 2 . 4 Plot the data from **Table 1** on **Figure 1**.

[2 marks]

Figure 1



Question 21 · continued

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

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

[1 mark]

Density = _____ mg/cm^3

0 2 . 6 The elements in Group 7 are called the halogens.

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

Which combination of solutions will produce a reaction when mixed?

[1 mark]

Tick (✓) **one** box.

- Chlorine and potassium fluoride ☐
- Chlorine and potassium bromide ☐
- Bromine and potassium fluoride ☐
- Bromine and potassium chloride ☐

0 2 . 7 Which of the following describes the trends going down Group 7?

[1 mark]

Tick (✓) **one** box.

- Relative molecular mass decreases and boiling point decreases. ☐
- Relative molecular mass decreases and boiling point increases. ☐
- Relative molecular mass increases and boiling point decreases. ☐
- Relative molecular mass increases and boiling point increases. ☐

11

4.1.1.5 Size and mass of atoms

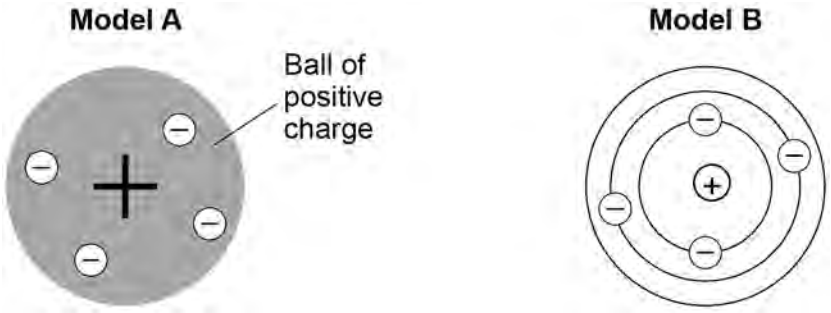
Question 22

June 2024 | 8462/1H | Original Q3

0 3 This question is about models of the atom.

Figure 2 shows two early models of the atom.

Figure 2



0 3 . 1 Name the models of the atom shown in **Figure 2**.

[2 marks]

Model **A** _____

Model **B** _____

0 3 . 2 Compare model **A** with the model of the atom used today.

Use **Figure 2**.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

4.1.1.5 Size and mass of atoms

Question 22 · continued

0 3 . 3 Chadwick's experiments showed the existence of neutrons in an atom.

This led to an understanding of isotopes.

Define the term 'isotopes'.

Refer to subatomic particles in your answer.

[2 marks]

8

Turn over for the next question

4.1.1.5 Size and mass of atoms

Question 23

June 2025 | 8462/1H | Original Q1

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

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

[1 mark]

0 1 . 2 Gallium (Ga) is a metallic element in Group 3.

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

[1 mark]

Tick (✓) **one** box.

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

4.1.1.5 Size and mass of atoms

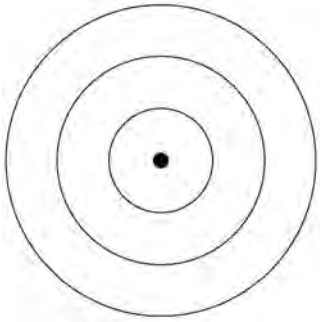
Question 23 · continued

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

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

[1 mark]

Figure 1



0 1 . 4 Mendeleev created an early periodic table.

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

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

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

[1 mark]

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

Explain why argon is unreactive.

[2 marks]

Question 23 · continued

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

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

Answer in terms of subatomic particles.

[2 marks]

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

Table 1

Mass number	Percentage abundance (%)
113	4
115	96

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

[1 mark]

Tick (✓) **one** box.

~113 ☐ ~114 ☐ ~115 ☐

9

4.1.1.5 Size and mass of atoms

Question 24

June 2025 | 8462/1H | Original Q5

0 5 This question is about small particles.

Before the discovery of the electron, atoms were thought to be tiny spheres that could not be divided.

0 5 . 1 The discovery of the electron led to the plum pudding model of the atom.

Describe the plum pudding model of the atom.

[2 marks]

0 5 . 2 The model of the atom changed again after the alpha particle scattering experiment.

Give **two** conclusions that were made from the alpha particle scattering experiment.

[2 marks]

1

2

0 5 . 3 Niels Bohr made another change to the model of the atom.

What was this change?

[1 mark]

4.1.1.5 Size and mass of atoms

Question 24 · continued

0 5 . 4 A helium atom has a radius of 1.4×10^{-10} m.

The nucleus of this atom has a radius of 1.7×10^{-15} m.

How many times larger is the radius of the atom than the radius of the nucleus?

[1 mark]

Tick (✓) **one** box.

~1000 times larger ☐

~10 000 times larger ☐

~100 000 times larger ☐

~1 000 000 times larger ☐

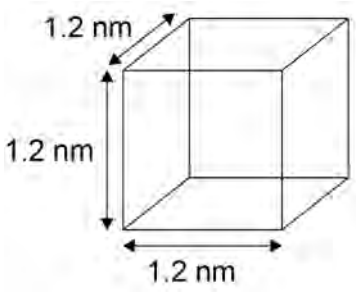
4.1.1.5 Size and mass of atoms

Question 24 · continued

Nanoparticles contain a few hundred atoms.

0 5 . 5 **Figure 5** represents a cubic nanoparticle.

Figure 5



Calculate the simplest surface area : volume ratio of the cubic nanoparticle.

[4 marks]

Simplest surface area to volume ratio = _____ : _____

0 5 . 6 Lenses in reading glasses often have a scratch-resistant coating that contains a hard substance.

Nanoparticles of the hard substance are used instead of fine particles of the hard substance.

Explain why nanoparticles are used instead of fine particles.

[2 marks]

12