

Atomic structure and the periodic table – GCSE Chemistry Paper 1

1. No.1.1

0 1

This question is about the elements in Group 7 of the periodic table.

Table 1 shows the melting points and boiling points of some of the elements.

Table 1

Element	Melting point in °C	Boiling point in °C
Fluorine	–220	–188
Chlorine	–101	–35
Bromine	–7	59

What is the state of bromine at 100 °C?

Use Table 1.

[1 mark]

Tick (✓) one box.

Gas

☐

Liquid

☐

Solid

☐

2. No.1.3

Complete the sentences.

[2 marks]

Going down Group 7 the melting points _____.

This is because the size of the molecules increases so the

intermolecular forces _____.

3. No.1.6

Fluorine is above chlorine in Group 7.

Predict what you would observe when fluorine gas reacts with iron.

Use **Table 2**.

[1 mark]

4. **No.2**

This question is about models of the atom.

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

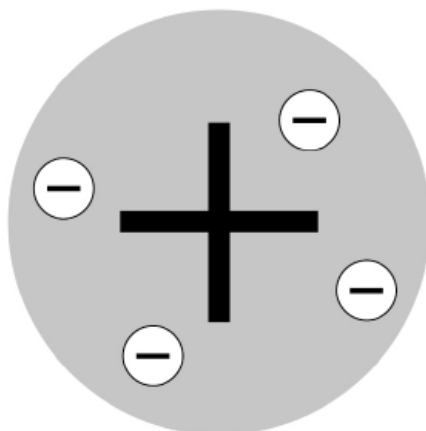
☐

Proton

☐

Figure 2 shows another model of the atom.

Figure 2



What is the name of this model of the atom?

[1 mark]

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

☐

Which scientist first suggested that electrons orbit the nucleus at specific distances?
[1 mark]

Tick (✓) **one** box.

Bohr ☐

Chadwick ☐

Mendeleev ☐

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 _____.

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

☐

5. No.9.4

Metal **M** has two isotopes.

Table 6 shows the mass numbers and percentage abundances of the isotopes.

Table 6

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) = _____

6. No.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.

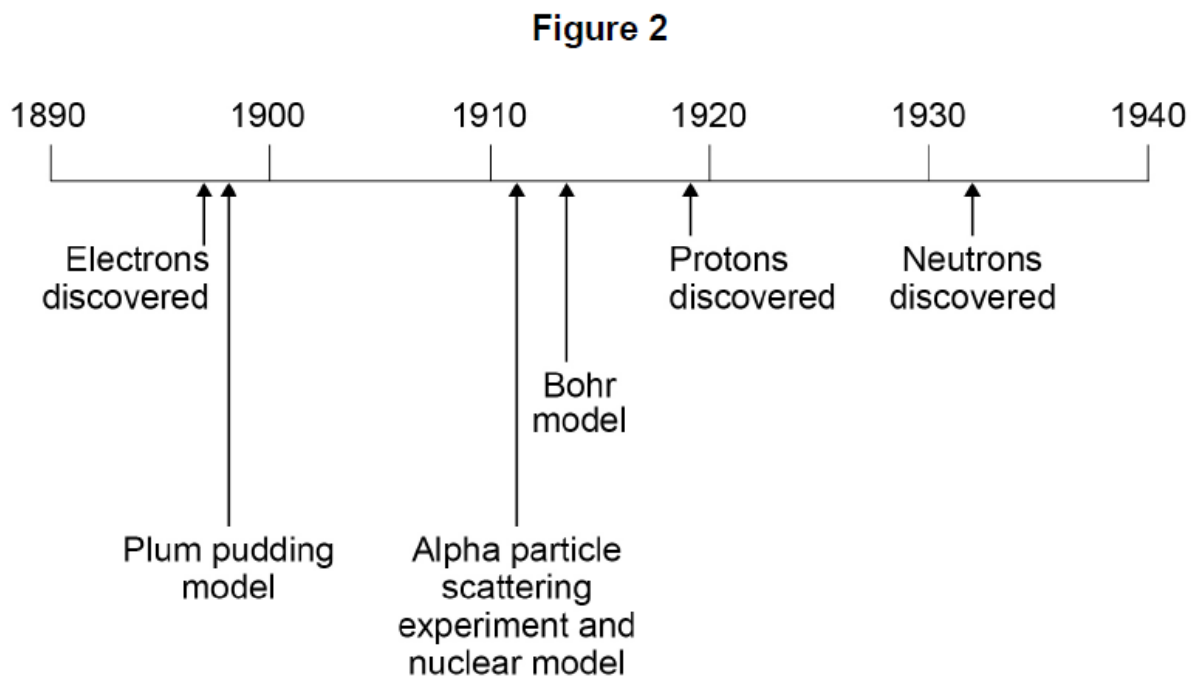
[2 marks]

Relative atomic mass (1 decimal place) = _____

7. No.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.



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 _____

Niels Bohr adapted the nuclear model.

Describe the change that Bohr made to the nuclear model.

[2 marks]

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]

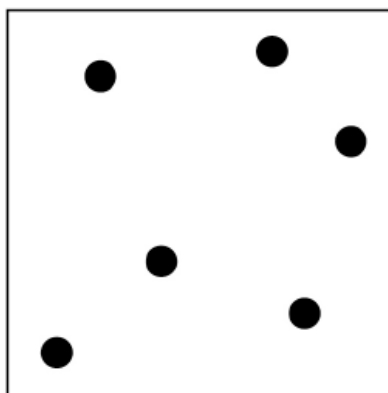
Give the correct reason why Mendeleev reversed the order of some pairs of elements.
[1 mark]

8. No.7.4

The three states of matter can be represented by a simple particle model.

Figure 4 shows a simple particle model for hydrogen gas.

Figure 4



Give **two** limitations of this simple particle model for hydrogen gas.

[2 marks]

1 _____

2 _____

9. No.8

This question is about the halogens.

Table 5 shows the melting points and boiling points of some halogens.

Table 5

Element	Melting point in °C	Boiling point in °C
Fluorine	-220	-188
Chlorine	-101	-35
Bromine	-7	59

What is the state of bromine at 0 °C and at 100 °C?

[1 mark]

Tick (✓) one box.

State at 0 °C

State at 100 °C

Gas

Gas

☐

Gas

Liquid

☐

Liquid

Gas

☐

Liquid

Liquid

☐

Solid

Gas

☐

Solid

Liquid

☐

Explain the trend in boiling points of the halogens shown in **Table 5**.

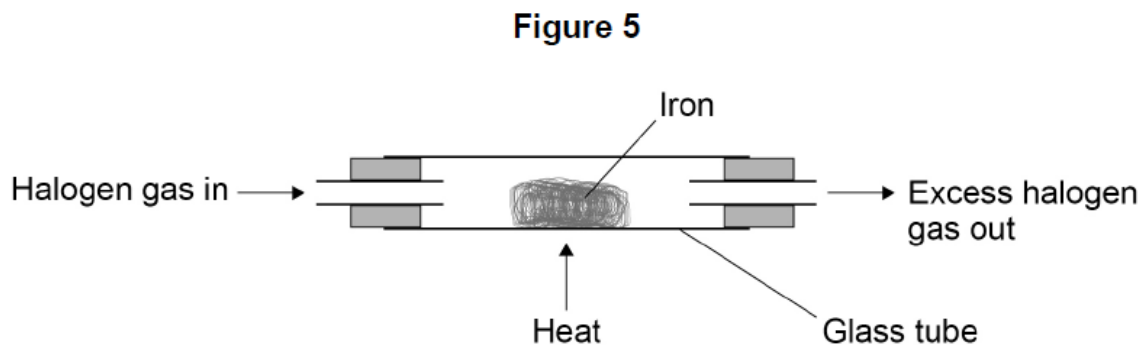
[4 marks]

Why is it **not** correct to say that the boiling point of a single bromine molecule is 59 °C?

[1 mark]

Iron reacts with each of the halogens in their gaseous form.

Figure 5 shows the apparatus used.



Give **one** reason why this experiment should be done in a fume cupboard.

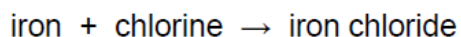
[1 mark]

Explain why the reactivity of the halogens decreases going down the group.

[3 marks]

A teacher investigated the reaction of iron with chlorine using the apparatus in **Figure 5**.

The word equation for the reaction is:



The teacher weighed:

- the glass tube
- the glass tube and iron before the reaction
- the glass tube and iron chloride after the reaction.

Table 6 shows the teacher's results.

Table 6

	Mass in g
Glass tube	51.56
Glass tube and iron	56.04
Glass tube and iron chloride	64.56

Calculate the simplest whole number ratio of:

moles of iron atoms : moles of chlorine atoms

Determine the balanced equation for the reaction.

Relative atomic masses (A_r): Cl = 35.5 Fe = 56

[6 marks]

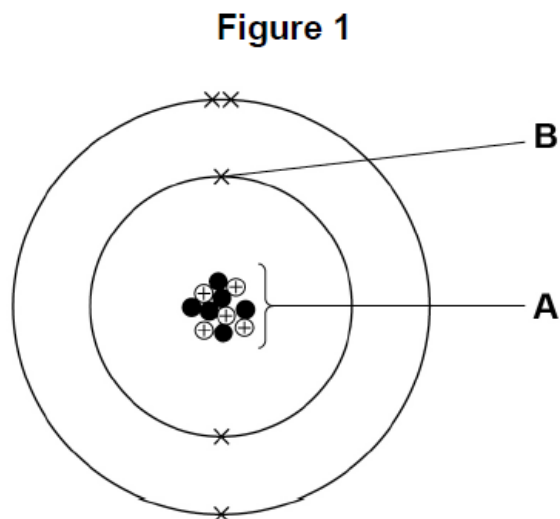
Moles of iron atoms : moles of chlorine atoms = _____ : _____

Equation for the reaction _____

10. No.1

This question is about atomic structure.

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



Name the parts of the atom labelled **A** and **B**.

Choose answers from the box.

[2 marks]

electron	neutron	nucleus	proton
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A _____

B _____

Which particle has the lowest mass?

Choose the answer from the box.

[1 mark]

electron	neutron	nucleus	proton
----------	---------	---------	--------

Which group of the periodic table contains element **Z**?

Use **Figure 1**.

[1 mark]

Group _____

Give the atomic number and the mass number of element **Z**.

Use **Figure 1**.

Choose answers from the box.

[2 marks]

1	5	6	11	16
---	---	---	----	----

Atomic number _____

Mass number _____

Bromine has two different types of atom.

The atoms have a different number of neutrons but the same number of protons.

What is the name for this type of atom?

[1 mark]

Tick (✓) **one** box.

Compound

☐

Ion

☐

Isotope

☐

Molecule

☐

The different types of bromine atom can be represented as $^{79}_{35}\text{Br}$ and $^{81}_{35}\text{Br}$

The relative atomic mass (A_r) of bromine is 80

Which statement is true about the number of each type of atom in bromine?

[1 mark]

Tick (✓) **one** box.

There are fewer $^{79}_{35}\text{Br}$ atoms than $^{81}_{35}\text{Br}$ atoms.

☐

There are more $^{79}_{35}\text{Br}$ atoms than $^{81}_{35}\text{Br}$ atoms.

☐

There are the same number of $^{79}_{35}\text{Br}$ atoms and $^{81}_{35}\text{Br}$ atoms.

☐

11. No.8

This question is about the periodic table.

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

Figure 11 shows the periodic table Mendeleev produced in 1869.

His periodic table was more widely accepted than previous versions.

Figure 11

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

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

Why did Mendeleev reverse the order of these two elements?

[1 mark]

Mendeleev left spaces marked with an asterisk *

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

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

[3 marks]

Mendeleev arranged the elements in order of their atomic weight.

What is the modern name for atomic weight?

[1 mark]

Tick (✓) **one** box.

Atomic number

☐

Mass number

☐

Relative atomic mass

☐

Relative formula mass

☐

Complete the sentence.

[1 mark]

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

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

Astatine (At) is below iodine in Group 7.

Predict:

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

[2 marks]

Formula of astatine molecule _____

State at room temperature _____

Sodium is in Group 1 of the modern periodic table.

Describe what you would see when sodium reacts with chlorine.

[2 marks]

12. No.1

This question is about the periodic table.

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

Figure 1 shows the periodic table Mendeleev produced in 1869.

His periodic table was more widely accepted than previous versions.

Figure 1

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

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

Why did Mendeleev reverse the order of these two elements?

[1 mark]

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

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

[3 marks]

Mendeleev arranged the elements in order of their atomic weight.

What is the modern name for atomic weight?

[1 mark]

Tick (✓) **one** box.

Atomic number

☐

Mass number

☐

Relative atomic mass

☐

Relative formula mass

☐

Complete the sentence.

[1 mark]

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

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

Astatine (At) is below iodine in Group 7.

Predict:

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

[2 marks]

Formula of astatine molecule _____

State at room temperature _____

Sodium is in Group 1 of the modern periodic table.

Describe what you would see when sodium reacts with chlorine.

[2 marks]

13. No.4

This question is about atomic structure.

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.

Define mass number.

[1 mark]

Why is the mass number different in the two isotopes?

[1 mark]

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]
