

Simple Model; Symbols; RAM; Charge; Isot

Question Paper 1

Level	GCSE (9-1)
Subject	Combined Science: Trilogy - Chemistry
Exam Board	AQA
Topic	5.1 Atomic Structure and the Periodic Table
Sub-Topic	Simple Model; Symbols; RAM; Charge; Isot
Difficulty Level	Gold Level
Booklet	Question Paper 1

Time Allowed: 54 minutes

Score: /51

Percentage: /100

Grade Boundaries:

Q1. Elements are made up of atoms.

(a) What is the approximate radius of an atom?

Tick **one** box.

$1 \times 10 \text{ m}$

☐

$1 \times 10^{-1} \text{ m}$

☐

$1 \times 10^{-10} \text{ m}$

☐

$1 \times 10^{-100} \text{ m}$

☐

(1)

(b) The figure below shows the atoms of five elements.

${}^6_3\text{R}$

${}^7_3\text{S}$

${}^{23}_{11}\text{T}$

${}^{39}_{19}\text{U}$

${}^{85}_{37}\text{V}$

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

Complete the sentence.

All of the elements in the figure above are in Group

..... of the periodic table.

(1)

(c) Which **two** atoms in the figure above are isotopes of the same element?

Explain your answer fully.

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(3)

- (d) The halogens are in Group 7 of the periodic table.

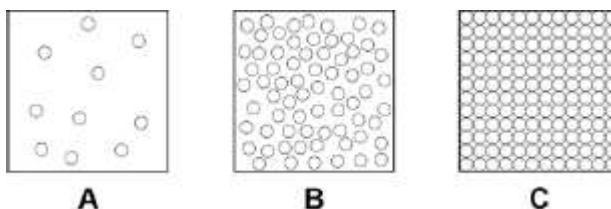
Explain the trend in reactivity of the halogens.

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(6)

(Total 11 marks)

Q2. The figure below shows a simple model of the three states of matter.



- (a) What is the correct equation to work out the density of a material?

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(1)

- (b) A student explains density to his teacher using the particle model in the figure above.

His teacher says there are limitations to the model.

Give **two** limitations of the particle model in the figure above.

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(2)

- (c) When the gas in a container with a fixed volume is heated, the pressure increases as the temperature increases.

Explain why the pressure increases.

Use the model in the figure above to help you.

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(4)

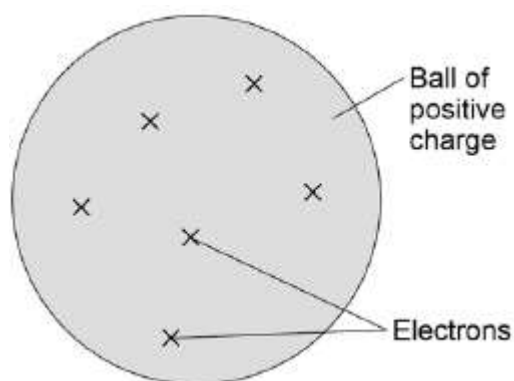
(Total 7 marks)

Q3.Figure 1 shows the plum pudding model of the atom.

This model was used by some scientists after the discovery of electrons in 1897.

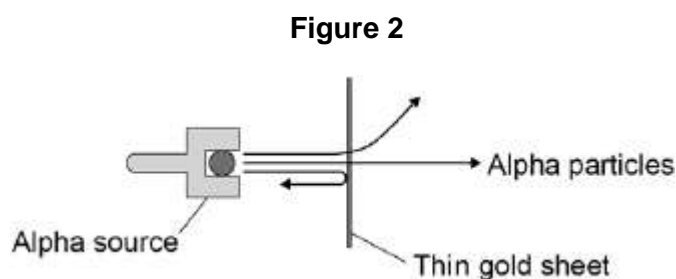
Figure 1

Plum-pudding model



In 1911 the scientists Geiger and Marsden investigated the effect of firing alpha particles at very thin sheets of gold foil.

Their experiment is shown in **Figure 2**. The arrows show the paths taken by alpha particles in the experiment.



- (a) Explain why scientists replaced the plum pudding model of the atom with the nuclear model of the atom as a result of the experiment.

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(4)

- (b) According to modern measurements:

- the radius of an atom is about $1 \times 10^{-10}\text{m}$

- the radius of an atomic nucleus is about $1 \times 10^{-14}\text{m}$

Show that these values fit with the nuclear model of the atom.

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(2)

- (c) In 1931 a scientist discovered that there are hydrogen atoms with mass number 2 as well as hydrogen atoms with mass number 1.

A year later, another scientist discovered neutrons.

Explain why the discovery of neutrons could explain the presence of hydrogen atoms with different mass numbers.

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(3)

- (d) How would the results of the experiment shown in **Figure 2** change if neutrons were used instead of alpha particles to bombard a thin sheet of gold?

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(2)

(Total 11 marks)

Q4. The elements in Group 1 of the periodic table are metals.

- (a) The elements in Group 1 are called the alkali metals.

Why are they called the alkali metals?

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- (b) Explain the increase in reactivity of elements further down the group.

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(4)

- (c) Lithium oxide is an ionic compound.

Draw a dot and cross diagram to show how lithium and oxygen combine to form lithium oxide.

Only show the electrons in the outer shell of each atom.

Give the charges on the ions formed.

(4)

(Total 10 marks)

Q5. Sulfur is a non-metal.

Sulfur burns in the air to produce sulfur dioxide, SO_2

(a) Why is it important that sulfur dioxide is **not** released into the atmosphere?

Tick (✓) **one** box.

Sulfur dioxide causes acid rain.

☐

Sulfur dioxide causes global dimming.

☐

Sulfur dioxide causes global warming.

☐

(1)

(b) Sulfur dioxide dissolves in water.

What colour is universal indicator in a solution of sulfur dioxide?

Give a reason for your answer.

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(2)

(c) Sulfur dioxide is a gas at room temperature.

The bonding in sulfur dioxide is covalent.

Explain, in terms of its structure and bonding, why sulfur dioxide has a low boiling point.

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(3)

- (d) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

Sulfur dioxide is produced when fossil fuels are burned.

It is important that sulfur dioxide is not released into the atmosphere.

Three of the methods used to remove sulfur dioxide from gases produced when fossil fuels are burned are:

- wet gas desulfurisation (**W**)
- dry gas desulfurisation (**D**)
- seawater gas desulfurisation (**S**).

Information about the three methods is given in the bar chart and in **Table 1** and **Table 2**.

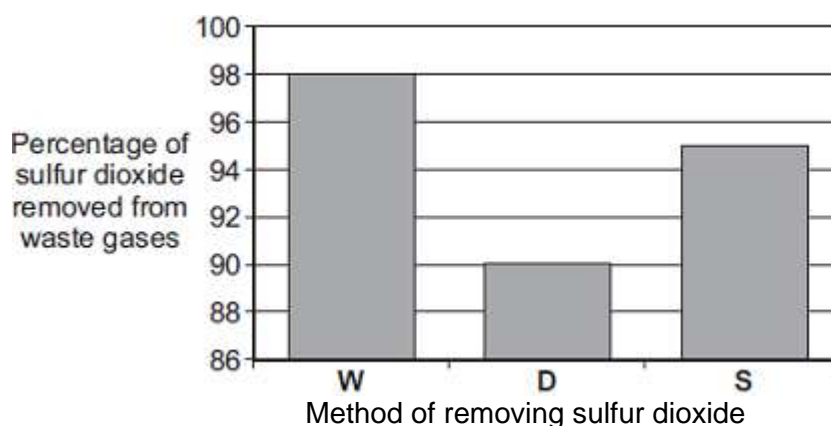


Table 1

Method	Material used	How material is obtained
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W	Calcium carbonate, CaCO_3	Quarrying
D	Calcium oxide, CaO	Thermal decomposition of calcium carbonate: $\text{CaCO}_3 \longrightarrow \text{CaO} + \text{CO}_2$
S	Seawater	From the sea

Table 2

Method	What is done with waste material
W	Solid waste is sold for use in buildings. Carbon dioxide is released into the atmosphere.
D	Solid waste is sent to landfill.
S	Liquid waste is returned to the sea.

Evaluate the three methods of removing sulfur dioxide from waste gases.

Compare the three methods and give a justified conclusion.

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(Total 12 marks)