

Simple Model; Symbols; RAM; Charge; Isot

Mark Scheme

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	Mark Scheme

Time Allowed: 54 minutes

Score: /51

Percentage: /100

Grade Boundaries:

- M1.(a)** $1 \times 10^{-10} \text{ m}$ 1
- (b) 1 / one 1
allow alkali metals
- (c) R and S 1
- because they have the same number of protons 1
allow same atomic number, different mass number
- and a different numbers of neutrons 1
- (d) **Level 3 (5–6 marks):**
A relevant and coherent explanation of the trend in reactivity. The response makes logical links between the points raised and considers both the number of energy levels and the distance between the nucleus and the outer energy level.
- Level 2 (3–4 marks):**
Statements that are linked to provide a simple explanation of the trend in reactivity using either the number of energy levels or the distance between the nucleus and the outer energy level.
- Level 1 (1–2 marks):**
Simple statements made about the halogens or the trend in reactivity.
- 0 marks:**
No relevant comment
- Indicative content**
- Simple statements / descriptions
- have 7 electrons in the outer shell

- need to gain an electron
- form ions with a -1 charge
- halogens further down the group are less reactive (or vice versa)
- halogens further down the group have more shells or energy levels (or vice versa)

Linked statements / explanations

- have 7 electrons in the outer shell so need to gain an electron to have the electronic structure of a noble gas
- halogens further down the group are less reactive because they have more shells or energy levels (or vice versa)
- halogens further down the group have more shells or energy levels so less attractive force on the incoming electron (or vice versa)
- halogens further down the group have more shells or energy levels so more 'shielding' against the incoming electron (or vice versa)
- outer electrons of halogens further down group are further away from the attractive force of the nucleus (or vice versa)
- an electron is less easily gained because there are more shells or energy levels (or vice versa)
- an electron is less easily gained because the outer electrons are further from the attractive force of the nucleus (or vice versa)

6

[11]

M2.(a) density = mass / volume

1

(b) any **two** from:

- no forces shown between spheres
- atoms / molecules / ions are not solid spheres
- not all the same size.

2

(c) at higher temperatures particles have more kinetic energy

1

(so) the (average) speed of the particles increases

1

(so there are) more frequent collisions with the wall of the container

1

which apply a greater force on wall of container (so pressure rises)

1

[7]

M3.(a) most alpha particles went straight through, suggesting lots of empty space

1

a few alpha particles bounced back, suggesting small central nucleus

1

with all the positive charge

1

the plum pudding model does not explain the results because it shows the whole atom as a ball of positive charge with no empty space

1

(b) the figures show that the radius of an atom is 10 000 times bigger than the nucleus

1

consistent with the nuclear model, which says that the atom has a tiny nucleus at the centre of the atom

1

(c) all hydrogen atoms have just one proton (in the nucleus)

1

some hydrogen atoms also have one neutron

1

protons and neutrons have the same relative mass so mass number of these atoms is 2

1

(d) neutrons are not attracted or repelled by a positive nucleus

1

so the neutrons would all pass through the foil

1

[11]

M4.(a) because they form hydroxides

1

that give alkaline solutions (in water)

1

(b) the atoms have more electron shells (as move down the group)

1

so the electron in the outer shell is further away from the nucleus

1

which reduces the attraction to the nucleus

1

so the electron is lost more easily from the atom

1

(c)



electronic structure of lithium drawn correctly

1

electronic structure of oxygen drawn correctly

1

correct charge on ions (Li^+ and O^{2-})

1

correct number of each ion (2 lithium, 1 oxygen)

1

[10]

M5.(a) Sulfur dioxide causes acid rain.

1

(b) red / orange / yellow

*do **not** accept any other colours*

1

because sulfur dioxide (when in solution) is an acid

1

(c) (there are) weak forces (of attraction)

*do **not** accept any reference to covalent bonds breaking*

1

between the molecules

*do **not** accept any other particles*

1

(these) take little energy to overcome

award third mark only if first mark given

1

- (d) Marks awarded for this answer will be determined by the Quality of Communication (QC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5 and apply a 'best-fit' approach to the marking.

0 marks

No relevant content

Level 1 (1 – 2 marks)

A relevant comment is made about the data.

Level 2 (3 – 4 marks)

Relevant comparisons have been made, and an attempt made at a conclusion.

Level 3 (5 – 6 marks)

Relevant, detailed comparisons made and a justified conclusion given.

examples of the points made in the response

effectiveness

- W removes the most sulfur dioxide
- D removes the least sulfur dioxide

material used

- Both W and D use calcium carbonate
- Calcium carbonate is obtained by quarrying which will create scars on landscape / destroy habitats
- D requires thermal decomposition, this requires energy
- D produces carbon dioxide which may cause global warming / climate change
- S uses sea water, this is readily available / cheap

waste materials

- W product can be sold / is useful
- W makes carbon dioxide which may cause global warming / climate change
- D waste fill landfill sites
- S returned to sea / may pollute sea / easy to dispose of

6

