

MARK SCHEME

GCSE

CHEMISTRY

AQA - COMBINED SCIENCE

C1 - TEST 3

ATOMIC STRUCTURE AND THE PERIODIC TABLE

Intermediate

Mark schemes

1.

(a) any **two** from:

- hydrogen is in a group
allow converse arguments
allow hydrogen is with the halogens
- only seven groups
- no group 0
allow no noble gases
- halogens are in Group 1
allow fluorine and / or chlorine are in Group 1
- other elements are in one group higher
allow one example of this
- transition metals included in groups
allow one example, eg, iron in same group as aluminium

2

(b) similar properties occur at regular intervals

1

(c) some elements appeared to be in the wrong group

1

(when) the elements were arranged in order of relative atomic mass

allow (so) he placed them into groups with similar properties

1

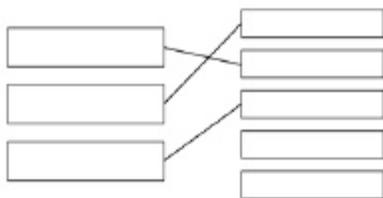
(d) most elements are mixtures of isotopes

1

(so) should be arranged in order of atomic number

1

(e)



1

1

1

[10]

2.	(a) (i)	atomic weights <i>allow atomic masses</i>	1
	(ii)	proton <i>allow proton number</i>	1
	(b) (i)	F/fluorine <i>allow F₂</i>	1
	(ii)	any one from: <ul style="list-style-type: none"> • copper has a higher density • copper is stronger • copper is harder • copper is less reactive <i>allow named property</i> <i>ignore colour, conductivity, melting point and boiling point</i> <i>allow converse for potassium</i>	1
	(iii)	relative distance from nucleus <i>allow more / fewer energy levels / shells or larger / smaller atom</i>	1
		relative attraction to nucleus <i>allow more / less shielding</i>	1
		relative ease of gain or loss of electron	1
		opposite explanation of ease of gain or loss of electron for other group <i>max 3 marks if 'outer' not mentioned</i>	1
			[8]
3.	(a) (i)	Na <i>allow sodium / phonetic spelling</i> <i>if more than one answer is given apply list principle</i>	1
	(ii)	Fe <i>allow iron / phonetic spelling</i> <i>if more than one answer is given apply list principle</i>	1
	(iii)	Na or S <i>allow sodium or sulfur / sulphur / phonetic spelling</i> <i>if more than one answer is given apply list principle</i>	1

(iv) S

allow sulfur / sulphur / phonetic spelling

if more than one answer is given apply list principle

1

(v) Na

allow sodium / phonetic spelling

if more than one answer is given apply list principle

1

(b) (i) any **three** from:

- effervescence / fizzing **or** bubbles **or** gas produced
do not allow incorrectly named gas
- sodium melts **or** turns into a ball
- sodium moves (on the surface)
- steam / mist / vapour is produced
ignore heat / temperature / flame / spark
- sodium gets smaller / disappears
allow dissolves
- colour of indicator is darker / more intense near the sodium
Must be linked to near the sodium.

3

(ii) hydroxide **or** OH⁻

allow OH without a charge

do not allow OH⁺

1

(c)

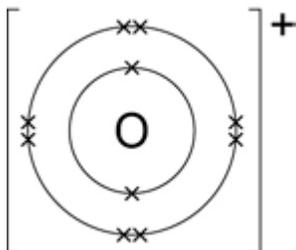


diagram showing electron configuration of ion is 2,8

1

charge on ion is +

Bracket not necessary

[2,8]⁺ is worth 1 mark as there is no diagram

1

[11]

4.

(a) similar properties

allow same properties

allow correct example of property

ignore answers in terms of atomic structure

1

(b) (i) in order of atomic / proton number

allow increasing number (of protons)

1

(ii) elements in same group have same number (of electrons) in outer shell **or**
highest energy level

allow number (of electrons) increases across a period

1

(c) any **two** from:

statements must be comparative

- stronger / harder

ignore higher densities

- less reactive

- higher melting points

ignore boiling point

2

(d) *reactivity increases down group*

allow converse throughout

*for next three marks, outer electron needs to be mentioned once
otherwise max = 2*

1

outer electron is further from nucleus

allow more energy levels / shells

allow larger atoms

1

less attraction between outer electron and nucleus

allow more shielding

1

therefore outer electron lost more easily

1

[9]

5.

- (a) (i) any **two** from:
- bubbles / effervescence / fizzing
ignore hydrogen / gas produced
 - lithium disappears / gets smaller
allow dissolves
*do **not** allow melts / burns*
 - lithium moves on the surface of the water
ignore floats
 - (universal indicator) turns blue / purple
- 2
- (ii) 2
- left-hand side correct*
- 1
- 2
- right-hand side correct*
allow multiples for full credit
- 1
- (iii) light / burn, which will give a (squeaky) pop / explosion
- 1
- (iv) all have 1 electron in their outer shell / energy level
allow have the same number of electrons in their outer shell / energy level
- 1
- (b) They react with oxygen
- 1
- They have low melting points
- 1
- (c) (i) electronic structure [2,8,8] is drawn
incomplete inner shells scores a maximum of 1 mark
- 1
- charge is +
- allow [2,8,8]⁺ for 1 mark*
- 1
- (ii) because (in potassium) the outer shell electron is further away from the nucleus
or because potassium atoms are larger than sodium atoms
it should be clear that the candidate is referring to the outer shell electron: if this is not clear a maximum of 2 marks can be awarded
- 1
- therefore the outer shell electron is less strongly attracted to the nucleus **or** is more shielded from the attraction of the nucleus and so the outer shell electron in potassium is more easily lost
- 1

3 marks can be scored for answering the question in terms of sodium

1

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6.

(a) (i) hydrogen

accept H_2

allow H

1

(ii) hydroxide

accept OH^-

allow OH

do not accept lithium hydroxide

1

(b) any **two** from:

'it' = potassium

potassium:

accept converse for lithium

- reacts / dissolves faster

allow reacts more vigorously / quickly / violently / explodes

ignore reacts more

- bubbles / fizzes faster

allow fizzes more

allow more gas

- moves faster (on the surface)

allow moves more

- melts

allow forms a sphere

- produces (lilac / purple) flame

allow catches fire / ignites

do not accept other colours

2

[4]

7.

(a) any **two** from:

- react with water **or** very reactive
- (react with water) releasing gas / hydrogen / fizzing
- (react with water) to form an alkaline / hydroxide solution
- form ions with a 1+ charge
allow lose one electron from the outer shell
ignore other references to electronic structure
ignore physical properties

2

(b) any **three** from:

- some boxes contain two elements
allow specific examples:
*Co, Ni **or** Ce, La **or** Di, Mo **or** Ro, Ru **or** Ba, V **or** Pt, Ir*
- groups / columns contain elements with different properties
allow groups / columns contain both metals and non-metals
ignore examples
- Newlands not a well-known / respected scientist
ignore references to sugar factory
- new idea (not readily accepted by other scientists)
allow musical scales thought to be silly by some scientists

3

(c) one for improvement **and** one for explanation from:

- left gaps (for undiscovered elements) (1)
 - so that elements were in their correct group (1)
allow so the elements fitted the pattern of properties
- or**
- did not always follow order of relative atomic weights / masses (1)
ignore references to atomic number / electronic structure
 - so that elements were in their correct group (1)
allow so the elements fitted the pattern of properties

2

[7]

8.

(i) any **two** sensible ideas such as:

- (why) put in order of mass
accept other equally valid orders, eg alphabetical
- he left gaps **or** table not complete
- no evidence for undiscovered elements
or they believed all the elements
had been discovered
accept predictions could not be backed by evidence
accept why change previous ideas
- he changed the order of some elements
or there were exceptions to the rule(s)
- he put metals and non-metals together
accept they didn't like his groupings / groups
- he did not explain his ideas clearly (owtte)
*do **not** accept modern explanations, eg proton number etc*

2

(ii) (the properties of gallium) fitted the predictions (owtte) **or** predictions were correct **or** (properties) would make it fit in the gap **or** (properties) would make it fit in group 3

*do **not** accept gallium fitted his theory*
accept finding gallium proved there were new elements to be discovered

1

[3]