AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.1.2.2

Development of the periodic table

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**3**
Available paper years	**2019–2021**

Using this booklet

1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

5.1.2.2 Development of the periodic table

Answer 01 · Mark scheme June 2019 | 8464/C/1H | Original Q4

04.1	atomic weight	do **not** accept atomic mass or A_r	1	AO1 5.1.2.2
04.2	left gaps / spaces **or** changed the order based on atomic weights	allow placed them in correct groups according to properties do **not** accept reference to atomic number	1	AO1 5.1.2.2
04.3	weak forces between the molecules **or** weak intermolecular forces	allow weak intermolecular bonds do **not** accept incorrect references to covalent bonds	1	AO1 AO3 5.1.2.6 5.2.2.4
	(so) little energy required to overcome / break the forces between molecules **or** (so) little energy required to overcome / break the intermolecular forces	allow (so) little energy required to separate the molecules allow (so) little energy required to overcome / break the intermolecular bonds ignore less energy	1	

5.1.2.2 Development of the periodic table

Answer 01 · Mark scheme

04.4	(the) molecules get larger going down the group (so the) forces <u>between the molecules</u> increase **or** (so the) intermolecular forces increase (so the) boiling points increase going down the group **or** (so the) boiling points increase with increasing relative atomic mass	allow converse explanation in terms of boiling point allow (so) more energy is needed to separate the molecules	1 1 1	AO1 AO3 5.1.2.6 5.2.2.4
04.5	2,8 (so) stable arrangement of electrons **or** (so) full outer shell	allow diagram or description	1 1	AO1 5.1.2.4
04.6	$\frac{1}{40} \times 6.02 \times 10^{23}$ **or** $0.025 \times 6.02 \times 10^{23}$ 1.51×10^{22}	an answer of 1.51×10^{22} scores **2** marks allow 1.505×10^{22}	1 1	AO2 5.3.2.1
Total			**11**	

5.1.2.2 Development of the periodic table

Answer 01 · Mark scheme

June 2019 | 8464/C/1H | Original Q4

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.1.2.2 Development of the periodic table

Answer 02 · Mark scheme November 2020 | 8464/C/1H | Original Q7

07.1		max **3** marks if reference to incorrect particles / bonding / structure		
	caesium atom loses one electron		1	AO1 5.1.2.5 5.2.1.2
	(and) oxygen atom gains two electrons		1	
	(so) two caesium atoms react with one oxygen atom	allow (to produce) Cs_2O	1	
	any **one** from: • (to form) Cs^+ and O^{2-} • (to form) caesium ion(s) and oxide ion(s) • (to form) ions with full outer shells / levels		1	

5.1.2.2 Development of the periodic table

Answer 02 · Mark scheme

November 2020 | 8464/C/1H | Original Q7

07.2		allow converse for sodium		
	(caesium has) more energy levels **or** (caesium has) more shells		1	AO2
	(so the) outer electron / shell is further from nucleus **or** outer electron / shell is more shielded		1	AO1
	(so) weaker attraction between nucleus and outer electron / shell		1	AO1
	(so) outer electron is more easily lost	allow (so) less energy needed to remove outer electron	1	AO1 5.1.2.3 5.1.2.5

07.3	early periodic tables were arranged with elements in order of their atomic weights	ignore atomic mass	1	AO1
	iodine has a lower atomic weight than tellurium	allow converse for tellurium	1	AO1
	(so) Mendeleev placed iodine with elements with same / similar properties **or** (so) Mendeleev placed tellurium with elements with same / similar properties	allow F / Cl / Br for elements allow O / S / Se for elements	1	AO2 5.1.2.2

Total			**11**

5.1.2.2 Development of the periodic table

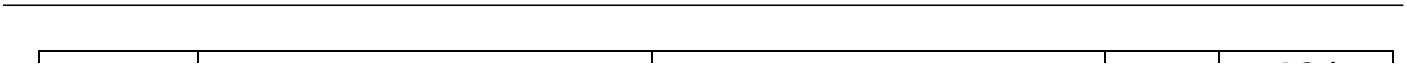
Answer 03 · Mark scheme November 2021 | 8464/C/1H | Original Q1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	(Group) 0 **or** noble gases		1	AO2 5.1.2.2
01.2	B		1	AO2 5.1.1.3
01.3	A		1	AO3 5.1.1.3
01.4	(atoms with the) same number of protons	allow atoms with the same atomic number allow atoms of the same element ignore the same number of electrons	1	AO1 5.1.1.5
	(but with) different numbers of neutrons	ignore (but with) different mass numbers do **not** accept (but with) different relative atomic mass	1	
01.5	$\frac{(39 \times 93.1) + (41 \times 6.9)}{100}$		1	AO2 5.1.1.6
	= 39.138		1	
	= 39.1	allow correctly rounded answer to **1** decimal place from an incorrect calculation using all the values given in the question	1	
Total			**8**	

5.1.2.2 Development of the periodic table

Answer 03 · Mark scheme

November 2021 | 8464/C/1H | Original Q1



5.1.2.2 Development of the periodic table

Answer 01 · Examiner comments

June 2019 | 8464/C/1H | Original Q4

Question 4

Most of this question was at standard/high demand.

04.1 Scientists' use of atomic weight to arrange elements in early periodic tables was not well known. Far too many students did not fully appreciate the historical nature of the question and provided concepts that were not known at the time, such as atomic number and electrons.

04.2 Over half the entry gave a correct reason. Large numbers of students appreciated that Mendeleev left gaps or grouped elements with similar properties. Changing the order based upon atomic weights was correct but less common.

04.3 Only the higher-attaining students were able to explain that halogens have low boiling points because of weak intermolecular forces. It is these forces that are overcome when a 'little energy' is applied; less energy did not gain this mark, as less does not necessarily equate to little. Many students answered this question incorrectly in terms of the covalent bonds within the halogens. A lot of students linked the listed values to reactivity within group 7.

5.1.2.2 Development of the periodic table

Answer 01 · Examiner comments June 2019 | 8464/C/1H | Original Q4

04.4 The concept of intermolecular forces and the fact that the intermolecular forces increase because the molecules got larger was rarely seen in explanations. Many students gained a mark for stating that the boiling points increased down the group; down the table or periodic table did not gain this mark. Students commonly tried to explain a trend in reactivity down the group and attempted to link that to boiling points. Some struggled with negative temperatures.

04.5 Most students were able to state that neon's outer shell was full. Many did not gain the second mark by not giving the electronic structure of neon.

04.6 A third of students calculated the correct answer for 2 marks. Many were confused by standard form, with only a few students making slight calculation errors.
Most wrong answers came from either dividing the Avogadro number by 0.025 (the number of moles) or from multiplying by 40; they did not appreciate that 1g of argon is less than 1 mole of argon so the answer to this question must be less than 6×10^{23}

Answer 03 · Examiner comments November 2021 | 8464/C/1H | Original Q1

Question 1 (standard demand)

01.1 More than two thirds of students knew that Group 0, the noble gases, had not been discovered when Mendeleev's version of the periodic table was published.

01.2 The plum pudding model was identified by more than four fifths of students.

01.3 Chadwick discovered the neutron. Just under half of students were able to make the link between this discovery and the figure which represented an atom containing neutrons.

01.4 The question required students to answer in terms of 'subatomic particles'; the answer was that isotopes are atoms with the same number of protons but different numbers of neutrons. Just over one third of students gained two marks.

01.5 Many students gained the first mark by showing that the weighted average had to be divided by 100. The evaluation of this gained the second mark which then needed to be correctly rounded to one decimal place. Approximately one third of students gained all three marks.