AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.2.2.4

Properties of small molecules

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**3**
Available paper years	**2019–2023**

Using this booklet

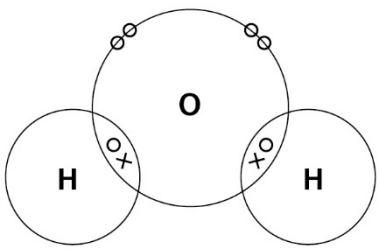
1. Booklet answer numbers match the question booklet.
2. Use the original question number within marking tables.
3. Examiner comments are included where available.

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.

5.2.2.4 Properties of small molecules

Answer 01 · Mark scheme June 2019 | 8464/C/1F | Original Q5

05.1	(g)	allow g ignore formulae	1	AO1 5.2.2.2
05.2	40 (%)		1	AO2 5.1.1.1
05.3		an answer of 3.94 (g) scores **3** marks		AO2 5.3.1.3
	$\frac{3.76 + 3.98 + 4.09}{3}$ **or** $\frac{11.83}{3}$		1	
	= 3.943(333333333333333)		1	
	= 3.94 (g)	allow a correctly written answer to 3 significant figures from an incorrectly calculated mean	1	
05.4		allow combination of circles, dots, crosses or $e^{(-)}$		AO1 5.2.1.4
	one shared pair in each overlap	do **not** accept extra electron(s) on outer shell of hydrogen	1	
	4 non-bonding electrons in outer shell of oxygen	ignore any inner shell electrons	1	
		 diagram scores 2 marks		

5.2.2.4 Properties of small molecules

Answer 01 · Mark scheme

June 2019 | 8464/C/1F | Original Q5

05.5	covalent		1	AO1 5.2.2.1 5.2.2.4

05.6	higher (than) stronger (than between oxygen molecules)		1 1	AO2 5.2.2.4

Total			**10**

5.2.2.4 Properties of small molecules

Answer 01 · Mark scheme

June 2019 | 8464/C/1F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.

5.2.2.4 Properties of small molecules

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

07.1	any **one** from: • not to scale • not 3 dimensional / D • incorrect arrangement in space • electrons / shells not shown	allow size of atoms incorrect allow atoms are separated ignore properties of water	1	AO2 5.2.1.4
07.2	weak	allow weaker	1	AO1 5.2.2.4
07.3	CH_4O	allow CH_3OH	1	AO2 5.2.1.4
07.4	4		1	AO1 5.2.3.1
07.5	any **two** from: • (very) hard • (very) high melting point • does not conduct electricity	allow strong allow high thermal conductivity ignore shiny	2	AO1 5.2.3.1

5.2.2.4 Properties of small molecules

07.6	graphite silicon dioxide	allow graphene allow silica allow silicon allow polymer(s) **or** allow (named) polymer(s) allow fullerene **or** allow carbon nanotubes ignore buckminsterfullerene	1 1	AO1 5.2.2.6

Total			**8**

5.2.2.4 Properties of small molecules

Answer 02 · Mark scheme

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

Question	Answers	Mark	AO/ Spec. Ref

5.2.2.4 Properties of small molecules

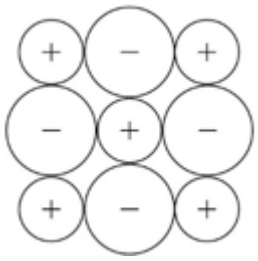
Answer 03 · Mark scheme

June 2023 | 8464/C/1F | Original Q3

Question 3

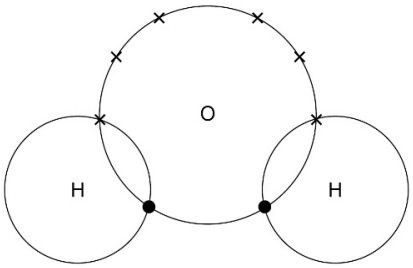
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	noble gases		1	AO1 5.2.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	potassium (atoms) lose electrons		1	AO2
	chlorine (atoms) gain electrons		1	AO2
	reference to one electron		1	AO2
	any **one** from: • to form ions • to form full outer shell(s) • to form full energy level(s)	allow to form a noble gas structure	1	AO1 5.2.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3			1	AO2 5.2.1.3

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Answer 03 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	one shared pair in each overlap	allow any combination of circles, dots, crosses, $e^{(-)}$ for electrons	1	AO1 5.2.1.1 5.2.1.4
	four non-bonding electrons in outer shell of oxygen	do **not** accept extra electron(s) on outer shell of hydrogen ignore any inner shell electrons the diagram below scores 2 marks 	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	1 Si : 2 O	allow 6 Si : 12 O	1	AO3 5.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	weak intermolecular forces		1	AO1 5.2.2.5

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Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7		ignore references to boiling point		AO3 5.2.2.4 5.2.2.5
	the melting point increases as the length of the polymer molecule increases	allow **1** mark for melting point increases	2	
	(then the) melting point levels off (as the polymer molecule length increases)	allow (then the) melting point becomes constant (as the polymer molecule length increases)	1	

Total Question 3	13

5.2.2.4 Properties of small molecules

Answer 03 · Examiner comments June 2023 | 8464/C/1F | Original Q3

Question 3 (low/standard demand)

03.1 More than half the students identified the noble gases as the group of elements that do not form ions.

03.2 This question was a good discriminator. Many gained the first three marks although MP4 was less common. Many incorrect terms such as ‘atoms sharing electrons to form ionic bonds’, ‘metal ions losing electrons’ and ‘non-metal ions gaining electrons’ were seen.

03.3 More than two thirds of students identified the structure that represents the arrangement of ions in solid potassium chloride. The first option was the best distractor.

03.4 More than a quarter of students correctly drew a dot and cross diagram for water. When only one mark was gained this was usually for the shared electrons in the overlap between oxygen and one of the hydrogen atoms. Some failed to show that there are four unshared electrons on the oxygen atom and others added more electrons into the circle around one or both of the hydrogen atoms.

03.5 More than three-quarters of students deduced the ratio of silicon atoms to oxygen atoms from the structure of silica.

Answer 03 · Examiner comments June 2023 | 8464/C/1F | Original Q3

03.6 Only 20% of students knew that weak intermolecular forces hold polymer molecules together in a polymer. Covalent bonds and electrostatic attraction between ions were perhaps terms more familiar to the students and both proved more popular options than the correct answer.

03.7 Students found difficulty in recognising the link between the two variables from the *x*-axis and the *y*-axis. Many stated that as the melting point increases the length of the polymer molecule increases. Students should appreciate that the independent variable is on the *x*-axis and that as this is changed, the effect on the dependent variable (*y*-axis) can be observed ie as the length of the polymer molecule increases (independent, *x*-axis) then the melting point increases (dependent, *y*-axis).