AQA GCSE Combined Science - Trilogy | 8464

SPECIFICATION POINT 5.2.3.1

Diamond

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**3**
Available paper years	**2020–2024**

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.

5.2.3.1 Diamond

Answer 01 · 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

5.2.3.1 Diamond

Answer 01 · Mark scheme

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

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**	

5.2.3.1 Diamond

Answer 01 · Mark scheme

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

Question	Answers	Mark	AO/ Spec. Ref

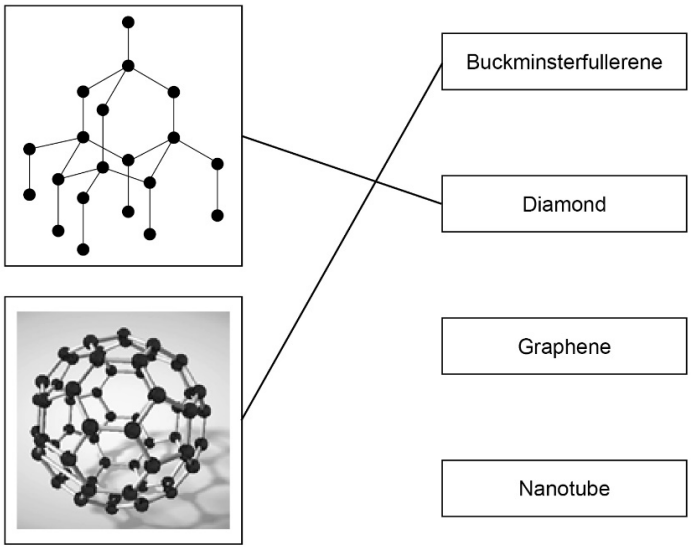
5.2.3.1 Diamond

Answer 02 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	0.1 nm		1	AO1 5.1.1.5
03.2	6 protons		1	AO2
	8 neutrons		1	AO2
	6 electrons	allow electron (structure) 2,4	1	AO2
	protons in nucleus		1	AO1
	neutrons in nucleus		1	AO1
	electrons (around nucleus) in energy levels / shells		1	AO1 5.1.1.4 5.1.1.5 5.1.1.7
03.3	3		1	AO1 5.2.2.6 5.2.3.2
03.4	covalent		1	AO1 5.2.2.6 5.2.3.2
03.5	layers slide (over each other)	allow atoms slide over each other	1	AO3 5.2.3.2

5.2.3.1 Diamond

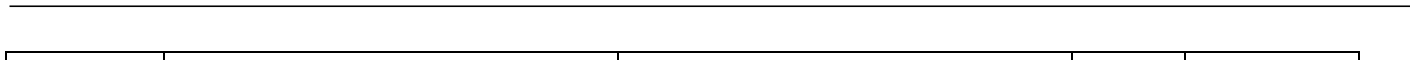
Answer 02 · Mark scheme

03.6	 do **not** accept more than **one** line from a box on the left	1 1	AO1 5.2.3.1 5.2.3.3
Total		**12**	

5.2.3.1 Diamond

Answer 02 · Mark scheme

November 2021 | 8464/C/1F | Original Q3

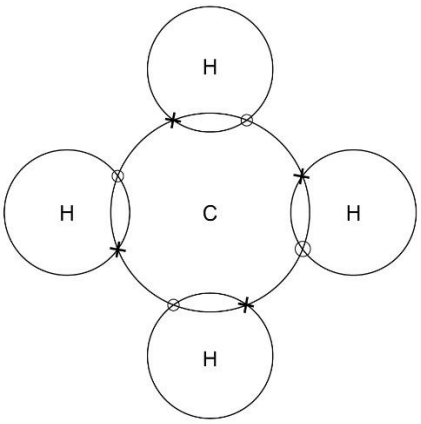


5.2.3.1 Diamond

Answer 03 · Mark scheme

June 2024 | 8464/C/1F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	one pair of electrons drawn in each of the three overlaps	allow any combination of circles, dots, crosses, $e^{(-)}$ for electrons ignore inner shell electrons on the carbon atom do **not** accept extra electron(s) on outer shell of carbon / hydrogen allow **1** mark for one shared pair in one overlap without non-bonding electron(s) on that hydrogen an answer of  scores **2** marks	2	AO1 5.2.1.1 5.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2			1	AO1 5.2.1.4 5.2.2.6 5.2.3.1

5.2.3.1 Diamond

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	3		1	AO1 5.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(delocalised) electrons	allow (free) electrons	1	AO2 5.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	in electronic components		1	AO1 5.2.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	any **two** from: • hollow (shape) • hexagonal rings • (of) carbon atoms • each (carbon) atom forms 3 (covalent) bonds	 allow cylindrical (shape) allow (nano)tube allow (made of) hexagons	2	AO1 5.2.3.3

Total Question 2	8

5.2.3.1 Diamond

Answer 02 · Examiner comments

November 2021 | 8464/C/1F | Original Q3

Question 3 (low demand)

03.1 Nearly two thirds of students were able to give the approximate radius of a carbon atom.

03.2 Students were good at describing the atomic structure of the carbon atom. More than half of students scored at least three marks. A few did not use the given diagram of the carbon atom to determine the number of neutrons located in this atom's nucleus.

03.3 Nearly half of students were able to use the diagram of graphite's structure to determine the number of covalent bonds each carbon atom has in graphite. Four proved to be a popular incorrect response, which is the number of covalent bonds each carbon atom forms in substances such as diamond or methane.

03.4 Nearly two thirds of students knew that covalent bonds hold carbon atoms together in graphite.

03.5 Few students stated that layers (of carbon atoms) can slide over each other in graphite or were able to use the diagram of graphite's structure to explain why graphite can be used as a lubricant.

03.6 Nearly two thirds of students gained one mark and approximately one sixth of students gained two marks for linking the structures with the correct form of carbon.

5.2.3.1 Diamond

Answer 03 · Examiner comments

June 2024 | 8464/C/1F | Original Q2

Question 2 (low & standard demand)

02.1 To help students complete the dot and cross diagram for a methane molecule one shared pair of electrons was drawn in one of the overlap areas. More than half the students correctly added three more shared pairs of electrons. Some gained only 1 mark by either adding just one shared pair or including extra electrons in the outer shells of either the carbon atom or hydrogen atoms.

02.2 Three-quarters of students recognised the structure of diamond. Buckminsterfullerene was the most common incorrect response.

02.3 A diagram to represent part of the structure of graphite was given to show that each carbon atom forms three covalent bonds. Nearly 60% of students answered the question correctly. Approximately equal numbers of students thought that carbon atoms formed either two or four bonds with only a small number choosing one bond.

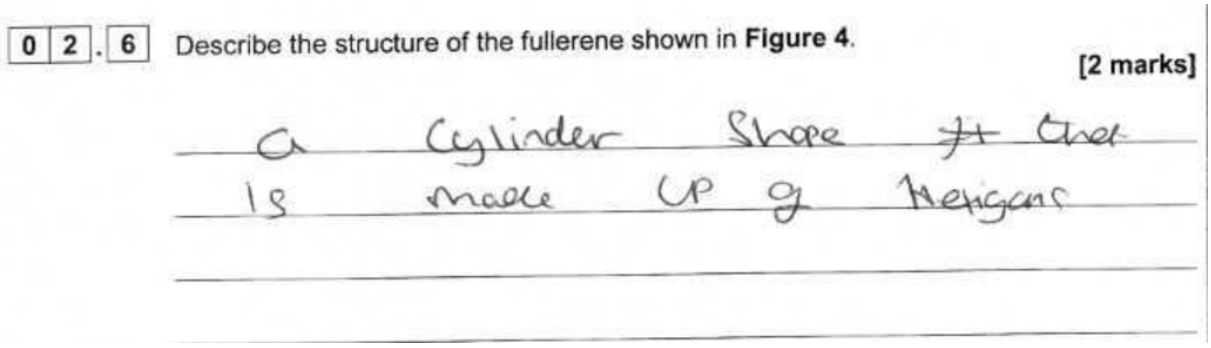
02.4 Just over 40% of the students knew that (delocalised) electrons carry electrical charge through graphite. Many students incorrectly answered that ions or atoms were the particles responsible or wrote carbon for their answer.

02.5 Half of the students knew that fullerenes are used in electronic components. The other two distractors were equally popular.

02.6 Nearly half of the students scored at least 1 mark. A diagram was included to help students describe the structure of a fullerene. The better responses stated that fullerenes are hollow and have hexagonal rings of carbon atoms, although few stated that each carbon atom forms three covalent bonds.

0 2 . 6 Describe the structure of the fullerene shown in **Figure 4**.

[2 marks]



This answer gave two points from the 'extra information' column of the mark scheme so gave *just* enough information to gain 2 marks.

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