AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.2.2.6

Giant covalent structures

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**29**
Available paper years	**2008–2025**

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.

4.2.2.6 Giant covalent structures

Answer 01 · Mark scheme January 2008 | CHY1F | Original Q8 | Legacy

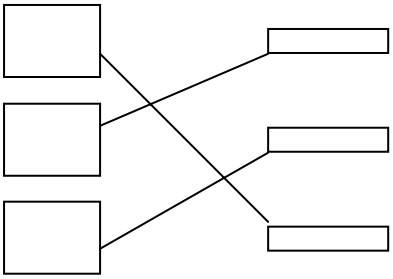
Question 8

question	answers	extra information	mark
(a)(i)	oxygen / O / O_2	do **not** accept oxide	1
(a)(ii)	sodium **and** carbon **and** oxygen	do **not** allow symbols alone do **not** allow oxide	1
	all correct numbers linked to correct elements ie 2 (sodium), a / 1 (carbon), 3 (oxygen)	accept statement 'the number **and** type of atoms' for **1** mark only ignore types of particles	1
(b)(i)	calcium carbonate →	allow $CaCO_3$	1
	calcium oxide + carbon dioxide	either way round allow CaO + CO_2 do **not** allow quick lime maximum **1** mark for unbalanced symbol equation	1
(b)(ii)	thermal decomposition	accept endothermic do **not** accept reversible / equilibrium	1
(c)	any **one** from: • lowers energy / temperature needed **or** conserves energy • decreases the amount of fuel needed • no / less glass going to landfill	do **not** accept no energy ignore cheaper / easier ignore conserves raw materials **or** more quarries needed	1
total			7

4.2.2.6 Giant covalent structures

Answer 02 · Mark scheme

Question 2

question	answers	extra information	mark
(a)		all three lines correct gains **2** mark one or two correct gains **1** mark if there are more than 3 lines then lose mark for each extra line	2
(b)(i)	covalent		1
(b)(ii)	four		1
(b)(iii)	hard		1
(b)(iv)	three		1
(b)(v)	soft		1
(c)	carbon	accept C	1
total			8

4.2.2.6 Giant covalent structures

Answer 02 · Mark scheme January 2008 | CHY2F | Original Q2 | Legacy

CHY2F

Answer 03 · Mark scheme June 2008 | CHY2F | Original Q3 | Legacy

question	answers	extra information	mark
3	high		1
	giant	allow covalent	1
	four		1
	covalent		1
Total			**4**

4.2.2.6 Giant covalent structures

Answer 04 · Mark scheme

June 2009 | CHY2F | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	any **two** from: • conducts electricity • soft • slippery • high melting point	ignore hardwearing / does not stick apply list principle	2
5(b)(i)	three covalent		1 1
5(b)(ii)	it is made of layers of atoms		1
Total			**5**

4.2.2.6 Giant covalent structures

Answer 04 · Mark scheme

June 2009 | CHY2F | Original Q5 | Legacy

CHY2F

4.2.2.6 Giant covalent structures

Answer 05 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)(i)	any **one** from: • contain metals / filaments / wires • contain other / toxic chemicals / materials • different type of glass	ignore contamination without explanation accept named metal(s) accept named chemical(s) / material(s) accept glass would not melt ignore thicker / thinner glass	1
7(a)(ii)	any **one** from: • (glass bottles are) recycled • need to be more expensive glass **or** strong / thicker / different glass (to be reused) • damaged / weaker (with reuse) • need to be cleaned / transported • different sizes / shapes / colours • no refunds paid	 accept made to be used only once accept glass bottles are made of readily available materials **or** thin / cheap glass accept need to be sorted	1
7(a)(iii)	any **two** from: • low / less energy / heat or lower temperature needed • low / less fuel burned • no (carbon dioxide) from carbonate(s)	allow converse arguments ignore no energy without explanation ignore no fuel without explanation accept less fuel for extraction / transportation of raw materials accept name(s) of this carbonate(s)	2
7(b)(i)	46		1

Question 7 continues on the next page…

CHY1F

Question 7 continued

question	answers	extra information	mark
7(b)(ii)	any **one** from: • (more) imported (as wine bottles) • not much green glass made in the UK • not a high demand (for green glass)	accept come from / made in other countries **or** made elsewhere	1
7(b)(iii)	any **two** from: • more (clear) glass is produced (64%) than recycled (40%) • (clear) glass going to landfill • (more) raw materials needed / extracted / quarried • (more) heat / energy / fuel would be needed • (more) carbon dioxide produced	accept not enough (clear) glass is recycled allow 'thrown away' ignore they will run out accept high carbon footprint / carbon emissions **or** global warming	2
Total			**8**

4.2.2.6 Giant covalent structures

Answer 06 · Mark scheme

January 2010 | CHY2F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)	the diameter of the tube is very small		1
4(b)(i)	three		1
4(b)(ii)	covalent		1
4(b)(iii)	bonds		1
Total			**4**

4.2.2.6 Giant covalent structures

Answer 06 · Mark scheme

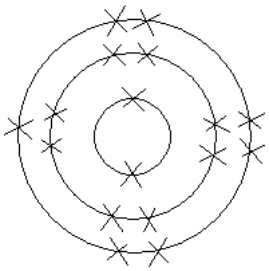
January 2010 | CHY2F | Original Q4 | Legacy

CHY2F

4.2.2.6 Giant covalent structures

Answer 07 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)		accept dots / crosses / e must be drawn on diagram electrons do not need to be paired ignore brackets or + or −charges ignore 2,8,7	1
7(b)	(one) electron lost / given away / transferred from sodium / transferred to chlorine owtte	recognition that electrons are involved must be linked to electrons accept loses electron(s) for **2** marks NB loses 2 or more electrons gains **1** mark reference to sharing / covalent max **1** mark ignore charges on ions formed	1 1
7(c)(i)	any **one** from: • ions / atoms / they are / it is negatively charged / anions • opposite (charges) attract	 accept they are negative accept they are attracted or it is oppositely charged ignore opposite forces attract	1
7(c)(ii)	hydrogen	accept H_2 ignore H or H^+	1

Question 7 continues on next page

CHY2F

Question 7 continued

question	answers	extra information	mark
7(d)(i)	poisons released into environment (owtte)	accept any sensible idea of harm / harmful / poisons / poisonous / pollution / damaging do **not** accept answers such as global warming / ozone layer etc. ignore safety unless qualified	1
7(d)(ii)	any **one** sensible idea eg • loss of work / unemployment **or** company goes out of business • any adverse effect on local economy (owtte) • any adverse effect on paper production / cost of paper / cost of water (treatment) • chlorine (compounds) have been used (for many years) without causing harm owtte • only a tiny amount of chlorine is released so it would not cause harm	eg shops / house prices etc. allow less expensive to use chlorine or converse ignore uses of chlorine to treat drinking water unless qualified	1
7(d)(iii)	ideas related to bias	accept more reliable or valid or fair ignore more accurate / fair test	1
Total			**8**

4.2.2.6 Giant covalent structures

Answer 07 · Mark scheme

January 2010 | CHY2F | Original Q7 | Legacy

CHY2F

4.2.2.6 Giant covalent structures

Answer 08 · Mark scheme June 2010 | CHY2F | Original Q4 | Legacy

Question 4

question	answers	extra information	mark
4(a)	carbon		1
4(b)	all		1
4(c)	covalent		1
4(d)	four		1
4(e)	hard		1
Total			**5**

4.2.2.6 Giant covalent structures

Answer 08 · Mark scheme

June 2010 | CHY2F | Original Q4 | Legacy

CHY2F

4.2.2.6 Giant covalent structures

Question 2

question	answers	extra information	mark
2(a)	any **two** from • shorter / quicker soaking time • takes less time / quicker to dry **or** faster evaporation • dissolves quicker / better in methanol	assume it = methanol allow converse for water allow it is quicker	2
2(b)(i)	CH_4O		1
2(b)(ii)	covalent		1
2(c)	it is made of small molecules		1
Total			**5**

4.2.2.6 Giant covalent structures

Answer 09 · Mark scheme January 2011 | CHY2F | Original Q2 | Legacy

CHY2F

Answer 10 · Mark scheme June 2011 | CHY2F | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	carbon		1
3(b)	layers have weak forces / attractions / bonds between them **or** are only held together weakly **or** can slide over each other **or** separate (1)	 second mark must be linked to layers	1 1
3(c)	covalent		1
Total			**4**

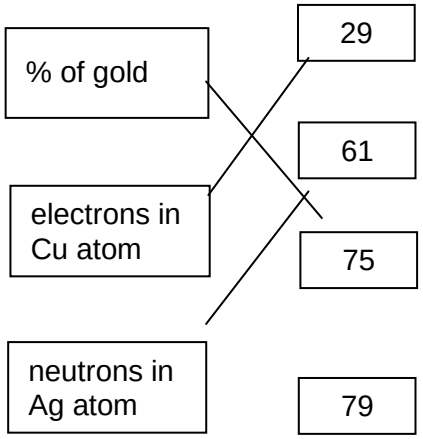
Answer 10 · Mark scheme June 2011 | CHY2F | Original Q3 | Legacy

CHY2F

4.2.2.6 Giant covalent structures

Answer 11 · Mark scheme January 2012 | CH1FP | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)	+1/+ electron	do **not** accept 1 without the + allow phonetic spelling	1 1
1(b)(i)	elements		1
1(b)(ii)	non-metal		1
1(c)	soft an alloy		1 1
1(d)		**one** mark for each correct link extra lines lose the mark	3
Total			9

4.2.2.6 Giant covalent structures

Answer 11 · Mark scheme

January 2012 | CH1FP | Original Q1 | Legacy

CH1FP

4.2.2.6 Giant covalent structures

Answer 12 · Mark scheme

June 2012 | CH2FP | Original Q5 | Legacy

Question 5

question	answers	extra information	Mark
5(a)(i)	covalent	two different answers indicated gains **0** marks	1
5(a)(ii)	carbon	two different answers indicated gains **0** marks	1
5(a)(iii)	3	two different answers indicated gains **0** marks	1
5(b)	layers can slide / slip because there are no bonds between layers **or** so (pieces of) graphite rubs / breaks off **or** graphite left on the paper	 accept because weak forces / bonds between layers	1 1
Total			**5**

4.2.2.6 Giant covalent structures

Answer 12 · Mark scheme

June 2012 | CH2FP | Original Q5 | Legacy

CH2FP

4.2.2.6 Giant covalent structures

Answer 13 · Mark scheme

January 2013 | CH2FP | Original Q2 | Legacy

question	answers	extra information	mark
2(a)	four covalent		1 1
2(b)	because it has a high melting point	accept it won't melt accept it won't decompose or react allow withstand high temperatures ignore boiling point	1
2(c)	thin		1
Total			**4**

4.2.2.6 Giant covalent structures

Answer 13 · Mark scheme

January 2013 | CH2FP | Original Q2 | Legacy

January 2013

CH2FP

4.2.2.6 Giant covalent structures

Answer 14 · Mark scheme

January 2013 | CH2FP | Original Q8 | Legacy

question	answers	extra information	mark
8(a)(i)	because they are positively charged	accept they are positive / H^+ accept oppositely charged **or** opposites attract ignore they are attracted	1
8(a)(ii)	gains one / an electron	accept $H^+ + e^- \rightarrow H$ or multiples allow gains electrons	1
8(b)	3 bonding pairs 1 lone pair	 accept 2 non-bonding electrons on outer shell of nitrogen	1 1
8(c)(i)	hydroxide / OH^-	do **not** accept sodium hydroxide	1
8(c)(ii)	$H^+ + OH^- \rightarrow H_2O$	ignore state symbols ignore word equation	1

4.2.2.6 Giant covalent structures

January 2013

CH2FP

question	answers	extra information	mark
8(d)	Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response. Examiners should also refer to the information on page 5.		6

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There are basic descriptions of advantages or disadvantages of the electrolysis cells.	There are clear descriptions of environmental or economic advantages or disadvantages of the electrolysis cells. Comparisons may be implied.	There are detailed descriptions of environmental and economic advantages and disadvantages, comparing the electrolysis cells.

examples of chemistry points made in the response:

Accept converse where appropriate.

- mercury cell is more expensive to construct
- mercury is recycled but membranes must be replaced
- mercury is toxic but membrane / polymer is not
- removing traces of mercury from waste is expensive
- mercury cell uses more electricity
- mercury cell produces chlorine that is purer
- mercury cell produces higher concentration / better quality of sodium hydroxide (solution)

Total			12

UMS conversion calculator www.aqa.org.uk/umsconversion

4.2.2.6 Giant covalent structures

Answer 15 · Mark scheme June 2013 | CH2FP | Original Q3 | Legacy

Question 3

question	answers	extra information	Mark
3(a)	(alloy) atoms / ions / particles not in layers	accept layers are distorted accept different (size) particles / atoms	1
	so, (alloy) layers / atoms / ions / particles can't slide	if no other mark awarded allow (an alloy) is a mixture of metals for **1** mark	1
3(b)	diamonds have a giant covalent structure		1
	diamonds have strong bonds between carbon atoms		1
3(c)(i)	a compound		1
3(c)(ii)	CH_4		1
3(c)(iii)	covalent		1
3(d)	methane has a low boiling point or boiling point less than 20°C		1
	because it has small molecules	accept it has forces between molecules accept weak forces between molecules for **2** marks	1
Total			**9**

4.2.2.6 Giant covalent structures

Answer 16 · Mark scheme

June 2014 | CH2FP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
1(a)(i)	high		1	1 / 2.2.3a	A
1(a)(ii)	hundred		1	1 / 2.2.6a	A
1(b)	hard		1	1 / 2.2.3b	A
1(c)(i)	carbon		1	1 / 2.2.3a	A
1(c)(ii)	four		1	1 / 2.2.3b	A
1(c)(iii)	covalent		1	1 / 2.2.3a/b	A
1(c)(iv)	all		1	1 / 2.2.3a	A
Total			7		

4.2.2.6 Giant covalent structures

Answer 16 · Mark scheme

June 2014 | CH2FP | Original Q1 | Legacy



4.2.2.6 Giant covalent structures

Answer 17 · Mark scheme

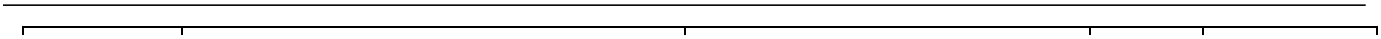
June 2015 | CH2FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	any **one** from: • protection/improve lifespan • improve appearance		1	**AO2** 2.7.1d
4(b)(i)	Bleach		1	**AO1** 2.7.1i
4(b)(ii)	Hydrogen is less reactive than sodium.		1	**AO2** 2.7.1f
4(b)(iii)	1 bonding pair of electrons 6 unbonded electrons on Cl	accept dot, cross or e or – or any combination	1	**AO1** 2.7.1e
4(b)(iv)	Covalent		1	**AO1** 2.7.1f
4(b)(v)	Hydrogen chloride has a low boiling point. Hydrogen chloride is made of simple molecules.		1 1	**AO1** 2.2.1a 2.1.1g
4(c)(i)	oxygen	accept carbon dioxide	1	**AO1** 2.7.1h
4(c)(ii)	aluminium ions are positive so are attracted (to the negative electrode)	allow opposites attract	1 1	**AO1/AO2** 2.7.1h 2.2.2b
4(c)(iii)	Reduction		1	**AO1** 2.7.1e
4(c)(iv)	slide	allow move	1	**AO1** 2.2.4b
4(d)(i)	C		1	**AO1** 2.2.3a,c
4(d)(ii)	strong covalent bonds		1	**AO1** 2.2.3a
Total			**14**	

4.2.2.6 Giant covalent structures

Answer 17 · Mark scheme

June 2015 | CH2FP | Original Q4 | Legacy



4.2.2.6 Giant covalent structures

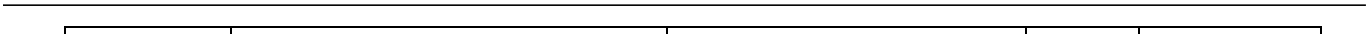
Answer 18 · Mark scheme June 2016 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
2(a)(i)	hard	ignore strong	1	AO2 2.2.3b
2(a)(ii)	hundred		1	AO1 2.2.6a
2(b)(i)	Covalent		1	AO1 2.2.3a
2(b)(ii)	3		1	AO1 2.2.3.c
2(b)(iii)	Soft and slippery		1	AO1 2.2.3a,c
2(c)(i)	cross-links	allow bonds ignore links do **not** accept intermolecular	1	AO1 2.2.5b
2(c)(ii)	melt		1	AO1 2.2.5b
2(c)(iii)	any **two** from: • temperature • pressure • catalyst	allow heat(ing)	2	AO1 / AO3 2.2.5a
2(d)(i)	CH_4		1	AO1 2.1.1g
2(d)(ii)	Small molecules		1	AO1 2.2.1a
Total			**11**	

4.2.2.6 Giant covalent structures

Answer 18 · Mark scheme

June 2016 | CH2FP | Original Q2 | Legacy



4.2.2.6 Giant covalent structures

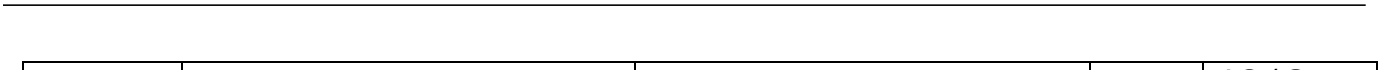
Answer 19 · Mark scheme June 2017 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	s		1	**AO2** 2.6.1a
2(a)(ii)	to speed up the reaction		1	**AO2** 2.6.1b
2(a)(iii)	tick (✓) by: 1		1	**AO1** 2.6.2d
2(a)(iv)	tick (✓) by: To make sure all the sulfuric acid has reacted		1	**AO1** 2.6.1b
2(b)(i)	funnel	accept filter funnel	1	**AO1** 2.6.1b
2(b)(ii)	heat / evaporate / boil	accept cool accept leave (to evaporate) do **not** accept heat until all water gone	1	**AO1** 2.6.1b
2(c)	tick (✓) by: The student left some copper sulfate crystals in the apparatus.		1	**AO3** 2.3.3d
2(d)(i)	white	accept grey	1	**AO1** 2.5.1d
2(d)(ii)	it goes blue	accept steam / water vapour ignore unspecified colour change	1	**AO1** 2.5.1d
2(e)(i)	polymers		1	**AO1** 2.2.5a
2(e)(ii)	as wealth decreases, ethene production decreases	accept converse	1	**AO2** 2.6; 3.7.12
2(e)(iii)	no relationship		1	**AO2** 2.6; 3.7.12
Total			**12**	

4.2.2.6 Giant covalent structures

Answer 19 · Mark scheme

June 2017 | CH2FP | Original Q2 | Legacy



4.2.2.6 Giant covalent structures

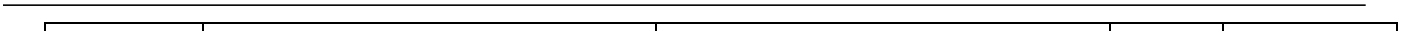
Answer 20 · Mark scheme June 2017 | CH2FP | Original Q3 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3(a)(i)	tick (✓) by: covalent		 1	**AO1** 2.1.1g
3(a)(ii)	ticks (✓) by: oxygen consists of small molecules oxygen has a low boiling point		 1 1	**AO1** 2.1.1g
3(b)(i)	magnesium (atom) loses (electrons) oxygen (atom) gains (electrons) two (electrons) ions formed	max 3 if reference to incorrect particle or incorrect bonding accept ionic bonding or full outer shells/noble gas structure is formed allow magnesium forms positive (ion) **or** oxygen forms negative (ion)	 1 1 1 1	**AO1** **AO2** 2.1.1a,b,c, d,e,f
3(b)(ii)	ticks (✓) by: nanoparticles contain a few hundred atoms nanoparticles have a high surface area to volume ratio		 1 1	**AO1** 2.2.6a
3(c)	giant covalent		1	**AO1** 2.2.3a
Total			**10**	

4.2.2.6 Giant covalent structures

Answer 20 · Mark scheme

June 2017 | CH2FP | Original Q3 | Legacy



Answer 21 · Mark scheme

June 2018 | 8462/1F | Original Q4

The full source mark scheme begins on page 52. Follow original question 4 in that document.

4.2.2.6 Giant covalent structures

Answer 22 · Mark scheme

November 2020 | 8462/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	(negative electrode) solid produced	allow the electrode changes colour ignore metal produced	1	AO3 4.4.3.4 RPA 3
	(positive electrode) bubbles / fizzing / effervescence	ignore gas produced	1	
04.2	potassium nitrate		1	AO3 4.4.3.4 RPA 3
	hydrogen is not a metal	allow hydrogen is a gas allow hydrogen is not a solid allow the products at both electrodes are gases allow the product at the negative electrode is not potassium allow potassium is more reactive than hydrogen	1	
04.3	(graphite) conducts (electricity)	allow (graphite) has delocalised / free electrons	1	AO1 4.2.3.2 4.4.3.4 RPA 3
	(graphite) is inert	allow (graphite) is unreactive	1	
04.4	the ions move towards the positive electrode		1	AO3
	the electrode attracts ions of the opposite charge	allow opposite charges attract	1	AO1 4.4.3.1
Total			**8**	

4.2.2.6 Giant covalent structures

Answer 23 · Mark scheme

November 2020 | 8462/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	poly(ethene) water		1 1	AO2 4.2.1.4 4.2.2.4 4.2.2.5

Question 8 continued

Question	Answers	Mark	AO/ Spec. Ref
08.2	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	4–6	AO1 4.2.1.2 4.2.1.3 4.2.1.4
	Level 1: Relevant features are identified and differences noted.	1–3	
	No relevant content	0	
	Indicative content • (both) carbon dioxide and silicon dioxide are made up of atoms • (but) magnesium oxide is made up of ions • (both) silicon dioxide and magnesium oxide are giant structures • (but) carbon dioxide is small molecules • with weak intermolecular forces • all three compounds have strong bonds • (both) carbon dioxide and silicon dioxide are formed from two non-metals • (so) bonds formed are covalent • (so) electron (pairs) are shared (between atoms) • (but) magnesium oxide is formed from a metal and a non-metal • (so) bonds in magnesium oxide are ionic • (so) electrons are transferred • from magnesium to oxygen • two electrons are transferred • bonds in silicon dioxide are single bonds • (where) each silicon forms four bonds • (and) each oxygen forms two bonds • (but) in carbon dioxide the bonds are double bonds • (where) carbon forms two double bonds • (and) oxygen forms one double bond ignore properties e.g. melting point, electrical conductivity		

Total			8

4.2.2.6 Giant covalent structures

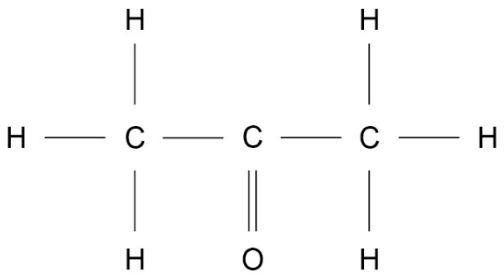
Answer 24 · Mark scheme

November 2021 | 8462/1F | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	spherical	allow ball-shaped ignore round / circular	1	AO1 4.2.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	any **one** from: • drug delivery (round the body) • hydrogen storage • anti-oxidants • reduction of bacterial growth • catalysts • (cylindrical fullerenes for) strengthening materials • (spherical fullerenes for) lubricants		1	AO1 4.2.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3			1	AO2 4.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	C_3H_6O	allow CH_3COCH_3 allow elements in any order	1	AO2 4.2.1.4

Question 8 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	the intermolecular forces are weak		1	AO1 4.2.2.1 4.2.2.4

Question	Answers	Mark	AO/ Spec. Ref
08.6	**Level 3**: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO1 4.2.2.6 4.2.3.2
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content • bonds are covalent • giant / macromolecular structure • three (covalent) bonds per carbon atom **or** only three electrons per carbon atom used in (covalent) bonds • so one electron per carbon atom (is delocalised) • these delocalised electrons • can move through the structure • carrying (electrical) charge • so graphite conducts electricity • layered structure • of (interlocking) hexagonal rings • with weak (intermolecular) forces between layers **or** no (covalent) bonds between layers • so the layers can slide over each other • so graphite is soft and slippery		

Total			11

4.2.2.6 Giant covalent structures

Answer 25 · Mark scheme

June 2022 | 8462/1F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	C		1	AO1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	D		1	AO1 4.2.1.4 4.2.2.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	4 / four		1	AO1 4.2.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	very hard		1	AO1 4.2.2.6 4.2.3.1

4.2.2.6 Giant covalent structures

Answer 25 · Mark scheme June 2022 | 8462/1F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.5	C_2H_6		1	AO2 4.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6	H^+		1	AO1 4.4.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.7	(M_r =) (1 × 2) + 12 + (16 × 3) = 62	allow (M_r =) 2 + 12 + 48	1 1	AO2 4.3.1.2

Total Question 6		**8**

4.2.2.6 Giant covalent structures

Answer 26 · Mark scheme

June 2023 | 8462/1F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	element		1	AO1 4.1.1.1

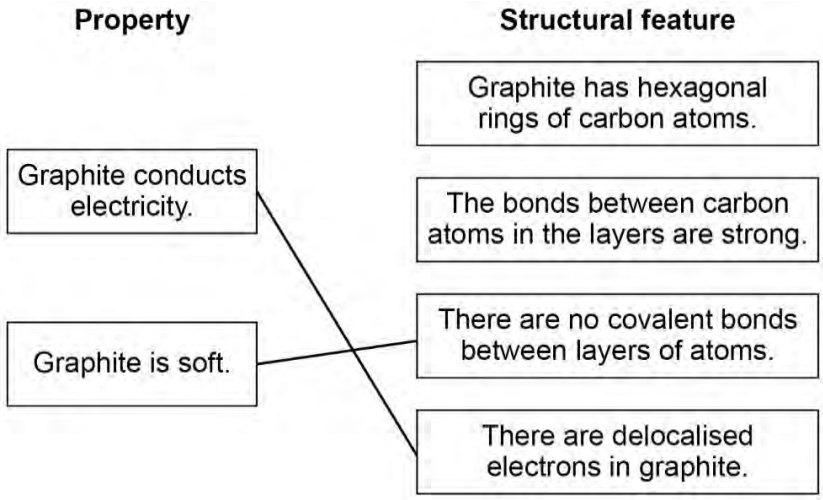
Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	protons neutrons	must be in this order allow electrons	1 1	AO1 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	$\frac{12}{6.02 \times 10^{23}}$		1	AO2 4.1.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4	B		1	AO1 4.2.3.3

4.2.2.6 Giant covalent structures

Answer 26 · Mark scheme

Question	Answers	Mark	AO / Spec. Ref.
03.5	 do **not** accept more than **one** line from a box on the left	1 1	AO1 4.2.3.2

Total Question 3	7

4.2.2.6 Giant covalent structures

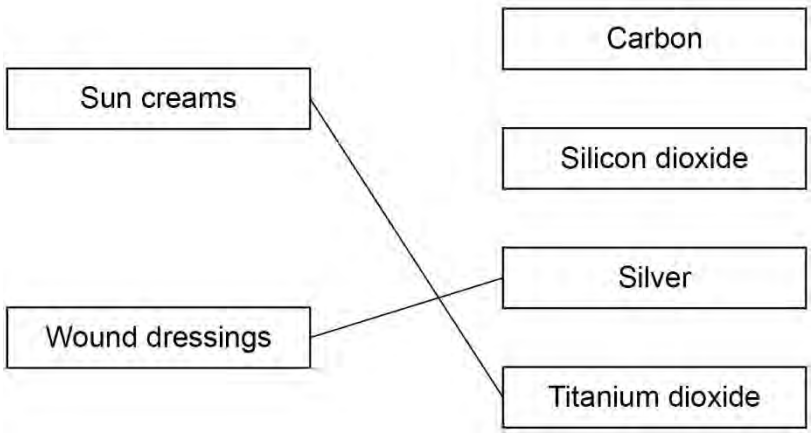
Answer 27 · Mark scheme

June 2024 | 8462/1F | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	a few hundred atoms		1	AO1 4.2.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	iron		1	AO3 4.1.3.2

Question	Answers	Mark	AO / Spec. Ref.
04.3	**Use** **Substance**  do **not** accept more than one line from a box on the left	1 1	AO3 4.2.4.2

4.2.2.6 Giant covalent structures

Answer 27 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	(surface area =) 6×4^2		1	AO2 4.2.4.1
	= 96 (nm^2)		1	
	(volume =) 4^3		1	
	= 64 (nm^3)		1	
	(ratio =) 96 : 64	allow correct use of incorrectly determined area and/or volume	1	
	= 3 : 2	allow correct use of an incorrectly determined ratio	1	

Total Question 4	**10**

4.2.2.6 Giant covalent structures

Answer 28 · Mark scheme

June 2024 | 8462/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	6		1	AO2 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	7		1	AO2 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	6		1	AO2 4.1.1.5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	C_2F_6		1	AO2 4.2.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	only intermolecular forces are weak		1	AO1 4.2.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	spherical		1	AO1 4.2.3.3

4.2.2.6 Giant covalent structures

Answer 28 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	3		1	AO1 4.2.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.8	giant structure	allow lattice	1	AO1 4.2.3.1
	(of atoms joined by) covalent bonds		1	
	each carbon / atom forms four bonds		1	

Total Question 5	**10**

4.2.2.6 Giant covalent structures

Answer 29 · Mark scheme

June 2025 | 8462/1F | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	CaS		1	AO2 4.2.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	calcium (atom) loses electrons		1	AO2 4.2.1.1 4.2.1.2
	sulfur (atom) gains electrons		1	
	reference to transfer of two electrons		1	
	calcium forms positive ions **and** sulfur forms negative ions	allow Ca^{2+} (ions) **and** S^{2-} (ions) are formed allow calcium ions **and** sulfide ions are formed	1	

4.2.2.6 Giant covalent structures

Answer 29 · Mark scheme

June 2025 | 8462/1F | Original Q9

Question	Answers	Mark	AO / Spec. Ref.
09.3	**Level 2:** Scientifically relevant facts, events or processes are identified and given in detail to form an accurate account.	3–4	AO1 4.2.1.1 4.2.1.4 4.2.2.6 4.2.3.2
	Level 1: Facts, events or processes are identified and simply stated but their relevance is not clear.	1–2	
	No relevant content	0	
	Indicative content • giant structure • layers • of hexagonal rings • each (carbon) atom forms three bonds • has no covalent bonds between layers • with delocalised electrons • one delocalised electron from each carbon atom • the bonds are covalent • with shared (pairs of) electrons • the (covalent) bonds are strong		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	the molecules do not have an (overall electric) charge	allow there are no ions allow there are no delocalised electrons	1	AO1 4.2.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.5	poly(ethene) has stronger intermolecular forces to overcome than methane		1	AO1 4.2.2.4 4.2.2.5

Total Question 9	11

4.2.2.6 Giant covalent structures

AQA

GCSE
CHEMISTRY

8462/1F - PAPER 1 FOUNDATION TIER

Mark scheme

8462

June 2018

Version/Stage: 1.0 Final

4.2.2.6 Giant covalent structures

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this mark scheme are available from aqa.org.uk

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PMT

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Information to Examiners

1. General

The mark scheme for each question shows:

- the marks available for each part of the question
- the total marks available for the question
- the typical answer or answers which are expected
- extra information to help the Examiner make his or her judgement
- the Assessment Objectives and specification content that each question is intended to cover.

The extra information is aligned to the appropriate answer in the left-hand part of the mark scheme and should only be applied to that item in the mark scheme.

At the beginning of a part of a question a reminder may be given, for example: where consequential marking needs to be considered in a calculation; or the answer may be on the diagram or at a different place on the script.

In general the right-hand side of the mark scheme is there to provide those extra details which confuse the main part of the mark scheme yet may be helpful in ensuring that marking is straightforward and consistent.

2. Emboldening and underlining

2.1 In a list of acceptable answers where more than one mark is available 'any **two** from' is used, with the number of marks emboldened. Each of the following bullet points is a potential mark.

2.2 A bold **and** is used to indicate that both parts of the answer are required to award the mark.

2.3 Alternative answers acceptable for a mark are indicated by the use of **or**. Different terms in the mark scheme are shown by a / ; eg allow smooth / free movement.

2.4 Any wording that is underlined is essential for the marking point to be awarded.

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which students have provided extra responses. The general principle to be followed in such a situation is that 'right + wrong = wrong'.

Each error / contradiction negates each correct response. So, if the number of error / contradictions equals or exceeds the number of marks available for the question, no marks can be awarded.

However, responses considered to be neutral (indicated as * in example 1) are not penalised.

Example 1: What is the pH of an acidic solution?

[1 mark]

Student	Response	Marks awarded
1	green, 5	0
2	red*, 5	1
3	red*, 8	0

Example 2: Name two planets in the solar system.

[2 marks]

Student	Response	Marks awarded
1	Neptune, Mars, Moon	1
2	Neptune, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a student writes a chemical symbol / formula instead of a required chemical name, full credit can be given if the symbol / formula is correct and if, in the context of the question, such action is appropriate.

3.3 Marking procedure for calculations

Marks should be awarded for each stage of the calculation completed correctly, as students are instructed to show their working. Full marks can, however, be given for a correct numerical answer, without any working shown.

3.4 Interpretation of 'it'

Answers using the word 'it' should be given credit only if it is clear that the 'it' refers to the correct subject.

3.5 Errors carried forward

Any error in the answers to a structured question should be penalised once only.

Papers should be constructed in such a way that the number of times errors can be carried forward is kept to a minimum. Allowances for errors carried forward are most likely to be restricted to calculation questions and should be shown by the abbreviation ecf in the marking scheme.

3.6 Phonetic spelling

The phonetic spelling of correct scientific terminology should be credited **unless** there is a possible confusion with another technical term.

3.7 Brackets

(…..) are used to indicate information which is not essential for the mark to be awarded but is included to help the examiner identify the sense of the answer required.

3.8 Allow

In the mark scheme additional information, 'allow' is used to indicate creditworthy alternative answers.

3.9 Ignore

Ignore is used when the information given is irrelevant to the question or not enough to gain the marking point. Any further correct amplification could gain the marking point.

3.10 Do not accept

Do **not** accept means that this is a wrong answer which, even if the correct answer is given as well, will still mean that the mark is not awarded.

4. Level of response marking instructions

Extended response questions are marked on level of response mark schemes.

- Level of response mark schemes are broken down into levels, each of which has a descriptor.
- The descriptor for the level shows the average performance for the level.
- There are two marks in each level.

Before you apply the mark scheme to a student's answer, read through the answer and annotate it (as instructed) to show the qualities that are being looked for. You can then apply the mark scheme.

Step 1: Determine a level

Start at the lowest level of the mark scheme and use it as a ladder to see whether the answer meets the descriptor for that level. The descriptor for the level indicates the different qualities that might be seen in the student's answer for that level. If it meets the lowest level then go to the next one and decide if it meets this level, and so on, until you have a match between the level descriptor and the answer.

When assigning a level you should look at the overall quality of the answer. Do **not** look to penalise small and specific parts of the answer where the student has not performed quite as well as the rest. If the answer covers different aspects of different levels of the mark scheme you should use a best fit approach for defining the level.

Use the variability of the response to help decide the mark within the level, ie if the response is predominantly level 2 with a small amount of level 3 material it would be placed in level 2 but be awarded a mark near the top of the level because of the level 3 content.

Step 2: Determine a mark

Once you have assigned a level you need to decide on the mark. The descriptors on how to allocate marks can help with this.

The exemplar materials used during standardisation will help. There will be an answer in the standardising materials which will correspond with each level of the mark scheme. This answer will have been awarded a mark by the Lead Examiner. You can compare the student's answer with the example to determine if it is the same standard, better or worse than the example. You can then use this to allocate a mark for the answer based on the Lead Examiner's mark on the example.

You may well need to read back through the answer as you apply the mark scheme to clarify points and assure yourself that the level and the mark are appropriate.

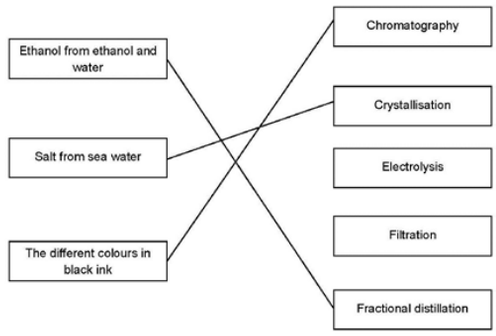
Indicative content in the mark scheme is provided as a guide for examiners. It is not intended to be exhaustive and you must credit other valid points. Students do **not** have to cover all of the points mentioned in the indicative content to reach the highest level of the mark scheme.

You should ignore any irrelevant points made. However, full marks can be awarded only if there are no incorrect statements that contradict a correct response.

An answer which contains nothing of relevance to the question must be awarded no marks.

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1			1 1 1	AO1 4.1.1.2
01.2	include a (filter) funnel	allow funnel drawn on the diagram ignore clamp stand	1	AO3 4.1.1.2
01.3	evaporate condense	must be this order	1 1	AO1 4.1.1.2
01.4	$\frac{2}{20} \times 100$ = 10 (%)	an answer of 10 (%) scores **2** marks an answer of 11.1(%) **or** 90 (%) scores **1** mark	1 1	AO2 4.2.2.7
01.5	an alloy		1	AO1 4.2.2.7
01.6	the layers in the mixture are distorted		1	AO1 4.2.2.7

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	8000 nm^3		1	AO2 4.2.4.1
Total			**11**	

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	7		1	AO1 4.1.2.6
02.2	small molecule		1	AO2 4.1.2.6 4.2.2.4
02.3	F_2		1	AO1 4.1.1.1 4.1.2.6
02.4	the reactivity decreases (going down Group 7) (because) chlorine displaces bromine and iodine (and) bromine displaces iodine **or** iodine does not react	allow the reactivity decreases from chlorine to iodine allow (because) chlorine has two reactions allow (because) neither bromine nor iodine can displace chlorine allow (and) bromine has one reaction **or** iodine has no reactions allow (and) iodine cannot displace bromine	1 1 1	AO1 4.1.2.6 AO3 4.1.2.6 AO3 4.1.2.6
02.5	80		1	AO2 4.3.1.2

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(1.2 kg =) 1200 (g) **or** (900 g =) 0.9 (kg)	an answer of 75 (%) scores **2** marks	1	AO2 4.3.3.1
	$(\frac{900}{1200} \times 100) = 75(\%)$ **or** $(\frac{0.9}{1.2} \times 100) = 75(\%)$	allow an answer correctly calculated from: $(\frac{900}{\text{incorrect attempt at conversion of 1.2}} \times 100)$ **or** $(\frac{\text{incorrect attempt at conversion of 900}}{1.2} \times 100)$	1	
Total			**9**	

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	nucleus neutron neutron electron proton	must be in this order	1 1 1 1 1	AO1 4.1.1.3 4.1.1.4 4.1.1.5
03.2	$(A_r)\ \frac{(63 \times 70) + (65 \times 30)}{100}$ = 63.6	an answer of 63.6 scores **2** marks	1 1	AO2 4.1.1.6
03.3	copper / Cu	allow ecf from answer to question **03.2**	1	AO2 4.1.1.1
03.4	$\frac{1.2 \times 10^{-10}}{10\,000}$ **or** $1.2 \times 10^{-10} \times 1 \times 10^{-4}$ $= 1.2 \times 10^{-14}$ (m)	an answer of 1.2×10^{-14} (m) scores **2** marks a correct answer not in standard form scores **1** mark	1 1	AO2 4.1.1.5
Total			**10**	

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	3.6 (cm^3)		1	AO2 4.4.3.4
04.2	hydrogen line only		1	AO3 4.4.3.4
04.3	both lines		1	AO3 4.4.3.4
04.4	graphite has delocalised electrons		1	AO1 4.2.3.2
04.5	**cathode** zinc (1) **anode** chlorine (1) hydrogen (1) bromine (1)	do **not** accept chloride allow **1** mark if chlorine and zinc the wrong way around do **not** accept bromide allow **1** mark if bromine and hydrogen the wrong way around	1+1 1+1	AO2 4.4.3.2 4.4.3.4
Total			**8**	

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	gas		1	AO1 4.2.2.2
05.2	the gas escapes	allow carbon dioxide escapes do **not** accept references to evaporation	1	AO1 4.3.1.3
05.3	5.12 (g)		1	AO2 4.3.1.3
05.4	4.00 (g) trial 1	allow 2.89 written in either space, or ringed in the table, unless contradicted by mass of copper carbonate or trial number	1	AO3 4.3.1.3
05.5	reheat (and reweigh) until constant mass	 an answer of heat to constant mass scores **2** marks if no other mark scored allow for **1** mark heat for longer **or** (heat at a) higher temperature **alternative approach**: (1) continue heating and pass gas through limewater (1) until the (lime)water stops bubbling **or** until the limewater no longer turns cloudy	1 1	AO3 4.3.1.3

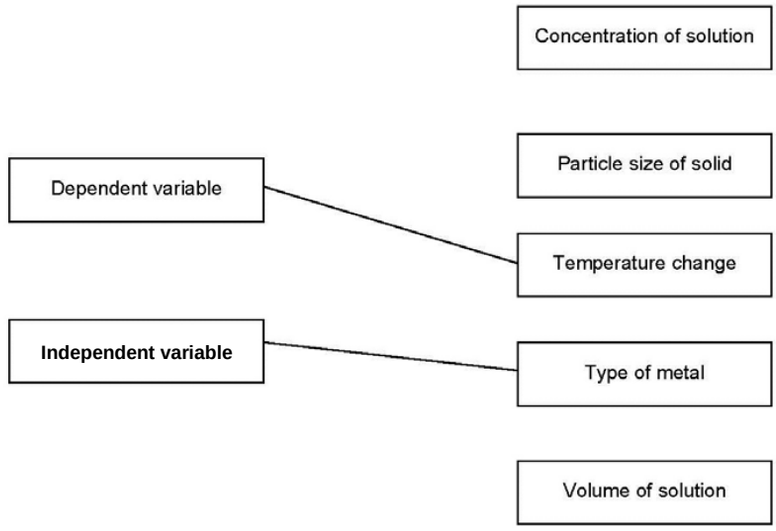
4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	straight line of best fit	must touch at least 5 of the 6 plots	1	AO2 4.3.1.3
05.7	correct value read from line of best fit in Figure 8	allow tolerance of ± ½ small square	1	AO2 4.3.1.3
05.8	(mass =) $168 \times \frac{\text{answer from question } \mathbf{05.7}}{8.4}$	a correctly calculated value from their answer to question **05.7** scores **2** marks allow (mass =) answer from question **05.7** × 20	1	AO2 4.3.1.3
	correctly calculated value (g)		1	
Total			**10**	

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	 allow **one** mark if answers are reversed		1 1	AO1 4.5.1.1
06.2	polystyrene is a better insulator		1	AO3 4.5.1.1
06.3	both bars labelled both bars correctly plotted	 allow tolerance of ± ½ small square ignore width and spacing of bars if no other mark scored, allow **1** mark for any one bar correctly plotted and labelled	1 1	AO2 4.5.1.1

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	temperature increases **or** temperature does not decrease	ignore because it is exothermic allow (because) energy / 'heat' is transferred to the surroundings energy / 'heat' is not taken in from the surroundings allow the energy of the products is less than the energy of the reactants	1	AO3 4.5.1.1
06.5	(most reactive) magnesium (zinc) nickel	this order only	1	AO3 4.5.1.1 4.4.1.2
06.6	suitable method described the observations / measurements required to place in order an indication of how results would be used to place the unknown metal in the reactivity series **approaches that could be used:** **approach 1:** add the unknown metal to copper sulfate solution (1) measure temperature change (1) place the metals in order of temperature change (1)		1 1 1	AO3 4.4.1.2 4.5.1.1

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.6 cont.	**approach 2:** add the metal to salt solutions of the other metals **or** heat the metal with oxides of the other metals (1) measure temperature change (only if salt solutions used) **or** observe whether a chemical change occurs (1) compare temperature change or whether there is a reaction to place in correct order (1) **approach 3:** add all of the metals to an acid (1) measure temperature change or means of comparing rate of reaction (1) place the metals in order of temperature change or rate of reaction (1) **approach 4:** set up electrochemical cells with the unknown metal as one electrode and each of the other metals as the other electrode (1) measure the voltage of the cell (1) place the metals in order of voltage (1)			
06.7	D		1	AO1 4.5.1.2
06.8	C		1	AO1 4.5.1.2
Total			**12**	

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	sodium oxide	allow Na_2O	1	AO2 4.1.1.1 4.1.2.5 4.4.1.1
07.2	oxidation		1	AO1 4.4.1.1
07.3	13		1	AO1 4.4.2.4
07.4	sodium hydroxide		1	AO2 4.1.1.1
07.5	OH^-		1	AO1 4.4.2.4
07.6	(volume =) $\frac{250}{1000}$ or ¼ or 0.25 (dm^3) **or** (mass per cm^3 =) $\frac{40}{1000}$ (g) or 0.04 (g) ($\frac{250}{1000}$ × 40 =) 10 (g)	an answer of 10 (g) scores **2** marks	1 1	AO2 4.3.2.5

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	all points correct	allow a tolerance of ± ½ a small square allow **1** mark for 3 points correct ignore any attempt at a line of best fit	2	AO2 4.1.2.5
07.8	39 (°C)	allow any value from 34 to 46 (°C)	1	AO2 4.1.2.5
Total			**10**	

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	any **one** from: • metal • (metal) hydroxide • (metal) carbonate • alkali	allow named example allow correct formula ignore base allow ammonium hydroxide allow ammonium carbonate allow soluble base allow ammonia	1	AO1 4.4.2.1 4.4.2.2 4.4.2.3
08.2	$Ca(NO_3)_2$	allow $Ca^{2+}(NO_3^-)_2$	1	AO2 4.4.2.2

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Mark	AO / Spec. Ref.
01.3	**Level 3:** The method would lead to the production of a valid outcome. All key steps are identified and logically sequenced.	5–6	AO1 4.4.2.3
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content • use magnesium oxide and sulfuric acid • add sulfuric acid to a beaker • warm sulfuric acid • add magnesium oxide • stir • continue adding until magnesium oxide is in excess • filter • using a filter paper and funnel • to remove excess magnesium oxide • heat solution in an evaporating basin • to crystallisation point • leave to crystallise • pat dry with filter paper credit may be given for diagrams		
Total			**8**

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	FeS_2	do **not** accept equations	1	AO2 4.2.1.3
09.2	 26 30 26	must be this order	 1 1 1	AO2 4.1.1.4 4.1.1.5
09.3	 any **two** from: • iron has a high(er) melting / boiling point • iron is dense(r) • iron is hard(er) • iron is strong(er) • iron is less reactive • iron has ions with different charges • iron forms coloured compounds • iron can be a catalyst	allow the converse statements for sodium allow transition metal for iron allow Group 1 metal for sodium ignore references to atomic structure ignore iron rusts allow iron is less malleable / ductile allow specific reactions showing difference in reactivity allow iron is magnetic	 2	AO1 4.1.2.5 4.1.3.1 4.1.3.2

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	carbon is more reactive (than nickel)	allow converse	1	AO1 4.4.1.2 4.4.1.3
	(so) carbon will displace / replace nickel (from nickel oxide) **or** (so) carbon will remove oxygen (from nickel oxide)	allow (so) nickel ions gain electrons allow (so) carbon transfers electrons to nickel (ions)	1	
09.5		an answer of 67.8 (%) scores **3** marks an answer of 67.8160919 (%) or correctly rounded answer to 2, 4 or more sig figs scores **2** marks an incorrect answer for one step does **not** prevent allocation of marks for subsequent steps		AO2 4.3.3.2
	(total M_r of reactants =) 87		1	
	(percentage atom economy) $= \frac{59}{87} \times 100$	allow (percentage atom economy) $= \frac{59}{\text{incorrectly calculated } M_r} \times 100$	1	
	= 67.8 (%)	allow an answer from an incorrect calculation to 3 sig figs	1	
Total			**11**	

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	copper, zinc, sodium chloride solution		1	AO2 4.5.2.1
10.2	a reactant is used up	allow the reaction stops allow electrolyte / electrode / ions / metal / metal hydroxide / alkali for reactant	1	AO1 4.5.2.1
10.3	the reaction is not reversible		1	AO1 4.5.2.1
10.4	$2H_2 + O_2 \rightarrow 2H_2O$	allow fractions / multiples allow **1** mark for O_2	2	AO1 AO2 4.1.1.1 4.5.2.2

4.2.2.6 Giant covalent structures

MARK SCHEME – GCSE CHEMISTRY – 8462/1F – JUNE 2018

<table>
<tr><th>Question</th><th>Answers</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td rowspan="5">10.5</td><td>Level 3: A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.</td><td>5–6</td><td>AO3</td></tr>
<tr><td>Level 2: Some logically linked reasons are given. There may also be a simple judgement.</td><td>3–4</td><td>AO3</td></tr>
<tr><td>Level 1: Relevant points are made. This is not logically linked.</td><td>1–2</td><td>AO2</td></tr>
<tr><td>No relevant content</td><td>0</td><td></td></tr>
<tr><td colspan="2">Indicative content

reasons why fuel cells could be judged as better

<table><tr><th>from the table</th><th>from other knowledge</th></tr><tr><td>• time for refuelling a fuel cell is faster than recharging
or
a fuel cell does not need to be recharged
• a fuel cell has a greater range</td><td>• hydrogen can be renewable if made by electrolysis using renewable energy
• lithium-ion batteries can catch fire
• produces only water
or
no pollutants produced
• lithium-ion batteries may release toxic chemicals on disposal
• lithium-ion batteries (eventually cannot be recharged so) have a finite life</td></tr></table>
reasons why the lithium-ion battery could be judged as better

<table><tr><th>from the table</th><th>from other knowledge</th></tr><tr><td>• lithium-ion uses energy more efficiently
• cost of lithium-ion car much less
• cost of recharging much less than refuelling with hydrogen</td><td>• hydrogen is often made from fossil fuels so is not renewable
• charging points are more widely available than hydrogen filling stations
• hydrogen takes up a lot of space
or
is difficult to store
• hydrogen can be highly flammable / explosive
• no emissions produced
• (catalyst in the hydrogen fuel-cell eventually becomes poisoned so) have a finite life</td></tr></table></td><td></td><td>4.4.3.4
4.5.2.1
4.5.2.2</td></tr>
<tr><td>Total</td><td colspan="2"></td><td>11</td></tr>
</table>

4.2.2.6 Giant covalent structures

Answer 21 · Examiner comments

June 2018 | 8462/1F | Original Q4

Question 4 (low and standard demand)

04.1 72% of students could read off the volume correctly, although 4.4 cm^3 was a popular wrong answer. Some students seem unfamiliar with 'upside down' apparatus.

04.2 This question was answered well, with 70% of students recognising a straight line through the origin as showing proportionality. The idea that neither line showed proportionality was more popular than that both showed proportionality.

04.3 77% of students recognised that both lines showed a positive correlation.

04.4 All four statements about graphite were true and 70% of students could pick out 'delocalised electrons' as the reason for graphite's electrical conductivity.

Answer 21 · Examiner comments

June 2018 | 8462/1F | Original Q4

04.5 Students found this question tough. Full marks were very rare, although 27% of students did achieve three marks.

Most suggested potassium, rather than hydrogen, would be a product from the electrolysis of potassium bromide solution. Partial credit was given for the correct products at the opposite electrodes. As a result many students achieved a mark for having zinc and chlorine the wrong way round.

4.2.2.6 Giant covalent structures

Answer 25 · Examiner comments June 2022 | 8462/1F | Original Q6

Question 6 (Low and standard demand)

06.1 Nearly two thirds of students could select the correct diagram to show graphite. The structures of the two fullerenes were popular distractors.

06.2 Fewer than half of students could identify **D** as representing poly(ethene). All three other diagrams were popular, with **B** attracting a quarter of the responses.

06.3 Although a diagram was provided, only just over a half of students gave 4 as their answer.

06.4 The great majority of students could identify that diamond is very hard.

06.5 Just over half of the students could count the atoms in the figure and then write the formula correctly. Many failed to gain credit because the numbers were not subscripts but the same size as the letters, or even larger.

06.6 Just over a third of students could demonstrate their knowledge and understanding of acids to choose the hydrogen ion, with the majority of students opting for the hydroxide ion.

06.7 Over a half of students got the correct answer. The most common error was to assume there were three atoms of carbon as well as oxygen, giving an answer of 86. Other common errors were to add 1, 12 and 16 together, or to multiply relative atomic masses together.

Answer 26 · Examiner comments June 2023 | 8462/1F | Original Q3

Question 3 (low and standard demand)

03.1 Three quarters of students recognised that carbon is an element. Most of the others thought carbon is a compound.

03.2 A third of students scored both marks, with another third scoring just one. Few students chose ions or molecules, but many could not select the correct sub-atomic particles for the correct space. Protons and neutrons were often seen the wrong way round.

03.3 A third of students gave the correct answer on this standard demand question. The most common incorrect response was the inverted expression.

03.4 Only a half of students recognised diagram B as buckminsterfullerene, with nearly as many selecting **C**, which was a diagram of a nanotube.

4.2.2.6 Giant covalent structures

Answer 26 · Examiner comments June 2023 | 8462/1F | Original Q3

03.5 The majority of students scored at least one mark. The role of the delocalised electrons in electrical conduction was well known. The lack of covalent bonds between layers causing the softness was less well known, with many opting for the hexagonal rings being the cause.

Answer 27 · Examiner comments June 2024 | 8462/1F | Original Q4

Question 4 (low and standard demand)

04.1 Fewer than one in eight students knew that a nanoparticle is only a few hundred atoms, despite this being clearly stated in the specification. The correct answer was a less popular option than all three distractors. The most popular answer was a few million atoms.

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Answer 27 · Examiner comments June 2024 | 8462/1F | Original Q4

04.2 Fewer than a third of students could apply their knowledge that transition metals make good catalysts and select iron as the most likely element. By far the most popular distractor was magnesium.

04.3 More than four fifths of students scored both marks. Nearly all students identified the use of titanium dioxide for sun creams, and most also identified silver for wound dressings. There was no apparent pattern to incorrect responses.

04.4 Two fifths of students scored all six marks, with well over four fifths scoring at least 1 mark. The most common error was in the surface area, where the answer was often given as 6 times the volume, ie 384 nm^3. Most students were able to cancel down their numbers to give the simplest whole number ratio and gained credit for doing so.

4.2.2.6 Giant covalent structures

Answer 28 · Examiner comments June 2024 | 8462/1F | Original Q5

Question 5 (low and standard demand)

05.1 Nearly four fifths of students identified the number of protons. 13 was the most common distractor.

05.1 Over a half of students identified the number of neutrons. 6 was the most common distractor.

05.1 Over a half of students identified the number of electrons. 13 was the most common distractor.

05.4 Nearly three fifths of students scored the mark. Although the vast majority counted 2 carbon and 6 fluorine atoms, many could not write the formula correctly, with numbers discernibly smaller than the letters.

05.5 Only about a third of students identified that only intermolecular forces are weak. The most popular response was that both covalent bonds and intermolecular forces are weak. The myth that covalent bonds are weak is a difficult one to dispel.

05.6 More than a half of students knew that Buckminsterfullerene is spherical. The most common distractor was cylindrical, with the students possibly thinking of nanotubes.

05.7 Just under three quarters of students identified the number of bonds formed by a carbon atom in graphite. The most common distractor was 4.

05.8 Students found this standard demand question difficult, with fewer than one in twenty scoring all three marks, although more than a half did score one mark. Many did not mention the giant structure, or did not state that each carbon atom forms 4 bonds (despite having counted the bonds per atom in graphite in the previous question). Many did mention covalent bonds but then contradicted themselves by referring to intermolecular forces; these are not present, so the type of bonding mark could not be awarded. Many students gave properties of diamond, which were not asked for and gained no credit.

4.2.2.6 Giant covalent structures

Answer 29 · Examiner comments

June 2025 | 8462/1F | Original Q9

Question 9 (standard demand)

09.1 Students found this very difficult, with only one in ten scoring the mark. Of those who knew they needed to count the ions of each element, few could then appreciate that the ratio was 1:1 so the formula was therefore CaS. Many just wrote the number of Ca atoms and of S atoms from the diagram.

09.2 Two fifths of students were able to score at least one mark, and one in eight scored all four. Many described electrons transferring from calcium to sulfur, and of those, most realised that 2 electrons would be transferred. Students were less able to gain the final marking point for a correct description of the ions formed. Some students contradicted an answer in terms of electron transfer by also referring to sharing electrons.

09.3 Students were unable to recall many details about the structure and bonding of graphite, even with the diagram as a prompt. Many did describe layers of carbon atoms, but few mentioned the giant structure or covalent bonding. Many focussed on the use of graphite in pencils, which was not relevant in the context of the question. Most responses did not mention the number of bonds per atom, or the delocalised electrons, or the lack of bonds between layers. The hexagonal rings, if mentioned at all, were not described well, with whole layers or even individual atoms being described as hexagonal. Fewer than a quarter of students scored a single mark and very few scored all four.

09.4 Only one in six students scored the mark, despite the clear statement in the specification that the molecules do not have an overall electrical charge. Those who did gain credit usually mentioned there being no delocalised electrons. 'Free' is not the same as delocalised in this context and did not gain credit. Popular incorrect responses were that the molecules are too small or that the molecules cannot move.

09.5 Only a third of students gave the correct reason, with stronger or more covalent bonds to break both being almost as popular.