AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.2.2.4

Properties of small molecules

Mark schemes and examiner comments

Tier	**Foundation**
Question groups	**19**
Available paper years	**2007–2025**

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.

4.2.2.4 Properties of small molecules

Answer 01 · Mark scheme January 2007 | CHY1F | Original Q5 | Legacy

Question 5

	answers	extra information	mark
(a)(i)	poly(ethene)	accept polythene	1
(ii)	cracking		1
(iii)	hydrogen		1
(b)(i)	bar labelled 9 bar drawn to correct height		1 1
(ii)	(boiling point) increases		1
(iii)	heat / evaporate (the crude oil) cool / condense (hydrocarbons at different temperatures)	accept separate by boiling point accept smaller molecules go to top / larger molecules stay at bottom accept fractional distillation for two marks **or** distillation / fractionation for **one** mark	1 1

Continued on next page

4.2.2.4 Properties of small molecules

Answer 01 · Mark scheme

	answers	extra information	mark
(c)	**yes** any **two** from: • because plastic does not biodegrade **or** running out of space for landfills **or** land cannot be used for a long time • it provides heat energy • which can be used to generate electricity / heat homes or greenhouses • any other advantage of burning • any other disadvantage of landfill **or** **no** • burning plastic produces carbon dioxide / carbon emissions / toxic gases • causes global warming / climate change / increase greenhouse effect / global dimming / acid rain • any other disadvantage of burning • any other advantage of landfill	accept landfill does not produce carbon dioxide / carbon emissions	2
total			10

4.2.2.4 Properties of small molecules

Answer 02 · Mark scheme

March 2007 | CHY1B | Original Q1 | Legacy

One	**A**	alkanes	**2**
	B	fuels	**1**
	C	monomers	**4**
	D	polymers	**3**

4.2.2.4 Properties of small molecules

Answer 03 · Mark scheme

Question 4

question	answers	extra information	mark
(a)(i)	monomers		1
(a)(ii)	crude oil		1
(b)	any **three** from: • metal may not corrode away / remains • plastic remains / does not break down (decay) / not affected by microorganisms • should recycle / conserve resources / mend the kettle / burn (plastic) as a fuel • landfill sites are limited / filling up • water pollution	accept non-biodegradable accept it is a waste of materials / resources ignore harms wildlife / habitats **or** problems caused by burning the kettle	3
total			5

4.2.2.4 Properties of small molecules

Answer 03 · Mark scheme January 2008 | CHY1F | Original Q4 | Legacy

CHY1F

Answer 04 · Mark scheme June 2008 | CHY1AP | Original Q9 | Legacy

Nine	**2**	**4**	**2**	**2**

Answer 05 · Mark scheme January 2010 | CHY2F | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1	the atoms are in layers the atoms can slide over each other		1 1
Total			**2**

Answer 06 · Mark scheme March 2011 | CHY1BP | Original Q9 | Legacy

Nine	**3**	**2**	**3**	**2**

Answer 07 · Mark scheme June 2011 | CHY1BP | Original Q4 | Legacy

Four	**A**	alkenes	**2**
	B	polymers	**3**
	C	monomers	**4**
	D	alkanes	**1**

4.2.2.4 Properties of small molecules

Answer 08 · Mark scheme June 2012 | CH2FP | Original Q1 | Legacy

Question 1

question	Answers	extra information	mark
1(a)	oxygen **and** water	both needed for mark allow hydrogen oxide for water in any order ignore formulae	1
1(b)(i)	best fit line, omitting point at 10s	straight line drawn through all correct points	1
1(b)(ii)	circle around point at 10 s	allow any indication	1
1(b)(iii)	7.5	allow ecf from candidate's line	1
1(b)(iv)	increases (with time)	accept goes from 0 to 12.5	1
1(c)(i)	higher		1
1(c)(ii)	more concentrated		1
1(d)(i)	share		1
1(d)(ii)	covalent		1
1(d)(iii)	simple molecules		1
1(e)	Water has a boiling point of 100°C Water has a melting point lower than room temperature		1 1
Total			**12**

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4.2.2.4 Properties of small molecules

Answer 08 · Mark scheme

June 2012 | CH2FP | Original Q1 | Legacy

CH2FP

4.2.2.4 Properties of small molecules

Answer 09 · Mark scheme

June 2014 | CH1FP | Original Q4 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
4(a)	hydrocarbons **or** hydrocarbon		1	1 / 1.4.1c	G
4(b)(i)	distillation		1	1 / 1.4.2b	G
4(b)(ii)	evaporation		1	2 / 1.4.2b	G
4(b)(iii)	condensation		1	2 / 1.4.2b	G
4(c)(i)	bond		1	1 / 1.4.2a	G
4(c)(ii)	$(C_6H)_{14}$		1	2 / 1.4.2a	G
4(c)(iii)	cracking		1	1 / 1.5.1a	G
4(d)(i)	poly(butene)	allow with or without brackets	1	1 / 1.5.2a	E
4(d)(ii)	Advantage=energy is released Disadvantage=carbon dioxide is produced	do **not** accept more than one tick in the advantage column do **not** accept more than one tick in the disadvantage column	1 1	3 / 1.5	G
Total			**10**		

4.2.2.4 Properties of small molecules

Answer 09 · Mark scheme

June 2014 | CH1FP | Original Q4 | Legacy



4.2.2.4 Properties of small molecules

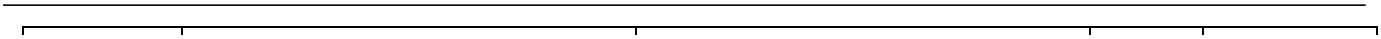
Answer 10 · Mark scheme June 2015 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	sharing/covalent/metallic = max 2			**AO1/AO2** 2.1.1b,c,d, e,f
	sodium loses (electron)		1	
	chlorine gains (electron)		1	
	1 **or** an (electron)		1	
2(b)(i)	Have no overall electric charge		1	**AO1** 2.2.1a,c
2(b)(ii)	Should iodine be added to salt?		1	**AO3** 2.2.1
	reason: any **one** from: • cannot be done by experiment	accept difficult to get / not enough evidence	1	
	• based on opinion / view	allow must be done by survey		
	• ethical **or** economic issue			
2(c)(i)	nitric (acid)		1	**AO1** 2.6.2b
2(c)(ii)	an alkali		1	**AO1** 2.6.2a
2(c)(iii)	indicator	accept any named acid base indicator	1	**AO1** 2.6.1b
2(d)(i)	Crystallisation		1	**AO1** 2.6.1c
2(d)(ii)	fertiliser	allow to help crops grow	1	**AO1** 2.6.2c
2(d)(iii)	any **one** from: • pressure	allow concentration	1	**AO1** 2.2.5a
	• temperature	ignore heat		
	• catalyst			
Total			**12**	

4.2.2.4 Properties of small molecules

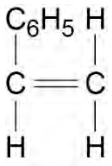
Answer 10 · Mark scheme

June 2015 | CH2FP | Original Q2 | Legacy



4.2.2.4 Properties of small molecules

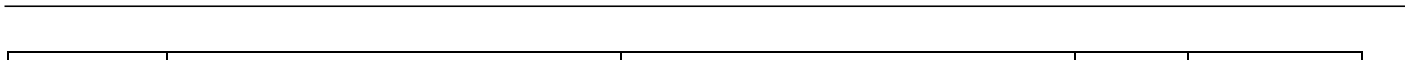
Answer 11 · Mark scheme June 2018 | 8462/2F | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1			1	AO2 4.7.3.1
06.2	polymerisation		1	AO2 4.7.3.1
06.3	monomers many polymers	must be in this order	1 1 1	AO1 4.7.3.1
06.4	**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.		3–4	AO3
	Level 1: Relevant features are identified and differences noted.		1–2	AO2
	No relevant content		0	
	Indicative content for coated paper cups – accept converse for poly(styrene) **advantages** • produced from a renewable resource • biodegradable so breaks down **disadvantages** • higher energy costs • greater use of fossil fuels and consequent pollution • not recyclable so uses landfill			4.10.1.1 4.10.2.1
Total			**9**	

4.2.2.4 Properties of small molecules

Answer 11 · Mark scheme

June 2018 | 8462/2F | Original Q6



4.2.2.4 Properties of small molecules

Answer 12 · Mark scheme

June 2019 | 8462/1F | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	contain delocalised electrons (so) electrons can move through the structure / nanotube	allow contain free electrons allow (so) electrons can carry charge through the structure / nanotube ignore throughout for through ignore current / electricity for charge	1 1	AO1 4.2.3.3

Question	Answers	Mark	AO / Spec. Ref.
10.2	**Level 2:** Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO3 4.2.3.3 4.2.2.7
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content • wood is the least dense so lightest to use • aluminium is the most dense so will make the racket too heavy • carbon nanotube is the strongest so least likely to break • wood / aluminium are too weak so the racket will break more easily • carbon nanotube is the stiffest so least likely to bend out of shape • wood / aluminium are not very stiff so could bend out of shape • justified conclusion		

Question 10 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.3		an answer of 4.0 x 10^4 (nm^2) scores **3** marks an answer of 40344 (nm^2) scores **2** marks		AO2 4.2.4.1
	(82^2 =) 6724 (nm^2)		1	
	(6 x 6724 =) 40344 (nm^2)	allow 40344 (nm^2) correctly rounded to any number of significant figures allow correct calculation using incorrectly calculated value of area of one face from step 1	1	
	= 4.0 x 10^4 (nm^2)	allow 4.0344 x 10^4 (nm^2) correctly rounded to 1 or more significant figures allow a correctly calculated and rounded conversion to standard form of an incorrect calculation of surface area	1	
10.4	any **one** from: • less can be used (for the same effect) • greater surface area (to volume ratio)	allow converse statements about fine particles ignore nanoparticles are smaller	1	AO3 4.2.4.2
Total			**10**	

4.2.2.4 Properties of small molecules

Answer 13 · Mark scheme

November 2020 | 8462/1F | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	gas		1	AO2 4.1.2.6 4.2.2.1
01.2	-35 (°C)	allow any value between -35 °C and -100 °C	1	AO2 4.1.2.6 4.2.2.1
01.3	increase increase	 allow become stronger	1 1	AO1 AO2 4.1.2.6 4.2.2.4
01.4	chlorine gas is toxic		1	AO3 4.1.2.6
01.5	increased chlorine (atoms) are now part of the solid (iron chloride) **or** the mass of the chlorine (atoms) is now also measured		1 1	AO2 4.1.2.6 4.3.1.3
01.6	burns very vigorously	allow burns violently allow brighter (orange) glow allow (orange) flame allow explodes	1	AO3 4.1.2.1 4.1.2.6

4.2.2.4 Properties of small molecules

Answer 13 · Mark scheme

November 2020 | 8462/1F | Original Q1

Question 1 continued

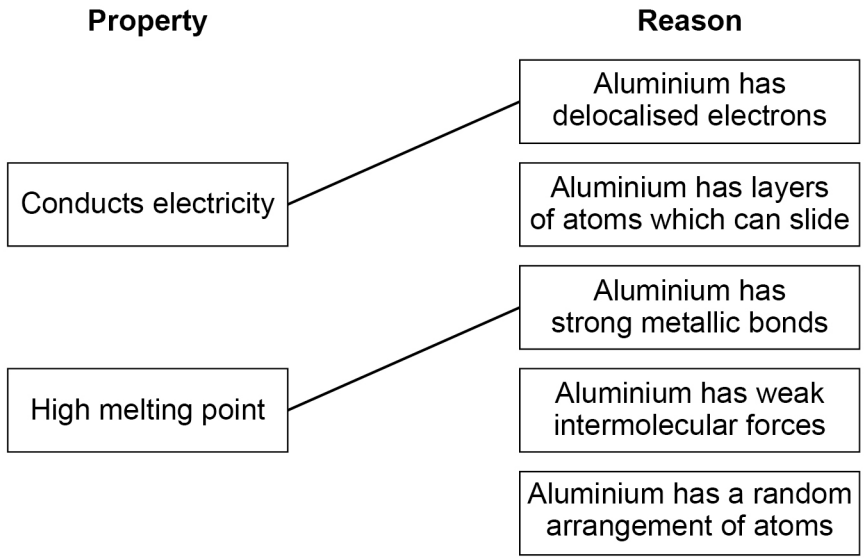
Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.7	$2\ Fe + 3\ Br_2 \longrightarrow 2\ FeBr_3$	allow multiples	1	AO2 4.1.1.1 4.1.2.6
01.8	56 + (3 × 80) = 296	 ignore units	1 1	AO2 4.3.1.2
Total			**11**	

4.2.2.4 Properties of small molecules

Answer 14 · Mark scheme

November 2020 | 8462/1F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	 additional line from a box on the left negates the mark from that box		1 1	AO1 4.2.1.5 4.2.2.7 4.2.2.8
05.2	a mixture of metals	allow a mixture of a metal with other elements	1	AO1 4.2.2.7
05.3	bauxite contains a variable percentage of aluminium	allow converse argument allow bauxite does not have a fixed proportion / percentage of aluminium	1	AO3 4.1.1.1
05.4	any **two** from: • danger of dam bursting • leakage of toxic substances from mud to environment • water pollution • damage to habitats • visual pollution • (dam) blocks light • reduces the value of houses	allow the lake (of mud) could overflow allow unpleasant smell	2	AO3 4.4.3.3

4.2.2.4 Properties of small molecules

Answer 14 · Mark scheme

November 2020 | 8462/1F | Original Q5

Question 5 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	10 / ten		1	AO2 4.1.1.1
05.6	to lower the melting point of the mixture		1	AO1 4.4.3.3
05.7	oxygen carbon	must be in this order	1 1	AO1 4.4.3.3
05.8	$\frac{25}{100}$ × 300 000 =75 000 (kg) = 7.5 ×10^4 (kg)	 allow correct conversion to standard form of an incorrectly calculated mass	1 1 1	AO2 4.4.3.3
Total			**13**	

4.2.2.4 Properties of small molecules

Answer 15 · Mark scheme

November 2020 | 8462/1F | Original Q8

Question 8

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

4.2.2.4 Properties of small molecules

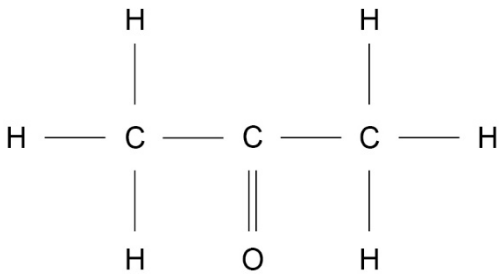
Answer 16 · Mark scheme

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**

4.2.2.4 Properties of small molecules

Answer 17 · Mark scheme

November 2021 | 8462/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	fuel		1	AO1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	propene		1	AO2 4.7.2.1 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	(percentage yield =) $\frac{380}{400} \times 100$ = 95 (%)		1 1	AO2 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	some ethanol changes back into ethene and steam some ethanol escapes from the apparatus		1 1	AO2 4.3.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	C_2H_5OH + **3** O_2 → 3 H_2O + 2 CO_2	allow multiples	1	AO2 4.1.1.1 4.3.1.1 4.7.2.3

4.2.2.4 Properties of small molecules

Question 7 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	(advantages) (fermentation) low energy usage (fermentation) uses renewable raw materials (disadvantages) (fermentation) produces impure ethanol (fermentation) slow rate of reaction		 1 1 1 1	AO3 4.7.2.2 4.7.2.3 4.10.1.1

Total			**11**

4.2.2.4 Properties of small molecules

Answer 18 · 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

4.2.2.4 Properties of small molecules

Answer 18 · 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**

4.2.2.4 Properties of small molecules

Answer 19 · 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	

Answer 19 · Mark scheme

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

4.2.2.4 Properties of small molecules

Answer 11 · Examiner comments

June 2018 | 8462/2F | Original Q6

Question 6 (low demand)

06.1 65% of students correctly identified the correct monomer.

06.2 79% of students correctly identified the correct process.

06.3 This question differentiated well, with a good spread of marks. 36% of students achieved full marks.

Answer 11 · Examiner comments

June 2018 | 8462/2F | Original Q6

06.4 This question required an ‘extended response’ and was marked holistically using a ‘levels’ mark scheme. The command word was ‘compare’. Lower-attaining students simply repeated the information in the question and gained no credit.

As a guideline, those who only identified the various properties as advantages and disadvantages were probably in level 1. 53% of responses moved beyond this into level 2, by explaining why. For example, that being made out of wood was an advantage because wood is renewable or that being non-recyclable was a disadvantage because it fills up landfill sites.

4.2.2.4 Properties of small molecules

Answer 12 · Examiner comments

June 2019 | 8462/1F | Original Q10

Question 10 (standard demand)

10.1 Approximately a third of students scored a mark for referring to the presence of delocalised electrons in carbon nanotubes.

Very few scored the mark for explaining the role of these electrons in the conduction of electricity.

10.2 Most students understood that they needed to compare the properties of the three materials. However, a few did not add value and just quoted data from the table, which is insufficient to be credited.

Approximately 45% of students achieved a Level 2 mark by giving a consequence of one of the stated differences in properties. Some gave a justified conclusion in referencing the most suitable material for a racket frame.

For some students, there was a misunderstanding that a high density was good because it made the racket strong, despite strength being one of the other properties given.

10.3 Almost a quarter of students scored full marks for this calculation. A similar proportion correctly calculated the surface area as 40344 nm^2 but did not score the mark for converting this answer to standard form.

Some students calculated the volume of the nanoparticle rather than the surface area.

Even if the answer to their calculation was incorrect, a mark could still be scored for correctly converting this answer to standard form, provided that an attempt to calculate the surface area had been made.

10.4 Students found it difficult to give a reason why it costs less to use nanoparticles in sun-cream with only approximately 10% scoring the mark.

4.2.2.4 Properties of small molecules

Answer 12 · Examiner comments June 2019 | 8462/1F | Original Q10

Common responses seen that were not credited included:

- nanoparticles are smaller
- nanoparticles are easier to make.

4.2.2.4 Properties of small molecules

Answer 12 · Examiner comments

June 2019 | 8462/1F | Original Q10

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.2.2.4 Properties of small molecules

Answer 18 · 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.

Answer 19 · Examiner comments

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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.