AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.10.3.3

Ceramics, polymers and composites

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**31**
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.

4.10.3.3 Ceramics, polymers and composites

Answer 01 · Mark scheme June 2007 | CHY1H | Original Q1 | Legacy

The full source mark scheme begins on page 36. Follow original question 1 in that document.

Answer 02 · Mark scheme November 2007 | CHY1B | Original Q6 | Legacy

Six	**4**	**2**	**3**	**4**

Answer 03 · Mark scheme January 2008 | CHY1H | Original Q2 | Legacy

No matching mark scheme was available in the supplied archive for this question.

Answer 04 · Mark scheme June 2008 | CHY1BP | Original Q3 | Legacy

Three	**1**	**1**	**4**	**1**

Answer 05 · Mark scheme June 2008 | CHY1BP | Original Q7 | Legacy

Seven	**4**	**4**	**1**	**3**

Answer 06 · Mark scheme June 2009 | CHY1BP | Original Q5 | Legacy

Five	**4**	**3**	**1**	**1**

4.10.3.3 Ceramics, polymers and composites

Answer 07 · Mark scheme June 2009 | CHY1H | Original Q1 | Legacy

Question 1

question	answers	extra information	mark
1(a)(i)	3 / three		1
1(a)(ii)	5 / five		1
1(b)	any **one** from: • less / no transport • less / no (fossil) fuel used	 accept less / no distance ignore references to carbon dioxide / carbon emissions	1
1(c)(i)	carbon dioxide / CO_2 (causes) global warming / climate change / greenhouse gas **or** (cement) particles / smoke (1) (causes) asthma / dust / (global) dimming (1) **or** sulfur dioxide / SO_2 / nitrogen oxides / NO_x (1) (causes) acid rain (1)	for a correct emission explanation must be correct for named emission ignore ozone layer accept breathing problems do **not** accept nitrogen or water vapour for emissions do **not** accept no named emission	1 1

Question 1 continues on the next page…

4.10.3.3 Ceramics, polymers and composites

CHY1H

Question 1 Continued

question	answers	extra information	mark
1(c)(ii)	absorb / trap / capture / filter / pass through water / scrub / electrostatic attraction	ignore condense / off setting / different fuel	1
Total			**6**

4.10.3.3 Ceramics, polymers and composites

Answer 07 · Mark scheme

June 2009 | CHY1H | Original Q1 | Legacy

CHY1H

4.10.3.3 Ceramics, polymers and composites

Answer 08 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)(i)	many ethene / molecules / monomers join to form a long hydrocarbon / chain / large molecule	accept double bonds open / break accept addition polymerisation ignore references to ethane correct equation gains **2** marks	1 1
6(a)(ii)	(can be deformed but) return to their original shape (when heated or cooled)	ignore 'it remembers its shape'	1
6(a)(iii)	cross links / extra bonds in PEX molecules / chains in PEX are held in position molecules / chains in PEX unable to slide past each other / move	it = PEX throughout accept inter-molecular bonds ignore inter-molecular forces accept rigid structure	1 1 1

Question 6 continues on the next page…

CHY1H

Question 6 Continued

question	answers	extra information	mark
6(b)	any **four** from: • less (hydrocarbon) fuels used • less / no electrical energy used • reduce carbon / carbon dioxide emissions • reduce / no pollution by sulfur dioxide / acid rain • continuous process • conserve copper which is running out or only low-grade ores available • reduce the amount of solid waste rock that needs to be disposed • reduce the need to dig large holes (to extract copper ores)	ignore costs / sustainability / non-renewable allow less energy allow no electrolysis allow less global warming allow less / no transportation allow less waste allow less mining	4
Total			**10**

4.10.3.3 Ceramics, polymers and composites

Answer 09 · Mark scheme March 2010 | CHY1AP | Original Q7 | Legacy

Seven	3	2	2	2

Answer 10 · Mark scheme March 2010 | CHY1BP | Original Q5 | Legacy

Five	2	3	3	2

Answer 11 · Mark scheme June 2010 | CHY1BP | Original Q3 | Legacy

Three	2	3	1	2

Answer 12 · Mark scheme November 2010 | CHY1BP | Original Q4 | Legacy

Four	3	2	4	3

Answer 13 · Mark scheme November 2010 | CHY1BP | Original Q7 | Legacy

Seven	3	1	4	2

Answer 14 · Mark scheme March 2011 | CHY1BP | Original Q4 | Legacy

Four	3	2	3	2

Answer 15 · Mark scheme June 2011 | CHY1BP | Original Q8 | Legacy

Eight	1	4	2	3

Answer 16 · Mark scheme November 2011 | CHY1AP | Original Q5 | Legacy

Five	4	2	2	2

Answer 17 · Mark scheme November 2011 | CHY1BP | Original Q5 | Legacy

Five	1	4	1	4

4.10.3.3 Ceramics, polymers and composites

Answer 18 · Mark scheme

June 2012 | CH1HP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)(i)	water	accept hydrogen oxide allow H_2O	1
5(a)(ii)	carbon dioxide	allow CO_2 accept any soluble carbonate **or** carbonic acid	1
5(b)(i)	$CaCO_3$ + **2** HCl → $CaCl_2$ + CO_2 + H_2O		1
5(b)(ii)	because sulfur reacts with oxygen / air to produce sulfur dioxide **or** sulfur burns to produce sulfur dioxide and (sulfur dioxide) causes acid rain that reacts with/erodes limestone/calcium carbonate	accept correct equation ignore wears away	1 1
5(c)(i)	 because carbon dioxide is produced from burning methane because carbon dioxide is produced from decomposing calcium carbonate/limestone	it = carbon dioxide ignore references to carbon dioxide is in the air accept correct equation accept correct equation do **not** accept carbon in calcium carbonate reacting with air	 1 1
5(c)(ii)	nitrogen this is the main gas / 75 – 80% / of air	 allow there is a lot of this gas in air	1 1
Total			**9**

4.10.3.3 Ceramics, polymers and composites

Answer 18 · Mark scheme

June 2012 | CH1HP | Original Q5 | Legacy

CH1HP

4.10.3.3 Ceramics, polymers and composites

Answer 19 · Mark scheme

January 2013 | CH2HP | Original Q4 | Legacy

question	answers	extra information	mark
4(a)	it is not used up	accept does not change accept reusable allow does not react	1
4(b)	they would melt **or** they have a low melting point	allow would lose their shape ignore soften	1
	because there are no cross links **or** there are weak intermolecular forces	accept there are weak bonds / forces between (polymer) chains	1
4(c)(i)		ignore reference to mass spectroscopy do **not** accept other incorrect process described	
	substances carried by gas	allow named gas	1
	(through) column / coil / tube **or** (through) solid (material) / powder		1
	at different speeds	accept different retention times	1
4(c)(ii)	(relative) molecular mass / M_r	allow (relative) formula mass **or** relative mass ignore relative atomic mass ignore identity of substance / molecule	1
Total			**7**

4.10.3.3 Ceramics, polymers and composites

Answer 19 · Mark scheme

January 2013

CH2HP

4.10.3.3 Ceramics, polymers and composites

Answer 20 · Mark scheme

June 2013 | CH1HP | Original Q5 | Legacy

Question 5

question	Answers	extra information	Mark
5(a)(i)	H_2O	must be formula	1
	CaO	must be formula	1
5(a)(ii)		it = carbon (dioxide)	
	carbon dioxide from the air / (Earth's early) atmosphere	accept carbon dioxide from millions of years ago	1
	formed (sedimentary) rocks **or** fossil fuels	ignore trapped / stored	1
5(b)(i)		it = carbon (dioxide)	
	decreases rapidly at first		1
	then slowly **or** levels off		1
		allow both marks if the description is correct using either 'rapidly' **or** 'slowly'	
		allow correct use of figures for either marking point	
		if no other mark awarded, allow CO_2 decreased for **1** mark	
5(b)(ii)	any **two** from: • used by plants • dissolved in oceans • 'locked up' in fossil fuels **or** formed fossil fuels • 'locked up' in rocks **or** formed rocks	it = carbon (dioxide) accept photosynthesis	2

Question 5 continues on the next page

Question 5 continued

question	Answers	extra information	Mark
5(c)		it = percentage of carbon (dioxide)	
	(yes)	ignore yes or no	
	because the percentage of carbon dioxide is increasing		1
	which causes global warming (to increase)	allow (carbon dioxide) causes greenhouse effect/climate change	1
	or		
	(no)		
	because the percentage of carbon dioxide is low (1)		
	compared to millions of years ago (1)	allow global warming can be caused by other factors (e.g. Sun / water vapour / methane)	
Total			**10**

4.10.3.3 Ceramics, polymers and composites

Answer 21 · Mark scheme

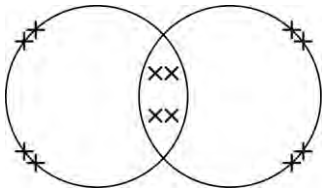
June 2013 | CH2HP | Original Q5 | Legacy

Question 5

question	Answers	extra information	Mark
5(a)	because atoms / ions / particles in alloy are different (sizes)	do **not** allow reference to molecules ignore reference to compounds	1
	so layers distorted		1
	(and layers / atoms / ions / particles) don't slide **or** slide less easily	accept all marking points in a suitably labelled or annotated diagram if no other mark awarded accept an alloy is a mixture **or** contains different metals / elements for **1** mark	1
5(b)		max **3** marks if incorrect bonding	
	giant structure **or** lattice **or** macromolecule		1
	strong bonds (between carbon / atoms)		1
	covalent (bonds)		1
	each carbon / atom forms 4 bonds	accept tetrahedral if no other marks awarded, allow carbon (atoms) for **1** mark	1
5(c)		reference to incorrect bonding = max **3** reference to 'weak covalent bonds' = max **2** allow correctly drawn diagram for first two marking points eg. (tangled) lines with no cross-links	
	chains **or** large molecules	ignore layers	1
	with intermolecular forces **or** forces between chains	allow bonds for forces accept no cross-links	1
	that are weak	must relate to 2nd marking point	1
	and are easily overcome/ broken (when heated)	accept molecules / chains can flow / move	1
Total			**11**

4.10.3.3 Ceramics, polymers and composites

Answer 22 · Mark scheme June 2014 | CH2HP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
7(a)	*weaker bonds* ***or*** *fewer bonds* ***or*** *disruption to lattice*	*allow (other substances) react with the silicon dioxide* *ignore weaker / fewer forces* *do **not** accept reference to intermolecular forces / bonds*	1	2 / 2.2.3a	E
7(b)(i)	Na_2O	*do **not** accept brackets or charges in the formula*	1	2 / 2.1	E
7(b)(ii)	 2 bonding pairs 2 lone pairs on each oxygen	*electrons can be shown as dots, crosses, e or any combination* *accept 4 electrons within the overlap* *accept 4 non-bonding electrons on each oxygen*	 1 1	1 / 2.1	E
7(c)	*lattice / regular pattern / layers / giant structure / close-packed arrangement* (of) positive ions **or** (of) atoms (with) delocalised / free electrons	reference to incorrect particles **or** incorrect bonding **or** incorrect structure = max **2**	 1 1 1	1 / 2.1.1h/i	E
Total			**7**		

4.10.3.3 Ceramics, polymers and composites

Answer 23 · Mark scheme

June 2015 | CH1HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	(calcium) carbonate	ignore $CaCO_3$	1	1 / 1.2.1a
2(a)(ii)	(thermal) decomposition		1	1 / 1.2.1b
2(a)(iii)	water	allow H_2O allow hydrogen oxide	1	1 / 1.2.1d
2(a)(iv)	alkali	allow base	1	1 / 1.2.1d
2(b)(i)	straight line through the first, second and fourth points straight line through the last four points	 allow a straight line through the last three points if the first straight line extrapolates below point four	1 1	2+3 / 1.2.1g
2(b)(ii)	repeat the experiment (at each mass of aggregate) (use the results to) calculate a mean/average value (for each mass of aggregate)	do not allow repeat at other masses	1 1	3 / 1.2.1g

4.10.3.3 Ceramics, polymers and composites

Answer 23 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(b)(iii)	line drawn to y axis showing extrapolation		1	2+3 / 1.2.1g
	correct value read from graph	allow +/- one small square do not allow 0 award 1 mark for a value of 34-40 if no extrapolation shown	1	
2(b)(iv)	at first, the force needed to break a concrete beam increases	allow values allow at first the statement is correct	1	3 / 1.2.1g
	but the force needed to break a concrete beam then decreases	allow values	1	
	mention of 400 g as the point at which the force needed changes or value from graph	allow 400g if there is no intercept on graph	1	
Total			**13**	

4.10.3.3 Ceramics, polymers and composites

Answer 23 · Mark scheme

June 2015 | CH1HP | Original Q2 | Legacy



Answer 24 · Mark scheme

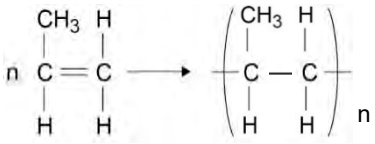
June 2017 | CH2HP | Original Q2 | Legacy

The full source mark scheme begins on page 49. Follow original question 2 in that document.

4.10.3.3 Ceramics, polymers and composites

Answer 25 · Mark scheme

June 2018 | 8462/2H | Original Q6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	water	allow H_2O allow hydrogen chloride **or** HCl	1	AO1 4.7.3.2
06.2		an answer of  scores **3** marks		AO2 4.7.3.1
	single C–C bond and nothing added to the trailing bonds		1	
	3 × H and CH_3 correct	must be four single bonds	1	
	n at bottom right		1	
		must be fully correct to score all **3** marks		
06.3	any **two** from: • poly(propene) comes from a non-renewable source • poly(propene) requires a lot of energy to make • poly(propene) is not biodegradable • a wool carpet needs replacing more often • wool requires the use of large areas of land (which could be used to grow food crops)	allow converse arguments allow poly(propene) will run out must refer to the carpet, not just the fibre ignore references to cost ignore pollution ignore landfill	2	AO3 4.10.1.1

4.10.3.3 Ceramics, polymers and composites

Answer 25 · Mark scheme

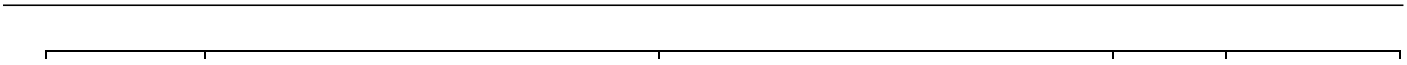
June 2018 | 8462/2H | Original Q6

Question	Answers	Extra information	Mark	AO/ Spec. Ref.
06.4	any **four** from: advantages of polyester • better flame resistance (so burns less easily) • higher melting point (so melts less easily) • absorbs water so less likely to ignite disadvantages of polyester: • high density so uniform is heavy • absorbs water so firefighter gets wet • absorbs water so uniform becomes heavy • justified conclusion	allow converse arguments throughout. **max 3** marks if only advantages or only disadvantages of one type of fibre allow good flame resistance so protects the firefighter allow high melting point so uniform is not damaged	4	AO3 4.7.3.1 4.7.3.2
Total			**10**	

4.10.3.3 Ceramics, polymers and composites

Answer 25 · Mark scheme

June 2018 | 8462/2H | Original Q6

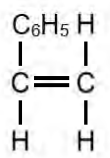


4.10.3.3 Ceramics, polymers and composites

Answer 26 · Mark scheme

June 2019 | 8462/2H | Original Q6

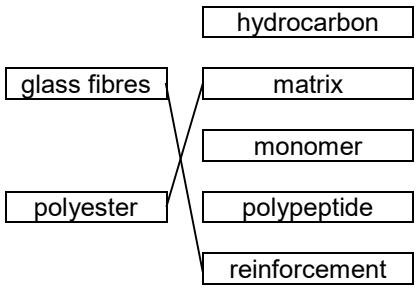
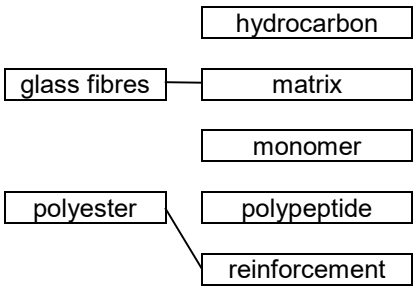
Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	C=C bond in correct position 3× C-H **and** 1× C-C bond in correct positions	 do **not** accept any additional bonds or atoms ignore brackets and n before and after displayed structural formula an answer of  scores **2** marks	1 1	AO2 4.7.3.1
06.2	carboxylic acid (group)	allow carboxyl (group)	1	AO1 4.7.2.4
06.3	water	allow H_2O	1	AO1 4.7.3.2
06.4	(polyester is) thermosoftening (polyester has) no cross-links	allow (polyester is) thermoplastic ignore thermoforming allow intermolecular forces are weak do **not** accept references to breaking covalent bonds or breaking chains	1 1	AO1 AO3 4.10.3.3

4.10.3.3 Ceramics, polymers and composites

Answer 26 · Mark scheme

June 2019 | 8462/2H | Original Q6

06.5		allow for **1** mark: 	1 1	AO3 4.10.3.3
06.6	any **two** from: (to make the board) • harder • stronger • tougher • more rigid • waterproof	must be implied comparative statements	2	AO3 4.10.3.3
Total			**10**	

4.10.3.3 Ceramics, polymers and composites

Answer 27 · Mark scheme

November 2020 | 8462/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	any **two** from: energy used in: • extraction of raw materials • processing raw materials • manufacturing • transportation • cleaning non-disposable plates • disposal • recycling	allow energy used to make food plate materials	2	AO3 4.10.2.1

Question 5 (continued)

Question	Answers	Mark	AO/ Spec. Ref
05.2	**Level 2:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO3 4.10.1.1 4.10.2.1 4.10.2.2
	Level 1: Some logically linked reasons are given. There may also be a simple judgement.	1–2	
	No relevant content	0	
	Indicative content **Raw materials** • Trees are renewable • Crude oil and clay are finite **Manufacturing and packaging** • Paper plates use the least packaging so conserve raw materials • Paper plates need less transportation overall as more plates in a 10 dm^3 cardboard box **Use and operation** • Paper plates are single use so must be replaced most often • Ceramic plates last longer than polymer plates so must be replaced less often **Disposal** • Polymer / ceramic plates take up landfill which is running out • Paper / polymer plates can be used to make new products • Recycling conserves raw materials **Reasoned judgement**		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(wet) clay is shaped		1	AO1 4.10.3.3
	(and) heated in a furnace	allow (and) heated in a kiln / oven allow (and) fired	1	

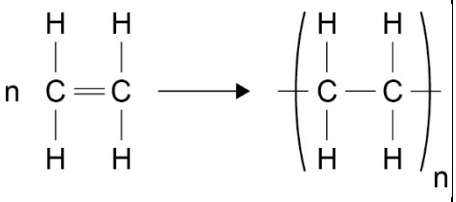
Total			8

4.10.3.3 Ceramics, polymers and composites

Answer 28 · Mark scheme

November 2021 | 8462/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1		if equation incorrect allow **1** mark for 5 single bonds **or** allow **1** mark for n	2	AO1 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2		allow converse statements about thermosetting polymers		
	(poly(ethene)) melts	allow thermosoftening polymers melt	1	AO1
	(so) can be reshaped (into new products)		1	AO3 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	use different (reaction) conditions	allow use different temperatures / pressures	1	AO1 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4		allow converse statements about LDPE		AO3 4.10.3.3
	(in HDPE) polymer chains / molecules are closer together	allow (HDPE has) unbranched polymer chains / molecules	1	
	(so) more atoms per unit volume	allow (so) more molecules per unit volume	1	

Question 4 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	circle around HO– **or** –OH on monomer **A**		1	AO2 4.7.2.3 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	H_2O **and** HCl	must be in this order	1	AO3 4.7.3.2

Total			9

4.10.3.3 Ceramics, polymers and composites

Answer 29 · Mark scheme

June 2024 | 8462/2H | Original Q6

Question 6

Question	Answers	Mark	AO / Spec. Ref.
06.1	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 4.10.2.1 4.10.3.2
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content • bamboo is renewable • aluminium is a finite resource • growing bamboo uses up agricultural land • mining aluminium ore is a polluting activity • cost of aluminium alloy is lower • (so) can be replaced more frequently • aluminium alloy is stronger • (so) can withstand larger forces • aluminium alloy has lower mass • (so) bicycle is faster • (so) is easier to carry / transport • the aluminium alloy frame lasts less long • (so) bicycle must be replaced more frequently • aluminium alloy is recyclable (so) aluminium ores are conserved • bamboo can provide renewable heat energy • (so) less overall contribution to global warming • (and) is carbon neutral • neither material may reach landfill • both materials have a sustainable disposal method **Reasoned judgment**		

4.10.3.3 Ceramics, polymers and composites

Answer 29 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	aluminium (alloy) has an oxide coating (so) contact between aluminium (alloy) and water / air / oxygen is prevented	 do **not** accept sacrificial protection	1 1	AO1 4.10.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3	(coating with) grease	allow (coating with) oil allow galvanise allow use stainless steel as the alloy	1	AO2 4.10.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	(carbon fibre) reinforcement (polymer resin) matrix / binder	allow reinforces the polymer / resin ignore (carbon) fibres allow binds the fibres / fragments ignore (polymer) resin	1 1	AO2 4.10.3.3

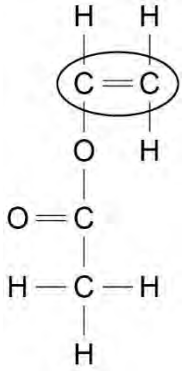
Total Question 6	11

4.10.3.3 Ceramics, polymers and composites

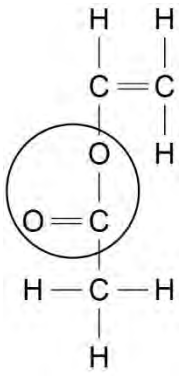
Answer 30 · Mark scheme

June 2024 | 8462/2H | Original Q8

Question 8

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1			1	AO2 4.7.2.1

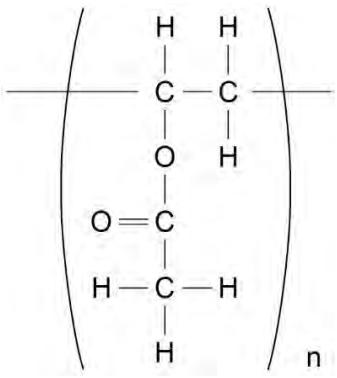
Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.2	orange (bromine water) turns colourless	allow yellow / brown allow is decolourised ignore clear	1 1	AO2 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.3			1	AO3 4.7.2.4 4.7.3.2

4.10.3.3 Ceramics, polymers and composites

Answer 30 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.4	$2\ C_4H_6O_2 + 9\ O_2 \rightarrow 8\ CO_2 + 6\ H_2O$	allow multiples allow **1** mark for $C_4H_6O_2 + O_2 \rightarrow$ with incorrect / no multipliers allow **1** mark for $\rightarrow CO_2 + H_2O$ with incorrect / no multipliers ignore state symbols	3	AO2 4.7.2.1 4.1.1.1 4.3.1.1 4.7.2.1 4.7.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.5	single C-C bond in polymer repeating unit n after polymer repeating unit	do **not** accept extra atoms added to trailing bonds an answer of  scores **2** marks	1 1	AO2 4.7.3.1

4.10.3.3 Ceramics, polymers and composites

Answer 30 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.6	addition polymer		1	AO2 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.7	thermosoftening	allow thermoplastic	1	AO1 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.8	cross-links between (polymer) chains (so) too much energy needed to overcome the cross-links	allow covalent bonds between (polymer) chains allow (so) too much energy needed to overcome the covalent bonds between (polymer) chains	1 1	AO1 4.2.2.5 4.10.3.3

Total Question 8	13

Answer 31 · Mark scheme

June 2025 | 8462/2H | Original Q7

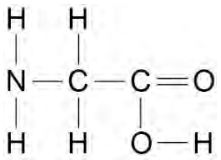
Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	(**A**) ethanediol (**B**) hexanedioic acid		1 1	AO1 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	polyester		1	AO1 4.7.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	water	allow H_2O	1	AO1 4.7.3.2

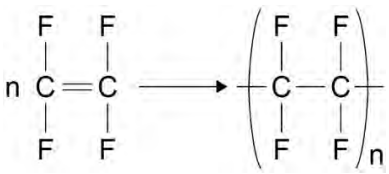
Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	polypeptide	allow polyamide ignore protein	1	AO1 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5			1	AO2 4.7.2.4 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6	protein		1	AO1 4.7.3.3

4.10.3.3 Ceramics, polymers and composites

Answer 31 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.7	4 × C-F **and** 1 × C-C bonds		1	AO2 4.7.3.1
	2 × single bonds extending through brackets		1	
	n after polymer repeating unit		1	
		an answer of  scores **3** marks		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.8	long chain molecules	allow long chains of monomers	1	AO1 4.10.3.3
	with covalent bonds between the chains	allow with cross links between the chains ignore intermolecular forces	1	

Total Question 7	12

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Mark Scheme

2007 examination - June series

4.10.3.3 Ceramics, polymers and composites

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' 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.

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Dr Michael Cresswell, Director General.

4.10.3.3 Ceramics, polymers and composites

MARK SCHEME

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 and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded.

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

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 lines 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.)

3. Marking points

3.1 Marking of lists

This applies to questions requiring a set number of responses, but for which candidates 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.

4.10.3.3 Ceramics, polymers and composites

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

Candidate	Response	Marks awarded
1	4,8	0
2	green, 5	0
3	red*, 5	1
4	red*, 8	0

Example 2: Name two planets in the solar system. (2 marks)

Candidate	Response	Marks awarded
1	Pluto, Mars, Moon	1
2	Pluto, Sun, Mars, Moon	0

3.2 Use of chemical symbols / formulae

If a candidate 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

Full marks can be given for a correct numerical answer, as shown in the column 'answers', without any working shown.

However if the answer is incorrect, mark(s) can be gained by correct substitution / working and this is shown in the 'extra information' column;

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 are 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 e.c.f. 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 Unexpected Correct Answers not in the Mark Scheme

The Examiner should use professional judgement to award credit where a candidate has given an unexpected correct answer which is not covered by the mark scheme. The Examiner should consult with the Team Leader to confirm the judgement. The Team Leader should pass this answer on to the Principal Examiner with a view to informing all examiners.

4.10.3.3 Ceramics, polymers and composites

CHY1H Question 1

	answers	extra information	mark
(a)	any **two** from: • nitrogen • carbon dioxide • water (vapour) / steam	 accept formulae N / N_2 accept formula CO_2 ignore CO accept formula H_2O	2
(b)	any **three** from: <u>limestone</u> • abundant / local • natural material **or** no 'processing' needed • relatively easy to cut • appearance better <u>concrete</u> • <u>raw materials</u> are abundant • can be reinforced (by steel rods) / strong(er) / supported (by steel rods) • concrete mixture can be poured / moulded / constructed on site • less reactive with acid rain / weathering / erosion	no mark for 'limestone' or 'concrete' on first line – mark advantages only ignore ideas of speed of production or easier to use accept 'can build higher' ignore density / extraction / quarrying / pollution / cost	3
total			5

4.10.3.3 Ceramics, polymers and composites

CHY1H Question 2

	answers	extra information	mark
(a)(i)	$Cu_2S + 2O_2 \rightarrow 2CuO + SO_2$	accept fractions and multiples	1
(ii)	any **two** from: • sulfur dioxide • causes acid rain • consequence of acid rain eg kills fish / plants	 accept sulphur dioxide / sulphur oxide / SO_2 ignore other comments eg global warming / ozone / global dimming / greenhouse effect	2
(b)	any **two** from: • heat (copper oxide with carbon) • oxygen is removed by carbon **or** carbon monoxide / carbon dioxide is produced **or** carbon displaces copper • because carbon is more reactive than copper	 accept copper (oxide) loses oxygen **or** carbon gains oxygen accept carbon oxide accept a correct word or balanced symbol equation allow a correct comparison of reactivity	2
(c)(i)	electrolysis	accept electroplating	1
(ii)	(electrical) wiring / appliances / coins / pipes / cladding for buildings / jewellery / making alloys **or** named alloys		1

Continued on next page

4.10.3.3 Ceramics, polymers and composites

Question 2 continued

	answers	extra information	mark
(d)	any **three** explanations from: <u>for recycling</u> • less acid rain (pollution) • copper reserves last longer / conserved **or** do not run out • energy for extraction (saved) **or** less energy required • less mining / quarrying • less waste (copper) / electrical appliances dumped **or** less landfill <u>against recycling</u> • collection problems • transport problems • difficult to separate copper from appliances • energy used to melt the collected copper	ignore electrolysis / pollution ignore ideas about less machinery / plant ignore idea of cost	3
total			10

4.10.3.3 Ceramics, polymers and composites

CHY1H Question 3

	answers	extra information	mark
(a)(i)	core		1
(ii)	plate (boundaries)	accept parts of the crust ignore crust alone	1
	sudden movement / colliding **or** normally move a few centimetres per year	accept movement but ignore movement apart accept continental drift	1
	convection currents / driven by heat from radioactive processes / decay	idea of source of energy for the movement	1
	the idea of uncertainty with an explanation eg scientists do not know (with any certainty) • what happens under the crust • where the forces / pressure are building up • we cannot measure the forces • when the forces reach their limit	ignore references to volcanoes	1
(b)(i)	78		1

Continued on next page

4.10.3.3 Ceramics, polymers and composites

Question 3 continued

	answers	extra information	mark
(ii)	marks awarded for any 2 gases from the following 3 gases	max **3** marks from CO_2	
	any **four** from: carbon dioxide has decreased: • used by plants / bacteria (stromatolites) • during photosynthesis (must be linked to CO_2 decrease) • 'locked up' in (sedimentary) rocks / carbonates / fossil fuels • dissolved in oceans **and / or** oxygen has increased because: • released by plants / bacteria (stromatolites) • during photosynthesis (must be linked to O_2 increase) **and / or** nitrogen has increased because • ammonia reacted with oxygen (to release nitrogen) • nitrogen is released by bacteria	ignore references to respiration	4
total			10

4.10.3.3 Ceramics, polymers and composites

CHY1H Question 4

	answers	extra information	mark
(a)	permitted additive / (added) chemicals **or** names / types of additives	accept the chemical name ignore food additive alone	1
(b)(i)	water and oil do not mix / are immiscible **or** don't dissolve each other	ignore density ignore emulsifier alone	1
(ii)	any **two** from: • emulsifier • forms an emulsion • holds the two components together • by lowering the surface tension	 accept description of an emulsion accept stops them separating / they mix allow bonds / binds for holds accept a description of how an emulsifier works for **two** marks eg 'tadpole' diagram or dispersal of oil drops	2
(c)(i)	(because they contain) a double (carbon carbon) bond	accept unsaturated ignore poly or mono	1
(ii)	results suggest sunflower oil is best **or** 'the one that took the least time' because (sunflower oil) has the highest amount of unsaturation / most double bonds / least saturated	 ignore uses up I_2 most quickly second mark is dependent on first	1 1

Continued on next page

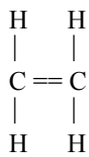
4.10.3.3 Ceramics, polymers and composites

Question 4 continued

	answers	extra information	mark
(d)(i)	any **one** from: • have a higher melting point than (vegetable) oil • are solid at (room temperature) / hardened / harder	 accept useful as spreads **or** doesn't soak into bread ignore hard / soft(er)	1
(ii)	any **two** from: • hydrogen added • to carbon carbon double bond / to saturate • (nickel) catalyst / temperature 60 - 150°C	 do **not** accept 'water' wrong catalyst doesn't get this mark ignore high / warm temperature	2
total			10

4.10.3.3 Ceramics, polymers and composites

CHY1H Question 5

	answers	extra information	mark
(a)(i)	by (fractional) distillation **or** fractionation	accept a description of the distillation process (heat and how separation works) eg heat **and** condense accept boil / vapourise etc for heat	1
(ii)	CO_2 H_2O	note the order of these products must be correct wrong way round = **1** mark	1 1
(b)(i)	(hexane) has been broken down (into smaller hydrocarbons / molecules)	accept (thermal) decomposition / cracked / split / broken up owtte	1
(ii)		accept $CH_2=CH_2$	1
(iii)	water / hydrogen oxide / steam	accept H_2O	1

Continued on next page

4.10.3.3 Ceramics, polymers and composites

Question 5 continued

	answers	extra information	mark
(c)	candidates must include both sugar cane and crude oil in their evaluation **and** both an advantage and a disadvantage to gain full marks. if they do not then the maximum mark is three any **four** from: <u>advantages of using sugar</u> • country has no wealth to buy (large quantities of) crude oil • country has limited technological development **or** underdeveloped / third world country • able / suitable climate to grow sugar cane • enough land to grow sugar cane / land cannot be used to grow food / deforestation • sugar is a renewable source **or** crude oil is a non-renewable resource / finite resource / limited resources • CO_2 / carbon neutral <u>advantages of using alkanes:</u> • economic costs are low • continuous process • country has large oil resources • country has oil refineries / cracking plants • very pure product • faster process	not 'expensive' alone	4
total			10

4.10.3.3 Ceramics, polymers and composites

GCSE

Additional Science / Chemistry

CH2HP
Final Mark scheme

4408 / 4402
June 2017

Version/Stage: v1.0

4.10.3.3 Ceramics, polymers and composites

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

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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 and help to delineate what is acceptable or not worthy of credit or, in discursive answers, to give an overview of the area in which a mark or marks may be awarded
- 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	Pluto, Mars, Moon	1
2	Pluto, 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

Full marks can be given for a correct numerical answer, without any working shown. However, if the answer is incorrect, mark(s) can be gained by correct substitution/working and this is shown in the 'extra information' column or by each stage of a longer calculation.

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 are 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 Accept/allow

Accept is used to indicate an equivalent answer to that given on the left-hand side of the mark scheme. Allow is used to denote lower-level responses that just gain credit.

3.9 Ignore/Insufficient/Do not allow

Ignore or insufficient is used when the information given is irrelevant to the question or not enough to gain a marking point. Any further correct amplification could gain the marking point.
Do **not** allow means that this is a wrong answer which, even if the correct answer is given, will still mean that the mark is not awarded.

4 Quality of Written Communication and levels marking

In Question 2 students are required to produce extended written material in English, and will be assessed on the quality of their written communication as well as the standard of the scientific response.

Students will be required to:
- use good English
- organise information clearly
- use specialist vocabulary where appropriate.

The following general criteria should be used to assign marks to a level:

Level 1: Basic

- Knowledge of basic information.
- Simple understanding.
- The answer is poorly organised, with almost no specialist terms and their use demonstrating a general lack of understanding of their meaning, little or no detail.
- The spelling, punctuation and grammar are very weak.

Level 2: Clear

- Knowledge of accurate information.
- Clear understanding.
- The answer has some structure and organisation, use of specialist terms has been attempted but not always accurately, some detail is given.
- There is reasonable accuracy in spelling, punctuation and grammar, although there may still be some errors.

Level 3: Detailed

- Knowledge of accurate information appropriately contextualised.
- Detailed understanding, supported by relevant evidence and examples.
- Answer is coherent and in an organised, logical sequence, containing a wide range of appropriate or relevant specialist terms used accurately.
- The answer shows almost faultless spelling, punctuation and grammar.

4.10.3.3 Ceramics, polymers and composites

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1(a)(i)	a smooth curve through or close to all points except (30,12)		1	AO2 2.4
1(a)(ii)	correct reading from the curve in 1(a)(i) (cm^3)	allow a tolerance of +/- 0.5 cm^3	1	AO2 2.4
1(a)(iii)	45-50 (seconds)		1	AO3 2.4
1(a)(iv)	line becomes less steep because gas is produced more slowly	ignore line levels out or plateaus allow examples with figures, eg 12 cm^3 gas from 0 to 20s but 1.5 cm^3 gas in last 20s ignore reaction has stopped or no more gas produced	1 1	AO3 2.4
1(a)(v)	0.6 (cm^3 per second)	allow 0.55 to 0.65	1	AO2 2.4
1(b)(i)	 temperature volume (of hydrogen peroxide)	concentration of hydrogen peroxide = max **1** ignore amount (of hydrogen peroxide)	 1 1	AO3 2.4
1(b)(ii)	 rate increases because more particles (in the same volume) so frequency of collisions increases	incorrect reference to energy = max **2** accept particles closer together allow greater chance of collisions ignore more collisions	 1 1 1	AO1 2.4.1e

4.10.3.3 Ceramics, polymers and composites

1(c)	(increasing the amount of catalyst) increases rate same final volume of gas	accept steeper graph or graph levels off earlier	1 1	**AO2** 2.4.1g
Total			**13**	

4.10.3.3 Ceramics, polymers and composites

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>2</td><td></td><td></td><td>6</td><td rowspan="6">AO1
2.1.1h
2.2.4b,c
2.2.5a,b</td></tr>
<tr><td colspan="4">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 and apply a ‘best-fit’ approach to the marking.</td></tr>
<tr><td colspan="4"><table>
<tr><th>0 marks</th><th>Level 1
(1–2 marks)</th><th>Level 2
(3–4 marks)</th><th>Level 3
(5–6 marks)</th></tr>
<tr><td>no relevant information given</td><td>a statement about the structure or a property of a metal
or
a statement about the structure or a property of a polymer</td><td>a statement about the structure or a property of a metal
and
a statement about the structure or a property of a polymer</td><td>a statement about the structure or a property of a metal
and
a statement about the structure or a property of a polymer
and
at least one statement linking structure and property</td></tr>
</table></td></tr>
<tr><td colspan="4">Statements shown as HT only are credited on both FT and HT.
However, HT only means that these statements are not expected in a FT answer.</td></tr>
<tr><td colspan="4">Examples of chemistry points made in response

Metal:

Properties
shiny
hardness
(tensile) strength
melting point/boiling point
density
malleable/flexible
ductile
conduct electricity or thermal energy</td></tr>
</table>

4.10.3.3 Ceramics, polymers and composites

Structure • metals contain atoms /((positive) ions HT only) • (the atoms/(positive) ions/particles are) closely packed / in a regular pattern / in a giant structure/in layers / in a lattice • strong bonds/(electrostatic attractions HT only) • (metal has delocalised electrons HT only) **Polymer:** **Properties** • flexible • melting/boiling point • density • can be shaped/moulded • poor conductor of electricity or thermal energy **Structure** • polymer consists of chains • polymer chains may be tangled • polymer has no cross links. • (polymer has weak intermolecular forces HT only) **Level 3:** **Examples of linked statements:** • metal can be bent and shaped because the layers can slide • some metals are soft because layers can slide • some metals are hard because they have strong bonds and/ or (the atoms/(positive) ions/particles) are closely packed / in a regular pattern / in a giant structure/ in a lattice • metal has high melting/boiling point because they have strong bonds and/ or (the atoms/(positive) ions/particles) are closely packed / in a regular pattern / in a giant structure / in a lattice • metal is strong because of strong bonds • some metals are dense because the atoms are closely packed • (metal can conduct thermal energy and electricity because metal has delocalised electrons HT only) • thermosoftening polymer melts when heated because it has no cross-links (or has weak intermolecular forces HT only) • thermosoftening polymer is flexible because the chains can move over each other			

Total			**6**

4.10.3.3 Ceramics, polymers and composites

Question	Answers	Extra Information	Mark	AO / Spec. Ref
3(a)(i)	2 bonding pairs 4 unbonded electrons on each atom	accept dots, crosses, e, - or any combination ignore any electrons on any inner shells if no other mark awarded allow **1** mark for 1 bonding pair and 6 unbonded electrons on each atom	1 1	**AO2** 2.1.1g
3(a)(ii)	covalent	allow convalent and covelant ignore single or double ignore shared, shared bond or sharing	1	**AO1** 2.1.1g
3(a)(iii)	weak intermolecular forces require little energy to overcome	reference to weak covalent or weak ionic bonds = **0** accept weak intermolecular bonds MP2 dependent on MP1 if no other mark awarded allow 1 mark for simple/small molecules	1 1	**AO1** **AO2** 2.2.1a,b

4.10.3.3 Ceramics, polymers and composites

3(b)(i)	**2** Mg + O_2 → **2** MgO	accept multiples	1	**AO2** 2.2.2
3(b)(ii)		reference to incorrect particles **or** incorrect bonding **or** incorrect structure = max **2**		**AO1** **AO2** 2.1.1a,b,c,f
	magnesium loses (electrons) **and** oxygen gains (electrons)		1	
	two (electrons transferred)		1	
	noble gas structure **or** 8 electrons in outer shells **or** (electrostatic) attraction between ions **or** forms ionic bonds	accept full outer shell (of electrons)	1	
3(b)(iii)	particles 1-100 nm in size	accept contain a few hundred atoms/ions accept have a high surface area to volume ratio ignore reference to (very) small particles do **not** accept smaller than an atom/ion	1	**AO1** 2.2.6a

3(c)	has a high melting point	allow will not melt allow a lot of energy needed to melt ignore boiling point reference to incorrect particles or incorrect bonding or incorrect structure = max **1** from MP2 and MP3	1	**AO1** **AO2** 2.2.3a
	because all atoms linked to other atoms	allow giant structure/lattice ignore many bonds	1	
	by covalent bonds	allow strong bonds allow a lot of energy needed to break bonds accept giant covalent structure for MP2 and MP3	1	
Total			**13**	

4.10.3.3 Ceramics, polymers and composites

Question	Answers	Extra Information	Mark	AO / Spec. Ref
4(a)	add copper oxide and (sulfuric) acid		1	**AO1** **AO2** 2.6.1b,c
	excess (copper oxide)		1	
	filter (to remove excess)	ignore impurities	1	
	heat /boil / evaporate / leave (to crystallise)	do **not** accept to dryness	1	
4(b)	(M_r CuO =) 79.5		1	**AO2** 2.3.3c
	24.95/249.5 **or** 0.1 **OR** 79.5/249.5 **or** 0.3186…	allow ecf for M_r CuO from step 1 allow correct rounding to min 2SF	1	
	(24.95/249.5 x 79.5=) 7.95	allow ecf for M_r CuO from step 1 allow ecf from step 2 of incorrect calculation/ rounding of correct ratio allow correct rounding to min 2SF correct answer with or without working gains 3 marks	1	
4(c)(i)	as wealth decreases, ethene production decreases (with the exception of country C or D)	accept converse	1	**AO2** **AO3** 2.6
	sulfuric acid production is not linked to wealth		1	

4.10.3.3 Ceramics, polymers and composites

4(c)(ii)	use of products of ethene has increased	allow use of polymers / plastics / ethanol / poly(ethene) has increased ignore use of ethene as a (bio)fuel ignore cost	1	**AO3** 2.2.5
Total			**10**	

4.10.3.3 Ceramics, polymers and composites

Question	Answers	Extra Information	Mark	AO / Spec. Ref
5(a)(i)	draw line on paper put (dots of) inks on line place (bottom of) paper in solvent / water any **one** from: line drawn in pencil allow dots of ink to dry line above solvent lid		1 1 1 1	**AO1** 2.3.2b
5(a)(ii)	any **two** from: • A has 3 colours **and** B has 4 colours • 2 colours are the same • **A** has 1 colour not in **B and B** has 2 colours not in **A**	accept 3 colours are different if no other mark awarded allow **one** more colour in ink **B** than in ink **A** (or converse)	2	**AO3** 2.3.2b
5(b)(i)	substances carried by gas through column / tube / coil (packed with solid) (different substances move through the column) at different speeds	 accept (different) substances come out at different times or have different retention times	1 1 1	**AO1** 2.3.2c
5(b)(ii)	(relative) molecular mass	allow (relative) formula mass allow RFM, RMM, M_r	1	**AO1** 2.3.2c
Total			**10**	

Question	Answers	Extra Information	Mark	AO / Spec. Ref
6(a)(i)	tick (✓) by: the initial temperature reading was too low		1	**AO3** 2.5
6(a)(ii)	the reaction is exothermic	allow energy is given out	1	**AO3** 2.5.1b
6(b)(i)	(positive/hydrogen) ions gain electrons hydrogen is below sodium in the reactivity series so hydrogen / H_2 is produced	accept (positive/hydrogen) ions are reduced accept reference to high reactivity of sodium If no other mark awarded allow hydrogen (and sodium) ions **or** positive ions are attracted to negative electrode for **1** mark	1 1 1	**AO1** **AO2** 2.7.1c,f,i
6(b)(ii)	**2** (Cl^-) → **Cl_2 + 2e^-**	must be completely correct allow multiples	1	**AO1** 2.7.1g
6(b)(iii)	solution is alkaline because sodium hydroxide / NaOH is produced **or** sodium hydroxide / NaOH is left over	accept hydroxide (ions) / OH^- is produced **or** hydroxide (ions) / OH^- is left over	1 1	**AO1** **AO2** 2.7.1i; 2.6.2d
Total			**8**	

Answer 25 · Examiner comments

June 2018 | 8462/2H | Original Q6

Question 6 (standard / high & high demand)

06.1 There was a variety of incorrect answers for the small molecule lost during condensation polymerisation, some of which were not molecules. However, 56% of students knew the answer was water.

06.2 Of those students who lost marks here, there was no clear-cut marking point that caused the problem. Some students did not make it clear that the bond joined on to the C atom of the methyl group, but were given benefit of the doubt provided it didn't join to the H_3. 28% of students gave faultless answers.

06.3 This question was not answered well, mainly because students did not appreciate that they were making a comparison with both of the fibres used alone.

- Some students restated the question stem by saying 'wool wears out quickly'.
- There was little mention of land usage for wool production or that poly(propene) is not biodegradable.
- There were many uncreditworthy references to cost, and the greater comfort of wool.
- Many students failed to make it clear whether they were talking about the fibre or the carpet, or whether they were comparing the mixed fibre carpet with wool or poly(propene) alone.

Most students who achieved any marks at all (39%) were only able to score one of the available marks.

06.4 This was generally well answered with 99% of students achieving at least one mark. There were various advantages and disadvantages given for the uniform absorbing water as covered by the marking points on the mark scheme (including an advantage of 'it would absorb lots of sweat'). 44% of the students were able to achieve all four marks.

4.10.3.3 Ceramics, polymers and composites

Answer 27 · Examiner comments November 2020 | 8462/2H | Original Q5

Question 5 (standard and standard / high demand)

05.1 A significant number of students did not realise they were being asked to name the processes for which the energy requirement needed to be known, but instead tried to guess which material would use more energy.

05.2 Very few students gave a reasoned judgement and so were unable to access level 2. Some did not even have comparisons, but simply described the characteristics of each material in isolation. Some referred to deforestation, missing the point that more trees can be grown. Many made valid comparisons of the number of plates that could be packaged in a box and of the number of times each plate could be used, but did not go on to look at the consequences, such as the relative energy cost of transporting the plates or the need for replacement of the plates. Few referred to the conservation of raw materials, either in the context of the number of uses or the lack of recyclability. There was confusion between the terms reusable and recyclable. Some were highly focused on energy usage, even though no energy data was provided.

05.3 Some students knew that moulding and heating were involved, but often did not mention a furnace, kiln or oven. There were some references to heating clay **before** it is shaped.

Answer 28 · Examiner comments November 2021 | 8462/2H | Original Q4

Question 4 (standard, standard / high and high demand)

04.1 Around half of the students either drew five single bonds or wrote ‘n’. Around one third provided a completely correct response.

04.2 Many of the students scored one mark, usually for stating that poly(ethene) melts. The consequence in terms of recycling was less well known.

04.3 How poly(ethene) is produced from ethene was not well known.

04.4 Approaching half of the students scored one mark but only a tiny number scored both. The fact that the chains are closer together or unbranched was well known but not how that linked to density.

04.5 Some students seem to think that any -OH is an alcohol group even if it is part of a carboxylic acid group. Other students circled whole molecules rather than functional groups.

04.6 Very few students were able to use the diagrams to work out that hydrogen chloride was the small molecule formed when a polyester was produced from monomers **A** and **B**.

4.10.3.3 Ceramics, polymers and composites

Answer 29 · Examiner comments June 2024 | 8462/2H | Original Q6

Question 6 (standard and standard / high demand)

06.1 Most students were able to compare the given data with mathematical processing commonly seen and where the majority of the credit for linked reasons was awarded. Most of the explicitly linked reasons in the indicative content were rarely seen.

Many students thought that burning bamboo to produce heat energy as a method of disposal was a negative point, commonly referring to the release of carbon dioxide as problematic. This was invalid given that bamboo can be seen as a carbon neutral material.

A significant number of students gave comprehensive responses in terms of logically linked reasons but were unable to reach Level 3 because they did not give a reasoned judgement as to which material is better. It is essential that students understand what is required when a particular command word is used, in this case 'evaluate'.

Around one-fifth of students gained a Level 3 mark, with roughly a further 55% achieving Level 2.

06.2 The idea of a protective oxide coating was scored much more often than the idea of contact between aluminium and water or air or oxygen being prevented.

Common misconceptions were that aluminium has too low a reactivity to react with water or oxygen, that the presence of other metals means that aluminium cannot react with water or oxygen - quite often the idea of sacrificial protection was included – or that iron is the only metal that can corrode. Less than 5% of students gained both marks.

06.3 Greasing, oiling and the use of a sacrificial metal, eg galvanising, were commonly seen. Around three-quarters of students gained this mark.

06.4 A significant number of students gave properties of the components, eg strong, flexible, light. The term 'matrix' was seen much more often than 'binder'. The components of a composite were often reversed. Around 15% of students were awarded both marks.

Answer 30 · Examiner comments

Question 8 (standard, standard / high and high demand)

08.1 Around 60% of students correctly identified the C=C bond. For students who were not awarded the mark common mistakes were incorporating the 3 Hs and 1 O atom attached to the C=C group in their circle or also circling the C=O group. Others circled only the double bond and not the carbon atoms on either side.

08.2 Those students who were awarded marking point 1 used a range of the colours allowed in the mark scheme to describe the starting colour of bromine water. The most common colours were orange or brown. A small number of students described the bromine water as turning clear rather than colourless. For students who were awarded one mark there seemed to be an even split between those awarded marking point 1 and those awarded marking point 2. Just over half scored both.

08.3 A variety of areas in the molecule were circled in an attempt to answer this question. A mistake some students made who were not awarded this mark was incorporating one of the C atoms either side of the ester bond in their circle. Around 40% of students gained credit.

08.4 Those students awarded 3 marks for this question often balanced the equation using half the values of those in the mark scheme and gained credit. A common error was use of inaccurate formulae, particularly a small O on H_2O or CO_2. Just over one-third of students gained all three marks.

08.5 For those students awarded one mark there was an even split between those achieving marking point 1 and marking point 2. A minority of students added atoms or groups to the extension bonds, which contradicted marking point 1. Around 40% gained both marks.

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4.10.3.3 Ceramics, polymers and composites

Answer 30 · Examiner comments June 2024 | 8462/2H | Original Q8

08.6 This multiple-choice question was well answered, with three quarters of students gaining the mark.

08.7 An array of answers were given for this question. Common incorrect responses included condensation, meltable, polyester, hydrocarbon and alkene. 'Thermoforming' was regarded as a process and not a description of the polymer used in that process. Nearly half of students gained a mark here.

08.8 Only around 10% of students achieved two marks for this question.

Common mistakes for marking point 1 were referencing crosslinks but saying they were between the polymers or molecules rather than the polymer chains, or mentioning bonds between polymer chains but not stating they were covalent. A number of students also referred to crosslinks between monomers in the polymer or crosslinks between bonds in the polymer.

For marking point 2 many students were not awarded the mark as they gave generalised answers about a lot of energy, or high amounts of energy being needed to break the strong bonds but did not make it clear that **too much** energy was needed to break the bonds between polymer chains.

4.10.3.3 Ceramics, polymers and composites

Answer 31 · Examiner comments June 2025 | 8462/2H | Original Q7

07.1 Although these compounds are clearly identified in the specification, very few had learnt them. Common attempts to give the names included di-ethanol and di-butanoic acid.

07.2 Around 15% of students correctly identified a polyester. The most common incorrect response was for an ester.

07.3 Just over two thirds of students correctly identified water as the small molecule produced during this condensation polymerisation reaction.

07.4 1 in 5 students gained the mark for this item by correctly identifying a polypeptide. Polyglycine was the most common incorrect response, but protein was also seen. The definition of a polypeptide is given in the specification, but many students could not apply the definition to the context given.

07.5 The structural formula of glycine is given in the specification, but only 15% of students were able to recognise that the displayed structure of the carboxylic acid functional group was required. It was expected that all bonds were shown, so -OH was insufficient, when -O-H was required. Many students added bonds to the amine, as well as adding amines to the carbon atom where the carboxylic acid group was required.

07.6 Three quarters of students correctly identified the definition of a protein that is given in the specification.

07.7 Two thirds of students gained all three marks on this familiar application for an unfamiliar polymer. Far fewer students than previously left the double bond between the two carbon atoms. The most common mistake was adding the trailing bonds incorrectly, often not breaking the line of the brackets.

07.8 The description of the structure of a thermosetting polymer was not well known by students with only 1 in 5 gaining any marks on this item. More students knew the idea of cross links between chains than the idea of the structure consisting of long chain molecules. A lot of the incorrect responses were definitions of thermosetting polymers in terms of heating and melting.