AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.10.3.3

Ceramics, polymers and composites

Mark schemes and examiner comments

Tier	**Foundation**
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 January 2007 | CHY1F | Original Q4 | Legacy

Question 4

	answers	extra information	mark
(a)	**1** / one **3** / three		1 1
(b)(i)	(wear safety) glasses / masks / gloves	accept do not handle hot objects / use tongs **or** accept other safety points such as, 'tie hair back'	1
(ii)	calcium oxide	accept quicklime	1
(iii)	carbon dioxide / CO_2 is given off	accept a gas is given off	1
(c)	any **two** from: • conserves (saves) resources • avoids dumping / landfill • lowers energy requirements / save energy • stops quarries opening • less carbon dioxide / carbon emissions / greenhouse gases • lowers the price of glass • glass is non-biodegradable	 accept reduces waste do **not** accept speeds up the process do **not** accept cheaper process	2
(d)(i)	any **two** from: • dust / atmospheric pollution • noise • eyesore • destroys habitats • (extra) traffic • any other named pollution or description of pollution		2

Continued on next page

4.10.3.3 Ceramics, polymers and composites

Answer 01 · Mark scheme

	answers	extra information	mark
(ii)	any **one** from: • employment • increases local trade / makes money • future development of quarry – recreation / park / lake / reservoir	do **not** accept cheaper houses / land / new roads	1
total			10

4.10.3.3 Ceramics, polymers and composites

Answer 02 · Mark scheme June 2007 | CHY1F | Original Q6 | Legacy

The full source mark scheme begins on page 44. Follow original question 6 in that document.

Answer 03 · Mark scheme November 2007 | CHY1B | Original Q2 | Legacy

Two	**A**	screwdriver	**3**
	B	disposable coffee cup	**4**
	C	bottle for soft drinks	**2**
	D	frying pan	**1**

4.10.3.3 Ceramics, polymers and composites

Answer 04 · Mark scheme January 2008 | CHY1F | Original Q8 | Legacy

Question 8

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

4.10.3.3 Ceramics, polymers and composites

Answer 05 · Mark scheme

March 2008 | CHY1BP | Original Q5 | Legacy

Five	**A** 3 **B** 4 **C** 1 **D** 2

Answer 06 · Mark scheme

June 2008 | CHY1BP | Original Q8 | Legacy

Eight	**1**	**1**	**4**	**1**

4.10.3.3 Ceramics, polymers and composites

Answer 07 · Mark scheme June 2009 | CHY1F | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	3 / three		1
6(a)(ii)	5 / five		1
6(b)	any **one** from: • less / no transport • less / no (fossil) fuel used	 accept less / no distance ignore references to carbon dioxide / carbon emissions	1
6(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 6 continues on the next page…

4.10.3.3 Ceramics, polymers and composites

CHY1F

Question 6 Continued

question	answers	extra information	mark
6(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 | CHY1F | Original Q6 | Legacy

CHY1F

Answer 08 · Mark scheme November 2009 | CHY1AP | Original Q7 | Legacy

Seven	**3**	**3**	**2**	**4**

Answer 09 · Mark scheme June 2010 | CHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	It is where thermal decomposition takes place.	**3**
	B	It is where only natural substances are mixed.	**2**
	C	It is where a natural substance is mixed with a man-made substance.	**4**
	D	It is where limestone is obtained.	**1**

Answer 10 · Mark scheme June 2010 | CHY1BP | Original Q8 | Legacy

Eight	**2**	**3**	**1**	**2**

Answer 11 · Mark scheme November 2010 | CHY1BP | Original Q9 | Legacy

Nine	**3**	**2**	**4**	**3**

Answer 12 · Mark scheme March 2011 | CHY1BP | Original Q9 | Legacy

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

Answer 13 · Mark scheme November 2011 | CHY1BP | Original Q2 | Legacy

Two	**A**	can withstand high temperatures and is non-stick	**2**
	B	can be stretched into fibres	**3**
	C	makes a very light, solid foam which is a good . . .	**1**
	D	strong, rigid and a good electrical insulator	**4**

4.10.3.3 Ceramics, polymers and composites

Answer 14 · Mark scheme

January 2012 | CH1FP | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	• one / 1 (molecule of) methane (reacts with) two / 2 (molecules of) oxygen • two / 2 (molecules of) water / steam / hydrogen oxide and one / 1 (molecule of) carbon dioxide (are produced)	if no other marks awarded all four names correct **or** correct number **and** name for two molecules **or** 4 correct numbers gains **1** mark allow all four names correct **and** correct number of atoms in each substance for **2** marks	1 1

Question 5(b) continues on the next page

CH1FP

Question 5(b) cont'd……

5(b)	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 2, and apply a 'best-fit' approach to the marking.	6

0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant content.	There is a simple description of a positive **and / or** a negative impact caused by the plan to quarry limestone and / or make cement.	There is a clear description of both a positive **and** a negative impact caused by the plan to quarry limestone and / or make cement.	There is a detailed description of both positive impacts **and** negative impacts caused by the plan to quarry limestone and / or make cement.

examples of the chemistry points made in the response

Positive impacts:

- Limestone / cement is used for building
- Limestone needed for industrial processes
- Company landscapes / provides recreation facilities in the quarry after use
- Provides employment
- Improves local economy
- Improved transport links

Negative impacts:

- Destruction of habitats
- Fewer plants / trees to absorb carbon dioxide
- Example of visual pollution
- Example of noise pollution
- Example of atmospheric pollution
- More traffic

Total			**8**

4.10.3.3 Ceramics, polymers and composites

Answer 14 · Mark scheme

January 2012 | CH1FP | Original Q5 | Legacy

CH1FP

4.10.3.3 Ceramics, polymers and composites

Answer 15 · Mark scheme

June 2012 | CH2FP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	79 79		1 1
2(b)	hundred		1
2(c)(i)	electron(s)		1
2(c)(ii)	three		1
2(d)	changes rate of reaction **or** speeds up / slows down reaction	accept lowers activation energy accept reduces costs	1
2(e)(i)	melt		1
2(e)(ii)	crosslinking **or** (covalent) bonds between polymers / chains	allow answers on diagram allow bonds between layers do **not** allow intermolecular	1
Total			**8**

4.10.3.3 Ceramics, polymers and composites

Answer 15 · Mark scheme

June 2012 | CH2FP | Original Q2 | Legacy

CH2FP

4.10.3.3 Ceramics, polymers and composites

Answer 16 · Mark scheme

January 2013 | CH2FP | Original Q4 | Legacy

question	answers	extra information	mark
4(a)	would melt	accept they have a low melting point allow lose their shape ignore would soften when hot ignore boiling point	1
4(b)	to speed up the reaction	accept can use a lower temperature accept less energy needed	1
4(c)(i)	mass spectrometer	allow mass spectroscopy	1
4(c)(ii)	any **one** from: • accurate • sensitive • rapid / quicker • small amount of sample	ignore reliable ignore more precise	1
4(d)	any **two** from: • pressure • temperature • catalyst **or** initiator • solvent	allow concentration	2
Total			**6**

4.10.3.3 Ceramics, polymers and composites

Answer 16 · Mark scheme

January 2013

CH2FP

4.10.3.3 Ceramics, polymers and composites

Answer 17 · Mark scheme

June 2013 | CH2FP | Original Q5 | Legacy

Question 5

question	answers	extra information	Mark
5(a)	giant lattices		1
5(b)(i)	heat / warm / increase the temperature	allow reduce pressure do not accept melt	1
5(b)(ii)	(polymer) chains cannot slide because they have cross-links	 if no other mark awarded allow polymers do not melt for **1** mark	1 1
5(c)(i)	separates (substances)		1
5(c)(ii)	any **two** from: • quick / rapid • accurate • can detect small quantities / sensitive	ignore reliable / precise / efficient ignore references to cost	2
Total			**7**

4.10.3.3 Ceramics, polymers and composites

Answer 18 · Mark scheme June 2014 | CH2FP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
2(a)	alloy		1	1 / 2.2.4d	A
2(b)	in mixture: *different sized / bigger atoms* *so there are no layers / rows / lines (to slide)*	accept converse	 1 1	1 / 2.2.4c / 2.1.1h	E
2(c)	any **two** from: • cost • toxicity • strength • *appearance of brace* • *unreactive **or** resistant to corrosion / saliva*	*ignore references to bend and mould* *allow rusting as alternative to corrosion*	2	3 / 2.2.4	E
2(d)	crosslinks	*allow lines / bonds between the rows / chains*	1	1 / 2.2.5b	E
Total			**6**		

4.10.3.3 Ceramics, polymers and composites

Answer 18 · Mark scheme

June 2014 | CH2FP | Original Q2 | Legacy



4.10.3.3 Ceramics, polymers and composites

Answer 19 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	(calcium) carbonate	ignore $CaCO_3$	1	1 / 1.2.1a
5(a)(ii)	(thermal) decomposition		1	1 / 1.2.1b
5(a)(iii)	water	allow H_2O allow hydrogen oxide	1	1 / 1.2.1d
5(a)(iv)	alkali	allow base	1	1 / 1.2.1d
5(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
5(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 19 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(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	
5(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 19 · Mark scheme

June 2015 | CH1FP | Original Q5 | Legacy



4.10.3.3 Ceramics, polymers and composites

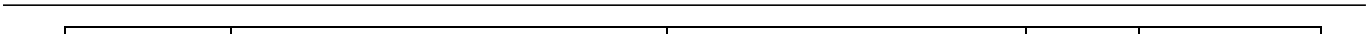
Answer 20 · Mark scheme June 2016 | CH2FP | Original Q2 | Legacy

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

4.10.3.3 Ceramics, polymers and composites

Answer 20 · Mark scheme

June 2016 | CH2FP | Original Q2 | Legacy



Answer 21 · Mark scheme

June 2017 | CH2FP | Original Q6 | Legacy

The full source mark scheme begins on page 56. Follow original question 6 in that document.

4.10.3.3 Ceramics, polymers and composites

Answer 22 · Mark scheme

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th></tr>
<tr><td>03.1</td><td><table>
<tr><th>property</th><th>J</th><th>K</th></tr>
<tr><td>density in g/cm^3</td><td></td><td></td></tr>
<tr><td>melting point in °C</td><td></td><td>✓</td></tr>
<tr><td>flame resistance</td><td></td><td>✓</td></tr>
<tr><td>water absorption</td><td>✓</td><td></td></tr>
</table></td><td>three correct = 2 marks

one or two correct = 1 mark</td><td>2</td><td>AO3
4.10.1.1
4.10.3.3</td></tr>
<tr><td>03.2</td><td>$\frac{1.4 \times 6.0}{0.90}$

= 9.3 (kg)</td><td>an answer of 9.3(333…)(kg) scores 2 marks

allow 9.3(333...)(kg)</td><td>1

1</td><td>AO2
4.10.1.1
4.10.3.3</td></tr>
<tr><td>03.3</td><td>polymer L will not melt</td><td></td><td>1</td><td>AO3
4.10.3.3</td></tr>
<tr><td>03.4</td><td>polymers are more hard-wearing</td><td></td><td>1</td><td>AO3
4.10.1.1</td></tr>
<tr><td>03.5</td><td>any two from:
• (wool / sheep) renewable
• (wool) will not run out
• (crude oil) non-renewable
• (crude oil) will run out</td><td>
allow wool grows back, etc
ignore (wool is) readily available
allow finite

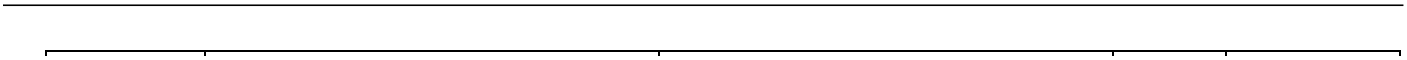
ignore references to cost

ignore properties from tables 1 and 2</td><td>2</td><td>AO2
4.10.1.1</td></tr>
<tr><td>Total</td><td></td><td></td><td>8</td><td></td></tr>
</table>

4.10.3.3 Ceramics, polymers and composites

Answer 22 · Mark scheme

June 2018 | 8462/2F | Original Q3



4.10.3.3 Ceramics, polymers and composites

Answer 23 · Mark scheme

November 2020 | 8462/2F | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	disposal at the end of useful life		1	AO3 4.10.2.1
06.2	heating in a furnace shaping wet clay		1 1	AO1 4.10.3.3
06.3	polymers propene	allow (a) monomer	1 1	AO1 AO2 4.7.3.1
06.4	cracking fractional distillation		1 1	AO2 4.7.1.2 4.7.1.4
06.5	covalent		1	AO1 4.2.2.5 4.7.3.1
06.6	thermosetting		1	AO3 4.10.3.3
06.7	polymer **A** has crosslinks (between polymer molecules) **or** polymer **B** has no crosslinks (between polymer molecules)		1	AO3 4.10.3.3
Total			**10**	

4.10.3.3 Ceramics, polymers and composites

Answer 24 · Mark scheme

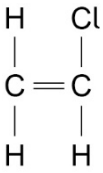
November 2021 | 8462/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	limestone sodium carbonate		1 1	AO1 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	(advantage) stronger (reason) less easily damaged		1 1	AO3 AO2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	(advantage) lower density (reason) lighter (to install)		1 1	AO3 AO2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.4			1	AO2 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	(add damp) litmus paper (litmus paper) is bleached **or** (litmus paper) turns white	ignore (litmus paper) turns red	1 1	AO1 4.8.2.4

Question 3 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	(polymers) last a long time (wood) renewable	ignore references to cost allow break down slowly allow trees can be replanted allow aesthetic reasons	 1 1	 AO3 AO1 4.10.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.7	(percentage of aluminium =) $\frac{5.94}{6.00} \times 100$ = 99 (%)		1 1	AO2 4.10.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.8	(alloy is) harder (than pure aluminium)	allow (alloy is) stronger (than pure aluminium) ignore references to cost	1	AO2 4.2.2.7 4.10.3.2

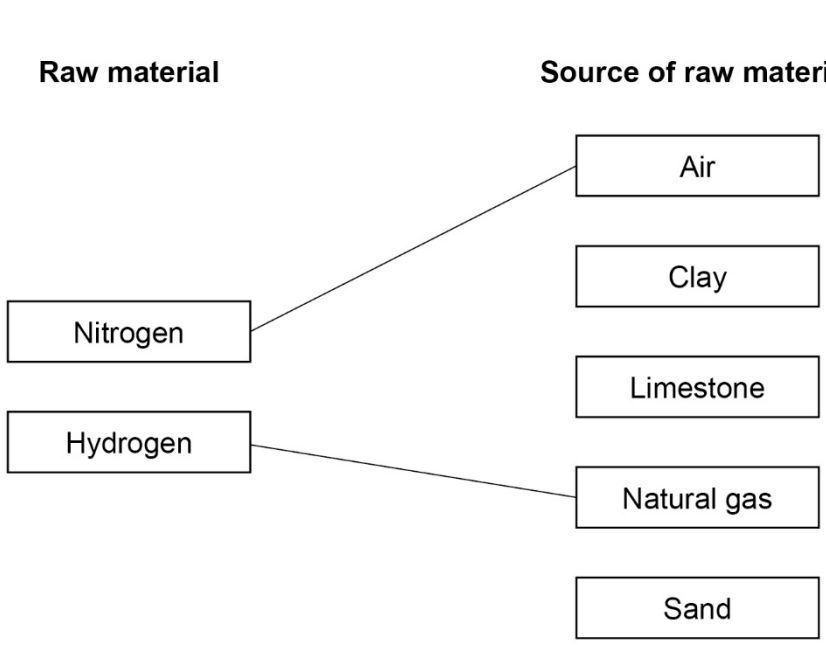
Total			14

4.10.3.3 Ceramics, polymers and composites

Answer 25 · Mark scheme

June 2022 | 8462/2F | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	 do not accept more than one line from a box on the left		1 1	AO1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	gas gas		1	AO1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	there is one product		1	AO2 4.3.3.2 4.10.4.1

4.10.3.3 Ceramics, polymers and composites

Answer 25 · Mark scheme

June 2022 | 8462/2F | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	liquefied recycled	must be in this order	1 1	AO1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	all six points plotted correctly line of best fit	allow a tolerance of ± ½ a small square allow **1** mark for four / five points plotted correctly	2 1	AO2 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	(percentage yield) increases		1	AO2 4.10.4.1

Total Question 5		10

4.10.3.3 Ceramics, polymers and composites

Answer 26 · Mark scheme

June 2023 | 8462/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	(the poly(propene) beaker will begin to) melt	allow poly(propene) has a low melting point	1	AO3 4.7.3.1
	(the poly(propene) beaker will) burn / ignite	allow poly(propene) is flammable	1	

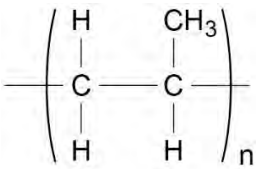
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(poly(propene) beakers are) less easily broken	allow (poly(propene) beakers are) less likely to shatter allow (poly(propene) beakers are) tougher allow (poly(propene) beakers have a) higher resistance to impact	1	AO3 4.7.3.1 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	boron trioxide		1	AO1 4.10.3.3

Question	Answers	Mark	AO / Spec. Ref.
02.4	<table><tr><th>Symbol for element</th><th>Name of element</th><th>Number of atoms of element in one molecule of propene</th></tr><tr><td>C</td><td>carbon</td><td>3</td></tr><tr><td>H</td><td>hydrogen</td><td>6</td></tr></table> if no other mark awarded allow **1** mark for a correct column	1 1	AO1 AO2 4.1.1.1 4.7.2.1

4.10.3.3 Ceramics, polymers and composites

Answer 26 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5			1	AO2 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	(**Stage 1** is) fractional distillation		1	AO1
	(**Stage 2** is) cracking		1	AO2
	(**Stage 3** is) polymerisation		1	AO2
				4.7.1.2 4.7.1.4 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	alkene		1	AO2 4.7.2.1
	monomer		1	4.7.3.1

Total Question 2	12

4.10.3.3 Ceramics, polymers and composites

Answer 27 · Mark scheme

June 2024 | 8462/2F | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	alloy		1	AO1
	reinforcement		1	AO2 4.10.3.2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.2	burning (of methane) releases carbon dioxide	allow burning methane ignore methane is a greenhouse gas	1	AO2 4.9.2.2 4.9.3.1
	decomposition (of limestone) releases carbon dioxide	allow decomposition of limestone	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.3	hydrochloric acid		1	AO1 4.8.3.3
	limewater		1	RPA7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4		allow converse for plain concrete		AO3 4.10.3.3
	(pre-stressed concrete) can bear the weight of (heavy) traffic	allow (pre-stressed concrete) bridge is less likely to collapse	1	
	(because pre-stressed concrete is) stronger	do **not** accept (because pre-stressed concrete is) more dense	1	

4.10.3.3 Ceramics, polymers and composites

Answer 27 · Mark scheme

June 2024 | 8462/2F | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.5	any **two** from: (plain concrete slabs) • are cheaper • will be lighter (to transport / lay) • do not need to carry vehicles	allow converse for pre-stressed concrete	2	AO3 4.10.3.3

Total Question 7	**10**

4.10.3.3 Ceramics, polymers and composites

Answer 28 · 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 28 · 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

4.10.3.3 Ceramics, polymers and composites

Answer 29 · Mark scheme

June 2025 | 8462/2F | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	propene		1	AO1 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	9		1	AO2 4.1.1.1 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	making a polymer		1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	(*y*-axis 0, 20), 40, 60, 80, (100)	ignore intermediate values	1	AO2 4.7.2.1
	carbon bar drawn to 86%	allow a tolerance of ± ½ a small square	1	
	carbon bar labelled		1	

Answer 29 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(test) add bromine (water) (result) (bromine water) turns (from orange to) colourless	 allow (bromine water) decolorises ignore clear MP2 is dependent upon MP1 being awarded	1 1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	$C_{10}H_{22} \longrightarrow C_3H_6 + C_7H_{16}$		1	AO2 4.1.1.1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	fuels		1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.8	the molecules collide more frequently at 750 °C		1	AO2 4.6.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.9	(at 750 °C the rate of reaction is) higher	allow (at 450 °C the rate of reaction is) lower	1	AO2 4.6.1.2

Total Question 2	12

4.10.3.3 Ceramics, polymers and composites

Answer 30 · Mark scheme

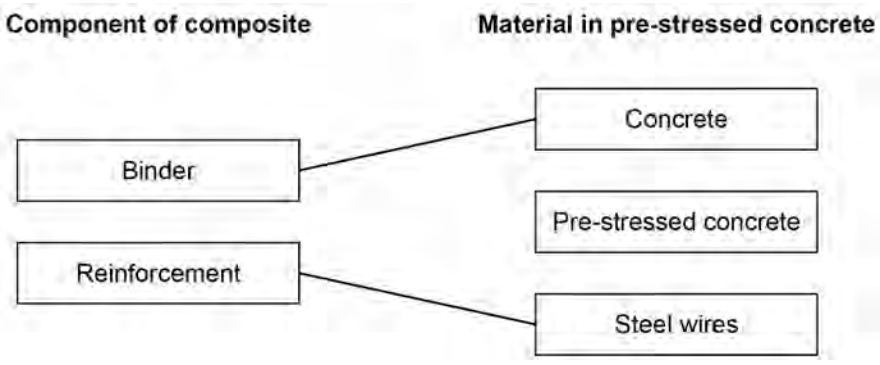
June 2025 | 8462/2F | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	(the sign) ⇌	allow a description of the reversible sign	1	AO1 4.6.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	endothermic	allow (thermal) decomposition	1	AO1 4.6.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.3	(energy released =) $\frac{4}{20} \times 23$ = 4.6 (kJ)		1 1	AO2 4.6.2.2

Question	Answers	Mark	AO / Spec. Ref.
03.4	 do **not** accept more than one line from a box on the left	1 1	AO2 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.5	iron	allow Fe	1	AO1 4.10.3.2

4.10.3.3 Ceramics, polymers and composites

Answer 30 · Mark scheme

June 2025 | 8462/2F | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.6	clay		1	AO1 4.10.3.3

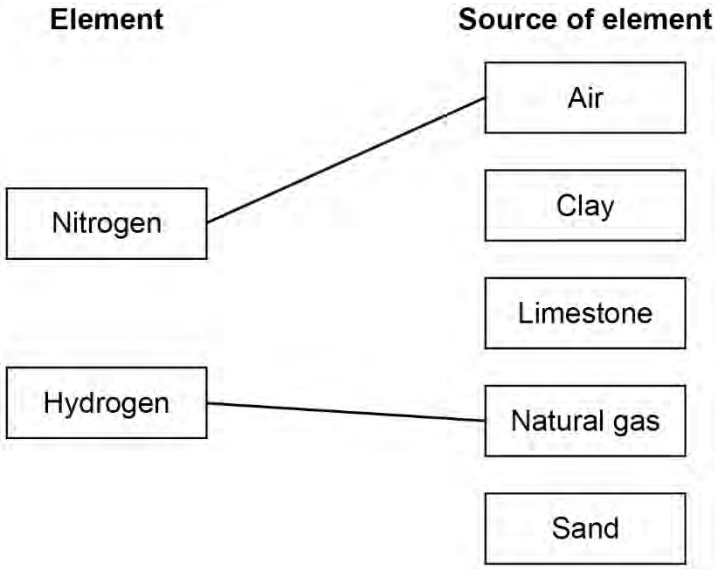
Total Question 3	8

4.10.3.3 Ceramics, polymers and composites

Answer 31 · Mark scheme

June 2025 | 8462/2F | Original Q4

Question 4

Question	Answers	Mark	AO / Spec. Ref.
04.1	 do **not** accept more than one line from a box on the left	1 1	AO1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2	cooling		1	AO3 4.2.2.1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	catalyst		1	AO1 4.10.4.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	(world production of ammonia) increased		1	AO3 4.10.4.1

4.10.3.3 Ceramics, polymers and composites

Answer 31 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	(change in mass = 165 – 130 =) 35 (arbitrary units)		1	AO2 4.10.4.1
	(number of years = 2020 – 2000 =) 20		1	
	(mean change =) $\frac{35}{20}$	allow correct use of incorrectly determined change in mass and / or number of years	1	
	= 1.75 (arbitrary units per year)	allow 1.75 (arbitrary units per year) correctly rounded to at least 2 significant figures	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.6	change in world population		1	AO3 4.10.4.1 4.10.4.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.7	$Ca(NO_3)_2$		1	AO2 4.1.1.1 4.10.4.2
	$(NH_4)_2SO_4$		1	

Total Question 4	12

4.10.3.3 Ceramics, polymers and composites

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1F 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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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.

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

CHY1F Question 1

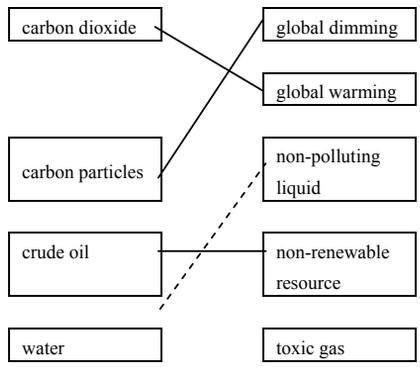
	answers	extra information	mark
(a)	low density unreactive		1 1
(b)	a polymer		1
(c)	any **one** from: • not broken down by (microorganisms) • does not decay (naturally)	ignore cannot recycle / degrade / disintegrate	1
total			4

CHY1F Question 2

	answers	extra information	mark
(a)(i)	additive		1
(b)	any **three** from: • colour 1 is made up of only one colour / dye • colour 2 is made up of only one colour / dye • colour 3 is made up of two colours / dyes **or** more colours (than colours 1 and 2) • colours 1, 2 and 3 are all different • colour 1 is less dark than colour 2	accept colour 3 is a mixture of colours 1 and 2 for **3** marks accept E-number or additive instead of colour ignore comments about height / level	3
total			4

4.10.3.3 Ceramics, polymers and composites

CHY1F Question 3

	answers	extra information	mark
(a)	hydrogen	ignore formulae	1
(b)	any **two** from: • different sized molecules / more or less (carbon) atoms (in molecules) • fuels have <u>different</u> boiling points • fuels condense at <u>different</u> temperatures	ignore different densities	2
(c)		all three correct = **3** marks two correct = **2** marks one correct = **1** mark	3
total			6

4.10.3.3 Ceramics, polymers and composites

CHY1F Question 4

	answers	extra information	mark
(a)(i)	any **one** from: • iron ore is a limited resource / non-renewable • iron is in high demand • provide jobs • economic advantage		1
(ii)	any **two** from: • would damage (wildlife) habitats / countryside / greenfield sites • extra traffic • visual (pollution) / eyesore • noise (pollution) / sound (pollution) • dust (pollution) • river (pollution) • carbon dioxide (from traffic) / adds to greenhouse effect / global warming • damage roads / buildings by <u>vibrations</u> / <u>shockwaves</u>		2
(b)(i)	carbon monoxide / carbon	accept formulae CO / C	1
(ii)	atoms are all the same (size) / type	accept (particles) are all the same (size) / type for one mark	1 1

Continued on next page

4.10.3.3 Ceramics, polymers and composites

Question 4 continued

	answers	extra information	mark
(iii)	any **two** from: • impurities / carbon / different (sized) atoms **or** elements **or** metals • changes the structure / disrupts the pattern or layers • prevents layers sliding over each other • it is an alloy		2
total			8

4.10.3.3 Ceramics, polymers and composites

CHY1F Question 5

	answers	extra information	mark
(a)	core	ignore outer or inner	1
	mantle		1
(b)(i)	carbon dioxide	accept formula CO_2	1
	oxygen	accept formulae O_2 / O	1
(ii)	4%		1
(iii)	carbon dioxide has <u>decreased</u> / from 95% to 0%		1
	oxygen has <u>increased</u> / from 0% to 21%		1
	any **one** from: (carbon dioxide decrease) • carbon dioxide used during photosynthesis / by plants • carbon dioxide dissolves in oceans • carbon dioxide is locked up in rocks / carbonates / fossil fuels (oxygen increase) • oxygen released during photosynthesis / by plants		1
total			8

4.10.3.3 Ceramics, polymers and composites

CHY1F Question 6

	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

CHY1F Question 7

	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

Question 7 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

GCSE

Additional Science / Chemistry

CH2FP
Final Mark scheme

4408 / 4402
June 2017

Version/Stage: v1.0

4.10.3.3 Ceramics, polymers and composites

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

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

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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 6 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)	the ink would run / smudge / smear	accept converse	1	**AO1** 2.3.2b
1 (a)(ii)	below		1	**AO1** 2.3.2b
1 (a)(iii)	any **two** from: • contains red • does not contain blue • contains two other colours • contains three colours in total	do **not** accept contains red and blue	2	**AO3** 2.3.2b
1(b)(i)	separated		1	**AO1** 2.3.2c
1(b)(ii)	6/six		1	**AO2** 2.3.2c
1(b)(iii)	any **one** from: • accurate • sensitive • rapid / fast • small sample.	do **not** accept more precise do **not** accept more reliable	1	**AO1** 2.3.2a
Total			**7**	

4.10.3.3 Ceramics, polymers and composites

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

4.10.3.3 Ceramics, polymers and composites

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

4.10.3.3 Ceramics, polymers and composites

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)	58.5		1	**AO2** 2.5.1b
4(b)	water		1	**AO2** 2.3.3a
4(c)(i)	prevents loss of thermal energy	allow prevents heat loss	1	**AO1** 2.6.1
4(c)(ii)	13/thirteen		1	**AO3** 2.5.1
4(c)(iii)	temperature changes/results are all similar	accept no anomalous results allow they are all similar do **not** accept temperature	1	**AO2** 2.5.1
4(c)(iv)	exothermic	allow giving out energy	1	**AO3** 2.5.1
4(d)(i)	ions move	allow they move ignore free ions do not accept movement of electrons	1	**AO1** 2.7.1a 2.2.2b
4(d)(ii)	(chloride ions are) negative	accept opposites attract do **not** accept chlorine is negative	1	**AO1** 2.7.1c
4(d)(iii)	Tick (✓) by: soap		1	**AO1** 2.7.1i
4(d)(iv)	1 bonding pair of electrons 6 unbonded electrons on Cl	accept dot, cross, e or – or any combination	1 1	**AO2** 2.1

4.10.3.3 Ceramics, polymers and composites

4(d)(v)	Tick (✓) by: $\frac{1}{36.5}$ x 100		1	**AO2** 2.3.3a
Total			**12**	

4.10.3.3 Ceramics, polymers and composites

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)(i)	a smooth curve through or close to all points except (30,12)		1	**AO2** 2.4
5(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
5(a)(iii)	45-50 (seconds)		1	**AO3** 2.4
5(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
5(a)(v)	0.6 (cm^3 per second)	allow 0.55 to 0.65	1	**AO2** 2.4
5(b)(i)	 temperature volume (of hydrogen peroxide)	concentration of hydrogen peroxide = max **1** ignore amount (of hydrogen peroxide)	 1 1	**AO3** 2.4
5(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

5(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>6</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>0 marks</td><td>Level 1 (1–2 marks)</td><td>Level 2 (3–4 marks)</td><td>Level 3 (5–6 marks)</td></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>
<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>

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**

Answer 22 · Examiner comments

June 2018 | 8462/2F | Original Q3

Question 3 (low demand)

03.1 67% of students achieved both marks. The most common error was to place the last tick under Polymer K, thinking that water absorption was an advantage.

03.2 A straightforward calculation in which 80% of students recognised selected the correct values from the table provided and inserted them into the given formula. A few students either inverted the values or, despite showing the correct working, multiplied the two densities instead of dividing.

03.3 80% of students correctly identified not melting as an advantage of firefighter's uniforms.

03.4 78% of students correctly identified being hard-wearing as an advantage of using polymers for firefighter's uniforms.

03.5 Many answers focussed on the fact that wool was readily available rather than picking up on the keyword in the question: 'sustainable'. Those who realised that wool was renewable often didn't go on to say that it would not run out, or the reverse argument for crude oil. Many answers simply referred to the properties given earlier in the table, missing the aim of the question.

Answer 25 · Examiner comments

June 2022 | 8462/2F | Original Q5

Question 5 (Low and standard demand)

05.1 Nearly 40% of the students gained two marks, with many of the remainder reversing the correct responses.

05.2 Over 40% of the students knew that nitrogen and hydrogen are both gases. Roughly the same number incorrectly selected an option that stated one of these elements is a gas and the other a liquid.

05.3 Fewer than 20% of the students gained a mark. A large majority thought that the reversibility of the reaction was linked to 100% atom economy.

05.4 Both evaporated and filtered were often seen. There was no obvious pattern in the responses and over 30% of the students gained both of the marks.

05.5 Around one-third of students obtained all three marks.
Over 50% of students plotted the points correctly but did not obtain the line of best fit mark. Common mistakes when drawing the line of best fit were to draw a straight line, a series of dot-to-dot straight lines, a very thick line or multiple lines.

05.6 About two-thirds of students realised that the percentage yield of ammonia would also increase.

Answer 26 · Examiner comments

June 2023 | 8462/2F | Original Q2

Question 2 (Low demand)

02.1 More than two thirds of students were able to use the information provided in the table to provide two correct reasons as to why poly(propene) beakers should not be used to heat liquids. More students suggested that poly(propene) would burn rather than melt. Common incorrect responses did not refer to the effect of heat on poly(propene) instead referring to the effect of the liquid being heated on the polymer.

02.2 More than half of students used the information in the table to suggest a reason why using poly(propene) beakers could save money. The most common incorrect responses did not include a comparison to the glass beakers so that the unqualified 'because they are tough' added no value to the data in the table. Some students used the wrong column and said the poly(propene) does shatter (on impact) even though this then made no sense in the context of saving money.

02.3 More than half of students successfully identified boron trioxide as a raw material for making borosilicate glass.

02.4 More that 90% of students obtained at least one mark on this question (usually for completing the 'name' column correctly) with just over 50% achieving both marks. The most common incorrect response was to incorrectly identify the number of carbon atoms. A minority of students failed to identify the number of atoms but instead calculated the mass of each element.

02.5 This question was very well answered with over 80% of students correctly identifying the repeating unit of poly(propene). The distractors attracted roughly equal support.

02.6 Students struggled to recognise and correctly identify the stages needed to produce poly(propene) from the descriptions provided in the question. Quite often, correct processes were identified but sequenced incorrectly. Less than one-third of students obtained all three marks and less than half achieved 2 marks.

02.7 Just over one third of students achieved 2 marks to identify both of the words that described a hexene molecule during a polymerisation reaction. About half of students achieved 1 mark by identifying hexene as an alkene or by identifying it as a monomer.

4.10.3.3 Ceramics, polymers and composites

Answer 27 · Examiner comments — June 2024 | 8462/2F | Original Q7

Question 7 (low and standard demand)

07.1 Approximately two out of five students gained both marks with a one in two gaining one mark. It is important that students read the question carefully as there was a significant number of students who ticked one box instead of two.

07.2 This question asked for two ways in which a greenhouse gas is released in the process described. Less than 25% of students gained both marks with just over 35% more gaining one mark. Incorrect or insufficient responses included 'heating the limestone' and general references to the equation, or that methane might escape during its combustion.

07.3 The carbonate test is poorly understood with less than 15% of students correctly identifying the substance added to the limestone and the test for carbon dioxide. Two in five students gained one mark. The most frequent incorrect response was to mistakenly identify the test as universal indicator.

07.4 Less than 35% of students gained one mark in this question, with less than 15% gaining two marks. Responses which did not gain credit included those referring to carrying heavy weights in general rather than the weight being from lorries or vehicles, responses in terms of the incorrect property from the table or failing to make a valid comparison.

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Answer 27 · Examiner comments — June 2024 | 8462/2F | Original Q7

07.5 This question proved to be easier than that for the concrete bridge with over 50% of students gaining one mark and over 35% gaining both marks. Responses which did not gain credit again included those that failed to make a valid comparison or those that simply quoted data from the table.

Answer 28 · Examiner comments

June 2025 | 8462/1F | Original Q9

Question 9 (standard demand)

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

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

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

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

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

4.10.3.3 Ceramics, polymers and composites

Answer 29 · Examiner comments June 2025 | 8462/2F | Original Q2

Question 2

02.1 Half of the students correctly identified the alkene as propene. Both butene and ethene were commonly seen.

02.2 Over 80% of students were able to give the number of atoms in the molecule as 9.

02.3 Over two thirds of students correctly identified the use of alkenes.

02.4 Nearly 80% of students scored all three marks for plotting the bar chart. Of the remaining students, most scored two marks, the most common error was to plot the bar at 92, rather than 86.

02.5 The test for alkenes is not well known. Slightly more than 1 in 10 students scored either mark on this question. A full range of tests was seen, with nearly 30% of students did not attempt this item.

Answer 29 · Examiner comments June 2025 | 8462/2F | Original Q2

02.6 Nearly two thirds of students correctly completed the formula in the equation. Many students recognised that the number should be 7, but did not follow the conventions of writing formulas, so did not gain the mark because the 7 was too large. When writing formulas, it is expected that the tops of numbers are discernibly below the tops of upper-case letters.

02.7 Over half of students correctly identified the use of alkanes as fuels. Both distractors were frequently seen.

02.8 Nearly 90 % of students correctly answered this item.

02.9 Three quarters of students correctly compared the rates, with many explaining why the rate changes using the ideas from the previous item.

4.10.3.3 Ceramics, polymers and composites

Answer 30 · Examiner comments June 2025 | 8462/2F | Original Q3

03.1 The reversible symbol was identified or correctly described by three quarters of students. Those that did not gain the mark talked about the 'equals sign' or the 'reversible sign' without a description.

03.2 Nearly 9 in 10 students correctly identified the type of reaction as 'endothermic'.

03.3 Well in excess of half of students correctly calculated the energy change. The methods employed were varied, with none being more common.

03.4 Around half of students correctly identified both materials. Many students completely reversed the responses. If 1 mark was awarded it was most likely for correctly identifying the reinforcement.

03.5 Over half of all students

Question 3

03.1 The reversible symbol was identified or correctly described by three quarters of students. Those that did not gain the mark talked about the 'equals sign' or the 'reversible sign' without a description.

03.2 Nearly 9 in 10 students correctly identified the type of reaction as 'endothermic'.

03.3 Well in excess of half of students correctly calculated the energy change. The methods employed were varied, with none being more common.

03.4 Around half of students correctly identified both materials. Many students completely reversed the responses. If 1 mark was awarded it was most likely for correctly identifying the reinforcement.

03.5 Over half of all students were able to identify iron. Aluminium and copper were the most frequently seen incorrect answers.

Answer 30 · Examiner comments June 2025 | 8462/2F | Original Q3

03.6 Three quarters of students correctly identified clay. Poly(ethene) was the most common incorrect response.

4.10.3.3 Ceramics, polymers and composites

Answer 31 · Examiner comments June 2025 | 8462/2F | Original Q4

Question 4

04.1 Around 40% of students correctly identified both sources of the gases. There is a strongly held misconception that hydrogen comes from the air.

04.2 Nearly half of students understood that cooling occurs at point X in the diagram. The two distractors were both equally commonly seen.

04.3 Around half of students knew that iron was used as a catalyst in the Haber process.

04.4 Over 90% of students correctly identified the trend from the given data.

04.5 Nearly three fifths of students achieved all four marks on this scaffolded calculation. Taking the correct numbers from the table was the most common step where students did not gain credit.

04.6 About half of students scored the mark for this item. Change in amount of acid rain was the more common distractor seen.

04.7 Nearly 4 in 5 students correctly identified both compounds that contain nitrogen. Most of the remainder gained one of the two marks.