AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.7.3.2

Condensation polymerisation (HT only)

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**7**
Available paper years	**2009–2025**

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.

4.7.3.2 Condensation polymerisation (HT only)

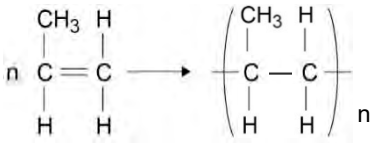
Answer 01 · Mark scheme

March 2009 | CHY1BP | Original Q4 | Legacy

Four	**3**	**3**	**4**	**2**

4.7.3.2 Condensation polymerisation (HT only)

Answer 02 · 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

4.7.3.2 Condensation polymerisation (HT only)

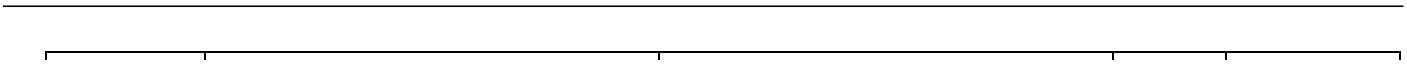
Answer 02 · Mark scheme

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**	

4.7.3.2 Condensation polymerisation (HT only)

Answer 02 · Mark scheme

June 2018 | 8462/2H | Original Q6

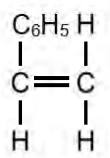


4.7.3.2 Condensation polymerisation (HT only)

Answer 03 · Mark scheme

June 2019 | 8462/2H | Original Q6

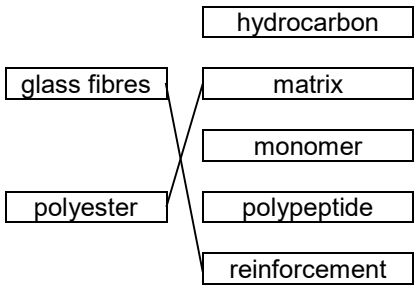
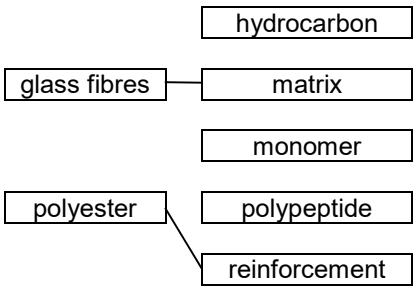
Question 6

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

4.7.3.2 Condensation polymerisation (HT only)

Answer 03 · 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**	

4.7.3.2 Condensation polymerisation (HT only)

Answer 04 · Mark scheme

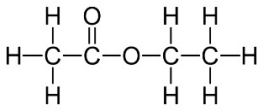
November 2020 | 8462/2H | Original Q7

Question 7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	HCOOH propanoic acid	allow HCO_2H	1 1	AO1 4.7.2.4
07.2	incomplete / partial ionisation (because) reaction is reversible	allow incomplete / partial dissociation allow (because) reaction is in equilibrium	1 1	AO3 4.7.2.4
07.3	mass (of flask and contents) decreases (because) carbon dioxide is produced (and) carbon dioxide escapes (from the flask)	allow **1** mark for the gas produced escapes (from the flask)	1 1 1	AO1 AO2 AO2 4.3.1.3 4.7.2.4
07.4	 ($0.01\ mol/dm^3$) methanoic acid has a lower pH (so $0.01\ mol/dm^3$) methanoic acid has a higher concentration of hydrogen ions (therefore) more collisions per unit time	allow converse argument for ethanoic acid allow ($0.01\ mol/dm^3$) methanoic acid is a stronger acid	 1 1 1	AO2 AO2 AO3 4.6.1.2 4.6.1.3 4.7.2.4
07.5	ethyl ethanoate		1	AO1 4.7.2.4

4.7.3.2 Condensation polymerisation (HT only)

Question 7 (continued)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6			1	AO2 4.7.2.4 4.7.3.2
Total			12	

4.7.3.2 Condensation polymerisation (HT only)

Answer 05 · Mark scheme

November 2020 | 8462/2H | Original Q9

Question 9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	**test:** (use a) glowing splint **result:** relights	do **not** accept burning splint dependent on correct test in MP1 ignore with a pop	1 1	AO1 4.8.2.2 4.9.1.3
09.2	starch cellulose	 allow glycogen	1 1	AO1 4.7.3.4
09.3	2		1	AO1 4.7.3.3
09.4	water	allow H_2O	1	AO1 4.7.3.3
09.5	ammonia nitrogen	 if no other mark awarded, allow **1** mark for NO / NO_2 / N_2O / NO_x or equivalent named compounds	1 1	AO3 4.7.3.3 4.9.1.2

4.7.3.2 Condensation polymerisation (HT only)

Question 9 (continued)

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	two polymer chains	allow two polymer strands	1	AO1 4.7.3.4
	four (different) monomers / nucleotides	allow four (different) bases allow cytosine, guanine, adenine and thymine allow C G A T	1	
	(double) helix	allow spiral	1	
		if no other mark awarded, allow **1** mark for DNA		

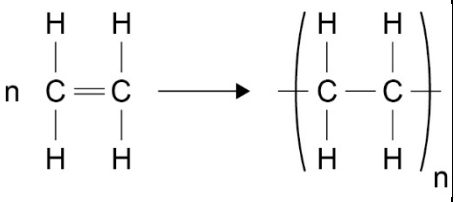
Total			**11**	

4.7.3.2 Condensation polymerisation (HT only)

Answer 06 · 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	

4.7.3.2 Condensation polymerisation (HT only)

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

4.7.3.2 Condensation polymerisation (HT only)

Answer 07 · Mark scheme

June 2025 | 8462/2H | Original Q7

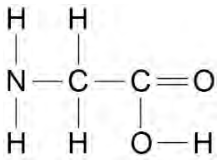
Question 7

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

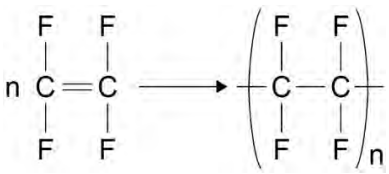
Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	polypeptide	allow polyamide ignore protein	1	AO1 4.7.3.3

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

4.7.3.2 Condensation polymerisation (HT only)

Answer 07 · 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

4.7.3.2 Condensation polymerisation (HT only)

Answer 02 · 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.

4.7.3.2 Condensation polymerisation (HT only)

Answer 04 · Examiner comments November 2020 | 8462/2H | Original Q7

Question 7 (standard, standard / high and high demand)

07.1 Propanoic acid was named correctly much more often than a correct formula was given for methanoic acid. CHCOOH was a commonly seen error here.

07.2 Many students scored at least one mark here. A common misconception was that incomplete / partial ionisation means that each CH_3COOH molecule produces only one H^+ ion, i.e. that the three hydrogen atoms in the CH_3COO^- ion would also form H^+ ions if ionisation were complete.

Answer 04 · Examiner comments November 2020 | 8462/2H | Original Q7

07.3 This part was quite well answered. Most students stated that the mass decreases. Not all of the students who identified carbon dioxide as a product of the reaction went on to explain that it is the escape of this gas that causes the mass to decrease.

07.4 This part was poorly answered by many students. Many recognised that the pH of methanoic acid was lower but far fewer made the link to hydrogen ion concentration. Only a small proportion of students referred to collisions between particles and, of those that did, a significant minority referred to 'more collisions', which was insufficient for the mark, or incorrectly justified the increased collision frequency in terms of the particles having more energy.

07.5 A minority of students were able to name ethyl ethanoate.

07.6 A majority of students were able to identify the displayed structural formula of ethyl ethanoate.

Answer 05 · Examiner comments November 2020 | 8462/2H | Original Q9

Question 9 (standard / high and high demand)

09.1 This part was not very well attempted. Those students who gave the correct test almost always gave the correct result too. However, many tests for carbon dioxide were seen, because students had focused on the first bullet point rather than the whole question. Splints that have been **put out** do not relight. Nor do **lighted** splints as they are already burning.

4.7.3.2 Condensation polymerisation (HT only)

Answer 05 · Examiner comments November 2020 | 8462/2H | Original Q9

09.2 These polymers were not well known. Other naturally occurring polymers were frequently seen, such as DNA and proteins. Many students stated that water, oxygen and carbon dioxide are polymers.

09.3 The majority of students knew that there are two functional groups in amino acids.

09.4 The majority of students knew that water was the other product of the polymerisation.

09.5 The vast majority of students scored the mark for nitrogen. Very few scored the mark for ammonia.

09.6 Most students identified a double helix, fewer mentioned four monomers, nucleotides or bases and very few referred to two polymer chains.

Answer 06 · 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**.

4.7.3.2 Condensation polymerisation (HT only)

Answer 07 · 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.