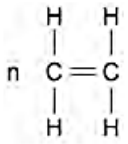
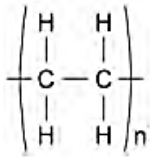
Organic Chemistry GCSE AQA Higher Chemistry Past Papers Answers

01.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	C_6H_{14}		1	AO2/1 4.7.1.1, 4
01.2	A		1	AO1/1 4.7.1.3
01.3	B		1	AO2/1 4.7.2.2, 4 4.9.3.1
01.4	C		1	AO1/1 4.7.2.4
01.5	Propanol		1	AO2/1 4.7.2.3
Total			5	

02.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	*(ethene)*  *(polyethene)* 		1 1	AO1/1 4.7.2.1 4.7.3.1

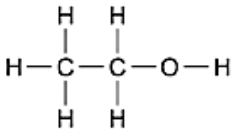
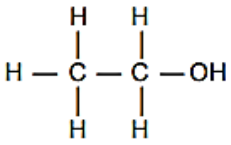
Question	Answers	Extra information	Mark	AO / Spec.
2	any **four** from: • poly(ethene) produced by addition polymerisation whereas polyester by condensation polymerisation • poly(ethene) produced from one monomer wheareas polyester produced from two different monomers • poly(ethene) produced from ethene / alkene whereas polyester from a (di)carboxylic acid and a diol/ alcohol • poly(ethene) is the only product formed whereas polyester water also produced • poly(ethene) repeating unit is a hydrocarbon whereas polyester has an ester linkage		4	AO1/1 AO2/1 AO2/1 AO2/1 AO2/1 4.7.3.1, 2
Total			**6**	

03.

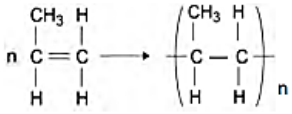
Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	both water vapour and ethanol will condense	allow steam for water vapour allow they both become liquids allow ethane condenses at a lower temperature allow some of the steam hasn't reacted allow it is a reversible reaction/equilibrium	1	AO3/2a 4.1.1.2 4.2.2.4 4.7.2.2
2	amount will decrease because the equilibrium will move to the left		1 1	AO1/1 AO2/1 4.6.2.1, 2, 4, 6 4.7.2.2
3	more ethanol will be produced because system moves to least/fewer molecules		1 1	AO2/1 4.6.2.1, 2, 3, 6 4.7.2.2
Total			**5**	

04.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	formulation		1	AO1 4.8.1.2
2	$\frac{23.3}{265.5 + 23.3 + 3.0 + 1.5}$ (× 100) = 7.9 (%)	an answer of 7.9 (%) scores **2** marks allow $\frac{23.3}{293.3}$ (× 100) allow 7.944084555 (%) rounded correctly	1 1	AO2 4.8.1.2
3	to deter consumption / drinking (by people)		1	AO3 4.7.2.3
4	any **one** from: • fuel • solvent • antiseptic	do **not** accept as an alcoholic drink allow specific uses eg • fuel additive • cleaning products • hand-sanitisers	1	AO2 4.7.2.3
5	ferment(ation) add yeast anaerobic (conditions) **or** warm	ignore distillation allow in the absence of oxygen allow a temperature value in range 5 – 45 °C inclusive allow room temperature ignore hot / heat ignore high temperature	1 1 1	AO1 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6		allow 	1	AO1 4.7.2.3
7	hydrogen	allow H_2	1	AO1 4.7.2.3
8	oxidising (agent)	allow permanganate / dichromate ions allow [O] ignore oxygen	1	AO1 4.7.2.3
Total			**11**	

05.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	water	allow H_2O allow hydrogen chloride **or** HCl	1	AO1 4.7.3.2
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		
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

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

06.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	a temperature between 400 (°C) and 500 (°C) inclusive	allow a temperature range entirely within 400 (°C) and 500 (°C) inclusive	1	AO3 4.7.1.2
2	(diesel oil has a) lower boiling point / range than heavy fuel oil (but diesel oil has a) higher boiling point / range than kerosene	ignore quoted values for boiling points ignore references to melting points ignore references to intermolecular forces or chain length allow temperature of vaporisation / condensation for boiling points throughout allow the boiling range (of diesel oil) is between those of heavy fuel oil and kerosene for **2** marks.	1 1	AO2 4.7.1.2
3	any **two** from: • (too) viscous • not (very) flammable • boiling point (too) high	ignore references to cost allow references to difficulty of flow allow references to difficulty of ignition / burning do **not** accept bitumen takes more energy to burn allow not (very) volatile	2	AO2 4.7.1.3
4	C_6H_{14}		1	AO2 4.7.1.1

	high temperature	ignore references to pressure allow a quoted temperature above 320 °C ignore hot / heat	1	AO1 4.7.1.4
5	any **one** from: • steam • catalyst	 ignore name of catalyst allow alumina allow aluminium oxide allow porous pot allow zeolite	1	
	greater demand (for smaller molecules)	allow converse argument for larger molecules	1	AO1 4.7.1.4
6	any **one** from: (because smaller molecules are) • more useful • better fuels • used to make alkenes • used to make polymers	 allow a named polymer ignore plastics	1	
7	C_3H_6		1	AO2 4.1.1.1 4.7.1.4
Total			**11**	

07.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	wood is renewable **or** (natural) gas is finite		1	AO3 4.9.2.2 4.10.1.1
	(burning) wood produces the same amount of carbon dioxide as the trees absorbed **or** (burning natural) gas increases the amount of carbon dioxide (in the atmosphere)	allow wood is carbon-neutral allow wood does not add to global warming allow (burning natural) gas adds to global warming allow (burning natural) gas adds greenhouse gases (to the atmosphere) ignore references to energy / cost	1	
2	not enough oxygen	allow not enough air do **not** accept no oxygen / air	1	AO1 4.9.3.1
	(so) incomplete combustion		1	
3	$2CH_4(g)+3O_2(g)\rightarrow 2CO(g)+4H_2O(g)$	allow correct multiples / fractions	1	AO2 4.9.3.1

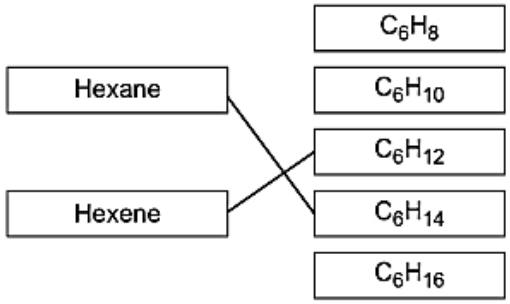
		an answer of 1250 (cm^3 oxygen unreacted) scores **4** marks		AO2 4.3.5 4.7.1.3
	ratio of $O_2 : CO_2 = 5 : 3$		1	
	(oxygen needed = $\frac{3.60 \times 5}{3}$) = 6.0 (dm^3)	allow correct calculation using an incorrectly determined mole ratio	1	
	(oxygen unreacted = 7.25 – 6.0) = 1.25 (dm^3)	allow correct subtraction of an incorrectly calculated volume of oxygen	1	
4	(oxygen unreacted = 1.25 × 1000) = 1250 (cm^3)	allow correct conversion to cm^3 anywhere in response	1	
		alternative approach for MP1 and MP2 moles CO_2 = 0.15 **and** moles O_2 = 0.25 (1) (0.25 x 24 =) 6.0 (dm^3 oxygen needed) (1)		
Total			**9**	

08.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	$\frac{6}{34} \times 100$	an answer of 17.6470588 (%) correctly rounded to at least 2 significant figures scores **2** marks	1	AO2 4.3.3.2
	= 17.6 (%)	allow 17.6470588 (%) correctly rounded to at least 2 significant figures	1	
2	higher yield (of hydrogen or carbon monoxide or product)	allow converse arguments in terms of higher pressure ignore references to rate allow more hydrogen or more carbon monoxide or more product allow equilibrium moves to the right allow equilibrium moves in the forward direction	1	AO2 4.6.2.4 4.6.2.7
	(because) fewer moles / molecules / particles on left hand side **or** (because) more moles / molecules / particles on right hand side	allow (because) the reverse reaction produces fewer moles / molecules / particles **or** allow (because) the forward reaction produces more moles / molecules / particles do **not** accept fewer / more atoms	1	
3	no effect (on yield of hydrogen)	allow position of equilibrium unaffected by pressure ignore references to rate of reaction	1	AO2 4.6.2.7

		an answer of 2.25 scores **3** marks		AO2 4.10.4.1
4	350 (°C) and 285 (atmospheres) = 63 (%) **and** 450 (°C) and 200 (atmospheres) = 28 (%)	allow a value between 62 (%) and 64 (%) inclusive	1	
	$\frac{63}{28}$	allow a correct expression using incorrectly determined value(s) for percentage yield	1	
	= 2.25 (times greater)	allow a correct calculation using incorrectly determined value(s) for percentage yield correctly evaluated and rounded to at least 2 significant figures	1	
5	any **one** from: • the energy costs would be high(er) • the equipment would need to be strong(er) • high(er) pressures are (more) dangerous	allow converse arguments in terms of low(er) pressure ignore energy / cost unqualified allow the equipment would be (more) expensive (to build / maintain) allow (more) dangerous because (greater) risk of explosion	1	AO1 4.10.4.1
6	higher temperatures produce a lower (percentage) yield (of ammonia)	allow converse allow correct reference to shift in equilibrium ignore references to pressure	1	AO2 4.6.2.6 4.10.4.1
7	world population has increased any **one** from: • demand for fertiliser has increased • increased demand for other specified ammonia-based products e.g. nitric acid, drugs, dyes, explosives	allow more food needed	1 1	AO3 AO1 4.10.4.1 4.10.4.2
Total			**12**	

09.

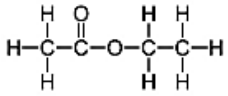
Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	 additional line from a box on the left negates the mark for that box		1 1	AO2 4.7.1.1 4.7.2.1
2	(remains) orange (becomes) colourless	must be in this order allow no (colour) change ignore initial colour ignore clear	 1 1	AO2 4.7.1.4

Question	Answers	Mark	AO/ Spec. Ref
3	**Level 2:** Scientifically relevant features are identified; the way(s) in which they are similar/different is made clear and (where appropriate) the magnitude of the similarity/difference is noted.	4–6	AO1 AO2
	Level 1: Relevant features are identified and differences noted.	1–3	
	No relevant content	0	4.7.1.1 4.7.1.3 4.7.1.4 4.7.2.1 4.7.2.2 4.9.3.1
	Indicative content **Structure and bonding** • both are hydrocarbons • both contain two carbon atoms (per molecule) • ethane contains six hydrogen atoms (per molecule) • (but) ethene contains four hydrogen atoms (per molecule) • both have covalent bonds • ethane contains a single C—C bond • (but) ethene contains a double bond • both contain C—H bonds • both small molecules **Reactions** • both react with oxygen in complete combustion reactions • to produce water and carbon dioxide • both react with oxygen in incomplete combustion reactions • to produce water, carbon monoxide and carbon • incomplete combustion is more likely with ethene • ethene decolourises bromine water • (but) ethane does not decolourise bromine water • ethene is more reactive (than ethane) • ethene can react with hydrogen (to produce ethane) • ethene can react with water (to produce ethanol) • ethene can react with halogens (to produce halogenoalkanes) • ethene can undergo addition reactions • ethene can polymerise (to produce poly(ethene)) ignore physical properties ignore references to flammability		

Total			10

10.

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6			1	AO2 4.7.2.4 4.7.3.2
Total			12	

11.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	use of oil has decreased by 0.8% **or** use of oil has decreased from 1.3% to 0.5%		1	AO2 4.10.1.1
	use of solar energy has increased by 3.4% **or** use of solar energy has increased from 0% to 3.4%	allow any value below 0.05% for 2007	1	
	any **one** from: • use of oil increased from 2007 to 2009 • no change in oil use between 2013 and 2015 • no change in solar energy use between 2007 and 2009 • use of solar energy increased most between 2013 and 2015 • between 2007 and 2011 more oil was used **and** between 2013 and 2017 more solar energy was used	allow use of oil was highest in 2009	1	
		if no other mark is awarded, allow **1** mark for oil decreased **and** solar energy increased		

Question	Answers	Mark	AO / Spec. Ref
2	**Level 3**: Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	AO1
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	AO1
	No relevant content	0	
	Indicative content • carbon dioxide produced • (which is) a greenhouse gas • (therefore) surface temperature increases • (therefore) global warming • (so) climate change • (so) polar ice caps melt • (so) increasing sea levels • (so) flooding • (so) extreme weather events • (so) reduction in biodiversity • (so) famine / drought • sulfur dioxide produced • (which causes) acid rain • (so) damage to buildings / statues • (so) damage to trees • (so) damage to aquatic animals • (so) respiratory problems in humans • carbon / soot produced • (which are) particulates • (which cause) global dimming • (so) respiratory problems in humans • carbon monoxide produced • (which is) toxic		4.9.2.2 4.9.2.3 4.9.3.1 4.9.3.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	solar is (a) renewable (source of energy)	allow oil is (a) finite (source of energy)	1	AO3 4.10.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4	any **two** from: • sunshine is unreliable • increased demand for energy • lack of space	ignore references to cost	2	AO3 4.9.2.4 4.10.1.1

Total			12

12.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	all five points plotted correctly	allow a tolerance of ± ½ a small square allow **1** mark for three or four points plotted correctly	2	AO2 4.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	98 (°C)	allow a value in the range 92 to 104 (°C)	1	AO3 4.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	the boiling point is lower than 0 (°C)	allow the graph cannot show negative temperatures	1	AO3 4.7.1.3

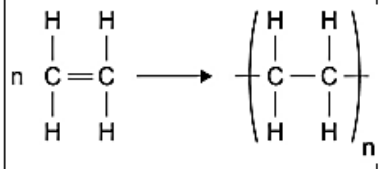
Question	Answers	Extra information	Mark	AO / Spec. Ref.
4	gas	allow (g)	1	AO2 4.2.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5	C_9H_{20}		1	AO2 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6		allow converse for the other alkanes		AO2 4.7.1.2
	(nonane) has a higher boiling point		1	
	(so nonane) condenses where the column has a higher temperature	allow (so nonane) collects where the column has a higher temperature	1	

Total			8

13.

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

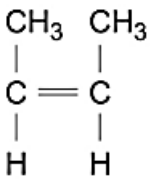
Question	Answers	Extra information	Mark	AO / Spec. Ref.
4		allow converse statements about LDPE		AO3 4.10.3.3
	(in HDPE) polymer chains / molecules are closer together	allow (HDPE has) unbranched polymer chains / molecules	1	
	(so) more atoms per unit volume	allow (so) more molecules per unit volume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

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

Total			9

14.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	C=C bond		1	AO2 4.7.3.1
	2x C-H bonds **and** 2x C-CH_3 bonds	do **not** accept extra bonds	1	
		an answer of  scores **2** marks		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	any **one** from: • (otherwise) the copper (produced) would be impure • (otherwise) the copper (produced) would be a mixture • (otherwise) the insulation would burn / melt (during recycling) • copper and poly(butene) are recycled by different methods	allow (otherwise) the copper (produced) would be contaminated allow (otherwise) poly(butene) could produce toxic fumes	1	AO3 4.10.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	(wire heated until) copper melts		1	AO1 4.10.2.2
	(re)cast / reformed (into pipes)	allow (re)shaped / extruded / (re)moulded	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4		allow converse statements for extracting copper from ores ignore references to cost		AO1 4.10.1.1 4.10.2.2
	any **two** from: (recycling scrap copper) • uses less energy • conserves copper (ore) • (produces) less waste • specified environmental impact	allow less landfill required	2	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5		MP2 dependent on MP1		AO1 4.8.3.2 RPA7
	sodium hydroxide (solution)	allow NaOH for sodium hydroxide	1	
	blue precipitate	allow blue solid	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6	(add acidified) barium chloride (solution)	MP2 dependent on MP1 allow $BaCl_2$ for barium chloride allow (add acidified) barium nitrate (solution) do **not** accept add sulfuric acid	1	AO1 4.8.3.5 RPA7
	white precipitate	allow white solid	1	

Total Question		**11**

15.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	crude oil is heated to vaporise (the hydrocarbons)		1	AO1 AO2 4.7.1.2
	there is a temperature gradient in the (fractionating) column	allow a (fractionating) column is cooler going up	1	
	(so) the gases condense at different levels **or** (so) lubricating oil condenses below naphtha (and petroleum gases do not condense)		1	
	(because of their) different boiling points		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	detergents solvents		1 1	AO1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	$C_9H_{20} + 14\,O_2 \rightarrow 9\,CO_2 + 10\,H_2O$	allow multiples allow **1** mark for $C_9H_{20} + O_2 \rightarrow CO_2 + H_2O$ with incorrect / no multipliers	2	AO2 4.1.1.1 4.3.1.1 4.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4	(when burned sulfur impurities) produce sulfur dioxide		1	AO1 4.9.3.1 4.9.3.2
	(which) causes acid rain **or** (which) causes respiratory problems	allow specified effects of acid rain allow specified respiratory problems	1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5		allow converse statements		AO2 4.7.1.3
	as molecular size increases viscosity increases		1	
	(and) heavy fuel oil has larger molecules (than kerosene)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6	(name of process) cracking		1	AO1 4.7.1.4
	(conditions) high temperature	allow a stated temperature in the range 300 to 900 °C	1	
	steam / catalyst		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7	C_7H_{14} and C_8H_{16}		1	AO2 4.7.1.4 4.7.2.1

Total Question		**16**

16.

Question	Answers	Extra information	Mark	AO / Spec. Ref.
1	(mass =) $\frac{39.8}{29.6}$ (×1) = 1.34 (g)	 allow 1.34459459 (g) correctly rounded to at least 2 significant figures	1 1	AO2 4.7.2.3

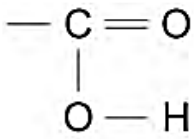
Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	all six points plotted correctly	allow a tolerance of ± ½ a small square allow **1** mark for four or five points plotted correctly	2	AO2 4.7.2.3

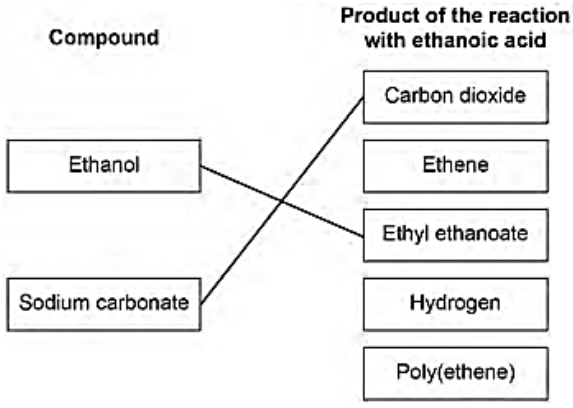
Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	40.6 (kJ)	allow a value in the range 40.4 – 40.8 kJ allow a value consistent with the plotted points	1	AO2 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4	calcium hydroxide		1	AO1 4.8.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5	(limewater turns) milky / cloudy	allow white precipitate (formed) allow calcium carbonate is produced	1	AO1 4.8.2.3

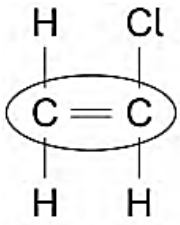
Question	Answers	Extra information	Mark	AO / Spec. Ref.
6	an oxidising agent		1	AO1 4.7.2.3

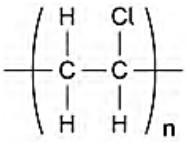
Question	Answers	Extra information	Mark	AO / Spec. Ref.
7			1	AO1 4.7.2.4

Question	Answers	Mark	AO / Spec. Ref.
8	 do **not** accept more than **one** line from a box on the left	1 1	AO1 4.7.2.4

Total Question	11

17.

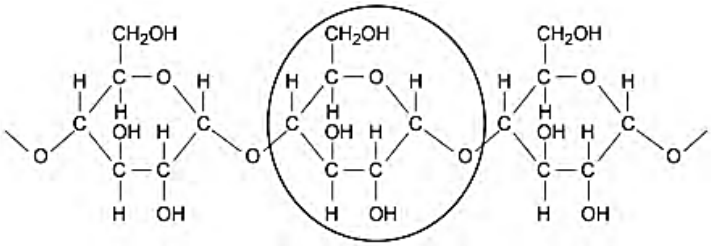
Question	Answers	Extra information	Mark	AO / Spec. Ref.
1			1	AO1 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2	C-C bond 3x C-H **and** 1x C-Cl bonds 2x single bonds extending through brackets **and** n below halfway	an answer of  scores **3** marks	1 1 1	AO2 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
3	composites		1	AO1 4.10.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4	water	allow H_2O	1	AO1 4.7.3.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5	(M_r of NH_2 and COOH) = (2 × 1) + 14 + 12 + (2 × 16) + 1 =) 61		1	AO2 4.3.1.2 4.7.3.3
	(M_r of section = 75 – 61) = 14	allow correct use of incorrectly determined M_r of NH_2 and COOH	1	

Question	Answers	Mark	AO / Spec. Ref.
6		1	AO2 4.7.3.1 4.9.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
7	starch	allow cellulose allow glycogen allow polysaccharide	1	AO3 4.7.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
8	nucleotides		1	AO1 4.7.3.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
9	double helix	ignore DNA	1	AO1 4.7.3.4

Total Question	12