

Question	Answers	Extra information	Mark	AO / Specification reference
01.1	top AL: short hydrocarbons out middle AL: crude oil in bottom AL: long hydrocarbons out		1 1 1	AO1 5.7.1.2
01.2	boiling lower		1 1	AO1 5.7.1.2
01.3	diesel – car engine fuel kerosene – aircraft fuel residue – making roads	one mark for one correct two marks for all correct	2	AO1 5.7.1.2
02.1	<b>one</b> from: <ul style="list-style-type: none"> <li>• lubricants</li> <li>• solvents</li> <li>• polymers</li> <li>• detergents</li> <li>• vehicle fuel</li> <li>• feedstock (for other substances)</li> <li>• petrol</li> </ul>	must specify vehicle fuel	1	AO1 5.7.1.2
02.1	from top: ethane butane		1 1	AO1 5.7.1.1
02.2	$C_{22}H_{46}$		1	AO2 5.7.1.1

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02.3	decane has a lower flammability, higher boiling point, and higher viscosity		1	AO1 5.7.1.3
03.1	Ethane		1	AO2 5.7.1.1
03.2	C <sub>3</sub> H <sub>8</sub> ten C <sub>20</sub> H <sub>42</sub>	one mark for both cells completed	1 1 1	AO2 5.7.1.1
03.3	ethane		1	AO1 5.7.1.1
03.4	2 C atoms and 5 H atoms are added to chain 2 H atoms attached to 1 C atom and 3 H atoms added to end C atom	one mark for correct number of carbons and hydrogens one mark for correct bonds	2	AO2 5.7.1.1
04.1	alkenes have (at least one) carbon-carbon double bond/alkenes are unsaturated	accept reverse argument for alkanes	1	AO1 5.7.1.4
04.2	brown to colourless/decolourises	'clear' does not gain any marks	1	AO1 5.7.1.4
04.3	C <sub>11</sub> H <sub>22</sub> C <sub>15</sub> H <sub>30</sub> C <sub>4</sub> H <sub>8</sub>		1 1 1	AO2 5.7.1.4
04.4	cracking	allow thermal decomposition	1	AO1 5.7.1.4

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04.5	<b>two</b> from: <ul style="list-style-type: none"> <li>ethene has a lower boiling point</li> <li>ethene has a lower melting point</li> <li>ethene is more flammable</li> <li>ethene has lower viscosity/is more runny/is a gas and is a liquid/solid</li> </ul> because pentacontene has a greater molecular size	for this section, award one mark for each correct point up to a maximum of two points  accept reverse argument for pentacontene	2    1	AO2 5.7.1.3
05.1	remains of ancient biomass/plankton that was buried in the mud		1	AO1 5.7.1.1
05.2	evaporation condensation		1 1	AO1 5.7.1.2
05.3	<b>Level 3:</b> Four or more correct uses are given. The writing is clear and coherent.		5-6	AO1 5.7.1.2
	<b>Level 2:</b> Three correct uses are given. The writing is reasonably clear, but not well-organised.		3-4	
	<b>Level 1:</b> One or two correct uses are given. The writing lacks clarity and organisation.		1-2	
	<b>No relevant content.</b>		0	

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	<b>Indicative content:</b> <ul style="list-style-type: none"> <li>• fuels, for example diesel, petrol, kerosene, liquefied petroleum gases</li> <li>• raw materials for solvents</li> <li>• raw materials for lubricants</li> <li>• raw materials for polymers</li> <li>• raw materials for detergents</li> </ul>			
06.1	a mixture of different length hydrocarbons		1	AO1 5.7.1.1
06.2	similar length hydrocarbon chains		1	AO1 5.7.1.2
06.3	boiling point		1	AO1 5.7.1.2
06.4	<b>three</b> from: <ul style="list-style-type: none"> <li>• fuel or named example (petrol, diesel, kerosene, LPG)</li> <li>• solvents</li> <li>• lubricants</li> <li>• polymers</li> <li>• detergents</li> </ul>	one mark for each correct answer up to maximum of three marks	3	AO1 5.7.1.2
06.5	<b>Level 3:</b> Fully detailed description that gives evaporation/vaporisation of crude oil and where each fraction condenses. Explains why the fractions condense at three different locations in the column.		5-6	AO1 5.7.1.2

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	<b>Level 2:</b> Description of the evaporation and condensation of the three fractions, but no explanation given.		3-4	
	<b>Level 1:</b> Identify that fractions condense at different points in the column.		1-2	
	<b>No relevant content.</b>		0	
	<b>Indicative content:</b> <ul style="list-style-type: none"> <li>• crude oil vaporised</li> <li>• passed into fractionating column</li> <li>• fractionating column is hotter at the bottom and cools up the column</li> <li>• residue condenses at the bottom of the column</li> <li>• as hydrocarbons have the highest boiling points</li> <li>• because they are made of the longest hydrocarbon chains</li> <li>• diesel and petrol travel up the column.</li> <li>• diesel condenses when it reaches its boiling point</li> <li>• diesel has higher boiling point than petrol as longer hydrocarbon chains, but lower boiling point than residue as shorter hydrocarbon chain</li> <li>• petrol travels furthest up the column</li> <li>• as it has shortest hydrocarbon chain</li> <li>• condense when it reaches its boiling point</li> <li>• all three tapped off as liquids</li> </ul>			

Question	Answers	Extra information	Mark	AO / Specification reference
07.1	$C_6H_{12}$		1	AO2 5.7.1.4
07.2	$C_{10}H_{22}$	allow error carried forward from question 07.1 if answer given is an alkane	1	AO2 5.7.1.4
07.3	catalytic steam		1 1	5.7.1.4
07.4	short hydrocarbons are more useful than long hydrocarbons (or better fuels/greater demand for short hydrocarbons) but not enough short hydrocarbons come from fractional distillation		1  1	AO1 5.7.1.4
07.5	mix with bromine water bromine water is brown/orange alkene will turn bromine water (back to) colourless	'clear' does not gain any marks	1 1 1	AO1 5.7.1.4
07.6	diesel shows an increase from 12 billion to 30 billion petrol shows a decrease from 32 billion to 18 billion	accept +/- 2 for each mark	1 1	
07.7	<b>one</b> from: <ul style="list-style-type: none"> <li>less diesel fractions cracked to produce petrol</li> <li>increase in the amount of fractions cracked to produce diesel then</li> <li>decrease in the amount of fractions cracked to produce petrol</li> </ul>		1	AO3 5.7.1.4

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08.1	both require heat In catalytic cracking, the vapour is passed over a hot catalyst. In steam cracking, the vapour is mixed with steam before heating.		1 1 1	AO1 5.7.1.4
08.2	$C_{10}H_{22} \rightarrow C_6H_{14} + 2C_2H_4$		1	AO2 5.7.1.1
08.3	to make more smaller alkane molecules for fuels to make alkenes to produce polymers/other chemicals		1 1	AO1 5.7.1.4
09.1	length lowest shortest viscous longest	answers must be in this order	1 1 1 1 1	AO1 AO2 5.7.1.3
09.2	methane		1	AO3 5.7.1.3
09.3	decane: $-30\text{ }^{\circ}\text{C}$ icosane: $36\text{ }^{\circ}\text{C}$ methane: $-182\text{ }^{\circ}\text{C}$ pentadecane: $17\text{ }^{\circ}\text{C}$	one mark for one correct, two marks for two correct, three marks for all correct	3	AO3 5.7.1.3
09.4	oxygen carbon dioxide + water	in either order	1 1	AO2 5.7.1.3

Question	Answers	Extra information	Mark	AO / Specification reference
10.1	compound that contains only carbon atoms and hydrogen atoms		1	AO1 5.7.1.1
10.2	propane		1	AO1 5.7.1.1
10.3	5 C atoms and 12 H atoms are drawn first and last C atoms in chain are attached to 3 H atoms and 1 C atom middle 3 C atoms are attached to 2 H atoms and 2 C atoms	one mark for carbons and hydrogens one mark for bonds	2	AO2 5.7.1.1