AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.7.1.4

Cracking and alkenes

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**26**
Available paper years	**2007–2019**

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.

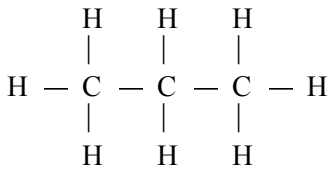
Name: _____ **Date:** _____

Where a precise marking extract is unavailable, the full source document is included in an appendix. Any missing mark scheme is explicitly identified.

4.7.1.4 Cracking and alkenes

Answer 01 · Mark scheme January 2007 | CHY1H | Original Q5 | Legacy

Question 5

	answers	extra information	mark
(a)(i)	heat / evaporate the crude oil / change to gas or vapour	do **not** accept heat with catalyst	1
	cool / condense (hydrocarbons)	allow small molecules at top and / or large molecules at bottom	1
	at different temperatures / boiling points	if the answer describes cracking – no marks	1
(ii)	C_4H_{10}		1
(b)			1
(c)(i)	C_5 to C_8 fraction are fuels **or** easier to burn **or** petrol (fraction)	accept C_{21} to C_{24} fraction not useful as fuels do **not** accept produce more energy	1
(ii)	C_2H_4	do **not** accept C_4H_8	1

Continued on next page

4.7.1.4 Cracking and alkenes

Answer 01 · Mark scheme

	answers	extra information	mark
(iii)	any **three** from: • use different / lighter crude oils • develop markets for low demand fractions • develop new techniques / equipment to use low demand fractions as fuels • cracking • convert low demand fractions to high demand fractions **or** bigger molecules to smaller molecules • develop alternative / bio fuels	do **not** accept price	3
total			10

4.7.1.4 Cracking and alkenes

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

Six	**A**	hydrocarbons undergo thermal decomposition	**3**
	B	hydrocarbons are heated	**1**
	C	hydrocarbons vaporise	**2**
	D	small hydrocarbon molecules	**4**

	A	**B**	**C**	**D**

Answer 03 · Mark scheme June 2007 | CHY1B | Original Q7 | Legacy

Seven	**1**	**3**	**3**	**2**

Answer 04 · Mark scheme January 2008 | CHY1H | Original Q6 | Legacy

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

Answer 05 · Mark scheme March 2008 | CHY1BP | Original Q1 | Legacy

One	**A**	Molecule A	**1**
	B	Molecule B	**4**
	C	Molecule C	**2**
	D	Molecule D	**3**

Answer 06 · Mark scheme March 2008 | CHY1BP | Original Q2 | Legacy

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

	A	**B**	**C**	**D**

Answer 07 · Mark scheme June 2008 | CHY1BP | Original Q2 | Legacy

Two	**A**	Carbon compound **A**	**4**
	B	Carbon compound **B**	**2**
	C	Carbon compound **C**	**3**
	D	Carbon compound **D**	**1**

	A	**B**	**C**	**D**

4.7.1.4 Cracking and alkenes

Answer 08 · Mark scheme

March 2009 | CHY1BP | Original Q6 | Legacy

Six	**4**	**1**	**4**	**2**

Answer 09 · Mark scheme

June 2009 | CHY1BP | Original Q1 | Legacy

One	**A**	Molecule **A**	**1**
	B	Molecule **B**	**4**
	C	Molecule **C**	**2**
	D	Molecule **D**	**3**

Answer 10 · Mark scheme

June 2009 | CHY1BP | Original Q2 | Legacy

Two	**A**	polymerisation	**4**
	B	thermal decomposition	**1**
	C	unsaturation	**2**
	D	hydration (addition of water)	**3**

	A	**B**	**C**	**D**

4.7.1.4 Cracking and alkenes

Answer 11 · Mark scheme

Question 2

question	answers	extra information	mark
2(a)(i)	calcium oxide / quicklime	allow calcium monoxide do **not** accept calcium dioxide ignore chemical formulae	1
2(a)(ii)	any **three** from: • carbon dioxide / CO_2 • (carbon dioxide) reacts (with the calcium hydroxide / slaked lime / plaster) • limestone / calcium carbonate / $CaCO_3$ forms • water is lost / evaporates	it = plaster allow reaction 3 identified do **not** allow incorrect reaction ignore mixes, unless they state the correct product allow marble / chalk allow moisture ignore dries	3
2(b)(i)	as the amount / volume of sand decreases the strength of the mortar increases	accept as sand decreases the mortar is stronger / harder to crack allow as sand decreases the mortar increases allow converse ignore references to height of metal ball	1

Question 2 continues on the next page…

CHY1H

Question 2 continued

question	answers	extra information	mark
2(b)(ii)	any **two** from: • 400 / 5th result is anomalous • the interval between the others is similar or the interval is about 6/7 • he has only one set of results	accept two results (36 and 37 / 400 and 500 / 4th and 5th) are almost the same accept result at 400 should be 42 allow the other results fit a pattern / are on a straight line allow he has only done it once ignore reliable	2
Total			**7**

4.7.1.4 Cracking and alkenes

Answer 11 · Mark scheme

June 2009 | CHY1H | Original Q2 | Legacy

CHY1H

4.7.1.4 Cracking and alkenes

Answer 12 · Mark scheme

June 2009 | CHY1H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	(gases from) volcanoes		1
3(a)(ii)	100	allow 99	1
3(a)(iii)	any **two** from: • photosynthesis • carbon dioxide used • oxygen produced	they = plants allow carbon dioxide decreased allow oxygen increased ignore nitrogen / respiration	2
3(b)(i)	any **one** from: • sea floor spreading • periodic measurements between continents • evidence from rocks / fossils on different continents • new mountain ranges	 accept oceanic ridges / magnetic stripes accept continents move a few centimetres each year accept continents fit together accept new islands	1
3(b)(ii)	in the mantle any **two** from: • convection (currents) / movement • radioactivity / radioactive decay / nuclear reactions • releases heat / thermal energy	 do **not** accept movement of the plates accept heat from core	1 2
Total			**8**

4.7.1.4 Cracking and alkenes

Answer 12 · Mark scheme

June 2009 | CHY1H | Original Q3 | Legacy

CHY1H

4.7.1.4 Cracking and alkenes

Answer 13 · Mark scheme

June 2009 | CHY1H | Original Q6 | Legacy

Question 6

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

Question 6 continues on the next page…

CHY1H

Question 6 Continued

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

4.7.1.4 Cracking and alkenes

Answer 14 · Mark scheme

November 2009 | CHY1BP | Original Q6 | Legacy

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

4.7.1.4 Cracking and alkenes

Answer 15 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)	vaporise / evaporate different condensing points / temperatures	allow boil for vaporise accept condense at different levels ignore different size molecules or different densities mention of cracking = max **1** allow boils at different temperatures and condenses for **2** marks if no other marks awarded allow fractional distillation for **1** mark	1 1
6(b)(i)	3 (C_2H_4)	accept +C_4H_8	1
6(b)(ii)	(decane / naphtha / hydrocarbon) vaporise / evaporate (passed over) a catalyst / alumina / porous pot	allow crude oil allow boil for vaporise ignore other names of catalysts	1 1
6(c)	any **two** from: • alkanes / butane (molecules) do not have a (carbon carbon) double bond / are saturated / have (carbon carbon) single bonds • alkenes / ethene (molecules) have (carbon carbon) double bonds **or** are unsaturated • alkenes / ethene molecules are able to bond to other molecules	'they' must be clarified	2
6(d)	single bonds between carbon atoms the $–CH_3$ group appears on each pair of carbons on the 'chain'	— C – C — NB any double bonds = **0** marks	1 1
Total			**9**

4.7.1.4 Cracking and alkenes

Answer 15 · Mark scheme

January 2010 | CHY1H | Original Q6 | Legacy

CHY1H

4.7.1.4 Cracking and alkenes

Answer 16 · Mark scheme

June 2010 | CHY1H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)	it is a mixture (of hydrocarbons) **or** contains hydrocarbons with different boiling points	accept 'to separate (crude) oil (into fractions) **or** obtain the naphtha (fraction) accept to get useful products ignore removal of impurities	1
6(b)(i)	heat / vaporise	mention of hydrogen = max **1** accept thermal (decomposition) for heat allow boil do not allow temperatures below 100°C ignore steam	1
	catalyst	allow alumina / porous pot ignore other catalysts	1
6(b)(ii)	4 × C – H **and** C = C	ignore brackets with or without an 'n' before them do not allow poly(ethene)	1

Question 6 continues on the next page

4.7.1.4 Cracking and alkenes

Answer 16 · Mark scheme

question	answers	extra information	mark
6(c)	any **four** from: **must** be at least **one** advantage and **one** disadvantage for all four marks <u>crops</u> advantages eg: • renewable (resource) / sustainable • low / less energy / fuel needed for process **or** lower temperature [ignore heat or quoted temperatures] • can use waste plant / crop material • carbon neutral • low safety risk (processes) • low technology disadvantages eg: • batch process / process is slow • many steps in the process • ethanol is impure / may contain water • food shortages • need very large areas of (arable) land to grow crops **or** can only grow in certain areas / climates • destruction of woodland / habitat • slow growth of crops • labour intensive a conclusion with a reasoned argument based on	ignore ideas about carbon dioxide formation / photosynthesis or cost / economics / environmentally friendly candidates are only awarded **1** mark if they use equivalent pairs of bulleted points <u>crude oil</u> disadvantages eg: • *non*-renewable (resource) / finite / running out • high / more energy needed for process **or** higher temperature • not carbon neutral **or** releases locked up carbon • high safety risk (process) • high technology • risk of major oil spillage • can be used to make other products advantages eg: • continuous process / process is fast • few steps in the process • ethanol is pure • ‘conserves’ food • can accept reverse arguments there must be at least one advantage and one disadvantage, however, a	4

4.7.1.4 Cracking and alkenes

Answer 16 · Mark scheme

	valid advantages **and** disadvantages	matched pair, although only awarded one mark would allow the conclusion mark to be awarded	1
Total			**9**

4.7.1.4 Cracking and alkenes

Answer 17 · Mark scheme

March 2011 | CHY1BP | Original Q2 | Legacy

Two	**A**	Molecule **A**	**1**		
	B	Molecule **B**	**4**		
	C	Molecule **C**	**2**		
	D	Molecule **D**	**3**		

	A	**B**	**C**	**D**

Answer 18 · Mark scheme

June 2011 | CHY1BP | Original Q8 | Legacy

Eight	**1**	**4**	**2**	**3**

4.7.1.4 Cracking and alkenes

Answer 19 · Mark scheme

June 2011 | CHY1H | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	heat / high temperature / hot / vaporise	if (fractional) distillation / hydrogenation mentioned as the method = max 1 allow thermal decomposition ignore evaporation do **not** accept 'burns' do **not** accept temperature < 100	1
	catalyst **or** silica / alumina / porous pot **or** steam	ignore other named catalyst allow heat (the vapour) to a very high temperature / >800°C for **2** marks	1
2(a)(ii)	C_2H_3Cl	ignore attempts to balance equation	1
2(a)(iii)	single bonds between C – H, C – Cl **and** C – C	do **not** accept symbols outside the bracket	1
2(b)(i)	so that the amount of plasticiser / (sample of) PVC is the independent / only variable that affects the bending / flexibility of the samples	allow because different sizes would give different results accept because size is a control variable ignore references to reliability / precision etc	1
2(b)(ii)	to improve the reliability (of the investigation)	accept to calculate a mean accept to check for anomalous results **or** to check the range of results ignore accuracy / precision etc	1

Question 2 continues on the next page . . .

4.7.1.4 Cracking and alkenes

CHY1H

Question 2 continued . . .

question	answers	extra information	mark
2(b)(iii)	23	correct answer with or without working = **2** marks if answer is incorrect allow $\frac{22+23+24}{3}$ **or** 21 for **1** mark	2
2(b)(iv)	(PVC) sample had been stretched / used / tested in first three tests	accept higher temperature allow worn **or** become weaker ignore (human) error ignore more flexible / softer ignore intermolecular forces	1
2(c)	does not bend (easily / much) **or** it is not flexible **or** it is rigid	ignore non-biodegradable / low maintenance ignore sturdy / stronger / harder	1
Total			**10**

4.7.1.4 Cracking and alkenes

Answer 19 · Mark scheme

June 2011 | CHY1H | Original Q2 | Legacy

CHY1H

4.7.1.4 Cracking and alkenes

Answer 20 · Mark scheme

Question 7

question	answers	extra information	mark
7(a)(i)	$C_{11}H_{24}$ it does not have a (carbon carbon) double bond **or** it has only single (carbon carbon) bonds.	 linked to first mark point accept it is an alkane **or** it is (a) saturated (hydrocarbon) accept converse statement	1 1
7(a)(ii)	ethene 4 x single C-H bonds 1 x double C=C bond ethanol 5 x single C-H bonds 1 x single C-C bond	 if additional bonds are given on water molecule then both ethene and ethanol must be correct for **1** mark	1 1
7(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 advantages **and / or** disadvantages of environmental or economic or social factors why Brazil should produce ethanol from crude oil or from sugar cane. There is a weak or no conclusion.	There a clear description of advantages **and /or** disadvantages of environmental **and** economic or social factors why Brazil should produce ethanol from crude oil or from sugar cane. There is a conclusion based on the factors described.	There is a detailed description of the advantages **and / or** disadvantages of environmental **and** economic or social factors why Brazil should produce ethanol from crude oil or from sugar cane, considering both processes. There is a justified conclusion.

examples of the chemistry points made in the response			
Sugar cane		**Crude oil**	
Advantage **Environmental:** • it is renewable / sustainable • it grows absorbing CO_2 which makes it 'carbon neutral' **Economical / Social:** • growing it is labour intensive so provides (local, rural) employment • low amount of energy / fuel needed so process costs are low • simple / low technology process so process / investment costs are low		Disadvantage **Environmental:** • it is non-renewable / will run out • it contains 'locked up' carbon / CO_2 **or** when released increases global warming • destruction of marine habitats caused by accidents / spillages **Economical / Social:** • process requires small number of trained workers • high amount of energy / fuel needed so process costs are high • complex / high tech process so process / investment costs are high	
Disadvantage **Environmental:** • destruction of habitats / biodiversity to provide land to grow sugar cane **Economical / Social:** • land should be used to grow food (shortage / cost / population increase) • growing or process is slow / batch / unreliable (crop failure)		Advantage **Environmental:** • does not use land as it is offshore **Economical / Social:** • no loss of food crops • extracting or process is fast / continuous / reliable	
Total			**10**

UMS Conversion Calculator www.aqa.org.uk/umsconversion

4.7.1.4 Cracking and alkenes

Answer 21 · Mark scheme

June 2012 | CH1HP | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)(i)	(1) 5 3 (6) 4 2	all numbers in the correct order gains both marks any two numbers in the correct position gains **1** mark	2
3(a)(ii)	water carbon dioxide	ignore formula if correct name given accept hydrogen oxide allow H_2O allow CO_2 accept carbon monoxide / CO **or** carbon / C	1 1

Question 3 continues on the next page . . .

CH1HP

Question 3 cont'd…

question	answers	extra information	mark
3(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 **basic** description of at least one advantage **or** one disadvantage caused by using plastic shopping bags made from poly(ethene).	There is a **clear** description of both an advantage **and** a disadvantage caused by using plastic shopping bags made from poly(ethene).	There is a **detailed** description of both advantages **and** disadvantages caused by using plastic shopping bags made from poly(ethene).

examples of the chemistry/social points made in the response:
ignore cost unqualified

Advantages:

- Simple properties eg strong / low density / water resistant
- Bags can be reused (for shopping) **or** another specified use eg bin liners
- Money charged for bags can go to good causes **or** encourage reuse
- Poly(ethene) bags can be recycled eg made into milk bottle crates
- Poly(ethene) bags can be burned to provide heat for buildings/generation of electricity
- New bags are now made that can biodegrade

Disadvantages:

- (Older) bags can take many years to biodegrade
- There is a shortage of landfill space
- Bags are made from (crude) oil which is a non-renewable resource/running out
- Large amounts of energy/fuel are used for the production of poly(ethene)
- Production of poly(ethene) releases carbon dioxide/causes global warming
- Specified issue caused by litter eg visual pollution or effect on wildlife
- Burning bags release carbon dioxide / causes global warming

Total			10

4.7.1.4 Cracking and alkenes

Answer 21 · Mark scheme

June 2012 | CH1HP | Original Q3 | Legacy

CH1HP

4.7.1.4 Cracking and alkenes

Answer 22 · Mark scheme

June 2012 | CH1HP | Original Q7 | Legacy

Question 7

question	answers	extra information	mark
7(a)	C_2H_4 a correct other product **and** balanced eg C_4H_{10}		1 1
7(b)	bubbling / fizzing / frothing / effervescence	ignore gas given off **or** solution goes cloudy	1
7(c)	any **five** from the following bullet points: To gain full marks there should be both advantageous and disadvantageous issues and their importance **Advantageous issues using sugar cane:** • sugar cane/plants absorb carbon dioxide / photosynthesise • sugar cane / plants are renewable / sustainable • low energy process	allow converse for ethanol from crude oil ignore costs – unless specified ignore safety ignore simple/low technology process ignore labour intensive as an advantage **linked importance** so is carbon neutral **or** reduce global warming and so save resources / oil **or** crude oil is non-renewable and so it saves fuel **or** / making ethanol from crude oil needs fuel for fractional distillation / cracking	5

Question 7(c) continues on the next page . . .

Question 7(c) cont'd…

question	answers	extra information	mark
7(c)	**Disadvantageous issues using sugar cane:**	ignore fermentation releases carbon dioxide; destruction of habitats/land to build production plants; types of pollution; waste products	
	• large areas of land are needed	which leads to destruction of habitats / forest	
	• land could be used for food crops	may cause food shortages **or** increases the price of food **or** increasing world population	
	• slow process	so limits supply / production of ethanol	
	• ethanol is impure **or** contains 50% ethanol	so needs further separation or ethanol from crude oil is 100% pure	
	• batch process	so uses more labour	
	• the crop yield / supply of ethanol is unreliable	because growth is seasonal / weather dependent **or** possibility of crop failure	
	a justified conclusion	**compensation mark,** if no other mark awarded allow one mark for two or more issues	
Total			**9**

4.7.1.4 Cracking and alkenes

Answer 22 · Mark scheme

June 2012 | CH1HP | Original Q7 | Legacy

CH1HP

4.7.1.4 Cracking and alkenes

Answer 23 · Mark scheme

January 2013 | CH1HP | Original Q3 | Legacy

question	answers	extra information	mark
3(a)	heat to vaporise (the crude oil)	do **not** accept cracking / burning	1
	vapours condense		1
	at different temperatures	allow they have different boiling points	1
3(b)	(alkanes) are hydrocarbons **or** are compounds of hydrogen and carbon only		1
	alkanes are saturated **or** have only (carbon-carbon) single bonds	accept have no (carbon-carbon) double bonds accept general formula is C_nH_{2n+2} for **2** marks	1

CH1HP

question		mark
3(c) Marks awarded for this answer will be determined by the Quality of Written Communication (QWC) as well as the standard of the scientific response.		6

0 marks	Level 1 (1-2 marks)	Level 2 (3-4 marks)	Level 3 (5-6 marks)
No relevant content.	There is a basic description of at least one advantage or one disadvantage of extracting petroleum products from oil sands.	There is a clear description of an advantage and a disadvantage of extracting petroleum products from oil sands.	There is a detailed description of both advantages and disadvantages of extracting petroleum products from oil sands.

examples of the chemistry/environmental/economic/social points made in the response

Advantages:

- the oil sands are needed because crude oil is running out
- this crude oil is needed because demand is increasing
- the oil sands contain a large amount of crude oil
- the oil sands could improve Canada's economy
- the oil sands provide employment for a lot of people
- the trees / forest are used for wood products / fuel

Disadvantages:

- destruction of environment / habitats
- fewer trees / forests to absorb carbon dioxide
- specified pollution, for example, visual, noise, atmospheric (including dust), water (including river or drinking) with cause, e.g. gases/particulates from burning diesel
- large amounts of methane(natural gas) are used to provide energy
- energy / fuel needed for cracking and fractional distillation
- burning fuel releases carbon dioxide
- crude oil / natural gas contains locked up carbon
- crude oil is non-renewable

Total			11

4.7.1.4 Cracking and alkenes

Answer 23 · Mark scheme

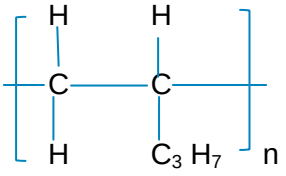
January 2013 | CH1HP | Original Q3 | Legacy

CH1HP

4.7.1.4 Cracking and alkenes

Answer 24 · Mark scheme

June 2015 | CH1HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	any **four** from: • (crude oil is) heated • to evaporate/vaporise/boil (the substances/ hydrocarbons) • the column is hotter at the bottom or is cooler at the top • (vapours/fractions) condense • at their boiling points or at different levels	marks can be taken from a diagram max 3 marks for reference to cracking allow fractional distillation allow vapours (enter the column) allow temperature gradient or (vapours) cool as they rise allow description e.g. vapour turns to liquid) allow they have different boiling points	4	1 / 1.4.1a/b / 1.4.2b
5(b)	acid rain is caused by sulfur dioxide or oxides of nitrogen they react with/are neutralised by calcium carbonate or limestone **OR** global warming is caused by carbon dioxide carbon dioxide will react or dissolve in suspension of limestone	allow consequences of acid rain second marking point is dependent on first marking point allow greenhouse effect is caused by or allow consequences of global warming	1 1 1	2+3 / 1.4.3a/b/c/d / 1.2.1f
5(c)(i)	C_2H_4	must be formula ignore any name	1	2 / 1.1.3b/c / 1.5.1b
5(c)(ii)	a single bond between carbon atoms other four bonds linking hydrogen atoms and C_3H_7 group plus two trailing/connecting bonds n at the bottom right hand corner of the bracket	 would score 3 marks	1 1 1	2 / 1.5.2a

4.7.1.4 Cracking and alkenes

Answer 24 · Mark scheme

5(c)(iii)	has a shape memory or (a smart polymer) can return to original shape (when conditions change)		1	2 / 1.5.2b
Total			**12**	

4.7.1.4 Cracking and alkenes

Answer 24 · Mark scheme

June 2015 | CH1HP | Original Q5 | Legacy

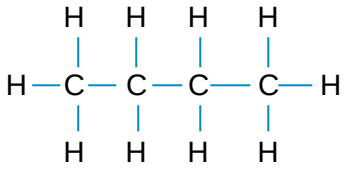


4.7.1.4 Cracking and alkenes

Answer 25 · Mark scheme

June 2016 | CH1HP | Original Q2 | Legacy

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	high temperature catalyst or steam	allow heating / hot / 250-900 °C allow named catalyst eg zeolite, Al_2O_3, silica, ceramic allow in the absence of air / oxygen ignore any references to pressure	1 1	AO1 1.5.1a
2(a)(ii)	colourless	allow decolourised ignore clear / discoloured	1	AO1 1.5.1d
2(a)(iii)			1	AO2 1.4.2a
2(b)(i)	20.3(0) (kJ)	if answer incorrect allow **1** mark for 24.36/1.2	2	AO2 1.4.3b
2(b)(ii)	use a lid reduce energy / heat loss	allow insulate beaker or use draught shield ignore references to thermometer or repeats or distance of flame or loss of water vapour allow stir (1) to distribute energy / heat (1) allow use a metal can (1) as it's a better conductor (1)	1 1	AO3 4.3.2b/c/d
2(b)(iii)	carbon/soot (produced by) incomplete combustion	ignore tar, smoke allow from a limited supply of oxygen/air	1 1	AO1+AO2 1.4.3a/b
2(b)(iv)	hexane gives out the greatest energy (per 1.0 g) hexane produces the least smoke / carbon / soot	ignore more energy allow has the cleanest flame ignore less smoke / carbon / soot	1 1	AO3 1.4.2c; 1.4.3a/b

QWC Mark Scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(c)			6	AO1+AO2+ AO3 1.1.3b; 1.4.1b/c; 1.4.3a/b/c/d ;1.7.2h/i

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.

0 marks	Level 1 (1–2 marks)	Level 2 (3–4 marks)	Level 3 (5–6 marks)
No relevant content	Statements made from the information that indicate whether at least one statement is an advantage **or** a disadvantage **or** a linked advantage or disadvantage	Descriptions of an advantage **and** a disadvantage with some use of their knowledge to add value.	Descriptions of advantages **and** disadvantages that are linked to their own knowledge.

Examples of the added value statements and links made in the response could include:
Note that link words are in bold; links can be either way round.
Accept reverse arguments and ignore cost throughout.

Advantages of using hydrogen:

- Combustion only produces water **so** causes no pollution
- Combustion does not produce carbon dioxide **so** this does not contribute to global warming or climate change
- Combustion does not produce sulfur dioxide **so** this does not contribute to acid rain
- Incomplete combustion of petrol produces carbon monoxide **that is** toxic
- Incomplete combustion of petrol produces particulates **that** contribute to global dimming
- Petrol comes from a non-renewable resource **but** there are renewable/other methods of producing hydrogen
- Hydrogen releases more energy **so** less fuel needed or more efficient

Disadvantages of using hydrogen:

- Hydrogen is a gas **so** is difficult to store or transfer to vehicles
- Hydrogen gas is very flammable **so** leaks cause a greater risk of explosion
- Most hydrogen is produced from fossil fuels **which** are running out
- Cannot be used in existing car engines **so** modification / development or replacement is needed
- Lack of filling stations **so** difficult to refuel your vehicle

Total			18

4.7.1.4 Cracking and alkenes

Answer 26 · Mark scheme

June 2019 | 8462/2H | Original Q1

Question 1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
01.1	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
01.2	(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
01.3	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
01.4	C_6H_{14}		1	AO2 4.7.1.1

4.7.1.4 Cracking and alkenes

Answer 26 · Mark scheme

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