AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.7.1.1

Crude oil, hydrocarbons and alkanes

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**124**
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.

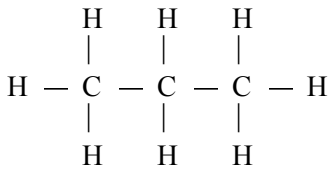
Name: _____ **Date:** _____

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 02 · Mark scheme March 2007 | CHY1A | Original Q3 | Legacy

Three	**A**	0	**3**
	B	5	**1**
	C	8	**2**
	D	70	**4**

Answer 03 · Mark scheme March 2007 | CHY1A | Original Q7 | Legacy

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

Answer 04 · Mark scheme March 2007 | CHY1A | Original Q8 | Legacy

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

Answer 05 · Mark scheme March 2007 | CHY1B | Original Q1 | Legacy

One	**A**	alkanes	**2**
	B	fuels	**1**
	C	monomers	**4**
	D	polymers	**3**

Answer 06 · Mark scheme March 2007 | CHY1B | Original Q2 | Legacy

Two	**A**	carbon dioxide	**1**
	B	nitrogen	**3**
	C	noble gases	**4**
	D	oxygen	**2**

Answer 07 · 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**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 08 · Mark scheme June 2007 | CHY1A | Original Q2 | Legacy

Two	**A** an alloy	**4**		
	B an element	**1**		
	C a hydrocarbon	**2**		
	D a mixture of compounds	**3**		
	A	**B**	**C**	**D**

Answer 09 · Mark scheme June 2007 | CHY1A | Original Q6 | Legacy

Six	**4**	**4**	**3**	**3**

Answer 10 · Mark scheme June 2007 | CHY1A | Original Q8 | Legacy

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

Answer 11 · Mark scheme June 2007 | CHY1A | Original Q9 | Legacy

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

Answer 12 · Mark scheme June 2007 | CHY1B | Original Q2 | Legacy

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 13 · Mark scheme June 2007 | CHY1B | Original Q7 | Legacy

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

Answer 14 · Mark scheme June 2007 | CHY1B | Original Q9 | Legacy

Nine	**4**	**1**	**3**	**4**

Answer 15 · Mark scheme June 2007 | CHY1H | Original Q5 | Legacy

The full source mark scheme begins on page 109. Follow original question 5 in that document.

Answer 16 · Mark scheme November 2007 | CHY1A | Original Q1 | Legacy

One	**A**	condense	**2**
	B	vaporise	**1**
	C	viscous	**4**
	D	volatile	**3**

Answer 17 · Mark scheme November 2007 | CHY1A | Original Q5 | Legacy

Five	**2**	**2**	**3**	**4**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 18 · Mark scheme

November 2007 | CHY1A | Original Q8 | Legacy

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

Answer 19 · Mark scheme

November 2007 | CHY1B | Original Q2 | Legacy

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

Answer 20 · Mark scheme

November 2007 | CHY1B | Original Q9 | Legacy

Nine	**1**	**2**	**3**	**4**

Answer 21 · Mark scheme

January 2008 | CHY1H | Original Q5 | Legacy

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 22 · Mark scheme

January 2008 | CHY1H | Original Q6 | Legacy

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

Answer 23 · Mark scheme

March 2008 | CHY1AP | Original Q2 | Legacy

Two	**A** Hydrocarbons in the crude oil turn to vapour **1** **B** Hydrocarbons collected as gases **2** **C** Hydrocarbons with high boiling points **3** **D** Hydrocarbons condense to form liquids **4**			
	A	**B**	**C**	**D**

Answer 24 · Mark scheme

March 2008 | CHY1AP | Original Q8 | Legacy

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

Answer 25 · 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 26 · Mark scheme

March 2008 | CHY1BP | Original Q2 | Legacy

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 27 · Mark scheme March 2008 | CHY1BP | Original Q9 | Legacy

Nine	**2**	**1**	**1**	**3**

* This question is removed

Answer 28 · Mark scheme June 2008 | CHY1AP | Original Q1 | Legacy

One	**A**	C_2H_5OH	**3**
	B	C_3H_8	**2**
	C	C_2H_4	**1**
	D	S	**4**

Answer 29 · Mark scheme June 2008 | CHY1AP | Original Q2 | Legacy

Two	**A**	carbon monoxide	**3**
	B	carbon particles	**4**
	C	oxygen	**1**
	D	carbon dioxide	**2**

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

Answer 30 · Mark scheme June 2008 | CHY1AP | Original Q4 | Legacy

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

Answer 31 · Mark scheme June 2008 | CHY1AP | Original Q6 | Legacy

Six	**1**	**2**	**4**	**3**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 32 · Mark scheme

June 2008 | CHY1BP | Original Q1 | Legacy

One	**A**	catalysis	**2**
	B	polymerisation	**3**
	C	combustion	**4**
	D	thermal decomposition	**1**

Answer 33 · 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**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 34 · Mark scheme June 2008 | CHY1H | Original Q2 | Legacy

question	answers	extra information	mark
2(a)	any **one** from: • gasoline / petrol / it contains short(er) chains / hydrocarbons **or** small(er) molecules **or** contains few(er) carbons • gasoline / petrol / it has weak(er) / small(er) intermolecular forces	accept fuel oil contains long(er) chain length / large(r) molecules **or** contains many carbons ignore particles accept fuel oil has strong(er) / great(er) intermolecular forces	1
2(b)	any **two** from: • gasoline / petrol / it is in high demand • gasoline / petrol / it is in short supply • (high) tax / duty • cracking costs in terms of money / energy	only accept figures if used in a comparative statement accept fuel oil is in low demand accept fuel oil is plentiful accept answers such as 'gasoline / petrol / its supply is less than demand for **2** marks **or** gasoline / petrol / its percentage in crude oil is less than demand for **2** marks accept cracking expensive	2
2(c)	any **two** from: • (fuel oil / it) heated / vaporised • with catalyst • (to give / form / produce) short(er) chains / hydrocarbons **or** small(er) molecules **or** contains few(er) carbons	ignore particles accept a named catalyst if first two bullet points are not awarded 'cracking' gains **1** mark if wrong process named max **1** mark	2
Total			**5**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 34 · Mark scheme June 2008 | CHY1H | Original Q2 | Legacy

COMPONENT NUMBER: CHY1H

COMPONENT NAME: Science B / Chemistry

STATUS: Final

DATE: June 2008

Answer 35 · Mark scheme November 2008 | CHY1AP | Original Q1 | Legacy

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

Answer 36 · Mark scheme November 2008 | CHY1AP | Original Q3 | Legacy

Three	**4**	**2**	**3**	**3**

Answer 37 · Mark scheme November 2008 | CHY1AP | Original Q9 | Legacy

Nine	**1**	**2**	**3**	**4**

Answer 38 · Mark scheme November 2008 | CHY1BP | Original Q6 | Legacy

Six	**2**	**3**	**2**	**1**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 39 · Mark scheme November 2008 | CHY1BP | Original Q7 | Legacy

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

Answer 40 · Mark scheme March 2009 | CHY1AP | Original Q1 | Legacy

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

Answer 41 · Mark scheme March 2009 | CHY1AP | Original Q6 | Legacy

Six	**3**	**1**	**4**	**2**

Answer 42 · Mark scheme March 2009 | CHY1AP | Original Q8 | Legacy

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

Answer 43 · Mark scheme March 2009 | CHY1BP | Original Q6 | Legacy

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

Answer 44 · Mark scheme June 2009 | CHY1AP | Original Q1 | Legacy

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

Answer 45 · Mark scheme June 2009 | CHY1AP | Original Q5 | Legacy

Five	**3**	**3**	**1**	**2**

Answer 46 · 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**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 47 · 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**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 48 · 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**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 49 · Mark scheme

November 2009 | CHY1AP | Original Q3 | Legacy

Three	**3**	**3**	**1**	**2**

Answer 50 · Mark scheme

November 2009 | CHY1BP | Original Q4 | Legacy

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

Answer 51 · Mark scheme

November 2009 | CHY1BP | Original Q6 | Legacy

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

Answer 52 · Mark scheme

November 2009 | CHY1BP | Original Q8 | Legacy

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 53 · 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**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 53 · Mark scheme

January 2010 | CHY1H | Original Q6 | Legacy

CHY1H

Answer 54 · Mark scheme

March 2010 | CHY1AP | Original Q1 | Legacy

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

Answer 55 · Mark scheme

March 2010 | CHY1AP | Original Q4 | Legacy

Four	**3**	**1**	**3**	**4**

Answer 56 · Mark scheme

March 2010 | CHY1AP | Original Q5 | Legacy

Five	**3**	**3**	**1**	**3**

Answer 57 · Mark scheme

March 2010 | CHY1BP | Original Q3 | Legacy

Three	**3**	**2**	**1**	**1**

Answer 58 · Mark scheme

March 2010 | CHY1BP | Original Q9 | Legacy

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 59 · Mark scheme June 2010 | CHY1AP | Original Q1 | Legacy

Question	Key		
One	**A**	nitrogen dioxide	**4**
	B	carbon monoxide	**3**
	C	carbon dioxide	**2**
	D	soot (carbon)	**1**

Answer 60 · Mark scheme June 2010 | CHY1AP | Original Q8 | Legacy

Eight	**2**	**4**	**2**	**2**

Answer 61 · Mark scheme June 2010 | CHY1BP | Original Q2 | Legacy

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

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

Answer 62 · Mark scheme June 2010 | CHY1BP | Original Q3 | Legacy

Three	**2**	**3**	**1**	**2**

Answer 63 · Mark scheme June 2010 | CHY1BP | Original Q8 | Legacy

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 64 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 64 · Mark scheme

June 2010 | CHY1H | Original Q6 | Legacy

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 65 · Mark scheme November 2010 | CHY1AP | Original Q7 | Legacy

Seven	**2**	**3**	**1**	**4**

Answer 66 · Mark scheme November 2010 | CHY1BP | Original Q2 | Legacy

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

Answer 67 · Mark scheme November 2010 | CHY1BP | Original Q4 | Legacy

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

Answer 68 · Mark scheme November 2010 | CHY1BP | Original Q6 | Legacy

Six	**4**	**3**	**3**	**1**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 69 · Mark scheme

January 2011 | CHY1H | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)	crude oil / it is evaporated / vaporised vapours / gases / fractions <u>cool and condense</u> (different) vapours / gases / fractions (condense) at different temperatures	ignore heated accept named fraction(s) accept (different) vapours / gases / fractions have different boiling points max **2** marks for description of laboratory method **or** mention of cracking	1 1 1
2(b)(i)	any **one** from: • range of boiling points • range of carbon atoms		1
2(b)(ii)	greater the number (of carbon atoms) the higher the boiling point	do **not** accept molecules / particles	1
2(c)(i)	burning / combustion	allow oxidation / redox	1
2(c)(ii)	any **two** from: • cracking / (thermal) decomposition • heat / vaporise • catalyst / aluminium oxide	reaction with hydrogen gains max of **1** mark only allow porous pot ignore names of other catalysts	2
Total			**8**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 69 · Mark scheme

January 2011 | CHY1H | Original Q2 | Legacy

CHY1H

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 70 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)	carbon / diesel / it reacts / burns in oxygen / air		1
	limited supply (of oxygen / air)	accept incomplete combustion $2C + O_2 \rightarrow 2CO$ **or** $C + CO_2 \rightarrow 2CO$ gains **2** marks	1
6(b)	any **four** from: for biodiesel: • less global dimming (because fewer carbon particles) • less acid rain (because less sulfur dioxide) • renewable resource / sustainable • use waste vegetable oils / fats • vegetables / plants absorbed carbon dioxide / carbon neutral • uses land which could be used to produce food • third world countries can produce bio diesel • biodegrades easily • more NOx released justified conclusion	accept converse statements for fossil diesel. ignore cost / ease of manufacture / usage issues if neither point awarded, fewer carbon particles and less sulfur dioxide = **1** mark accept fossil fuel / diesel supplies are limited accept fossil fuel / diesel releases locked up carbon / is not carbon neutral	4 1
Total			**7**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 71 · Mark scheme March 2011 | CHY1AP | Original Q5 | Legacy

Five	**4**	**3**	**2**	**1**

Answer 72 · Mark scheme March 2011 | CHY1AP | Original Q9 | Legacy

Nine	**3**	**2**	**1**	**4**

Answer 73 · Mark scheme March 2011 | CHY1BP | Original Q1 | Legacy

Question	Key		
One	**A**	Formula **A**	**2**
	B	Formula **B**	**3**
	C	Formula **C**	**1**
	D	Formula **D**	**4**

Answer 74 · 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 75 · Mark scheme March 2011 | CHY1BP | Original Q4 | Legacy

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

Answer 76 · Mark scheme March 2011 | CHY1BP | Original Q8 | Legacy

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 77 · Mark scheme June 2011 | CHY1AP | Original Q2 | Legacy

Two	**A**	CO			**1**
	B	CS_2			**4**
	C	C_2H_4			**2**
	D	C_3H_8			**3**
	A		**B**	**C**	**D**

Answer 78 · Mark scheme June 2011 | CHY1AP | Original Q4 | Legacy

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

Answer 79 · Mark scheme June 2011 | CHY1AP | Original Q8 | Legacy

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

Answer 80 · Mark scheme June 2011 | CHY1BP | Original Q2 | Legacy

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

Answer 81 · Mark scheme June 2011 | CHY1BP | Original Q3 | Legacy

Three	**3**	**3**	**3**	**2**

Answer 82 · Mark scheme June 2011 | CHY1BP | Original Q7 | Legacy

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

Answer 83 · Mark scheme June 2011 | CHY1BP | Original Q8 | Legacy

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 84 · 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 . . .

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 84 · Mark scheme

June 2011 | CHY1H | Original Q2 | Legacy

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**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 84 · Mark scheme

June 2011 | CHY1H | Original Q2 | Legacy

CHY1H

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 85 · Mark scheme

June 2011 | CHY1H | Original Q5 | Legacy

Question 5

question	answers	extra information	mark
5(a)	complete diagram with 2 carbon atoms and 5 hydrogen atoms each C–C and each C–H linked by a single line (bond)		1
5(b)(i)	the greater the number of (carbon) atoms (in an alkane molecule) the greater its boiling point **or** vice versa	allow as the (carbon) chain gets longer the boiling point increases ignore melting points do **not** accept reference to greater number of molecules	1
5(b)(ii)	any **two** from: • low boiling point / volatile • low viscosity • high flammability • small molecules • burn completely	they = hydrocarbons from the graph it = $C_{30}H_{62}$ accept they are gases or liquids accept easier to burn / ignite accept short chains ignore number of carbon atoms ignore speed of burning	2
5(c)(i)	16 (CO_2) + 18 (H_2O)		1
5(c)(ii)	(carbon dioxide in the Earth's early) atmosphere	accept from volcanoes (millions of years ago) **or** from dead plants / animals allow dead sea creatures ignore shells	1

Question 5 continues on the next page . . .

4.7.1.1 Crude oil, hydrocarbons and alkanes

CHY1H

Question 5 continued . . .

question	answers	extra information	mark
5(c)(iii)	increase in burning / use of fossil fuels		1
	locked up carbon (carbon dioxide) is released	allow carbon / carbon dioxide from millions of years ago is released accept extra carbon dioxide is not 'absorbed' (by the carbon cycle)	1
Total			**8**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 86 · Mark scheme

June 2011 | CHY1H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6	any **four** from: **Arguments for biodiesel** max **three** from: • sustainable / renewable • (carbon neutral) absorbs CO_2 when growing / during photosynthesis • burning biodiesel produces low amounts particulates / carbon monoxide • can use waste vegetable oils / fats (from food industry) **or** can use waste plant material • can be used to conserve crude oil (instead of / mixed with petroleum diesel) • produced by a low energy / temperature process • biodegrades (easily) **Arguments against biodiesel** max **three** from: • creates food shortages • deforestation to plant more crops leads to loss of habitat / biodiversity **or** deforestation leads to a reduction in absorption of CO_2 • burning biodiesel produces high amounts of nitrogen oxides • crops takes time to grow • vast areas of land needed to grow crops conclusion supported by the argument presented, which must give added value to the points for and against given above	to gain **4** marks both pros and cons should be given allow burning biodiesel produces little / low amount of global dimming ignore sulfur dioxide accept produced by a low tech process ignore engine effects accept price of food increases allow burning trees increases CO_2 allow deforestation increases global warming allow increases acid rain allow crops can fail	4 1
Total			**5**

The AQA UMS Conversion Calculator is available on the Results statistics page of the AQA Website

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 87 · Mark scheme

June 2011 | CHY3H | Original Q6 | Legacy

Question 6

question	answers	extra information	mark
6(a)(i)	(brown / red / orange / yellow) goes colourless / decolourised	ignore discoloured / goes clear do **not** accept incorrect initial colour	1
6(a)(ii)	(carbon carbon) double bond	accept triple / multiple bonds do **not** allow incorrect double bond	1
6(b)	CO_2: 6.6/44 **or** 0.15(mole) H_2O: 2.7/18 **or** 0.15(mole) CH_2	 ignore multiples	1 1 1
Total			**5**

The AQA UMS Conversion Calculator is available on the Results statistics page of the AQA Website

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 88 · Mark scheme November 2011 | CHY1AP | Original Q2 | Legacy

Two	**A**	Hydrocarbons turn to vapour			**1**
	B	Hydrocarbons cool			**3**
	C	Hydrocarbons with low boiling points			**2**
	D	Hydrocarbons condense to form liquids			**4**

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

Answer 89 · Mark scheme November 2011 | CHY1AP | Original Q3 | Legacy

Three	**3**	**1**	**2**	**3**

Answer 90 · Mark scheme November 2011 | CHY1AP | Original Q5 | Legacy

Five	**4**	**2**	**2**	**2**

Answer 91 · Mark scheme November 2011 | CHY1BP | Original Q4 | Legacy

Four	**1**	**3**	**1**	**3**

Answer 92 · Mark scheme November 2011 | CHY1BP | Original Q8 | Legacy

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 93 · Mark scheme

January 2012 | CH1HP | Original Q2 | Legacy

Question 2

question	answers	extra information	mark
2(a)(i)	C_7H_{16}	mark answer line first answer may be given in the table	1
2(a)(ii)	C_nH_{2n+2}		1
2(b)(i)	carbon monoxide	do **not** accept carbon oxide do **not** accept water ignore CO	1
2(b)(ii)	because of partial / incomplete combustion (in reaction 2) **or** complete combustion (in reaction 1)	allow because there is less/insufficient oxygen (in reaction 2) **or** sufficient oxygen (in reaction 1) allow different amounts of oxygen used (in the reactions) **or** $19O_2$ (in reaction 1) **and** $13O_2$ (in reaction 2) ignore air	1
2(c)(i)	15 (%)	ignore units	1
2(c)(ii)	water (vapour) / steam	allow H_2O / OH_2 / hydrogen oxide	1
2(c)(iii)	sulfur in petrol / crude oil (reacts with oxygen)	it = sulfur dioxide	1
2(c)(iv)	because nitrogen **and** oxygen (are in the air and) react at high temperature (inside a petrol engine)	allow nitrogen **and** oxygen burn accept nitrogen + oxygen → nitrogen oxide **or** symbol equation ignore air allow heat/hot (engine)	1 1

Question 2 continues on the next page……..

CH1HP

Question 2 cont'd….

question	answers	extra information	mark
2(d)	because carbon dioxide / it causes global warming **or** because carbon dioxide / it has an impact on oceans because this carbon dioxide / carbon / it was 'locked up' (in fossil fuels) **or** because the percentage/amount of carbon dioxide/it in the atmosphere is increasing	allow because carbon dioxide/it causes greenhouse effect / climate change	1 1
Total			**11**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 93 · Mark scheme

January 2012 | CH1HP | Original Q2 | Legacy

CH1HP

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 94 · Mark scheme

January 2012 | CH1HP | Original Q7 | Legacy

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.

Answer 94 · Mark scheme

examples of the chemistry points made in the response			
Sugar cane 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:** • 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)		**Crude oil** 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 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 95 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 95 · Mark scheme

June 2012 | CH1HP | Original Q3 | Legacy

CH1HP

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 96 · 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**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 96 · Mark scheme

June 2012 | CH1HP | Original Q7 | Legacy

CH1HP

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 97 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 97 · Mark scheme

January 2013 | CH1HP | Original Q3 | Legacy

CH1HP

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 98 · Mark scheme

January 2013 | CH1HP | Original Q8 | Legacy

question	answers	extra information	mark
8(a)	methane		1
	because at the surface temperature of -179°C only methane has melted but has not boiled	accept a correct explanation using the boiling points(and melting points) of the gases **or** methane is a liquid **and** all the others are gases	1
8(b)	CH_4 is a hydrocarbon **or** methane / carbon monoxide contains carbon **or** carbon monoxide + hydrogen → hydrocarbon		1
	nitrogen **and** hydrogen are present in Titan's atmosphere **or** nitrogen + hydrogen → ammonia		1
	carbon monoxide contains oxygen **or** carbon monoxide + hydrogen / methane → water		1
	amino acids contain carbon, hydrogen, nitrogen + oxygen **or** amino acids can be made from (methane), hydrogen, carbon monoxide and nitrogen **OR** lightning / ultraviolet / electrical discharge / high energy needed for reaction		1
Total			**6**

UMS conversion calculator www.aqa.org.uk/umsconversion

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 99 · Mark scheme

June 2013 | CH1HP | Original Q3 | Legacy

Question 3

question	answers	extra information	Mark
3(a)(i)	exothermic	accept combustion allow burning **or** oxidation **or** redox	1
3(a)(ii)	carbon monoxide / *CO* (is produced) because there is incomplete / partial combustion (of the fuel)	allow monoxide (is produced) ignore carbon oxide accept because there is insufficient oxygen / air (to burn the fuel)	1 1

Question 3(b) continues on the next page

Question 3 continued

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 5.		6

0 marks	**Level 1 (1-2 marks)**	**Level 2 (3-4 marks)**	**Level 3 (5-6 marks)**
No relevant content.	There is a statement that crude oil is heated **or** that substances are cooled. However there is little detail and any description may be confused or inaccurate.	There is some description of heating / evaporating crude oil **and either** fractions have different boiling points **or** there is an indication of a temperature difference in the column.	There is a reasonable explanation of how petrol is or fractions are separated from crude oil using evaporating **and** condensing.

If cracking is given as a preliminary or subsequent process to fractional distillation then ignore.

However, if cracking / catalyst is given as part of the process, maximum is **level 2**

examples of chemistry points made in the response could include:

- Some / most of the hydrocarbons (or petrol) evaporate / form vapours or gases
- When some of / a fraction of the hydrocarbons (or petrol) cool to their boiling point they condense
- Hydrocarbons (or petrol) that have (relatively) low boiling points and are collected near the top of the fractionating column or hydrocarbons with (relatively) high boiling points are collected near the bottom of the fractionating column
- The process is fractional distillation
- Heat the crude oil / mixture of hydrocarbons or crude oil / mixture is heated to about 350°C
- Some of the hydrocarbons remain as liquids
- Liquids flow to the bottom of the fractionating column
- Vapours / gases rise up the fractionating column
- Vapours / gases cool as they rise up the fractionating column
- The condensed fraction (or petrol) separates from the vapours / gases and flows out through a pipe
- Some of the hydrocarbons remain as vapours / gases
- Some vapours / gases rise out of the top of the fractionating column
- There is a temperature gradient in the fractionating column or the fractionating column is cool at the top and hot at the bottom

Total			**9**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 100 · Mark scheme

June 2013 | CH1HP | Original Q5 | Legacy

Question 5

question	Answers	extra information	Mark
5(a)(i)	H_2O	must be formula	1
	CaO	must be formula	1
5(a)(ii)		it = carbon (dioxide)	
	carbon dioxide from the air / (Earth's early) atmosphere	accept carbon dioxide from millions of years ago	1
	formed (sedimentary) rocks **or** fossil fuels	ignore trapped / stored	1
5(b)(i)		it = carbon (dioxide)	
	decreases rapidly at first		1
	then slowly **or** levels off		1
		allow both marks if the description is correct using either 'rapidly' **or** 'slowly'	
		allow correct use of figures for either marking point	
		if no other mark awarded, allow CO_2 decreased for **1** mark	
5(b)(ii)	any **two** from: • used by plants • dissolved in oceans • 'locked up' in fossil fuels **or** formed fossil fuels • 'locked up' in rocks **or** formed rocks	it = carbon (dioxide) accept photosynthesis	2

Question 5 continues on the next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 5 continued

question	Answers	extra information	Mark
5(c)		it = percentage of carbon (dioxide)	
	(yes)	ignore yes or no	
	because the percentage of carbon dioxide is increasing		1
	which causes global warming (to increase)	allow (carbon dioxide) causes greenhouse effect/climate change	1
	or		
	(no)		
	because the percentage of carbon dioxide is low (1)		
	compared to millions of years ago (1)	allow global warming can be caused by other factors (e.g. Sun / water vapour / methane)	
Total			**10**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 101 · Mark scheme

June 2013 | CH1HP | Original Q7 | Legacy

Question 7

question	Answers	extra information	Mark
7(a)	ethanol is made up of only one type of molecule **or** ethanol is a compound	allow ethanol is pure	1
	diesel / petrol / rapeseed oil are mixtures	accept composition of diesel / petrol / rapeseed oil varies / changes allow different hydrocarbons have different melting points ignore diesel, petrol and rapeseed oil are impure	1
7(b)(i)	sugar is mixed with / dissolved in water	accept sugar cane for sugar	1
	yeast (is added)	allow enzymes are added if no other mark awarded, allow correct word or chemical equation for **1** mark	1
7(b)(ii)		accept carbon for carbon dioxide	
	(growing sugar cane / rapeseed) plants absorbs carbon dioxide	accept carbon dioxide is used for photosynthesis	1
	which is released (when the biofuel burns)	do **not** accept no carbon dioxide is released (when biofuels burn)	1
7(c)	nitrogen / N_2 **and** oxygen / O_2 (in the air)	do **not** accept fuels contain nitrogen	1
	react in the hot engine / at high temperature		1

Question 7 continues on the next page

Question 7 continued

question	Answers	extra information	Mark
7(d)	any **three** from: • ethanol needs a higher temperature to burn than petrol **or** ethanol has a higher flashpoint than petrol • ethanol releases less energy (per litre) than petrol • sugar is renewable **or** crude oil is non-renewable / will run out • sugar cane growth is unreliable / slow **or** crude oil is a reliable supply • ethanol is made by a batch / slow process **or** petrol is made by a continuous / fast process • ethanol is carbon neutral **or** petrol contains 'locked up' carbon dioxide • sugar / sugar cane should be used for food not for fuels	ignore references to melting point allow ethanol is not readily available **or** petrol is readily available accept idea of food shortages	3
	a justified conclusion that adds value	accept one **additional** point from the list above as long as one comparison of replacing petrol with ethanol is made	1
Total			**12**

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 102 · Mark scheme

June 2013 | CH2HP | Original Q5 | Legacy

Question 5

question	Answers	extra information	Mark
5(a)	because atoms / ions / particles in alloy are different (sizes)	do **not** allow reference to molecules ignore reference to compounds	1
	so layers distorted		1
	(and layers / atoms / ions / particles) don't slide **or** slide less easily		1
		accept all marking points in a suitably labelled or annotated diagram	
		if no other mark awarded accept an alloy is a mixture **or** contains different metals / elements for **1** mark	
5(b)		max **3** marks if incorrect bonding	
	giant structure **or** lattice **or** macromolecule		1
	strong bonds (between carbon / atoms)		1
	covalent (bonds)		1
	each carbon / atom forms 4 bonds	accept tetrahedral	1
		if no other marks awarded, allow carbon (atoms) for **1** mark	
5(c)		reference to incorrect bonding = max **3**	
		reference to 'weak covalent bonds' = max **2**	
		allow correctly drawn diagram for first two marking points eg. (tangled) lines with no cross-links	
	chains **or** large molecules	ignore layers	1
	with intermolecular forces **or** forces between chains	allow bonds for forces accept no cross-links	1
	that are weak	must relate to 2nd marking point	1
	and are easily overcome/ broken (when heated)	accept molecules / chains can flow / move	1
Total			**11**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 103 · Mark scheme

June 2014 | CH1HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
2(a)(i)	reaction with water / steam	allow add water / steam *(to produce ethanol)* *allow H_2O or hydrogen oxide for water* *ignore mix*	1	1 / 1.5.3a	E
2(a)(ii)	filter / decant (to remove the yeast)	*allow answers in either order* *accept description of decanting* *ignore sieve*	1	2 / 1.5.3b	E
	(fractional) distillation / distil	*accept evaporation then condensation*	1		

Answer 103 · Mark scheme

<table>
<tr><td colspan="4">2(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 5, and apply a ‘best-fit’ approach to the marking.</td><td>1+2+3 / 1.4.3e</td><td>E</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><td rowspan="2"></td><td rowspan="2"></td></tr>
<tr><td>No relevant content</td><td>There is a stated advantage or disadvantage of using biodiesel or petroleum diesel.</td><td>There is a stated advantage or disadvantage of using biodiesel or petroleum diesel with a linked consequence.</td><td>There is at least one stated advantage and at least one stated disadvantage of using biodiesel or petroleum diesel with a linked consequence for each.</td></tr>
<tr><td colspan="4">Examples of points made in the response could include:
Advantages of biodiesel:
• Produces less carbon dioxide
• Produces no sulfur dioxide
• Produces less particulates
• Sustainable / renewable
• Growing crops absorb carbon dioxide
• Carbon neutral
• Produces less acid rain
• Conserves the limited amount of petroleum diesel
Disadvantages of biodiesel:
• Produces more nitrogen oxides
• Deforestation for land
• Destruction of habitats for land
• Uses land that could be used for food crops
• Creates food shortages
• Crops are not reliable</td><td></td><td></td></tr>
</table>

Total			**9**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 103 · Mark scheme

June 2014 | CH1HP | Original Q2 | Legacy



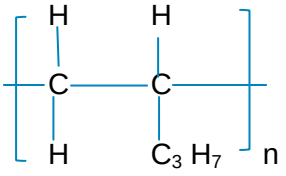
4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 104 · Mark scheme June 2014 | CH1HP | Original Q7 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
7(a)(i)	alkanes **and** alkenes	any order allow saturated **and** unsaturated (hydrocarbons)	1	1 / 1.4.2a	E
7(a)(ii)	high temperature catalyst **or** steam	*allow temperatures from 300 – 900 °C* *allow vapours* *ignore heat / hot **or** pressure* *allow zeolite / aluminium oxide* *ignore names of other catalysts*	1 1	1 / 1.5.1a	E
7(a)(iii)	<u>oxygen</u> could react / *burn* with the hydrocarbons	allow <u>oxygen</u> could cause an explosion	1	2 / 1.5.1a	E
7(a)(iv)	*(fractional)* distillation		1	2 / 1.4.2b	E
7(b)(i)	displayed structure of butene drawn		1	2 / 1.5.1c	E
7(b)(ii)	many monomers **or** many butene molecules *form chains **or** very large molecules*	 if no other mark awarded allow double bond breaks / opens up **or** double bond forms a single bond for **1** mark	1 1	1 / 1.5.2a	E
Total			**8**		

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 105 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 105 · 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**	

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 105 · Mark scheme

June 2015 | CH1HP | Original Q5 | Legacy

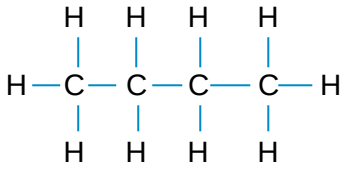


4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 106 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 107 · Mark scheme

June 2016 | CH1HP | Original Q4 | Legacy

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	add yeast		1	AO1
	and ferment **or** by fermentation	allow in a warm place **or** temperatures within the range 20-45°C **or** with an airlock/absence of air	1	1.5.3b
4(a)(ii)	by hydration with steam	allow react with/addition of steam	1	AO1 1.5.3a
	in the presence of a catalyst	ignore names of catalyst and any other conditions allow a correctly named catalyst e.g. phosphoric acid	1	
4(b)		"it" = crude oil		AO1+AO2 1.4; 1.4.3e
		allow the link pairs in either order		
		ignore cost throughout		
	Advantages			
	crude oil is reliable source of ethanol	**or** produces pure ethanol	1	
	because it is not affected by weather conditions or plant growth is affected by weather condition	so purification/separation is not required	1	
	or does not cause food shortages	**or** quick / continuous process		
	because farmland not used	whereas fermentation takes a long time/is a batch process		
	Disadvantages			
	crude oil is a non-renewable / finite resource	allow production of ethanol from crude oil uses more energy or a higher temperature or burns more fossil fuels	1	
	so it will run out / plants grow again	so releases more carbon dioxide or causes global warming (or an effect)	1	

4.7.1.1 Crude oil, hydrocarbons and alkanes

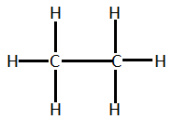
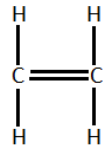
Answer 107 · Mark scheme

June 2016 | CH1HP | Original Q4 | Legacy

4(c)	heat (the mixture) ethanol has a lower boiling point than water **or** more ethanol than water vaporises **or** ethanol evaporates first or when the temperature reaches 78°C condense (the vapour)	 allow ethanol and water boil at different temperatures allow condense at different temperatures for the last two marking points if no other mark is awarded, allow repeat distillation or use fractional distillation apparatus for 1 mark	1 1 1	AO2 1.4.1 b; 1.5.3 b
Total			**11**	

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 108 · Mark scheme June 2017 | CH1HP | Original Q2 | Legacy

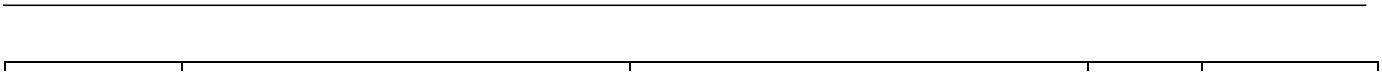
Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)(i)	electronic structure drawn	allow any representation of an electron allow 2,4	1	**AO2** 1.1.1h
2(a)(ii)	six / 6 protons (protons) are positively charged	 do **not** allow electrons in nucleus otherwise ignore electrons do **not** allow nucleus is neutral allow (protons are) + / +1 / 1+ ignore statements about mass if no other mark awarded allow one mark for nucleus	1 1 1	**AO1** **AO2** 1.1.1c;d;e
2(b)	(a hydrocarbon is) made up of hydrogen and carbon (atoms) only	do **not** allow mixture	1	**AO1** 1.4.1a;c
2(c)(i)	 	ethane correctly drawn with another hydrogen on each carbon and another three single bonds ethene correctly drawn with a double bond between the carbon atoms	1 1	**AO1** 1.4.2a 1.5.1c
2(c)(ii)	as the number of carbon atoms increases the boiling point increases	allow converse ignore alkene	1	**AO3** 1.4.2c

2(c)(iii)	the boiling points of alkanes are higher than the boiling points of alkenes that have the same number of carbon atoms **or** state a correct example	allow the boiling points of alkenes are lower than the boiling points of alkanes consequential on first marking point e.g. hexane has a higher boiling point than hexene **or** hexane boils at 69ºC hexene boils at 64ºC if no other mark awarded allow both alkanes and alkenes have the same pattern of the more carbon atoms the higher the boiling point for one mark	1 1	**AO2** 1.4.2b;c
2(d)	(alkane molecules are) cracked to produce small(er) molecules / alkanes / hydrocarbons and alkenes **or** a named alkene	allow break down / up **or** decompose **or** split up ignore separate allow short chain for small allow molecules that have a double bond **or** are unsaturated if no other mark awarded allow evaporate **or** boil for one mark ignore turns to gas	1 1 1	**AO1** **AO2** **AO3** 1.5.1a;b;d
Total			**13**	

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 108 · Mark scheme

June 2017 | CH1HP | Original Q2 | Legacy



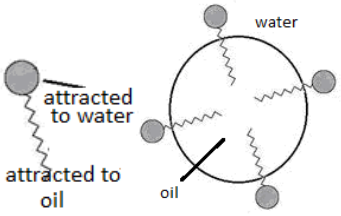
4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 109 · Mark scheme

June 2017 | CH1HP | Original Q6 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
6(a)		accept reverse arguments about fossil diesel throughout		AO2 AO3
	biodiesel is carbon neutral	allow does not contribute to global warming **or** no extra carbon dioxide is released	1	1.4/1.4.3a;c;e
	because biodiesel releases the carbon dioxide that was used by the plants (during photosynthesis) OR biodiesel is renewable / sustainable (1) because crops can be replanted (to produce more biodiesel) (1) OR fossil diesel is non-renewable (1) because it takes millions of years to form (1)		1	

Answer 109 · Mark scheme June 2017 | CH1HP | Original Q6 | Legacy

6(b)	<u>emulsifier</u> is shaken with **or** added to a mixture of water and oil the head (of the emulsifier molecule) **or** hydrophilic end dissolves in the water the tail (of the emulsifier molecule) **or** hydrophobic end dissolves in the oil so that a suspension **or** stable droplets of oil in water (or vice versa) is formed	allow diagrams for the last three marking points allow one mark for wrong way round  (M2 + M3) (M2+M3+M4)	1 1 1 1	**AO1** 1.6.2a;b
6(c)	orange to colourless	allow brown ignore clear / transparent allow decolourised	1 1	**AO1** 1.6.3a
6(d)	(hydrogen) adds to the (carbon-carbon) double bond (hydrogenated oils) have higher melting points so are hardened **or** are solid (at room temperature)	allow opens up / breaks ignore spreadable if no other mark awarded allow one mark for unsaturated oils become saturated	1 1 1	**AO1** 1.6.3a;b
Total			**11**	

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 110 · Mark scheme

June 2018 | 8462/2H | Original Q7

Question	Answers	Extra information	Mark	AO/Spec. Ref.
07.1	incomplete combustion (because) insufficient / limited oxygen supply		1 1	AO1 4.9.3.1
07.2	any **two** from: • carbon monoxide toxic / poisonous • greater public concern / awareness about pollution • more cars so otherwise there would be more carbon monoxide entering atmosphere • improved engine technology • catalytic converters have been introduced	allow description of how carbon monoxide is toxic / poisonous ignore carbon monoxide is harmful / dangerous / deadly ignore comments about the effects of other pollutants ignore unspecified comments about carbon monoxide pollution	2	AO1 AO3 4.9.3.2
07.3	any **one** from: • (to reduce) health problems • (to reduce) global dimming	allow (to reduce) specified health problems eg breathing difficulties, asthma, lung cancer allow (to reduce) the effects of global dimming eg reduced light levels allow (to reduce) smog allow (to reduce) the formation of particulates ignore global warming do **not** accept to reduce soot	1	AO1 4.9.3.1 4.9.3.2

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 110 · Mark scheme

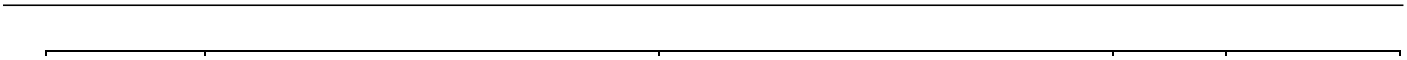
June 2018 | 8462/2H | Original Q7

Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.4	nitrogen (from atmosphere) reacts with oxygen (from atmosphere) at high temperature (in engine) **or** with a spark (from spark plug)	 ignore heat / hot	1 1	AO1 4.9.3.1
07.5	**2** $NO_2 \rightarrow N_2$ + **2** O_2	allow multiples if incorrect, allow N_2 for **1** mark	2	AO2 4.1.1.1 4.3.1.1
07.6	any **two** from: • acid rain • respiratory problems • carbon monoxide • global dimming **or** smog	**max 1** mark if global warming mentioned allow specific effects of acid rain allow specific respiratory problems eg breathing difficulties, asthma	2	AO1 4.9.3.2
07.7	transition metals		1	AO2 4.1.3.2
Total			**12**	

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 110 · Mark scheme

June 2018 | 8462/2H | Original Q7



4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 111 · Mark scheme

June 2018 | 8462/2H | Original Q10

Question	Answers	Mark	AO / Spec. Ref.
10.1	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	AO3
	Level 1: Relevant points are made. They are not logically linked.	1–2	AO2
	No relevant content	0	
	Indicative content **raw materials** • crude oil finite **or** will run out (so will be unavailable for other uses) • wood is a renewable resource • wood involves land use for forestry (so less available for agriculture / food) • wood may involve deforestation (so reduces biodiversity) **manufacturing** • both require energy which may be derived from finite fuels (so they run out more quickly) • paper more energy intensive (so more pollution is possible) • the need for more energy for paper potentially releases more carbon dioxide to the atmosphere (so increases global warming) • paper involves higher water usage (so increases the potential for water pollution) • paper cups are heavier to transport (so have higher energy requirement) • packaging requirements similar (so neither has an advantage) **usage** • both single-use (so neither has an advantage) **disposal** • paper releases more energy if incinerated (so more energy can be used for other purposes) • paper will decompose (so will not remain in landfill) • poly(styrene) could release toxins on incineration • poly(styrene) will not decompose (so will remain in landfill) • poly(styrene) can be used to manufacture other products (so conserves energy **or** finite resources) • both can cause litter **or** visual pollution		4.10.1.1 4.10.2.1

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 111 · Mark scheme

June 2018 | 8462/2H | Original Q10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2		an answer of 6.63×10^4 (kJ) scores **2** marks		AO2 4.10.2.1
	$\frac{1000}{8.3} \times 550$ (kJ)		1	
	$= 6.63 \times 10^4$ (kJ)	allow $6.6265060240963 \times 10^4$ (kJ) correctly rounded allow 66265.060240963 (kJ) correctly rounded for **1** mark	1	
10.3	(melamine is a) thermosetting (polymer)		1	AO3 4.10.3.3
	(which) contains crosslinks / bonds (between polymer chains)	do **not** accept reference to intermolecular forces allow (so) it decomposes	1	AO2 4.10.3.3
Total			**10**	

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 112 · 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 112 · Mark scheme

June 2019 | 8462/2H | Original Q1

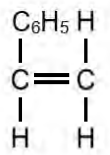
01.5	high temperature any **one** from: • steam • catalyst	ignore references to pressure allow a quoted temperature above 320 °C ignore hot / heat ignore name of catalyst allow alumina allow aluminium oxide allow porous pot allow zeolite	1 1	AO1 4.7.1.4
01.6	greater demand (for smaller molecules) any **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**	

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 113 · Mark scheme

June 2019 | 8462/2H | Original Q6

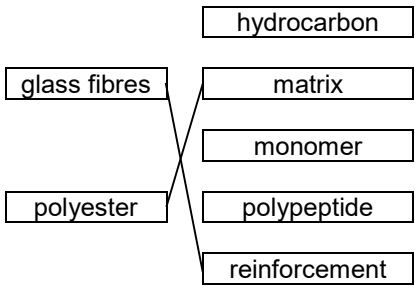
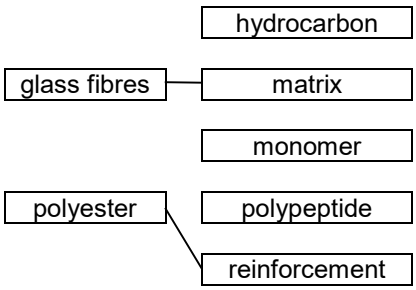
Question 6

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 113 · 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**	

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 114 · Mark scheme

June 2019 | 8462/2H | Original Q8

Question 8

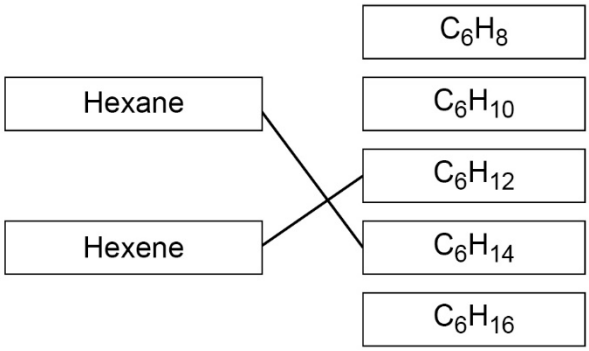
Question	Answers	Extra information	Mark	AO / Spec. Ref.
08.1	(Titan has) little / no oxygen	ignore references to respiration	1	AO3 4.9.1.3
	(so) photosynthesis has not occurred (on Titan)	allow (so) no plants / algae to produce oxygen (on Titan)	1	
	(therefore) little / no carbon dioxide present (on Titan) **or** (therefore) oxygen-using animals cannot have evolved (on Titan)		1	
08.2	(methane) allows short(er) wavelength radiation to pass through (from the sun)	allow (methane) allows uv / ultraviolet radiation to pass through (from the sun)	1	AO1 4.9.2.1
	(which is) re-emitted from the surface as long(er) wavelength radiation	allow (which is) re-emitted from the surface as ir / infra-red radiation	1	
	(which is) absorbed (by methane in the atmosphere)	allow (which is) trapped (by methane in the atmosphere) if no other mark is awarded, allow **1** mark for methane absorbs long(er) wavelength radiation **or** methane absorbs ir / infra-red radiation	1	
08.3	(add) bromine (water)	do **not** accept bromide	1	AO1 4.7.1.4 4.7.2.1 4.7.2.2
	(changes from) orange to colourless	dependent on correct test in MP1 allow (changes from) brown to colourless ignore clear	1	
Total			**8**	

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 115 · Mark scheme

November 2020 | 8462/2H | Original Q3

Question 3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.1	 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
03.2	(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 3 (continued)

Question	Answers	Mark	AO/ Spec. Ref
03.3	**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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 116 · Mark scheme

November 2020 | 8462/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	any **two** from: energy used in: • extraction of raw materials • processing raw materials • manufacturing • transportation • cleaning non-disposable plates • disposal • recycling	allow energy used to make food plate materials	2	AO3 4.10.2.1

Question 5 (continued)

Question	Answers	Mark	AO/ Spec. Ref
05.2	**Level 2:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	3–4	AO3 4.10.1.1 4.10.2.1 4.10.2.2
	Level 1: Some logically linked reasons are given. There may also be a simple judgement.	1–2	
	No relevant content	0	
	Indicative content **Raw materials** • Trees are renewable • Crude oil and clay are finite **Manufacturing and packaging** • Paper plates use the least packaging so conserve raw materials • Paper plates need less transportation overall as more plates in a 10 dm^3 cardboard box **Use and operation** • Paper plates are single use so must be replaced most often • Ceramic plates last longer than polymer plates so must be replaced less often **Disposal** • Polymer / ceramic plates take up landfill which is running out • Paper / polymer plates can be used to make new products • Recycling conserves raw materials **Reasoned judgement**		

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	(wet) clay is shaped		1	AO1 4.10.3.3
	(and) heated in a furnace	allow (and) heated in a kiln / oven allow (and) fired	1	

Total			8

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 117 · Mark scheme

November 2021 | 8462/2H | Original Q2

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	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.
02.2	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.
02.3	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.
02.4	gas	allow (g)	1	AO2 4.2.2.1

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 2 continued

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

Total			8

4.7.1.1 Crude oil, hydrocarbons and alkanes

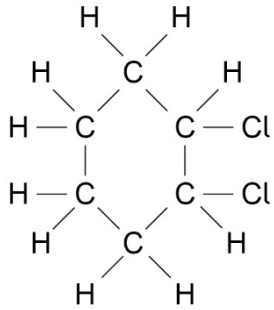
Answer 118 · Mark scheme

November 2021 | 8462/2H | Original Q6

Question 6

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.1	(test) (add) bromine (water) (result) (changes from) brown / orange to colourless	 ignore clear	 1 1	AO1 4.7.1.4 4.7.2.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.2	C_nH_{2n-2}		1	AO2 4.7.2.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.3		allow **1** mark for the structure of 1, 1-dichlorocyclohexane **or** 1, 3-dichlorocyclohexane **or** 1, 4-dichlorocyclohexane	2	AO2 4.7.2.2

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 118 · Mark scheme

November 2021 | 8462/2H | Original Q6

Question 6 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
06.4	(M_r ($C_6H_{10}Cl_2$) =) 153		1	AO2 4.3.1.2
	(% chlorine=) $\frac{71}{153}$ × 100	allow correct use of an incorrectly calculated value of M_r	1	
	= 46.4 (%)	allow 46.405228758 (%) correctly rounded to at least 2 significant figures	1	

Total			**8**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 119 · Mark scheme

November 2021 | 8462/2H | Original Q10

Question 10

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.1	(steam / catalytic) cracking	allow thermal decomposition	1	AO1 4.7.1.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.2	high temperature steam / catalyst	allow a temperature in the range 300 – 900 °C	1 1	AO1 4.7.1.4

Question 10 continued

Question	Answers	Mark	AO/ Spec. Ref
10.3	**Level 3:** Relevant points (reasons/causes) are identified, given in detail and logically linked to form a clear account.	5–6	AO2 4.6.1.3 4.6.2.4 4.6.2.6 4.6.2.7 4.7.2.2
	Level 2: Relevant points (reasons/causes) are identified, and there are attempts at logical linking. The resulting account is not fully clear.	3–4	
	Level 1: Points are identified and stated simply, but their relevance is not clear and there is no attempt at logical linking.	1–2	
	No relevant content	0	
	Indicative content **Rate** • higher temperature gives higher rate • because more frequent collisions • higher pressure gives higher rate • because more frequent collisions • a catalyst can be used to give a higher rate • because the activation energy is reduced **Yield** • higher temperature gives lower yield • because the reaction is exothermic • higher pressure gives higher yield • because there are more molecules on left hand side **Other factors** • higher temperatures use more energy so costs increase • higher pressures use more energy so costs increase • higher pressures require stronger reaction vessels so costs increase **Compromise** • chosen temperature is a compromise between rate and yield • chosen temperature is a compromise between rate and cost (of energy used) • chosen pressure is a compromise between rate and cost (of energy used) • chosen pressure is a compromise between yield and cost (of energy used)		

Question 10 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.4	fermentation	allow ferment(ing)	1	AO1 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.5	warm anaerobic (conditions)	allow a value in the range 25 °C to 45 °C allow without oxygen / air	1 1	AO2 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.6	(conversion) 200 km = 200,000 m (moles =) $\frac{200000 \times 1.95 \text{ (mol)}}{1300}$ = 300 (mol)	 allow correct use of incorrect / no conversion for distance	1 1 1	AO2 4.7.2.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
10.7	$C_4H_9OH + 6\,O_2 \rightarrow 4\,CO_2 + 5\,H_2O$	allow $C_4H_{10}O$ for C_4H_9OH allow multiples allow **1** mark for $C_4H_9OH + O_2 \rightarrow CO_2 + H_2O$ with incorrect / no multipliers ignore state symbols	2	AO2 4.1.1.1 4.3.1.1 4.7.2.3

Total			17

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 120 · Mark scheme

June 2022 | 8462/2H | Original Q3

Question 3

Question	Answers	Mark	AO / Spec. Ref
03.1	**Level 3:** A judgement, strongly linked and logically supported by a sufficient range of correct reasons, is given.	5–6	AO3 4.10.1.1 4.10.2.1
	Level 2: Some logically linked reasons are given. There may also be a simple judgement.	3–4	
	Level 1: Relevant points are made. They are not logically linked.	1–2	
	No relevant content	0	
	Indicative content **raw materials** • crude oil is finite • quarrying / mining pollute the environment • glass uses more energy to process raw materials **manufacturing** • glass uses more energy to make bottles • glass is heavier so takes more energy to transport **use and operation** • glass bottles are reusable • reuse of glass conserves (natural) resources • reuse of glass consumes energy during washing • reuse of glass consumes water during washing **disposal** • both glass and polymer bottles can be recycled • recycling polymer conserves finite resources • recycling glass and polymer uses less energy than making new glass and polymer • both methods reduce use of landfill **other points** • energy needed may be derived from fossil fuels • use of fossil fuels causes (specified) pollution • total energy for glass (bottle) (7500 kJ) is greater than total energy for polymer (bottle) (1800 kJ) **reasoned judgement**		

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 120 · Mark scheme

June 2022 | 8462/2H | Original Q3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
03.2	mass = density × volume mass = 0.40 × 40 = 16 (g)		1 1 1	AO2 4.10.1.1 4.10.2.1

Total Question 3		9

Answer 121 · Mark scheme

June 2022 | 8462/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1	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.
04.2	detergents		1	AO1 4.7.1.2
	solvents		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.3	$C_9H_{20} + 14\,O_2 \rightarrow 9\,CO_2 + 10\,H_2O$	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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 121 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.4	(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.
04.5		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.
04.6	(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	

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 121 · Mark scheme

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

Total Question 4		**16**

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 122 · Mark scheme

June 2024 | 8462/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	high temperatures (cause) nitrogen (from air) and oxygen (from air) to react	ignore pressure	1 1	AO1 4.9.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2		ignore references to water vapour		
	less climate change	allow less global warming allow an effect of climate change for climate change	1	AO1
	(because) no carbon dioxide (produced)		1	AO3 4.7.1.3 4.9.2.4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.3	more oxides of nitrogen (produced)		1	AO1
	(so) more acid rain **or** (so) more respiratory problems	allow an effect of acid rain for acid rain allow a named respiratory problem for respiratory problems MP2 cannot be linked to an incorrect gas from MP1	1	AO3 4.7.1.3 4.9.3.2

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 122 · Mark scheme

June 2024 | 8462/2H | Original Q5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4	(volume of oxygen = $3.50 \times \frac{1}{2}$ =) 1.75 (dm^3)		1	AO2 4.3.5 4.9.1.1
	(volume of air =) $1.75 \times \frac{100}{20}$	allow correct use of an incorrectly determined volume of oxygen	1	
	= 8.75 (dm^3)		1	

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.5	there is a temperature gradient in the (fractionating) column	allow the (fractionating) column gets cooler going up	1	AO1
	(so) kerosene condenses	allow (so) the hydrocarbons / vapours condense	1	AO2
	at the level (in the column) corresponding to kerosene's boiling point (range)	allow at the level (in the column) corresponding to the boiling point of the hydrocarbons / vapours for the award of 2 marks for MP2 and MP3, a reference to kerosene must be made	1	AO1 4.7.1.2

Total Question 5	12

Answer 123 · Mark scheme

Question 2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	fractional distillation		1	AO1 4.1.1.2 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.2	(heater) evaporation (column) condensation	allow liquid to gas allow boiling allow gas to liquid	1 1	AO1 4.2.2.1 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	petrol		1	AO3 4.7.1.2

Question	Answers	Mark	AO / Spec. Ref.
02.4	heavy fuel oil ⟶ diesel oil ⟶ kerosene	1	AO3 4.7.1.2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	C_4H_{10}		1	AO2 4.2.1.4 4.7.1.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.6	butane		1	AO1 4.7.1.1

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 123 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7	C_3H_8 + 5 O_2 → **3** CO_2 + **4** H_2O	allow **1** mark for **3** CO_2 allow **1** mark for **4** H_2O	2	AO2 4.1.1.1 4.3.1.1 4.7.1.3

Total Question 2	**9**

Answer 124 · Mark scheme

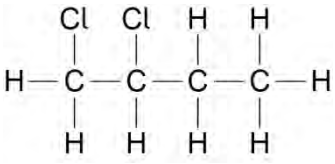
June 2025 | 8462/2H | Original Q5

Question 5

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.1	– 6 (°C)	allow a value in the range (+)4 to –16 (°C)	1	AO2 4.7.1.3

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.2	ethanol	allow C_2H_5OH	1	AO2 4.7.2.2

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.4			1	AO2 4.7.2.2

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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 124 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.6	(because of) incomplete combustion	ignore insufficient oxygen	1	AO1 4.7.2.2

Answer 124 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
05.7	(conversion 24 dm^3 =) 24 000 cm^3	allow conversion of volume anywhere in method	1	AO2 4.3.1.2 4.3.2.1 4.3.5
	(M_r = (3 × 12) + (6 × 1) =) 42		1	4.7.2.1
	(moles = $\frac{2.1}{42}$ =) 0.05	allow correct use of an incorrectly determined M_r	1	
	(volume =) 24 000 × 0.05	allow correct use of an incorrectly determined number of moles allow correct use of an incorrect / no conversion of volume	1	
	= 1200 (cm^3)		1	
	alternative approach			
	(conversion 24 dm^3 =) 24 000 cm^3 (1)	allow conversion of volume anywhere in method		
	(M_r = (3 × 12) + (6 × 1) =) 42 (1)			
	(ratio of mass = $\frac{42}{2.1}$ =) 20 (1)	allow correct use of an incorrectly determined M_r		
	(volume =) $\frac{24\,000}{20}$ (1)	allow correct use of an incorrect / no conversion of volume		
	= 1200 (cm^3) (1)			

Total Question 5	12

Version 1.0: 0707

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Science B 4462 / Chemistry 4421

CHY1H Unit Chemistry 1

Mark Scheme

2007 examination - June series

4.7.1.1 Crude oil, hydrocarbons and alkanes

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.

Further copies of this Mark Scheme are available to download from the AQA Website: www.aqa.org.uk

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Dr Michael Cresswell, Director General.

4.7.1.1 Crude oil, hydrocarbons and alkanes

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.

4.7.1.1 Crude oil, hydrocarbons and alkanes

CHY1H Question 1

	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

4.7.1.1 Crude oil, hydrocarbons and alkanes

CHY1H Question 2

	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

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 2 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

4.7.1.1 Crude oil, hydrocarbons and alkanes

CHY1H Question 3

	answers	extra information	mark
(a)(i)	core		1
(ii)	plate (boundaries)	accept parts of the crust ignore crust alone	1
	sudden movement / colliding **or** normally move a few centimetres per year	accept movement but ignore movement apart accept continental drift	1
	convection currents / driven by heat from radioactive processes / decay	idea of source of energy for the movement	1
	the idea of uncertainty with an explanation eg scientists do not know (with any certainty) • what happens under the crust • where the forces / pressure are building up • we cannot measure the forces • when the forces reach their limit	ignore references to volcanoes	1
(b)(i)	78		1

Continued on next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 3 continued

	answers	extra information	mark
(ii)	marks awarded for any 2 gases from the following 3 gases	max **3** marks from CO_2	
	any **four** from: carbon dioxide has decreased: • used by plants / bacteria (stromatolites) • during photosynthesis (must be linked to CO_2 decrease) • 'locked up' in (sedimentary) rocks / carbonates / fossil fuels • dissolved in oceans **and / or** oxygen has increased because: • released by plants / bacteria (stromatolites) • during photosynthesis (must be linked to O_2 increase) **and / or** nitrogen has increased because • ammonia reacted with oxygen (to release nitrogen) • nitrogen is released by bacteria	ignore references to respiration	4
total			10

4.7.1.1 Crude oil, hydrocarbons and alkanes

CHY1H Question 4

	answers	extra information	mark
(a)	permitted additive / (added) chemicals **or** names / types of additives	accept the chemical name ignore food additive alone	1
(b)(i)	water and oil do not mix / are immiscible **or** don't dissolve each other	ignore density ignore emulsifier alone	1
(ii)	any **two** from: • emulsifier • forms an emulsion • holds the two components together • by lowering the surface tension	 accept description of an emulsion accept stops them separating / they mix allow bonds / binds for holds accept a description of how an emulsifier works for **two** marks eg 'tadpole' diagram or dispersal of oil drops	2
(c)(i)	(because they contain) a double (carbon carbon) bond	accept unsaturated ignore poly or mono	1
(ii)	results suggest sunflower oil is best **or** 'the one that took the least time' because (sunflower oil) has the highest amount of unsaturation / most double bonds / least saturated	 ignore uses up I_2 most quickly second mark is dependent on first	1 1

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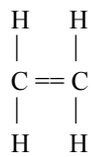
4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 4 continued

	answers	extra information	mark
(d)(i)	any **one** from: • have a higher melting point than (vegetable) oil • are solid at (room temperature) / hardened / harder	 accept useful as spreads **or** doesn't soak into bread ignore hard / soft(er)	1
(ii)	any **two** from: • hydrogen added • to carbon carbon double bond / to saturate • (nickel) catalyst / temperature 60 - 150°C	 do **not** accept 'water' wrong catalyst doesn't get this mark ignore high / warm temperature	2
total			10

4.7.1.1 Crude oil, hydrocarbons and alkanes

CHY1H Question 5

	answers	extra information	mark
(a)(i)	by (fractional) distillation **or** fractionation	accept a description of the distillation process (heat and how separation works) eg heat **and** condense accept boil / vapourise etc for heat	1
(ii)	CO_2 H_2O	note the order of these products must be correct wrong way round = **1** mark	1 1
(b)(i)	(hexane) has been broken down (into smaller hydrocarbons / molecules)	accept (thermal) decomposition / cracked / split / broken up owtte	1
(ii)		accept $CH_2=CH_2$	1
(iii)	water / hydrogen oxide / steam	accept H_2O	1

Continued on next page

4.7.1.1 Crude oil, hydrocarbons and alkanes

Question 5 continued

	answers	extra information	mark
(c)	candidates must include both sugar cane and crude oil in their evaluation **and** both an advantage and a disadvantage to gain full marks. if they do not then the maximum mark is three any **four** from: <u>advantages of using sugar</u> • country has no wealth to buy (large quantities of) crude oil • country has limited technological development **or** underdeveloped / third world country • able / suitable climate to grow sugar cane • enough land to grow sugar cane / land cannot be used to grow food / deforestation • sugar is a renewable source **or** crude oil is a non-renewable resource / finite resource / limited resources • CO_2 / carbon neutral <u>advantages of using alkanes:</u> • economic costs are low • continuous process • country has large oil resources • country has oil refineries / cracking plants • very pure product • faster process	not 'expensive' alone	4
total			10

Answer 110 · Examiner comments

June 2018 | 8462/2H | Original Q7

Question 7 (standard & standard / high demand)

07.1 This was generally well answered with 72% of students achieving one or two marks. The mark most commonly not achieved was for an insufficient or limited oxygen supply. This was usually because the students either did not mention oxygen or failed to say the supply was limited. However a number of students did not achieve the mark by stating that **no** oxygen was present. Global warming was a frequent response but was not creditworthy.

07.2 This was less well answered with 5% of students achieving both marks. Many students realised that CO is toxic in some way, but were too vague using words like 'harmful' or 'dangerous'. However this was the mark which was most frequently awarded.

Many students struggled to find a second reason. Again specific responses were required. Responses such as 'improved technology', 'more efficient cars' were not, on their own, sufficient to gain the 'improved engine technology' mark.

Although the question specifically mentioned new cars, responses comparing old cars to new cars did not normally contain creditworthy material.

07.3 This was not well answered with 11% of students achieving the mark. Most students did not appear to have realised that the question was asking about unburned hydrocarbons. Many who did were side-tracked into talking about wasting petrol / resources, or the flammability of unburned hydrocarbons. Again, global warming was a frequent response which did not gain credit.

07.4 There were a few good responses, but many that were not. 11% of students achieved both marks.

Students did not have to state where the oxygen and nitrogen came from, but when they did this needed to be correct. Nitrogen coming from the petrol or from combustion was not an acceptable response. The second mark was frequently not given because of the use of vague terms such as 'hot', rather than naming the conditions required ('high temperature')

07.5 This was generally well answered, although ‘2N’ was a common incorrect response. Students need to remember that gases such as nitrogen, hydrogen and oxygen normally exist as diatomic molecules. 61% of students achieved both the marks.

07.6 Again global warming and other associated responses were frequently seen, and in this case lost credit. Vague responses were also frequently seen. However most responses referred correctly to acid rain and one mark was often awarded. Some good responses included details about the pollutants that contribute to these effects. 56% of students were able to gain at least one mark.

07.7 61% of students knew that the transition metal block was the most likely source of catalysts.

Answer 111 · Examiner comments

June 2018 | 8462/2H | Original Q10

Question 10 (standard / high & high demand)

10.1 This was an 'extended response', 'level marked' question. There were three levels and the command word was 'evaluate'. The question was marked holistically. Most answers considered all three relevant stages of a Life Cycle Assessment for both types of cup.

However, many answers failed to consider the environmental impact of the factors discussed. For example, students might say that paper cups are heavier to transport, but did not go on to say what environmental impact that might have in terms of more pollution from lorries, or a greater energy requirement burning more fossil fuels and adding to climate change. This limited their mark to level 2, as did failure to give a strongly linked judgement.

Some students misinterpreted 'recyclable' as 'reusable': the terms are not synonymous. The question stated that both types of cup are disposable, ie single use.

Some answers focussed on the economics or ease of use of the cup, rather than environmental impact. Most students were able to acquire at least one mark with 50% of students achieving four marks. 22% of students made it into level 3.

10.2 A mark was often missed through inappropriate rounding to a whole number of cups at an intermediate stage in the working. Others rounded 1000 ÷ 83 to 120.5, then multiplied this figure by 550 and quoted an answer to five significant figures. This gave an answer which did not fit the correct value. Had they rounded to two, three or four significant figures they would have achieved the mark. It is never appropriate to quote an answer to more significant figures than an earlier intermediate step. 50% of students achieved both marks.

10.3 Many students tainted an otherwise good answer by referring to intermolecular forces, often alongside a reference to cross-links. They seem not to realise that the cross-links are covalent bonds.

Others were confused and referred to strong bonds or cross-links between monomers. Some referred to layers rather than chains. 21% of students achieved both marks here, although many more gained a mark for 'thermosetting'.

Use of statistics

Statistics used in this report may be taken from incomplete processing data. However, this data still gives a true account on how students have performed for each question.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 115 · Examiner comments November 2020 | 8462/2H | Original Q3

Question 3 (standard demand)

03.1 The vast majority of students scored both marks here. Again some reversed the responses and there was no pattern in the selection of the distractors.

03.2 Quite well answered, with the majority of students gaining at least one mark. A very wide range of colours for bromine water were seen in addition to orange, including red, yellow, brown and intermediate shades. A common error was to assert that the bromine water **becomes** orange upon addition to hexane. The difference between colourless and clear is now well understood by most.

03.3 This part was not very well answered by many, usually because they focused exclusively on structure and bonding at the expense of reactions, which could indicate that they didn't read the question carefully enough or didn't refer back to the question when constructing their response. Structure and bonding were well understood, but few of the reactions were mentioned. Additionally, students often reversed their answers because they confused ethane and ethene or the formation of their handwriting made it unclear whether a compound name ended 'ane' or 'ene'. The command word 'compare' demands that students mention both compounds to access level 2 and there were some imprecise comparisons such as 'ethane undergoes complete combustion whereas ethene undergoes incomplete combustion'. Because of these points, rather fewer than half of students were able to access level 2.

Answer 116 · Examiner comments November 2020 | 8462/2H | Original Q5

Question 5 (standard and standard / high demand)

05.1 A significant number of students did not realise they were being asked to name the processes for which the energy requirement needed to be known, but instead tried to guess which material would use more energy.

05.2 Very few students gave a reasoned judgement and so were unable to access level 2. Some did not even have comparisons, but simply described the characteristics of each material in isolation. Some referred to deforestation, missing the point that more trees can be grown. Many made valid comparisons of the number of plates that could be packaged in a box and of the number of times each plate could be used, but did not go on to look at the consequences, such as the relative energy cost of transporting the plates or the need for replacement of the plates. Few referred to the conservation of raw materials, either in the context of the number of uses or the lack of recyclability. There was confusion between the terms reusable and recyclable. Some were highly focused on energy usage, even though no energy data was provided.

05.3 Some students knew that moulding and heating were involved, but often did not mention a furnace, kiln or oven. There were some references to heating clay **before** it is shaped.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 117 · Examiner comments November 2021 | 8462/2H | Original Q2

Question 2 (standard demand)

02.1 This was very well attempted and three quarters of students gained both marks.

02.2 Most students were able to determine the boiling point of heptane.

02.3 Two thirds of students identified that the *y*-axis did not fall below 0°C.

02.4 Just over two-thirds of students identified the gaseous nature of butane at 20°C.

02.5 More than three-quarters of students were able to apply the general formula to nonane.

02.6 Many students were able to state that nonane has a higher boiling point than the other alkanes in the table, but far fewer could use this to explain the condensing location in the column.

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Answer 118 · Examiner comments November 2021 | 8462/2H | Original Q6

Question 6 (standard / high and high demand)

06.1 The bromine water test was known by many students, but some of these were then unable to gain the second mark, usually because an incorrect colour change was stated.

06.2 A large number of students were able to apply their knowledge of general formulae to the unfamiliar context of cycloalkenes.

06.3 Only around a third of students gained at least one mark in this demanding question.

06.4 The vast majority of students were able to calculate the relative formula mass of $C_6H_{10}Cl_2$ as 153, although a few used 35 as the relative atomic mass for chlorine even though 35.5 was given in the question stem. Over half of students scored all three marks.

Answer 119 · Examiner comments November 2021 | 8462/2H | Original Q10

Question 10 (standard, standard / high and high demand)

10.2 More than two thirds of students knew one condition (high temperature) and more than one third knew two.

10.3 There was a very wide range of marks but many did not score above Level 1. The main failure to reach Level 2 was that the question focuses on economics so that an answer which fails to mention energy, cost or a compromise in reaction conditions does not meet the level descriptor for Level 2. Similarly, the requirements for Level 3 were not usually met if the references did not mention the impact of reaction conditions on both rate and yield. Only a handful of students gave a Level 3 answer.

Answer 119 · Examiner comments

10.4 Fermentation was well known.

10.5 Around half of students scored one mark by extending their knowledge of fermentation to this unfamiliar context, 'warm' was seen much more often than 'anaerobic'.

10.6 This was completely correct in the responses of nearly half of students. Where a mark was not obtained, this was usually caused by a failure to convert kilometres to metres.

10.7 A challenging concluding equation with no scaffolding which students found difficult.

Concluding Remarks

There is still some evidence that command words are misunderstood or ignored. This limits the marks awarded, especially in extended response questions. This is particularly true where a command word demands a reasoned judgement.

Students seemed well prepared for questions based on Organic Chemistry and Chemistry of the Atmosphere. In this series they seemed less equipped to deal with Chemical Analysis, Rate of Reaction and some aspects of Using Resources.

There were a number of instances of key reagents, techniques and colour changes still not being well known.

Mark Ranges and Award of Grades

Grade boundaries and cumulative percentage grades are available on the Results Statistics page of the AQA Website.

Answer 120 · Examiner comments

June 2022 | 8462/2H | Original Q3

Question 3 (Standard demand)

03.1 In this extended response question, the command word was 'evaluate'. This command word demands a reasoned judgement to be given for a fully complete answer. The vast majority of students did not include a judgement and were therefore unable to access Level 3. Only about 10% of students gained 5 or 6 marks.

Even some students who did give a judgement gained a mark in Level 1 (1-2) often by only comparing the values given in the table or a mark in Level 2 (3-4), by introducing only one or two pieces of 'added value' information about the impacts of the data provided. Roughly 30% of students gained a Level 1 mark and nearly 60% were awarded a Level 2 mark

03.2 Well over 90% of the students gained all three marks on this calculation.

Answer 121 · Examiner comments

June 2022 | 8462/2H | Original Q4

Question 4 (Standard, standard/high and high demand)

04.1 The vast majority of students wrote detailed answers to this question and the full range of marks was awarded although relatively few answers were awarded full marks. About 1 in 10 students scored all four marks, while a quarter scored three. Students often neglected to state the crude oil must be heated to begin the separation process. Some students failed to score the second marking point in the mark scheme because their description of a temperature gradient was not in the context of gases rising through a fractionating column or fractionating tower. A handful of students illustrated this idea by referring to a labelled diagram.

The idea of fractions collecting at different levels in the fractionating column was well understood but many described the collection of fractions without mentioning condensing and so could not access this mark. Some students incorrectly suggested that petroleum gases would condense at the top of the column. The idea that the separation of crude oil is based on differences in boiling points was an accessible mark but many failed to mention boiling points or simply quoted boiling point ranges from the table.

04.2 Just over a third of students were able to score both of the marks available in this multiple choice question. This suggests that the feedstock concept in the specification is not well known.

04.3 Nearly half of the students scored both marks by being able to write a correctly balanced equation for the combustion of nonane. Many were able to pick up one mark for writing the correct formulae for oxygen, carbon dioxide and water. Some students failed to score any marks because they included hydrocarbon molecules in their equation, perhaps confusing this combustion reaction with cracking. Students should be advised to take care when writing numbers in equations. A quickly written 14 sometimes looked like 19 and 19 H_2O was occasionally written by students who had double-counted the oxygen atoms in water. Similarly, excessively large subscript numbers and excessively small capital letters (especially O) are likely not to gain credit.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 121 · Examiner comments

June 2022 | 8462/2H | Original Q4

04.4 This question was generally well answered but some students stated that the combustion of sulfur would cause damage to the car engine while others appeared to confuse the effects of burning sulfur with a lack of oxygen and named the products of incomplete combustion. Some seemed to think that sulfur would be released into the air as a toxic gas but these students could still be credited for a description of the problems caused by sulfur dioxide. These problems were well known; acid rain or respiratory problems were common answers. Around 30% of the students gained both marks.

04.5 Most students scored at least one mark for this question, usually by giving a statement that heavy fuel oil has larger molecules. A relatively small proportion scored the first marking point in the mark scheme for stating the general relationship between molecular size and viscosity. A statement about heavy fuel oil being more viscous than kerosene was insufficient for credit because this repeated information given in the question. Nearly 30% of the students gained both of the marks.

04.6 The full range of marks was awarded. The name of the process was well known but a large proportion of students failed to mention either the high temperature or the use of steam or a catalyst and so gained only two of the three marks. Marks were awarded independently so even students who could not name the process could pick up two marks for correctly describing the conditions. Nearly half of the students gained all three marks here.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 122 · Examiner comments

June 2024 | 8462/2H | Original Q5

Question 5 (standard and standard / high demand)

05.1 This was not well understood. Some students knew that nitrogen and oxygen were reacting together. However, some thought that nitrogen came from the fuel and some that oxygen is a product of combustion. Only a minority mentioned high temperature although many said, 'very hot'. About 15% scored both marks.

05.2 Some students stated that no carbon dioxide is produced when hydrogen burns. However, many simply described what carbon dioxide does to the environment, rather than stating that burning hydrogen instead of methane **reduces** the rate of climate change. Many referred to the greenhouse effect without referencing the effect on the environment, ie climate change. Around 40% scored both marks.

05.3 Most realised that increased levels of nitrogen oxides would be produced. Although there were some good descriptions of what nitrogen oxides do to the environment, very few said that those effects would be increased by burning hydrogen instead of methane, ie **more** acid rain etc. Many thought that nitrogen oxides are greenhouse gases rather than a precursor of acid rain. Some suggested more nitrogen was released to the atmosphere, rather than oxides of nitrogen. Less than 10% of students scored both marks, although more than half scored one.

05.4 Over one-third of students gained all three marks. However, some students appeared to believe that the other 80% of the air was hydrogen. Some tried to involve the relative atomic masses, even though these were not provided. A few unnecessarily converted the volume of hydrogen to moles and then the moles of oxygen to volume, not realising that the mole ratio is the volume ratio for gases. This did score full marks if correct.

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Answer 122 · Examiner comments

June 2024 | 8462/2H | Original Q5

05.5 Most scored the mark for kerosene, or the vapours condensing, and many also described the temperature gradient correctly. Far fewer scored the mark for linking the height in the column to the boiling point and the condensation of kerosene. Most did not mention the height or level in the column, while others seem to think that a vapour only condenses at a temperature below, rather than at, its boiling point. A few students thought that kerosene was either a product of cracking, or a polymer. Just over 10% scored all the marks.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 123 · Examiner comments June 2025 | 8462/2H | Original Q2

Question 2

02.1 Over 90% of students correctly identified fractional distillation.

02.2 More than 4 in 5 students gained both marks here. Incorrect answers gave the state alone, rather than the change.

02.3 Over 90% of students made the link between boiling point and position of production on the column. Petroleum gases was the most common incorrect response given.

02.4 Around three fifths of students correctly linked the boiling point and flammability in this multichoice question. The distractors were equally chosen.

02.5 Nearly 90% of students gained the mark for this item. The most common error was getting the number of atoms of carbon and hydrogen the wrong way round. Very few students did not gain the mark because the numbers were too big.

Answer 123 · Examiner comments June 2025 | 8462/2H | Original Q2

02.6 4 in 5 students correctly named the alkane. Some student responses were unclear between butane and butene, most often when the handwriting was very small and indistinguishable.

02.7 Over 90% of students gained both marks in balancing the equation. Most of the remainder scored one mark, usually for balancing the number of CO_2 produced.

4.7.1.1 Crude oil, hydrocarbons and alkanes

Answer 124 · Examiner comments — June 2025 | 8462/2H | Original Q5

Question 5

05.1 Over four fifths of students correctly estimated the boiling point. Those that did not gain the mark were often giving values that were just outside of the range given in the mark scheme.

05.2 Fewer than half of the students correctly identified ethanol as the product of the reaction between ethene and steam. Many of those who did not gain this mark gave the product as alcohol, which was insufficient.

05.3 Over half of students gained both marks on this item. Where students gained one mark, about 20%, it was because 'damp' was omitted from the test and only litmus paper was given.

05.4 The product of the chlorination of butene was well known by over 90% of students.

05.5 Around three quarters of students correctly identified propene. The most common incorrect response was butene. Very few students did not identify an alkene.

05.6 Around two fifths of students knew that alkenes burn with a smoky flame due to incomplete combustion. Many of the incorrect answers seen referred to there being a double bond present, or that there was insufficient oxygen.

05.7 This multi-step calculation was well answered by over 40% of students who gained all five marks. The most common error was the omission of the volume conversion from dm^3 to cm^3. Some students divided by the volume, rather than multiplying. Equally, a number multiplied by the M_r to calculate the number of moles. In both instances, marks were awarded where clear working was shown for correct

Answer 124 · Examiner comments — June 2025 | 8462/2H | Original Q5

additional steps. when one mark alone was awarded, it was for the correct determination of the M_r.