AQA GCSE Chemistry | 8462

SPECIFICATION POINT 4.7.2.3

Alcohols

Mark schemes and examiner comments

Tier	**Higher**
Question groups	**46**
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.

4.7.2.3 Alcohols

Answer 01 · Mark scheme

March 2007 | CHY1A | Original Q3 | Legacy

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

Answer 02 · Mark scheme

March 2007 | CHY1B | Original Q9 | Legacy

Nine	**2**	**2**	**2**	**4**

4.7.2.3 Alcohols

Answer 02 · Mark scheme

March 2007 | CHY1B | Original Q9 | Legacy

CHY1B (Oils, Earth and Atmosphere) Higher Tier

Question	Key		
One	**A**	hydrocarbons undergo thermal decomposition	**3**
	B	hydrocarbons are heated	**1**
	C	hydrocarbons vaporise	**2**
	D	small hydrocarbon molecules	**4**
Two	**A**	**2**	
	B	**4**	
	C	**3**	
	D	**1**	

	A	B	C	D
Three	**3**	**4**	**4**	**1**
Four	**2**	**2**	**2**	**4**
Five	**4**	**4**	**3**	**1**
Six	**3**	**2**	**4**	**2**
Seven	**2**	**3**	**3**	**2**
Eight	**4**	**4**	**2**	**3**
Nine	**4**	**1**	**3**	**4**

4.7.2.3 Alcohols

Answer 03 · Mark scheme June 2007 | CHY1B | Original Q4 | Legacy

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

Answer 04 · Mark scheme June 2007 | CHY1H | Original Q5 | Legacy

The full source mark scheme begins on page 66. Follow original question 5 in that document.

Answer 05 · Mark scheme November 2007 | CHY1A | Original Q8 | Legacy

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

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

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

Answer 07 · Mark scheme November 2007 | CHY1B | Original Q8 | Legacy

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

4.7.2.3 Alcohols

Answer 08 · Mark scheme

Question 1

question	answers	extra information	mark
(a)	either: calculations: all correct (ethanol = 6, methanol = 3, peanut oil = 10, vegetable oil = 15) **or** implication of correct calculation (vegetable oil) gives largest temperature / heat increase <u>per gram</u> (owtte)	ignore repetition of data from table unqualified allow 'produced most heat in proportion to the fuel used' owtte for **1** mark	2
(b)	any **one** from: • smoke • soot • carbon • carbon monoxide • carbon dioxide • global warming / climate change / greenhouse gases • (air) pollution • harmful / poisonous scrub / wash the gases owtte	owtte ignore references to crops/food filter / remove (gases / fumes / appropriate named substance) owtte (add extra oxygen) can burn more efficiently owtte use a cleaner fuel owtte plant more trees or similar linked to CO_2 any sensible answer 'don't burn so much fuel' insufficient alone ignore extractor fans / air conditioning	1 1

continued…

4.7.2.3 Alcohols

CHY3H

Question 1 continued…

question	answers	extra information	mark
(c)(i)	A		1
(c)(ii)	B		1
total			6

4.7.2.3 Alcohols

Answer 08 · Mark scheme January 2008 | CHY3H | Original Q1 | Legacy

CHY3H

Answer 09 · Mark scheme March 2008 | CHY1BP | Original Q8 | Legacy

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

Answer 10 · Mark scheme June 2008 | CHY1AP | Original Q4 | Legacy

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

Answer 11 · Mark scheme June 2008 | CHY1BP | Original Q1 | Legacy

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

4.7.2.3 Alcohols

Answer 12 · Mark scheme June 2008 | CHY3H | Original Q7 | Legacy

question	answers	extra information	mark
7(a)(i)	energy / heat of products less than energy of reactants	owtte allow products are lower than reactants allow more energy / heat given out than taken in allow methanol is lower allow converse allow energy / heat is given out / lost allow ΔH is negative	1
7(a)(ii)	lowers / less activation energy	owtte allow lowers energy needed for reaction **or** it lowers the peak/ maximum do **not** allow just 'lowers the energy'	1
7(b)(i)	bonds broken: (2 × 435) + 498 = 1368 bonds made: (2 × 805) + (2 × 464) = 2538 energy change: 1368 – 2538 = (–)1170	 allow: (8 × 435) + 498 = 3978 allow: (6 × 435) + (2 × 805) + (2 × 464) = 5148 allow: 3978 – 5148 = (–)1170 ignore sign allow ecf correct answer (1170) = **3** marks	1 1 1
7(b)(ii)	energy released forming new bonds is greater than energy needed to break existing bonds owtte	allow converse do **not** accept energy needed to form new bonds greater than energy needed to break existing bonds	1
Total			**6**

4.7.2.3 Alcohols

Answer 12 · Mark scheme June 2008 | CHY3H | Original Q7 | Legacy

COMPONENT NUMBER: CHY3H

COMPONENT NAME: Chemistry

STATUS: Final

DATE: June 2008

Answer 13 · Mark scheme November 2008 | CHY1AP | Original Q3 | Legacy

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

Answer 14 · 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**	

Answer 15 · Mark scheme June 2009 | CHY1BP | Original Q7 | Legacy

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

Answer 16 · Mark scheme November 2009 | CHY1BP | Original Q2 | Legacy

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

Answer 17 · Mark scheme November 2009 | CHY1BP | Original Q8 | Legacy

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

4.7.2.3 Alcohols

Answer 18 · Mark scheme

March 2010 | CHY1BP | Original Q2 | Legacy

Two	**A**	Ethane		**1**	
	B	Ethene		**2**	
	C	Ethanol		**4**	
	D	Hydrogen		**3**	
	A		**B**	**C**	**D**

Answer 19 · Mark scheme

June 2010 | CHY1BP | Original Q7 | Legacy

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

4.7.2.3 Alcohols

Answer 20 · 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

Answer 20 · Mark scheme

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

4.7.2.3 Alcohols

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

4.7.2.3 Alcohols

Answer 21 · Mark scheme

Question 6

question	answers	extra information	mark
6(a)(i)	less drying time **and/or** less soaking time	allow it is quicker / faster allow converse if they state water	1
6(a)(ii)	forces of attraction / bonds between molecules are weak (owtte) **or** intermolecular forces / bonds are weak (owtte)	do not accept intramolecular forces / covalent bonds are weak forces of attraction are weak (without specifying between molecules / intermolecular) gains **1** mark (accept easily broken / not much energy needed to break instead of weak) bonds are weak without specifying intermolecular would **not** gain a mark and would be ignored. made of small molecules / simple molecular gain **1** mark an answer such as, it is made of small molecules with weak forces of attraction, would gain **2** marks	2
6(b)(i)	exothermic reaction (owtte)	accept answers based on Le Chatelier eg when temperature is low the reaction moves to increase the temperature accept reverse argument	1

Question 6 continued on the next page

Question 6 contd

question	answers	extra information	mark
6(b)(ii)	fewer product molecules / particles (than reactants molecules) (owtte)	accept three molecules / particles / volumes / moles on the left and one on the right (numbers given must be correct) accept answers based on Le Chatelier eg when pressure is high, reaction moves to the side with fewest molecules / smaller volume **or** when pressure is high, reaction moves to reduce the pressure do **not** accept reference to atoms do not accept more reactants than products unless qualified	1
6(b)(iii)	any **two** from: • molecules / particles / they move faster • collide more (often) / quicker • more of the collisions are successful **or** more have the activation energy (owtte) **or** more energetic collisions	 ignore move / vibrate more allow harder collisions allow collide with more force	2
6(c)(i)	16	correct answer with or without working accept correct rounding if the answer is incorrect then check the working. for **1** mark look for correct method in one line of the working. Moles of CO = 14/28 **or** 0.5 **or** Mass of CH_3OH = 0.5 × 32 **or** 28 → 32 **or** 14 → 32/2 **or** $\frac{32}{28} \times 14$	2

Question 6 contd

question	answers	extra information	mark
6(c)(ii)	75	correct answer with or without working allow correct answer with ecf from (c)(i) for **2** marks if the answer is incorrect $\frac{12}{16}\times 100$ **or** $\frac{12}{\text{their (c)(i)}}\times 100$ gains **1** mark **OR if working from 18 g** 66.6 recurring or correctly rounded to a max of 67 = **2** marks incorrect rounding eg 66 = **1** mark **or** $\frac{12}{18}\times 100$ gains **1** mark	2
6(c)(iii)	reversible reaction **or** not all reactants converted to product (owtte) **or** other sensible reason such as: loss of product / reactant **or** impurities in reactants **or** side reactions / other products **or** temperature too high / pressure too low	 allow 'it did not all react' allow gas is lost ignore mass lost ignore some is lost	1
Total			**12**

4.7.2.3 Alcohols

Answer 22 · Mark scheme

January 2011 | CHY3H | Original Q3 | Legacy

Question 3

question	answers	extra information	mark
3(a)	A = energy / enthalpy change / difference	allow heat change **or** ΔH allow energy released	1
	B = activation energy / EA	allow definition of activation energy	1
	C = carbon dioxide and water	accept products	1
3(b)	exothermic	allow combustion / redox / oxidation ignore reduction / burning	1
Total			**4**

4.7.2.3 Alcohols

Answer 22 · Mark scheme January 2011 | CHY3H | Original Q3 | Legacy

CHY3H

Answer 23 · Mark scheme March 2011 | CHY1AP | Original Q6 | Legacy

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

Answer 24 · 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 25 · Mark scheme June 2011 | CHY1AP | Original Q4 | Legacy

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

Answer 26 · Mark scheme June 2011 | CHY1BP | Original Q7 | Legacy

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

Answer 27 · Mark scheme November 2011 | CHY1BP | Original Q2 | Legacy

Two	**A**	Ethane	**4**
	B	Ethanol	**3**
	C	Ethene	**2**
	D	Poly(ethene)	**1**

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

4.7.2.3 Alcohols

Answer 28 · 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.

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

4.7.2.3 Alcohols

Answer 29 · 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 . . .

4.7.2.3 Alcohols

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**

4.7.2.3 Alcohols

Answer 29 · Mark scheme

June 2012 | CH1HP | Original Q7 | Legacy

CH1HP

4.7.2.3 Alcohols

Answer 30 · Mark scheme

question	answers	extra information	mark
6(a)	CO_2 (+) H_2O	correct products	1
	3(O_2) **2**(CO_2) **3**(H_2O)	correct balancing	1
6(b)(i)	add bromine water	allow iodine	1
	changes (from orange) to colourless / decolourised	ignore clear	1
6(b)(ii)		ignore any references to butane (C_4H_{10}) ignore incorrect names of catalysts	
	octane vapours		1
	are passed over a catalyst (to produce ethene)		1
	OR		
	octane mixed with steam (1)	for steam cracking, second mark is conditional on 'steam'	
	at a (very) high temperature (1)		
	steam is added (to ethene)	ignore the formula H_2O / water	1
	in the presence of a catalyst (to produce ethanol)		1
		if no other marks awarded then allow **1** mark for cracking of octane **or** hydration of ethene	
Total			**8**

4.7.2.3 Alcohols

Answer 30 · Mark scheme

January 2013 | CH1HP | Original Q6 | Legacy

CH1HP

4.7.2.3 Alcohols

Answer 31 · 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**

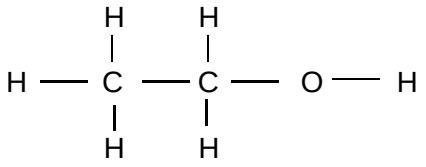
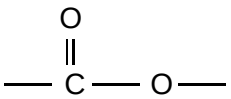
UMS Conversion Calculator: www.aqa.org.uk/umsconversion

4.7.2.3 Alcohols

Answer 32 · Mark scheme

June 2013 | CH3HP | Original Q2 | Legacy

Question 2

question	Answers	extra information	Mark
2(a)(i)		allow other arrangements provided connectivity is correct allow —OH	1
2(a)(ii)	oxygen oxidation	accept O_2 allow O allow oxidisation / oxidising / oxidised allow redox	1 1
2(b)(i)	ring around 		1
2(b)(ii)	ester(s)	do **not** allow ether(s)	1
2(b)(iii)	propanol	accept propan-1-ol allow propyl alcohol	1
Total			**6**

4.7.2.3 Alcohols

Answer 33 · 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		

4.7.2.3 Alcohols

<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**

4.7.2.3 Alcohols

Answer 33 · Mark scheme

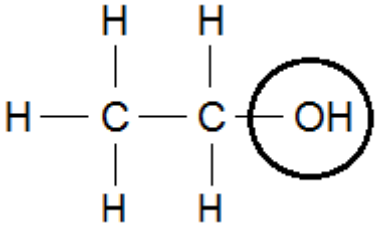
June 2014 | CH1HP | Original Q2 | Legacy



4.7.2.3 Alcohols

Answer 34 · Mark scheme

June 2014 | CH3HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.	ID
2(a)(i)			1	1 / 3.6	G
2(a)(ii)	ethanol	*allow ethyl alcohol* *do **not** accept ethanal* *ignore all formulae*	1	1 / 3.3.1a	G
2(b)(i)	any **two** from: • lid • *metal* calorimeter • insulation (around sides of beaker) • excluding draughts • stirrer	 allow *metal* beaker do **not** allow flammable insulation / beaker *allow stirring*	2	3 / 3.3.1a	E

4.7.2.3 Alcohols

Answer 34 · Mark scheme

June 2014 | CH3HP | Original Q2 | Legacy

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / Spec. Ref.</th><th>ID</th></tr>
<tr><td colspan="4">2(b)(ii) 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.

<table>
<tr><th>0 marks</th><th>Level 1 (1–2 marks)</th><th>Level 2 (3–4 marks)</th><th>Level 3 (5–6 marks)</th></tr>
<tr><td>No relevant content</td><td>There is a description of part of an experimental method or a measurement which should be taken.</td><td>There is a description of some parts of an experimental method and a measurement which should be taken.</td><td>There is a description of an experimental method and measurements which should be taken.</td></tr>
</table>
Examples of the points that may be made in the response

• light ethanol and heat water
• extinguish ethanol
• after suitable temperature rise or after a suitable time
• stir water
• measure mass / volume of water
• measure initial temperature of water
• measure final temperature of water
• measure temperature rise
• measure initial mass of ethanol (and burner)
• measure final mass of ethanol (and burner)
• measure change in mass of ethanol</td><td></td><td>1 + 3 / 3.3.1a</td><td>E</td></tr>
<tr><td>Total</td><td></td><td></td><td>9</td><td></td><td></td></tr>
</table>

4.7.2.3 Alcohols

Answer 34 · Mark scheme

June 2014 | CH3HP | Original Q2 | Legacy



4.7.2.3 Alcohols

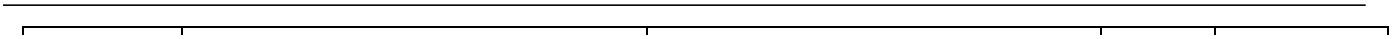
Answer 35 · Mark scheme June 2015 | CH3HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
5(a)	any **two** from: • fuel • solvent • antiseptic	 allow source of energy allow perfume / aftershave allow antibacterial	2	**AO1** 3.6.1.b
5(b)	Hydrogen		1	**AO1** 3.6.1.b
5(c)(i)	oxidation	do **not** allow redox	1	**AO1** 3.6.1.c
5(c)(ii)	correct structure		1	**AO1** 3.6.2.a
5(c)(iii)	 ethanoic acid is a weak / weaker acid because it does not completely ionise.	it = ethanoic acid allow because it does not completely dissociate allow it has a lower concentration of hydrogen ions allow converse for hydrochloric acid do **not** allow ionising	 1 1	**AO1/ AO2** 3.6.2.b
5(d)(i)	ethyl ethanoate		1	**AO1** 3.6.2.b
5(d)(ii)	acid	allow any strong acid allow correct formulae	1	**AO1** 3.6.2.b
5(d)(iii)	evaporates easily / quickly	allow low boiling point do **not** allow flammable	1	**AO1** 3.6.3.a
Total			**10**	

4.7.2.3 Alcohols

Answer 35 · Mark scheme

June 2015 | CH3HP | Original Q5 | Legacy



4.7.2.3 Alcohols

Answer 36 · Mark scheme

June 2016 | CH1HP | Original Q4 | Legacy

Question 4

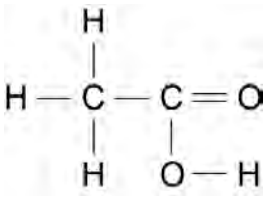
Question	Answers	Extra information	Mark	AO / Spec. Ref.
4(a)(i)	add yeast		1	AO1
	and ferment **or** by fermentation	allow in a warm place **or** temperatures within the range 20-45°C **or** with an airlock/absence of air	1	1.5.3b
4(a)(ii)	by hydration with steam	allow react with/addition of steam	1	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(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**	

4.7.2.3 Alcohols

Answer 37 · Mark scheme

June 2016 | CH3HP | Original Q1 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
1(a)(i)	fizz / effervescence / bubbles	allow calcium carbonate decreases in size or dissolves	1	AO2/AO3 3.4.1d, 3.6.2b
	because carbon dioxide produced / released	allow because gas produced / released	1	
	limewater turns cloudy / milky / white		1	
	because (a precipitate of or solid) calcium carbonate forms	allow because of carbon dioxide if not already credited	1	
1(a)(ii)		allow –OH do not allow lower case 'h'	1	AO1 3.6.2a
1(a)(iii)	acid	must be in this order ignore any name of an acid	1	AO1 3.6.2b
	ester(s)		1	
1(b)	white (precipitate) no change no change no change	all four correct 2 marks any two correct 1 mark	2	AO2 3.4.1e,f
1(c)(i)	lilac red	must be in this order allow purple	1 1	AO1 3.4.1a
1(c)(ii)	colours are masked / changed by each flame colour		1	AO3 3.4.1a
Total			12	

4.7.2.3 Alcohols

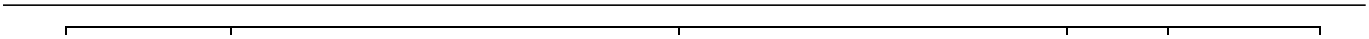
Answer 37 · Mark scheme

<table>
<tr><th>Question</th><th>Answers</th><th>Extra information</th><th>Mark</th><th>AO / SpecRef</th></tr>
<tr><td>2</td><td></td><td></td><td>6</td><td rowspan="6">2AO1 / 3AO2 / 1AO3
3.4.1g</td></tr>
<tr><td colspan="4">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></tr>
<tr><td colspan="4"><table>
<tr><th>0 marks</th><th>Level 1 (1–2 marks)</th><th>Level 2 (3–4 marks)</th><th>Level 3 (5–6 marks)</th></tr>
<tr><td>No relevant content.</td><td>There is a simple description of using some of the apparatus.</td><td>There is a description of an experimental method including addition of acid to alkali which may include an indicator or colour change and may include a measurement of volume.</td><td>There is a description of titrations that would allow a comparison to be made between the two solutions of hydrochloric acid.</td></tr>
</table></td></tr>
<tr><td colspan="4">examples of chemistry points made in the response could include:
• acid in burette or flask
• alkali/sodium hydroxide or acid in burette or flask
• volume of acid or alkali measured using the pipette
• indicator in flask
• white tile under the flask
• slow addition
• swirling/mixing
• colour change of indicator
• burette volume measured</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td>Total</td><td></td><td></td><td>6</td><td></td></tr>
</table>

4.7.2.3 Alcohols

Answer 37 · Mark scheme

June 2016 | CH3HP | Original Q1 | Legacy



4.7.2.3 Alcohols

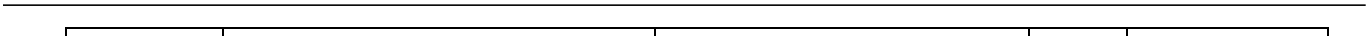
Answer 38 · Mark scheme June 2016 | CH3HP | Original Q5 | Legacy

Question	Answers	Extra information	Mark	AO / SpecRef
5(a)	CH_4 + $2O_2$ → CO_2 + $2H_2O$	allow multiples	1	AO2 3.3.1a
5(b)	3444 J	if answer incorrect: one mark for temperature increase = 16.4 °C one mark for mass of water = 50 g ecf for one incorrect value gains two marks for correct calculation no ecf for two incorrect values	3	AO2 3.3.1a
5(c)(i)	1276 (kJ per mole)	ignore + or - if answer incorrect: [(5 x 413) + 347 + 358 +467] + [(3 x 495)] = 4722 (1 mark) [(4 x 799) + (6 x 467)] = 5998 (1 mark) correct subtraction of calculated energy values (1 mark)	3	AO2 3.3.1f
5(c)(ii)	because energy released when bonds form is greater than energy used when bonds broken	allow converse if no mark awarded allow one mark for energy is used to break bonds or one mark for energy is released when bonds form	2	AO1 3.3.1e,f
5(c)(iii)	products line lower than reactants activation energy labelled overall energy change labelled		1 1 1	2AO2 / 1AO3 3.3.1d
Total			**12**	

4.7.2.3 Alcohols

Answer 38 · Mark scheme

June 2016 | CH3HP | Original Q5 | Legacy



4.7.2.3 Alcohols

Answer 39 · Mark scheme

June 2017 | CH3HP | Original Q2 | Legacy

Question	Answers	Extra information	Mark	AO / Spec. Ref.
2(a)	tick (✓) by: CH_3OH		1	AO2 3.6.1a
2(b)	tick (✓) by: C		1	AO2 3.3.1d
2(c)(i)			6	AO1 AO2 AO3 3.3.1a

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	some of the steps for a method **or** measurements are stated	a method **and** some measurements are described	a method **and** measurements are described which would allow a comparison to be made between the two alcohols

Examples of chemistry points made in response:

- measure mass or volume of water
- measure initial mass of ethanol (and burner)
- measure initial temperature of water
- ignite alcohol to heat the water
- stir water
- after a suitable temperature rise **or** time (or after a given volume is burned)
- extinguish the flame
- measure final temperature of water
- measure final mass of ethanol (and burner)
- repeat with next alcohol
- calculate the energy released and compare or compare temperature rise (for given mass of alcohol burnt or for given time of burning).

4.7.2.3 Alcohols

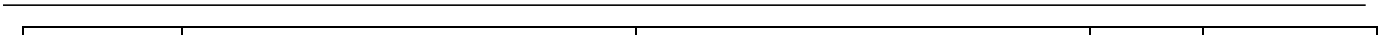
Answer 39 · Mark scheme

2(c)(ii)	lid **or** lagging **or** windshield **or** copper/metal container (so that) less energy lost (to surroundings) OR stir(rer) (1) (so that) energy distributed (1)	M2 dependent on M1 ignore digital thermometer ignore evaporation	1 1	**AO3** 3.3.1a
Total			**10**	

4.7.2.3 Alcohols

Answer 39 · Mark scheme

June 2017 | CH3HP | Original Q2 | Legacy



4.7.2.3 Alcohols

Answer 40 · Mark scheme

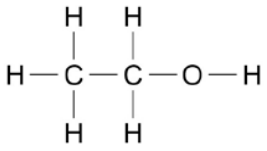
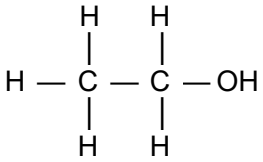
June 2018 | 8462/2H | Original Q2

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.1	formulation		1	AO1 4.8.1.2
02.2	$\frac{23.3}{265.5 + 23.3 + 3.0 + 1.5}$ (× 100) = 7.9 (%)	an answer of 7.9 (%) scores **2** marks allow $\frac{23.3}{293.3}$ (× 100) allow 7.944084555 (%) rounded correctly	 1 1	AO2 4.8.1.2
02.3	to deter consumption / drinking (by people)		1	AO3 4.7.2.3
02.4	any **one** from: • fuel • solvent • antiseptic	do **not** accept as an alcoholic drink allow specific uses eg • fuel additive • cleaning products • hand-sanitisers	 1	AO2 4.7.2.3
02.5	ferment(ation) add yeast anaerobic (conditions) **or** warm	ignore distillation allow in the absence of oxygen allow a temperature value in range 5 – 45 °C inclusive allow room temperature ignore hot / heat ignore high temperature	1 1 1	AO1 4.7.2.3

4.7.2.3 Alcohols

Answer 40 · Mark scheme

June 2018 | 8462/2H | Original Q2

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

4.7.2.3 Alcohols

Answer 40 · Mark scheme

June 2018 | 8462/2H | Original Q2

4.7.2.3 Alcohols

Answer 41 · Mark scheme

June 2018 | 8462/2H | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.1	enzyme		1	AO2 4.6.1.4
09.2	2.0×10^3 moles		1	AO2 4.3.2.1
09.3	smaller yield (because) favours endothermic reaction	allow less methanol is produced allow (because) favours reverse reaction allow equilibrium / reaction shifts to the left allow equilibrium / reaction shifts to reduce the temperature ignore reference to forward reaction is exothermic ignore references to rate	1 1	AO2 4.6.2.4 4.6.2.6

4.7.2.3 Alcohols

Answer 41 · Mark scheme

June 2018 | 8462/2H | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.4	(yield) equilibrium position moves to the product side	allow converse arguments allow equilibrium / reaction moves to the right allow equilibrium / reaction shifts to reduce the pressure	1	AO2 4.6.1.3 4.6.2.4 4.6.2.7
	(because) fewer molecules / moles / particles on product side	allow (because) fewer molecules / moles / particles on the right allow (because) smaller volume on product side	1	
	(rate) more collisions per unit time	allow increases collision frequency / rate ignore more collisions alone ignore faster collisions do **not** accept any indication of more energetic / forceful collisions	1	
	(because) more molecules / particles per unit volume	allow (gas) molecules / particles closer together ignore more molecules / particles alone	1	
09.5	provides different reaction pathway	allow provides a different mechanism / route	1	AO1 4.6.1.4
	(which has a) lower activation energy	 ignore references to collisions	1	

4.7.2.3 Alcohols

Answer 41 · Mark scheme

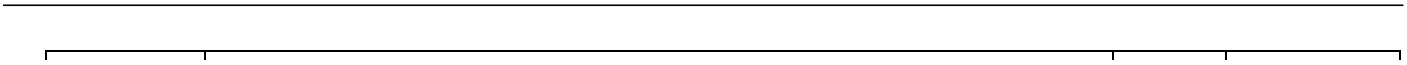
June 2018 | 8462/2H | Original Q9

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.6	less energy is needed	allow reduces the temperature required allow reduces costs ignore references to pressure ignore references to rate or time	1	AO2 4.6.1.4
09.7	no effect / change		1	AO3 4.6.1.4 4.6.2.3
Total			12	

4.7.2.3 Alcohols

Answer 41 · Mark scheme

June 2018 | 8462/2H | Original Q9



4.7.2.3 Alcohols

Answer 42 · Mark scheme

November 2020 | 8462/2H | Original Q7

Question 7

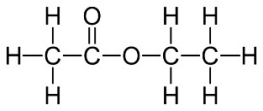
Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.1	HCOOH propanoic acid	allow HCO_2H	1 1	AO1 4.7.2.4
07.2	incomplete / partial ionisation (because) reaction is reversible	allow incomplete / partial dissociation allow (because) reaction is in equilibrium	1 1	AO3 4.7.2.4
07.3	mass (of flask and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

4.7.2.3 Alcohols

Answer 42 · Mark scheme

November 2020 | 8462/2H | Original Q7

Question 7 (continued)

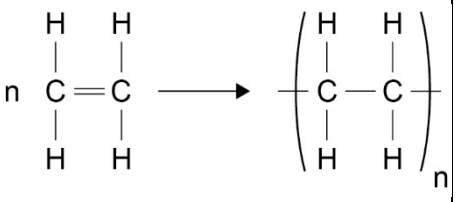
Question	Answers	Extra information	Mark	AO / Spec. Ref.
07.6			1	AO2 4.7.2.4 4.7.3.2
Total			12	

4.7.2.3 Alcohols

Answer 43 · Mark scheme

November 2021 | 8462/2H | Original Q4

Question 4

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.1		if equation incorrect allow **1** mark for 5 single bonds **or** allow **1** mark for n	2	AO1 4.7.3.1

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.2		allow converse statements about thermosetting polymers		
	(poly(ethene)) melts	allow thermosoftening polymers melt	1	AO1
	(so) can be reshaped (into new products)		1	AO3 4.10.3.3

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

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

Question 4 continued

Question	Answers	Extra information	Mark	AO / Spec. Ref.
04.5	circle around HO– **or** –OH on monomer **A**		1	AO2 4.7.2.3 4.7.3.2

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

Total			9

4.7.2.3 Alcohols

Answer 44 · 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

4.7.2.3 Alcohols

Answer 45 · Mark scheme

June 2023 | 8462/2H | Original Q2

Question 2

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

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.3	40.6 (kJ)	allow a value in the range 40.4 – 40.8 kJ allow a value consistent with the plotted points	1	AO2 4.7.2.3

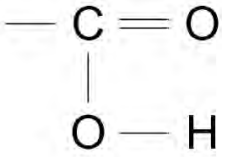
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.4	calcium hydroxide		1	AO1 4.8.2.3

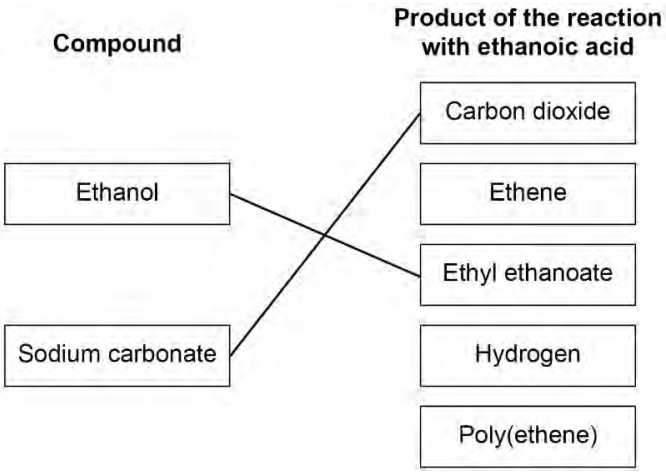
Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.5	(limewater turns) milky / cloudy	allow white precipitate (formed) allow calcium carbonate is produced	1	AO1 4.8.2.3

4.7.2.3 Alcohols

Answer 45 · Mark scheme

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

Question	Answers	Extra information	Mark	AO / Spec. Ref.
02.7			1	AO1 4.7.2.4

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

Total Question 2	11

4.7.2.3 Alcohols

Answer 46 · Mark scheme

June 2025 | 8462/1H | Original Q9

Question 9

Question	Answers	Mark	AO / Spec. Ref.
09.1	**Level 3:** The method would lead to the production of a valid outcome. The key steps are identified and logically sequenced.	5–6	AO3 4.1.1.2 4.4.2.3 RPA1
	Level 2: The method would not necessarily lead to a valid outcome. Most steps are identified, but the method is not fully logically sequenced.	3–4	
	Level 1: The method would not lead to a valid outcome. Some relevant steps are identified, but links are not made clear.	1–2	
	No relevant content	0	
	Indicative content **dissolve iodine in ethanol** • in a beaker **add zinc to iodine solution** • stir **continue adding until zinc is in excess** • shown by solid remaining **filter (the reaction mixture)** • to remove the excess zinc **heat the solution** • using a water bath **or** using an electric heater • to evaporate off some of the ethanol • cool / leave remaining solution to crystallise		

Answer 46 · Mark scheme

Question	Answers	Extra information	Mark	AO / Spec. Ref.
09.2	$\left(\text{moles } I_2 = \frac{6.35}{254} =\right)$ 0.025		1	AO2 4.3.1.1 4.3.2.1 4.3.2.2 4.3.3.1
	(moles ZnI_2 = 0.025 theoretical mass ZnI_2 = 0.025 × 319 =) 7.975 (g)	allow (moles Zn = 0.025 mass of Zn = 0.025 × 65 = 1.625 g theoretical mass ZnI_2 = 1.625 + 6.35 =) 7.975 (g) allow correct use of an incorrectly determined number of moles of I_2	1	
	(% yield =) $\frac{6.29}{7.975} \times 100$	allow correct use of an incorrectly determined theoretical mass of ZnI_2	1	
	= 78.871 (%)		1	
	= 78.9 (%)	allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses both mass values in the question	1	
	alternative approach 1: $\left(\text{moles } I_2 = \frac{6.35}{254} =\right)$ 0.025 (1) $\left(\text{moles } ZnI_2 = \frac{6.29}{319} =\right)$ 0.019717868 (1) (% yield =) $\frac{0.019717868}{0.025} \times 100$ (1) = 78.871 (%) (1) = 78.9 (%) (1)	allow correct use of an incorrectly determined number of moles of I_2 and/or ZnI_2 allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses both mass values in the question		

	alternative approach 2: (moles ZnI_2 = $\frac{6.29}{319}$ =) 0.019717868 (1) (moles I_2 reacted = 0.019717868 mass I_2 reacted = 0.019717868 × 254 =) 5.0083 (g) (1) (% yield =) $\frac{5.0083}{6.35}$ × 100 (1) = 78.871 (%) (1) = 78.9 (%) (1)	allow correct use of an incorrectly determined number of moles of ZnI_2 allow correct use of an incorrectly determined mass of I_2 reacted allow an answer correctly rounded to 3 significant figures from an incorrect calculation which uses both mass values in the question		

Total Question 9	**11**

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

4.7.2.3 Alcohols

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.

4.7.2.3 Alcohols

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.

4.7.2.3 Alcohols

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

4.7.2.3 Alcohols

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

4.7.2.3 Alcohols

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

4.7.2.3 Alcohols

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

4.7.2.3 Alcohols

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

4.7.2.3 Alcohols

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

Continued on next page

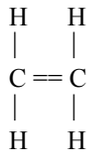
4.7.2.3 Alcohols

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

4.7.2.3 Alcohols

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

4.7.2.3 Alcohols

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

4.7.2.3 Alcohols

Answer 40 · Examiner comments

June 2018 | 8462/2H | Original Q2

Question 2 (standard demand)

02.1 28% of students recognised a formulation from this part of the specification.

02.2 This question presented little difficulty, with 81% of students achieving full marks.

02.3 Reading the stem would have avoided answers such as 'to make it more attractive to drink'. 33% of students realised that it was to warn people not to drink it.

02.4 Uses of ethanol, and therefore methylated spirits, as a solvent, steriliser and fuel were well known.

02.5 Few students could give both yeast and the reaction conditions for the production of ethanol from sugar solution by fermentation. Some knew the name of the process but could give no correct detail.

02.6 34% of students could complete the displayed formula for ethanol. Ethane was the most common incorrect answer, but ethanoic acid was also frequently seen.

02.7 45% of the students knew that hydrogen would be the gas produced.

02.8 6% of students knew that an oxidising agent was required.

Answer 41 · Examiner comments

June 2018 | 8462/2H | Original Q9

Question 9 (standard, standard / high & high demand)

09.1 88% of students could identify an enzyme as a (biological) catalyst.

09.2 64% of students could use the equation to work out that 2.0×10^3 moles of carbon monoxide would react.

09.3 The endothermic nature of the backwards reaction was often identified as the reason the equilibrium position moved to the left; however many made no comment about the yield of methanol. Many students thought there would be a higher yield. 39% of students achieved both marks.

09.4 While many students did well, there were many others who demonstrated partial knowledge or who did not express themselves clearly. Many thought that an increase in pressure caused an increased yield of methanol because it was an exothermic reaction, rather than because the equilibrium moved to the position of fewer moles / molecules / particles.

The increased rate of reaction was better understood; students usually gave some indication that the particles are closer or there are **more particles** in a **fixed** volume or there are the **same number of particles** in a **smaller** volume. Simply saying there were more particles was insufficient.

In addition, students needed to link collisions **and** time to gain credit, usually by saying that the particles collide more often or there are more frequent collisions. Simply saying **more collisions** alone was insufficient. The idea that an increase in pressure supplied energy (and therefore increased the speed of the particles) was discounted.

73% of students were able to achieve some credit, with 12% of students achieving full marks.

09.5 Higher-attaining students achieved both marks for stating that catalysts reduce the activation energy by providing an alternative route or pathway, though the second point was less well known than the first. Sometimes one or other of these points was omitted. A popular incorrect idea was that catalysts supply energy.

09.6 47% of students knew that catalysts reduce costs, save energy or allow lower temperatures to be used. Others just mentioned that catalysts can be reused or that they speed up the reaction.

09.7 The effect of a catalyst on the equilibrium yield of methanol was not well understood. It was widely thought that a catalyst increased the yield of methanol because the reaction was faster and would, therefore, produce more of the product. 24% of students answered correctly.

4.7.2.3 Alcohols

Answer 42 · Examiner comments — November 2020 | 8462/2H | Original Q7

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

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

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

Answer 42 · Examiner comments — November 2020 | 8462/2H | Original Q7

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

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

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

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

4.7.2.3 Alcohols

Answer 43 · Examiner comments

November 2021 | 8462/2H | Original Q4

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

04.1 Around half of the students either drew five single bonds or wrote ‘n’. Around one third provided a completely correct response.

04.2 Many of the students scored one mark, usually for stating that poly(ethene) melts. The consequence in terms of recycling was less well known.

04.3 How poly(ethene) is produced from ethene was not well known.

04.4 Approaching half of the students scored one mark but only a tiny number scored both. The fact that the chains are closer together or unbranched was well known but not how that linked to density.

04.5 Some students seem to think that any -OH is an alcohol group even if it is part of a carboxylic acid group. Other students circled whole molecules rather than functional groups.

04.6 Very few students were able to use the diagrams to work out that hydrogen chloride was the small molecule formed when a polyester was produced from monomers **A** and **B**.

Answer 44 · 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.

4.7.2.3 Alcohols

Answer 44 · 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.

4.7.2.3 Alcohols

Answer 44 · Examiner comments

Mark Ranges and Award of Grades

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

4.7.2.3 Alcohols

Answer 45 · Examiner comments

June 2023 | 8462/2H | Original Q2

Question 2 (standard demand)

02.1 This simple calculation was answered correctly by more than three-quarters of the students. Occasionally errors were seen using 38.9 kJ/g rather than 39.8 kJ/g. In these cases, it was impossible to tell whether this was a transcription error or use of the value for hexanol. Either way, we cannot award credit for transcription errors.

02.2 Nearly 9 in 10 students were able to plot the data within tolerance on all points. However, nearly all drew a line of best fit, which for a discrete variable in this context was not appropriate. These lines of best fit were ignored.

02.3 Around two-thirds of students gained this mark. The answer, within the tolerances stated in the mark scheme, was estimated from the plotted points alone, and was as stated in the mark scheme unless misplotted points (usually for hexanol and/or heptanol) suggested otherwise.

02.4 Fewer than half of students knew that lime water is aqueous calcium hydroxide.

02.5 Around 90% of students could describe the result of this test adequately to gain credit.

02.6 More than half of the students gave a correct response. 'An alkali metal' was a strong distractor.

02.7 This was not well known, with only around 30% scoring the mark. Many students completed a square of bonds around the four atoms provided.

02.8 More than half of the students gained both marks. There was no discernible pattern amongst those who scored one mark.

Answer 46 · Examiner comments

June 2025 | 8462/1H | Original Q9

Question 9 (standard/high and high demand)

09.1 This question discriminated well. Nearly all were able to reach level 1, with two thirds reaching level 2 and one third reaching level 3; one in six students were awarded full marks. This was an AO3 question which required students to apply techniques they had learned in a required practical to a new situation. There were many excellent answers, with students realising that the first step should be to make a solution of iodine in ethanol and then carry out a normal salt preparation adding excess zinc, filtering, and crystallising the solution. The most common error was to ignore the flammability of ethanol and heat with a direct flame instead of over a water bath or electric heater. Some

Answer 46 · Examiner comments June 2025 | 8462/1H | Original Q9

students ignored the instruction to use zinc and iodine, using zinc oxide, zinc hydroxide or even zinc carbonate. Many students believed that iodine is a liquid or should be used in aqueous solution; this was not penalised as the students' experience of iodine is probably only as a solution. This did lead to problems for some students, however, as they believed that both ethanol and water were present. Those who missed out a key step, such as adding excess zinc or filtering to remove the excess zinc, were limited to level 2. Those who started with the product, zinc iodide, were limited to level 1.

09.2 Nearly a half of students gained full marks in this calculation and over three quarters could make some progress. This was a multi-step calculation, which is classed as an extended response question. As such, the working has to make sense chemically. Those students who managed to put the data together in such a way as to obtain an answer of 78.9%, but whose working made no sense chemically, were often limited to the mark for the correct number of significant figures.

There were many excellent fully correct answers, and many students were able to make some progress by calculating the number of moles of iodine and / or zinc iodide. While most adopted the expected approach, calculating the expected mass of zinc iodide and finding the actual mass as a percentage of that value, two other valid approaches also gained credit. One of these was to find the moles of zinc iodide produced as a percentage of the expected moles. The other, far less commonly seen, was to find the mass of iodine actually reacted and take that as a percentage of the mass provided. Of those who adopted the approach of calculating the expected mass of zinc iodide, many surprisingly calculated the mass of zinc and added that to the mass of iodine, rather than simply multiplying the number of moles by the M_r of ZnI_2, which was provided. Students had little difficulty in rounding correctly to 3 significant figures.

4.7.2.3 Alcohols

Answer 46 · Examiner comments

Mark Ranges and Award of Grades

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