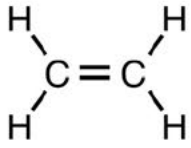
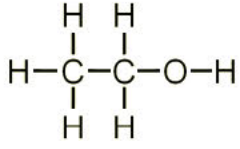
<table>
<tr><th colspan="3">Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>1</td><td>(a)</td><td></td><td>B (a pressure of 65 atm)</td><td></td><td>1</td></tr>
<tr><td></td><td>(b)</td><td></td><td>
<table>
<tr><th></th><th>Displayed formula</th></tr>
<tr><td>ethene</td><td></td></tr>
<tr><td>ethanol</td><td></td></tr>
</table>
</td><td>All atoms and bonds must be shown
Ignore bond angles</td><td>2</td></tr>
</table>

Question number			Answer	Notes	Marks
1	(c)		M1 (saturated because) there are only single bonds / all the bonds are single M2 (not a hydrocarbon) because it contains oxygen/another element	Accept no double bonds / no multiple bonds Accept contains an OH group / an alcohol group Accept does not contain only hydrogen and carbon	2
	(d)		Any three of the following: M1 correct statement about connection between crude oil and ethene, eg: crude oil is converted /fractionally distilled /cracked to obtain ethene M2 correct statement about connection between sugar cane or glucose and ethanol, eg: sugar/glucose is converted into ethanol / sugar/glucose fermented to make ethanol M3 correct statement about effect of crude oil being less available, eg: less ethene available /ethene more expensive / ethene production (more) difficult OR process 1 used less / less favoured / (more) expensive	Ignore references to time taken to obtain ethene or ethanol Ignore references to purity of ethene or ethanol Ignore references to global warming / finite and renewable resources	3

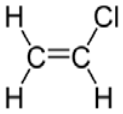
			M4 correct statement about effect of climate change, eg: more sugar can be fermented / more ethanol can be produced / ethanol cheaper / ethanol production easier/easy OR process 2 used more / more favoured / less expensive		
				Total for Question 1	**8**

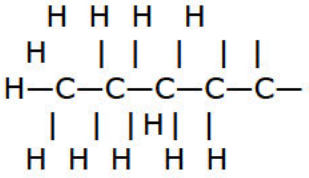
Question number	Answer	Accept	Reject	Marks
2(a)(i)	fermentation			1
(ii)	(to provide the) catalyst/enzyme/zymase	to increase the rate of the reaction		1
(b)(i)	**M1** (test) – flame test	suitable description of flame test		2
	M2 (observation) – brick red / orange-red	red		
(ii)	copper(II) ions:	accept other suitable alkalis		5
	M1 (test) – (aqueous) sodium hydroxide / NaOH	suitable alternatives to precipitate	all other colours	
	M2 (observation) – blue precipitate ignore shades of blue			
	M2 dep on **M1** or near miss of formula, eg $Na(OH)_2$			
	sulfate ions:	(dilute) nitric acid / HNO_3	Reject sulfuric acid for **M1** only	
	M1 (test) – (dilute) hydrochloric acid / HCl	(aqueous) barium nitrate / $Ba(NO_3)_2$		
	M2 (test) - (aqueous) barium chloride / $BaCl_2$			
	M3 (observation) – white precipitate			
	M3 dep on **M2** or near miss			

Question number	Answer	Accept	Reject	Marks
2 (c)	**M1** (pressure) – 60-70 atm **M2** (catalyst) – phosphoric acid / H_3PO_4 ignore references to concentration	any pressure or range within this range phosphoric(V) acid	 any other oxidation state	2
(d)	**M1** (Σ bonds broken) 348 + 412 + 360 (= 1120) **M2** (Σ bonds made) 612 + 463 (= 1075) **M3** **M1** – **M2** / **Σ** bonds broken – Σ bonds made **M4** (+)45 (kJ/mol) Correct answer with no working scores 4 **– 5 (kJ/mol) scores 3**	3231 3186		4

Total 15 marks

Question number	Answer	Accept	Reject	Marks
3 (a)	$C_{12}H_{22}O_{11} + H_2O \rightarrow 2C_6H_{12}O_6$ Ignore yeast		lower case symbols and numbers not given as subscripts	1
(b) (i)	no more bubbles/fizzing/effervescence IGNORE when no more ethanol is formed/all the glucose has reacted/all the yeast has reacted/references to mass/references to temperature	no more gas/carbon dioxide given off		1
(ii)	filtration/filtering IGNORE sieving	decant	evaporation/distillation	1
(c) (i)	(the elements of) water removed	H_2O removed 2 hydrogen (atoms) and 1 oxygen (atom) are removed		1
(ii)	aluminium oxide/Al_2O_3	(concentrated) sulfuric acid (concentrated) phosphoric acid	dilute acid phosphorus/phosphorous	1
(iii)	chlorine (gas) / Cl_2 If both name and formula given, both must be correct	correct name or formula as part of an equation	chloride / Cl^-	1
(iv)	$CH_2ClCH_2Cl \rightarrow CH_2(=)CHCl + HCl$	$C_2H_4Cl_2$ for CH_2ClCH_2Cl and C_2H_3Cl for $CH_2=CHCl$		1

Question Number	Answer	A	Reject	Marks
(d) (i)	 IGNORE bond angles and positions of H and Cl relative to each other			1
(ii)	**Any three from:** **M1** - (one bond in the) double bond breaks **M2** - small **m**olecules/monomers/chloroethene molecules join together **M3** - to form a (long) chain/macromolecule **M4** - product/polymer contains only single bonds			3
			Total	**11**

<table>
<tr><th>Question number</th><th>Answer</th><th>Notes</th><th>Marks</th></tr>
<tr><td>4 (a)</td><td>
<table>
<tr><th>Statement</th><th>Fractional distillation</th><th>Cracking</th></tr>
<tr><td>Crude oil is heated</td><td>(✓)</td><td></td></tr>
<tr><td>A catalyst may be used</td><td></td><td>✓</td></tr>
<tr><td>Alkenes are formed</td><td></td><td>✓</td></tr>
<tr><td>Decomposition reactions occur</td><td></td><td>✓</td></tr>
<tr><td>Fuels are obtained</td><td>✓</td><td>✓</td></tr>
<tr><td>Separation is the main purpose</td><td>✓</td><td></td></tr>
</table>
</td><td>1 mark for each line correct</td><td>5</td></tr>
<tr><td>(b) i</td><td>C_5H_{12}</td><td>Accept $H_{12}C_5$</td><td>1</td></tr>
<tr><td>ii</td><td></td><td></td><td>1</td></tr>
<tr><td>ii i</td><td>C_5H_{12}</td><td>Accept $H_{12}C_5$</td><td>1</td></tr>
<tr><td>iv</td><td>pentane</td><td></td><td>1</td></tr>
<tr><td>v</td><td>C_nH_{2n+2}</td><td>Accept x and other letters in place of n
Accept answers like $C_nH_{2n}+2$
Ignore 2(n+1)</td><td>1</td></tr>
</table>

Question number	Answer	Notes	Marks
4 (c) i	(products) 2 2 (oxygen 3)	M1 and M2 independent	1 1
ii	4 electrons shared between 2 (carbon) atoms 4 electron pairs between 2C and 4H atoms	Ignore inner electrons even if wrong Ignore number of hydrogen atoms Accept all permutations of dots and crosses Ignore intersecting circles Accept H atoms at all angles At least one C or one H atom must be labelled Max 1 if not labelled Max 1 if more than 2 C atoms Max 1 if wrong number of electrons in outer shell of any atom	1 1
(d) i	phosphoric acid / H_3PO_4 any value in range 250 – 350 °C	Ignore concentrated / dilute Accept value without unit Accept 523 – 623 K Marks independent	1 1
ii	20 (mol) M1 × 24 480 (dm^3)	Accept 480 000 cm^3 If M1 incorrect but 480 is final answer, then only M3 can be awarded If no answer to amount of ethene, then 20 x 24 = 480 scores M2 and M3	1 1 1
		Total	**19**