Question number	Answer	Accept	Reject	Marks
1 (a) (i)	poly(ethene)	polyethene / polythene / polyethylene		1
(ii)	cracking			1
(b) (i)	**M1** - bar labelled 9			1
	M2 - drawn to correct height			1
(ii)	(boiling point/it) increases as number of carbon atoms increases	ORA as one goes up, the other goes up positive correlation	(directly) proportional	1

Question number	Answer	Accept	Reject	Marks
1 (c)	**A/buried underground** because **Any two from:** • **M1** (plastics) do not produce carbon dioxide/carbon emissions / toxic / poisonous gases **IGNORE** harmful/dangerous/polluting gases / sulfur dioxide • **M2** (plastics) do not contribute to global warming /climate change / greenhouse effect / acid rain • **M3** Does not pollute the soil / cause damage to the soil. **IGNORE** references to effect on wildlife/habitats / cost OR **B/burned** because • **M1** (burning) space in landfill not taken up / does not cause landfill sites to get filled up **/** will not run out of space for landfills • **M2** it provides heat **/** can be used to generate electricity IGNORE just provides energy	ORA carbon monoxide / nitrogen dioxide / hydrogen chloride / chlorine / formulae	References to ozone layer for M2 only	1 1 **OR** 1 1
			Total	**7**

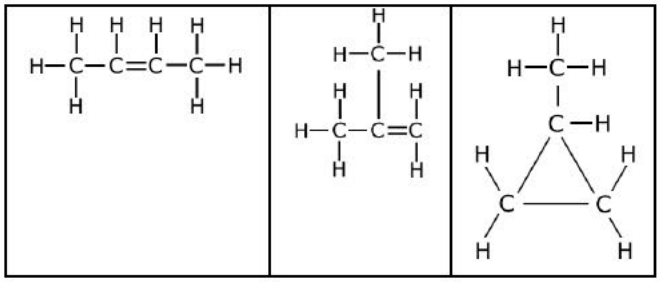
<table>
<tr><th>Question number</th><th>Answer</th><th>Accept</th><th>Reject</th><th>Marks</th></tr>
<tr><td>2 (a)</td><td><table><tr><td>M1 temperature after</td><td>27.1</td></tr><tr><td>M2 temperature before</td><td>18.8</td></tr><tr><td>M3 temperature change</td><td>(+) 8.3</td></tr></table>
Recorded temperatures correct but in wrong order scores 1 for M1 and M2

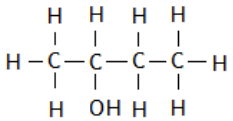
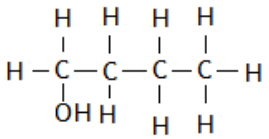
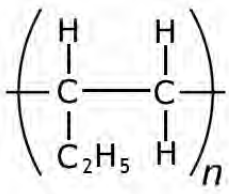
M3 csq on M1 and M2</td><td>one trailing zero</td><td>more than one trailing zero</td><td>3</td></tr>
<tr><td>(b)</td><td>M1 heat (energy) /thermal energy lost (to the atmosphere)
ignore just energy lost

M2 potassium hydroxide dissolves (very/too) slowly</td><td>water evaporates

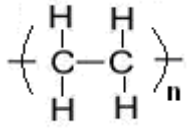
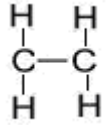
potassium hydroxide does not completely dissolve
potassium hydroxide is impure
less than 3 g of potassium hydroxide is used
more than 50 cm^3 of water is used</td><td></td><td>2</td></tr>
</table>

Total 5 marks

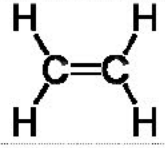
Question number	Answer	Notes	Marks
3 (a) (i)	**M1** (compounds/molecules with the) same molecular formula /same number of each type of atom	Ignore references to chemical/general/empirical formula If use elements/atoms instead of compounds/molecules can score M2 only Allow reference to isomers in question ie have same number of carbon and hydrogen (atoms as each other)	2
	M2 but different displayed formula / structural formula / structures / arrangement of atoms	Ignore atoms in different order Ignore references to stereoisomerism	
(ii)		Accept structure of trans but-2-ene Ignore bond angles	1
	Any one for 1 mark		
(iii)	**M1** (Reagent) – bromine (water)		3
	M2 (But-1-ene) – goes (from orange) to colourless	accept decolourised Ignore clear/discolours	
	M3 (cyclobutane) – no change (unless UV light present)	accept stays orange ignore no reaction If start with bromine (water) in presence of UV light then scores 0/3	

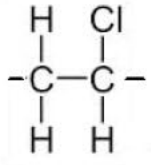
(b) (i)	 OR 	Allow -O-H and -OH but not -HO	1
(ii)	 **M1** correct formula of repeat unit (with carbon to carbon single bond) **M2** brackets <u>and</u> continuation bonds <u>and</u> n	Accept displayed C_2H_5 Accept C_2H_5 on either C Allow if more than one monomer correctly joined together Accept n anywhere after brackets but not before M2 dep on M1or near miss	2

Question number	Expected answer	Accept	Reject	Marks
4 (a) (i)	Co a (carbon to carbon) double bond / contains C=C / multiple bond IGNORE references to 'free' bond /spare bond	Can undergo addition reactions / does not contain the maximum number of hydrogen (atoms)		1
(ii)	(add) bromine (water) / Br_2 IGNORE references to any other solvent	$KMnO_4$ / potassium (per)manganate		1
	decolourised / turns (from orange/brown to) colourless IGNORE starting colour IGNORE clear IGNORE discolour	(VII) either an acid or an alkali		1
	2nd mark dependent on 1st mark having been awarded, but for near miss on reagent, e.g. bromine in presence of uv, observation mark can be awarded	(purple to) colourless (if acid used) (purple to) green (if alkali used)		
	Ignore references to any products, correctly named or otherwise			

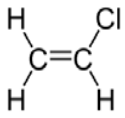
4 (b) (i)	H_2O			1
(ii)	Dehydration	Elimination		1
(c)			Any double-bonded product scores 0/2	2
	 i.e. double to single	CH_2 - CH_2		
	1 mark for rest of formula, including extension lines, brackets and the 'n'	n as superscript	n before the brackets	
		Max 1 for skeletal formula		

Total 7 Marks

Question number				Answer	Notes	Marks
5	a			cross in box C (fractional distillation)		1
	b		M1	larger molecules in crude oil	Accept longer (chains)/ bigger M_r in place of larger Accept molecules in crude oil have wide range of sizes AND molecules in kerosene have similar sizes	4
			M2	more covalent bonds in crude oil (molecules) / bonds have different strengths	Accept no difference / same type of covalent bonding Reject references to double bonds in kerosene	
			M3	crude oil has higher viscosity	Accept less runny / less thick	
			M4	correct reference to other difference - eg crude oil darker colour crude oil harder to ignite crude oil burns with a smokier flame crude oil has a higher boiling point / wider range of boiling points		
					Any three points from four Accept converse statements for (molecules in) kerosene	
	c	i		C_9H_{20}	Accept $H_{20}C_9$	1
		ii		pentane		1
		iii			Ignore bond angles Ignore dot and cross diagram Ignore non-displayed formulae	1

Question number				Answer	Notes	Marks
5	d		M1 M2		M1 for 4 correct atoms joined to 2 C atoms (ignore C=C and extra atoms joined to C) Accept Cl in any position of four M2 for all 7 bonds correct provided that continuation bonds are shown but have no atoms attached Cl_2 in place of Cl but otherwise correct scores M2 but not M1 Ignore brackets and any subscript	1 1
	e	i		(in condensation polymerisation) a small molecule/H_2O/HCl is (also) formed /lost/released OR two (different) monomers / more than one product	Accept converse statement for addition polymerisation eg (only) one product formed / no atoms are lost/gained	1
					If no reference to type of polymerisation, assume that condensation is referred to	
		ii	M1	breakdown / decomposition	Ignore wear away / rot	1
			M2	by bacteria/microbes/micro-organisms	Accept biologically / naturally M2 dep on M1 or near miss	1
		iii		inert(ness)	Accept unreactive / non-polar Ignore strong bonds / long chains	1
TOTAL						**13**

Question number	Answer	Accept	Reject	Marks
6 (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