

Alkanes, Alkenes & Polymers

Mark Scheme

Level	International A Level
Subject	Chemistry
Exam Board	Edexcel
Topic	Chemistry Lab Skills 1
Sub Topic	Alkanes, Alkenes & Polymers
Booklet	Mark Scheme

Time Allowed: 46 minutes

Score: /38

Percentage: /100

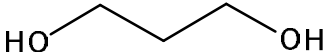
Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

Question Number	Acceptable Answers	Reject	Mark
1(a)(i)	Rate of reaction between solids is slow OR Difficult for two solids to react easily ALLOW Both (acid(s) and reagent) are solid IGNORE reference to any need for heating	"Dissolves" for "reacts"	1

Question Number	Acceptable Answers	Reject	Mark
1(a)(ii)	<p>Marking point 1 Sodium/potassium carbonate and solution/aqueous/water OR Sodium/potassium hydrogencarbonate and solution/aqueous/water (1)</p> <p>Marking point 2 Effervescence/Fizzing/Bubbles (1)</p> <p>MP2 conditional on MP1</p> <p>ALLOW MP2 for effervescence etc. for any carbonate/hydrogencarbonate given as reagent</p> <p>OR Marking point 1 Named alcohol + named strong acid (1)</p> <p>Marking point 2 Fruity smell (1)</p> <p>MP2 conditional on MP1</p>	Sodium/Na Indicators	2

Question Number	Acceptable Answers	Reject	Mark
1(b)	$(\rightarrow) \text{HO} - \overset{\text{O}}{\parallel} \text{C} - \text{CHBr} - \text{CHBr} - \overset{\text{O}}{\parallel} \text{C} - \text{OH}$ <p>OR Displayed formula</p> <p>IGNORE Position of the bond to the hydrogen of the OH group</p>	Additional products	1

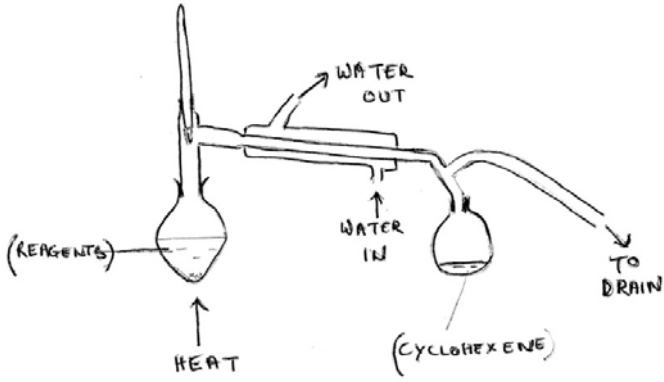
Question Number	Acceptable Answers	Reject	Mark
1(c)(i)	 <p>Ignore bond lengths, bond angles, and bond between O and H</p>	Bond clearly to the hydrogen of the OH group e.g. -HO	1

Question Number	Acceptable Answers	Reject	Mark
1(c)(ii)	<p>Peak/Absorption/Absorbance/Trough for C=O (only) present in propanedioic acid infrared spectrum</p> <p>ALLOW Peak/Absorption/Absorbance/Trough for C=O absent from propane-1,3-diol infrared spectrum</p> <p>OR</p> <p>O-H peak/absorption/trough for carboxylic acid has a different wavenumber to that for the alcohol</p> <p>OR</p> <p>Different fingerprint region</p>	Line	

(TOTAL FOR QUESTION 1 = 6 MARKS)

Question Number	Acceptable Answers	Reject	Mark
2(a)	<p>Two different hazards must be given to score 2 marks.</p> <p>Phosphoric acid corrosive</p> <p>ALLOW burns skin/ damages skin (1)</p> <p>Cyclohexanol / cyclohexene (in)flammable</p> <p>ALLOW Irritant (1)</p> <p>IGNORE Comments on glass wool, calcium chloride Cyclohexene / cyclohexanol is volatile</p>	<p>Additional hazards e.g. irritant harms skin carcinogenic</p> <p>Additional hazards e.g. explosive carcinogenic</p>	2

Question Number	Acceptable Answers	Reject	Mark
2(b)	<p>Correct final answer scores (2)</p> <p>Mass of 12 cm³ C₆H₁₁OH = 12 x 0.962 (1) = 11.544 / 11.54 / 11.5 (g)</p> <p>Number of moles = (11.544 / 100 = 0.11544) = 0.115 / 0.12 (mol)</p> <p>ALLOW TE from incorrect mass (1)</p> <p>Ignore sf except 1 sf</p>	0.11	2

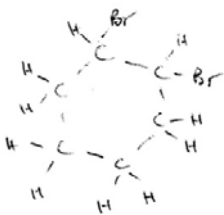
Question Number	Acceptable Answers	Reject	Mark
<p>2(c)</p>	<p>Flask with heat source AND stillhead AND a closed system to the left hand side of the outlet to the condenser.</p> <p>Heat source can be electrical heater, water bath ALLOW bunsen or just arrow</p> <p>ALLOW appropriate tubing or flask with long neck as alternative to stillhead (1)</p> <p>Bulb of thermometer opposite opening to condenser (1)</p> <p>Water condenser sloping downwards AND direction of water (1)</p> <p>Connected to receiver with a vent OR delivery tube to an open narrow necked flask (1)</p> <p>Ignore fractionating column if included.</p> <p>Drawing showing reflux distillation scores max 1 for water direction in condenser.</p> 	<p>Conical flask</p> <p>Sealed receiver, beaker</p>	<p>4</p>

Question Number	Acceptable Answers	Reject	Mark
2(d)	<p>D rating agent removes water in a (chemical) reaction OR causes two H and one O atoms to be lost (in a reaction) OR removes the elements of water (from reactant molecules) OR removes water from molecules of a compound</p> <p>ALLOW answers indicating a reaction occurs eg H⁺ protonates OH in alcohol forming water removes water causing bonds to break reference to elimination reactions (1)</p> <p>Drying agent removes water mixed with other materials OR removes water from a mixture OR removes water in a physical change</p> <p>ALLOW Absorbs water (1)</p> <p>"A dehydrating agent removes water in a reaction but there is no reaction when a drying agent removes water" scores 1</p>	Reference to removal of solvents other than water	2

Question Number	Acceptable Answers	Reject	Mark
2(e)	Glass wool less absorbent OR No cyclohexene left on wool OR filtration is faster through glass wool OR filter paper absorbs liquids/ product/ mixture IGNORE yield is higher with glass wool/ lower with filter paper more efficient filtration		1

Question Number	Acceptable Answers	Reject	Mark
<p>2(f)</p>	<p>Look at final answer. If correct award 3 marks.</p> <p>There are several correct methods. All involve calculating a number of moles of cyclohexene, a mass of cyclohexanol and the use of the 75% but these stages can be done in different orders.</p> <p>EITHER</p> <p>Need theoretical yield of $(10.0 \times 100/75) = 13.3333 / 13.33 / 13.3 \text{ g}$ (1)</p> <p>$13.3333 \text{ g} = (13.3333/82) = 0.1626 / 0.163 \text{ mol cyclohexene}$ (1)</p> <p>$0.1626 \text{ mol cyclohexanol} = \mathbf{16.26 / 16.3 / 16 \text{ g}}$ (1)</p> <p>OR</p> <p>Mol of cyclohexene = $(10/82) = 0.12195$ (1)</p> <p>Mol of cyclohexanol = $(0.12195 \times 100/75) = 0.1626$ (1)</p> <p>Mass of cyclohexanol = $(0.1626 \times 100) = \mathbf{16.26 / 16.3 / 16 \text{ g}}$ (1)</p> <p>OR</p> <p>Mol of cyclohexene = $(10/82) = 0.12195$ (1)</p> <p>Theoretical mass of cyclohexanol = $(0.12195 \times 100) = 12.195/12.2 \text{ g}$ (1)</p> <p>Mass of cyclohexanol = $(12.2 \times 100/75) = \mathbf{16.26 / 16.3 / 16 \text{ g}}$ (1)</p> <p>ALLOW</p> <p>16.2 (g) in all methods from rounding 9.146 (g) from incorrect use of 75% scores (2)</p> <p>Ignore SF in final answer except 1 SF</p>	<p>Theoretical yield = $(10.0 \times 75/100) = 7.5 \text{ g}$</p> <p>$(0.12195 \times 75/100) = 0.09146$</p>	<p>3</p>

Question Number	Acceptable Answers	Reject	Mark
2(g) (i)	Brown / red-brown / orange / yellow/ yellow-brown to colourless ALLOW Brown / red-brown / orange / yellow is decolorised. IGNORE Clear for colourless	Red to colourless	1

Question Number	Acceptable Answers	Reject	Mark
2(g) (ii)	 ALLOW Rings with CH ₂ and/or CHBr IGNORE Angles in ring Placing of H and Br inside or outside ring	Benzene ring Just skeletal formula/ molecular formula Bromoalcohols Non-adjacent Br atoms	1

Total for Question 2 = 16 marks

Question Number	Acceptable answers	Reject	Mark
3(a)(i)	Dehydrating agent / dehydration/ removes (elements of) water / removes H ₂ O / eliminates water / eliminates H and OH IGNORE reference to catalyst	Drying agent Just elimination	1

Question Number	Acceptable answers	Reject	Mark
3(a)(ii)	Corrosive / burns skin (1) Wear gloves (1) Second mark depends on first being corrosive or harms skin or irritant	Just "harms skin" Toxic Use tongs Avoid spillage Use fume cupboard	2

Question Number	Acceptable answers	Reject	Mark
3(b)	F Apparatus should not be completely sealed / put vent in apparatus / leave gap between condenser and receiving flask / insert gas outlet / use receiving flask with opening (1) ALLOW "Open end of apparatus for pressure release" Second mark Move (bulb of) thermometer to opposite opening to condenser (1) These points may be shown on diagram.	Just "Move thermometer up"/ "position in neck of flask" / "position in mouth of flask"	2

Question Number	Acceptable answers	Reject	Mark
3(c)(i)	<p>EITHER</p> <p>Cyclohexene only forms London forces / cyclohexene only forms van der Waals forces / cyclohexene can only form weak forces / cyclohexene is non-polar AND water is polar (1)</p> <p>Hydrogen bonds would be broken if cyclohexene mixed with water / cyclohexene cannot form hydrogen bonds with water / cyclohexene cannot replace hydrogen bonds with a strong bond / cyclohexene cannot form bonds with water of comparable strength (to original ones) (1)</p> <p>OR (alternative approach)</p> <p>Hydrogen bonds would be broken if cyclohexene mixes with water (1)</p> <p>Only weaker London forces would replace them (1)</p> <p>IGNORE comments on ionic bonding in sodium chloride</p>	<p>Just</p> <p>“cyclohexene is non-polar”</p> <p>Cyclohexene forms permanent dipole-dipole forces</p> <p>Just “there are hydrogen bonds in water”</p>	2

Question Number	Acceptable answers	Reject	Mark
3(c)(ii)	<p>Separating funnel with tap (and stopper)</p> <p>ALLOW</p> <p>Any shaped tube with opening at top which can be stoppered and tap at bottom (1)</p> <p>Cyclohexene in upper layer (1)</p> <p>Don't penalise if labelled cyclohexane, not -ene.</p> <p>Mark independently</p>	<p>Filter funnel</p> <p>Buchner funnel</p> <p>Very large opening at the top of the funnel.</p> <p>3 layers</p>	2

Question Number	Acceptable answers	Reject	Mark
3(d)(i)	(anhydrous) calcium chloride / CaCl_2 / magnesium sulfate / MgSO_4 / sodium sulphate / Na_2SO_4 ALLOW silica gel	Other compounds, even if anhydrous Incorrect formulae (concentrated) sulfuric acid	1

Question Number	Acceptable answers	Reject	Mark
3(d)(ii)	(cloudy) liquid would go clear/ liquid becomes less cloudy	Volume decreases Water layer disappears Viscosity changes	1

Question Number	Acceptable answers	Reject	Mark
3(e)	(re)distillation (collecting liquid close to its boiling point) ALLOW Simple distillation Fractional distillation Correct description of process	collecting liquid more than 5° from its boiling point) Filtering	1

Question Number	Acceptable answers	Reject	Mark
3(f)(i)	Mass cyclohexanol = (0.100×100) = 10.0/ 10 g (1) Volume = $\frac{10.0}{0.962}$ = 10.395 / 10.40/ 10.4 (cm^3) (1) Second mark TE from mass of cyclohexanol calculated	10/ 10.39(cm^3)	2

Question Number	Acceptable answers	Reject	Mark
3(f)(ii)	<p>EITHER</p> <p>Max yield = (0.100×82) $= 8.20 / 8.2\text{g}$ (1)</p> <p>% yield = $\frac{(5.50 \times 100)}{8.20} =$ 67.073/ 67.1/ 67% (1)</p> <p>Second mark TE from mass of cyclohexene, but NOT if max yield = 10.4 or 10 (ie from volume of cyclohexanol or molar mass of cyclohexanol).</p> <p>OR</p> <p>Mol cyclohexene = $\frac{5.5}{82}$ $= 0.067073$ (1)</p> <p>Ignore sf except 1 sf</p> <p>% yield = $\frac{(0.067073 \times 100)}{0.1} =$ 67.073/ 67.1/ 67% (1)</p> <p>Correct answer with no working scores 2 Use of 84 as molar mass cyclohexene scores max 1</p> <p>Ignore SF except 1</p>	0 overall if yield greater than 100%	2

Total for Question 3 = 16 marks