Alcohols & Halogenoalkanes

Mark Scheme 2

Level	International A Level
Subject	Chemistry
Exam Board	Edexcel
Topic	Chemistry Lab Skills 1
Sub Topic	Alcohols & Halogenoalkanes
Booklet	Mark Scheme 2

Time Allowed: **57 minutes**

Score: **/47**

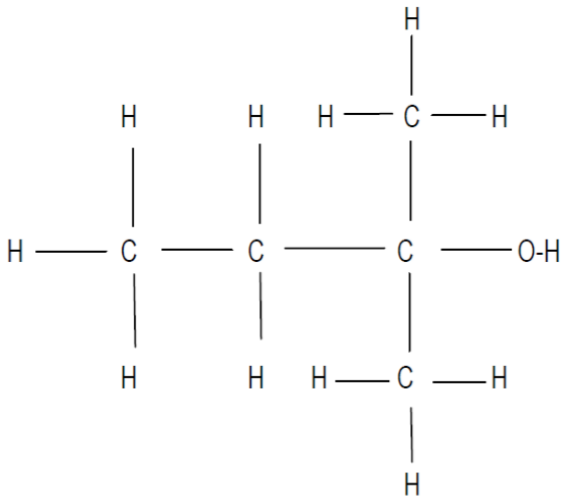
Percentage: **/100**

Grade Boundaries:

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

Question Number	Acceptable Answer	Reject	Mark
1(a)(i)	From maximum value of *m/e* OR From maximum value of *m/z* OR From maximum mass / charge ratio OR From (position of) peak furthest to right of spectrum (excluding small peaks due to isotopes) ALLOW Value furthest to the right hand side from (position of) last peak "line" for peak IGNORE Molecular ion	Just "highest value" Biggest peak Highest peak	**1**

Question Number	Acceptable Answers	Reject	Mark
1a(ii)	x = 5 y = 11		**1**

Question Number	Acceptable Answers	Reject	Mark
1(b)	 TE on (a)(ii) for a correct tertiary alcohol with the number of C atoms given in (a) (ii) ALLOW Partial display eg –OH, -CH_3, -C_2H_5 ALLOW CH_3 | CH_3-C-OH | C_2H_5	Structure shown as fully structural (no bonds shown) skeletal formula -HO Bonds should not go from C to H of OH	**1**

Question Number	Acceptable Answer	Reject	Mark
1(c)(i)	Hydrogen chloride / hydrochloric acid / HCl / HCl(aq)		**1**

Number			
1(c)(ii)	$NH_3(g) + HCl(g) \rightarrow NH_4Cl(s)$ Correct formulae ALLOW $NH_4^+ Cl^-$ / $NH_4^+ + Cl^-$ Multiples **(1)** State symbols **(1)** Second mark depends on equation showing **only** correct species even if unbalanced. ALLOW HCl(aq)		**2**

Question Number	Acceptable Answer	Reject	Mark
1(d)	Alcohol has a peak for O-H bond OR ether has no peak for O-H bond ALLOW Alcohol has a peak for C-OH / C-O-H / -OH OR **Identification from C-O if stated that** C-O in ether absorbs at a different wavenumber from C-O in alcohol / ether has C-O-C OR Look at fingerprint region **and** compare with a compound of known identity ALLOW Use of " absorption / stretch / vibration / wave number / reading / drop / trough" instead of peak R-O for C-O IGNORE "ester" if apparently written by mistake for "ether" Broad and sharp (peaks)	Just 'alcohol has an OH bond / group' Just identification from C-O without detail C-O peak higher in ether range / spectrum instead of peak	**1**

Total for Question 1 = 7 marks

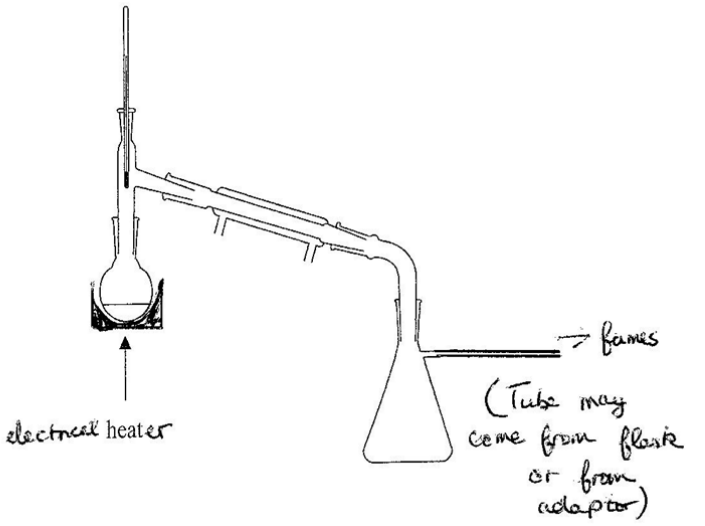
Question Number	Acceptable Answers	Reject	Mark
2(a)	Orange to green / blue / brown ALLOW Orange to blue-green Orange to dark green		**1**

Question Number	Acceptable Answers	Reject	Mark
2(b)	To prevent solvent boiling / vaporising / escaping (from mouth of flask) ALLOW **Solvent** may ignite / is flammable Reactant / product / butan-2-ol / butanone are prevented from boiling / vaporising / escaping (from mouth of flask) IGNORE Comments on sulfuric acid spray being corrosive Butan-2-ol / solvent / butanone is volatile or has a low boiling temperature		**1**

Question Number	Acceptable Answers	Reject	Mark
2(c)	(Purpose:) removes / neutralizes (excess) acid **(1)** (Method:) Put in a (stoppered) **separating funnel / tap funnel** with sodium hydrogencarbonate (and shake the mixture) **(1)** Open the tap at intervals / remove stopper at intervals / release pressure at intervals ALLOW Pressure builds up because carbon dioxide forms **(1)** Final mark can be awarded if washing is carried out in a **stoppered** flask IGNORE comments on separating organic product after washing	Removes impurities	**3**

Question Number	Acceptable Answers	Reject	Mark
2(d)	Drying agent / removes water / removes moisture ALLOW Absorbs water	Dehydrating agent Reacts with water Removes impurities	**1**

Question Number	Acceptable Answer	Reject	Mark
2(e)	**Fi mark**: Suitable flask (round bottom or pear shaped) fitted with stillhead, **and** with thermometer in correct position with bulb opposite opening to condenser ALLOW Flask with long neck and delivery tube in place of flask & stillhead IGNORE Fractionating column **(1)** **Second mark:** Condenser angled downwards with correctly drawn inner tube and (water cooled) outer tube IGNORE (Direction of) water flow in condenser **(1)** **Third mark**: Collecting flask with vent in flask or in connection to it ALLOW Open necked flask / beaker **(1)** **Fourth mark**: Electrical heater ALLOW Water bath heated by electrical heater / Bunsen / heat arrow If heat source is shown as "Heat" or with an arrow then ALLOW either of these precautions: Tube between condenser and collecting flask to lead fumes away to drain or fume cupboard OR Cool collecting flask in ice **(1)** Labels only needed for items which cannot be identified in diagram eg electric heater	Conical flask Still head open Air condenser (ie no water jacket) Sealed system Use of Bunsen but no water bath	**4**

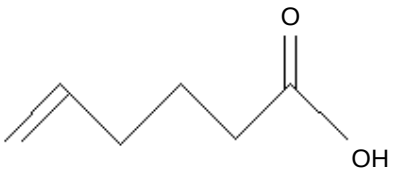


Question Number	Acceptable Answers	Reject	Mark
2(f)(i)	(5.0 / 0.805) = 6.2112 / 6.211 / 6.21 / 6.2 (cm^3) ALLOW comma for decimal point	6 (cm^3)	**1**

Question Number	Acceptable Answers	Reject	Mark
2(f)(ii)	There are many possible correct methods for this calculation. Two of these methods are shown below: **Look at final answer:** **4.8(2) (g) scores 3 marks,** **1.97 (g) OR 3.08 (g) scores 2 marks** For other answers, look at working; do not penalise intermediate rounding. 0.042 moles butanone gives final answer of 4.9 (g) **First mark:** 3.0 g butanone = 0.041609 mol **(1)** **THEN Route 1:** **Second mark** Need to make $\frac{(0.0416 \times 100)}{64}$ = 0.065 mol **(1)** **Third mark** Mass butanol = (0.065 x 74.1) = 4.8175 / 4.8(2) (g) **(1)** **OR Route 2:** **Second mark** Mass of 0.041609 mol butanol = 0.041609 x 74.1 = 3.082 (g) (Use of 0.042 mol gives 3.11 (g)) **(1)** **Third mark** **M**ass butanol needed = (3.082 x 100/ 64) = 4.8175 / 4.8(2) (g) **(1)** IGNORE sf except 1 sf at all stages Rounding may be done at different stages of calculation and intermediate values may not be shown		**3**

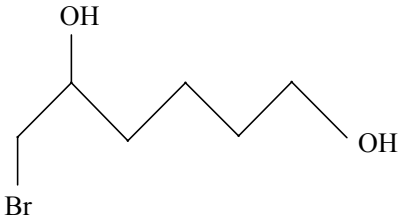
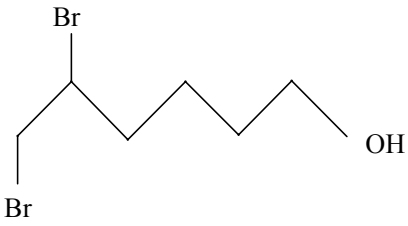
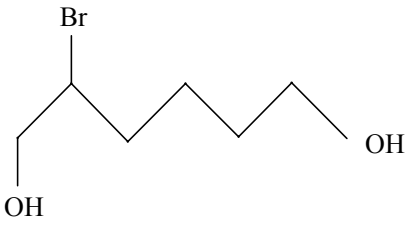
Total for Question 2 = 14 marks

Question Number	Acceptable answers	Reject	Mark
3(a)(i)	Orange to green / blue / brown ALLOW Dark green / green-brown	Combinations of blue and green Green to orange	**1**

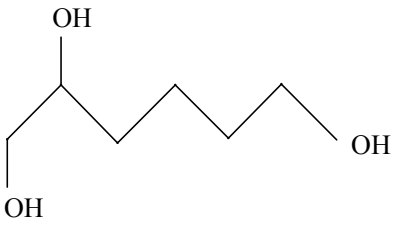
Question Number	Acceptable answers	Reject	Mark
3(a)(ii)	$CH_2=CH(CH_2)_3COOH$ Double bond need not be shown ALLOW CO_2H for COOH ALLOW  ALLOW displayed formula	$C_6H_{10}O_2$ Formulae not showing H atoms	**1**

Question Number	Acceptable answers	Reject	Mark
3(b)	Any TWO of Bubbles / effervescence / fizzing Sodium dissolves / disappears **White** residue / solid / ALLOW **White** precipitate ALLOW Rise in temperature / gets hotter / heat is given out IGNORE Moves / Floats / Sinks / Catches fire / Hydrogen given off	 Just “Gas forms” Bubbles form if incorrect gas identified. White solid dissolves Crystals form Just “exothermic”	**2**

Question Number	Acceptable answers	Reject	Mark
3(c)(i)	Brown / red-brown / orange / yellow / combinations of these colours to colourless	Red to colourless Clear for colourless Paler for colourless White for colourless	**1**

Question Number	Acceptable answers	Reject	Mark
3(c)(ii)	 ALLOW  ALLOW  IGNORE orientation of Br and OH, eg both Br pointing down IGNORE lengths of bonds Check that there are **6C** in formula	Br at left hand end without a bond to it	**1**

Question Number	Acceptable answers	Reject	Mark
3(d)(i)	Purple / pink to colourless ALLOW For purple pink: pinkish-purple, dark purple For colourless: brown	Clear for colourless White for colourless Green / orange for colourless Lilac for purple	**1**

Question Number	Acceptable answers	Reject	Mark
3(d)(ii)	 IGNORE orientation of OH, eg both OH pointing down IGNORE lengths of bonds Check that there are **6C** in formula	OH at left hand end without a bond to it Bond to H of OH group	**1**

Question Number	Acceptable answers	Reject	Mark
3(e)	hex-5-en-1-ol Alkene/ C=C at 1669 – 1600 (cm^{-1}) (alkene) C-H at 3100-3010 (cm^{-1}) Correct identification **and** one correct piece of evidence (**1**) Correct identification with two pieces of evidence (**2**) Correct identification and correct bonds quoted without any data can score 1.		**2**

Total for Question 3 = 10 marks

Question Number	Acceptable answers	Reject	Mark
4(a)(i)	Dehydrating agent / dehydration/ removes (elements of) water / removes H_2O / eliminates water / eliminates H and OH IGNORE reference to catalyst	Drying agent Just elimination	**1**

Question Number	Acceptable answers	Reject	Mark
4(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
4(b)	**t mark** 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
4(c)(i)	EITHER 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**) 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**) OR (alternative approach) Hydrogen bonds would be broken if cyclohexene mixes with water (**1**) Only weaker London forces would replace them (**1**) IGNORE comments on ionic bonding in sodium chloride	Just "cyclohexene is non-polar" Cyclohexene forms permanent dipole-dipole forces Just "there are hydrogen bonds in water"	**2**

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

Question Number	Acceptable answers	Reject	Mark
4(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
4(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
4(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
4(f)(i)	Mass cyclohexanol = (0.100 x 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
4(f)(ii)	EITHER Max yield = (0.100 x 82) = 8.20/ 8.2g (**1**) % yield = $\frac{(5.50 \times 100)}{8.20}$ = 67.073/ 67.1/ 67% (**1**) 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). OR Mol cyclohexene = $\frac{5.5}{82}$ = 0.067073 (**1**) Ignore sf except 1 sf % yield = $\frac{(0.067073 \times 100)}{0.1}$ = 67.073/ 67.1/ 67% (**1**) Correct answer with no working scores 2 Use of 84 as molar mass cyclohexene scores max 1 Ignore SF except 1	0 overall if yield greater than 100%	**2**

Total for Question 4 = 16 marks