Alcohols

Mark Scheme 1

Level	International A Level
Subject	Chemistry
Exam Board	Edexcel
Topic	Application of Core Principles of Chemistry
Sub Topic	Alcohols
Booklet	Mark Scheme 1

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%

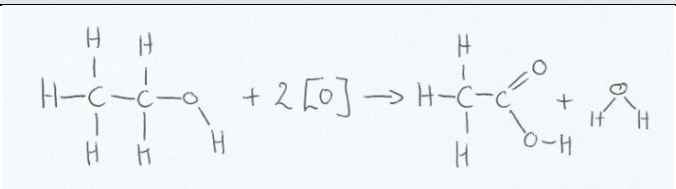
Question Number	Correct Answer	Mark
1	A	**(1)**
	Incorrect answers B – incorrect mass C - incorrect mass D - incorrect mass	

Question Number	Correct Answer	Mark
2	A	**(1)**
	Incorrect answers B – has fewer oxygen atoms than A C - has fewer oxygen atoms than A D - has fewer oxygen atoms than A	

Question Number	Correct Answer	Mark
3	D	**1**

Question Number	Correct Answer	Reject	Mark
4	B		1

Question Number	Correct Answer	Reject	Mark
5	C		1

Question Number	Acceptable Answers	Reject	Mark
6(a)	 Displayed formula for ethanol **(1)** Displayed formula for ethanoic acid **(1)** Balancing correct equation **(1)** Penalise OH and/or CH_3 and/or omission of square bracket around the O for the oxidizing agent **once** only Ignore absence of displayed formula for water Ignore state symbols even if incorrect ALLOW full marks for one equation for the oxidation of ethanol to ethanal and then a second equation for the oxidation of ethanal to ethanoic acid as long as displayed formulae are given	O_2	3

Question Number	Acceptable Answers	Reject	Mark
6(b)(i)	Primary/ 1°	Secondary Tertiary	1

Question Number	Acceptable Answers	Reject	Mark
6(b)(ii)	**Marking point 1** Ethanal... volatile/has low boiling temperature (compared to ethanol) ALLOW evaporates easily/readily **(1)** **Marking point 2** Ethanal... Distils OR Boils out of the mixture/boils off OR Condenses in the right-hand flask ALLOW Passes through the condenser **(1)** Ignore 'fractional' **Marking point 3** Ethanal... Separates before being oxidized further/completely OR Away from the oxidizing agent ALLOW Reflux is needed for complete oxidation OR Reflux is needed for oxidation (of ethanol) to ethanoic acid OR Reflux is needed otherwise only partial oxidation occurs **(1)**	ethanoic acid	3

Question Number	Acceptable Answers	Reject	Mark
6(b)(iii)	Prevents pressure building up (by allowing gases to escape) ALLOW: prevent explosion Ignore the identification of any gases produced even if incorrect		1

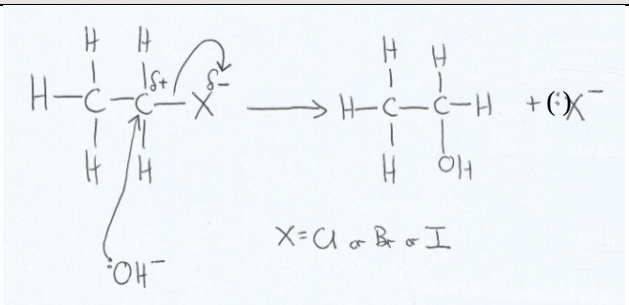
Question Number	Acceptable Answers	Reject	Mark
6(c)(i)	**An incorrect test scores zero** Either of the following approaches: (Reagent) PCl_5 / phosphorus(V) chloride / phosphorus pentachloride OR $SOCl_2$ / thionyl chloride **(1)** (Observation) Misty fumes/steamy fumes / white fumes **(1)** OR (Reagent) Na/Sodium **(1)** (Observation) Effervescence / bubbles **(1)** Observation consequential on reagent or a 'near miss' such as PCl_3 / PCl_5(l) PCl scores 0/2	White smoke Just 'gas' Any incorrect gas	2

Question Number	Acceptable Answers	Reject	Mark
6(c)(ii)	**Allow the atoms in any order** (Mass Spectrum fragment) $CH_3CO^+/C_2H_3O^+$ ALLOW HCO^+ **(1)** (Infrared spectrum difference) Any from (Presence of) C=O absorption/peak/stretch OR (Presence of) C-H in CHO absorption/peak/stretch ALLOW Lack of O-H absorption/peak/stretch OR Lack of C-O absorption/peak/stretch **(1)** Ignore any wave numbers quoted	Absence of $^+$ sign CH_3CHO^+	2

Question Number	Acceptable Answers	Reject	Mark
6(d)(i)	$C_3H_8O_3 + 3½O_2 \rightarrow 3CO_2 + 4H_2O$ OR multiples Ignore state symbols even if incorrect		1

Question Number	Acceptable Answers	Reject	Mark
6(d)(ii)	Many possibilities but the most likely are $C_3H_8O_3 + ½O_2 \rightarrow 3C + 4H_2O$ OR $C_3H_8O_3 + 2O_2 \rightarrow 3CO + 4H_2O$ One mark for species **(1)** One mark for balancing **(1)** ALLOW any suitable combination of above e.g. $C_3H_8O_3 + 1½O_2 \rightarrow 2CO + C + 4H_2O$ $C_3H_8O_3 + 2O_2 \rightarrow CO_2 + CO + C + 4H_2O$ Ignore state symbols even if incorrect (Observation – standalone mark) black smoke/black fumes / sooty / yellow flame ALLOW Black solid/black deposit/soot **(1)**	 H_2 as product scores 0/2 Equation for complete combustion scores 0/2 Just 'smoke' Just 'carbon' Just 'blue flame' Grey	3

Question Number	Acceptable Answers	Reject	Mark
6(e)(i)	Nucleophilic **(1)** Substitution **(1)** ALLOW phonetic/alternative spellings of nucleophilic ALLOW for one mark: S_N2/ S_N1 alone ALLOW in any order	Elimination Addition	2

Question Number	Acceptable Answers	Reject	Mark
6(e)(ii)	 Dipole on halogenoalkane **and** lone pair on the oxygen of the hydroxide ion **and** negative charge on the hydroxide ion **(1)** curly arrows (ALLOW from any part of the OH^- including the charge) **(1)** Both correct products **(1)** S_N1 mechanism scores first and third marks only If ethanol is not the alcohol formed max 2	X = F	3

TOTAL FOR QUESTION 6 = 21 MARKS

Question Number	Acceptable Answers	Reject	Mark
7(a)(i)	$C_{10}H_{18}O$ ALLOW symbols in any order i.e. $C_{10}OH_{18}$ /$H_{18}C_{10}O$ /$H_{18}OC_{10}$ /$OC_{10}H_{18}$ / $OH_{18}C_{10}$ IGNORE any other formulae as working	$C_{10}H_{17}OH$	**(1)**

Question Number	Acceptable Answers	Reject	Mark
7(a)(ii)	C_5H_8 ALLOW H_8C_5 IGNORE any other formulae as working		**(1)**

Question Number	Acceptable Answers	Reject	Mark
7(a)(iii)	Linalool and geraniol Both needed for the mark They can be in either order	Any additional names: limonene, citronellol	**(1)**

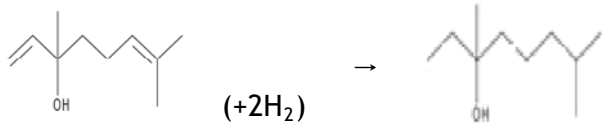
Question Number	Acceptable Answers	Reject	Mark
7(a)(iv)	Geraniol	Any additional names: limonene, linalool, citronellol	**(1)**

Question Number	Acceptable Answers	Reject	Mark
7(b)	**Alkene:** Bromine water /aqueous bromine / $Br_2(aq)$ ALLOW Bromine / $Br_2((l))$ **(1)** Decolorises / changes (from yellow / orange / brown / red) to colourless **(1)** ALLOW Acidified potassium manganate (VII)/ H^+ and MnO_4^- **(1)** Purple to colourless **(1)** **Alcohol:** Phosphorus(V) chloride / PCl_5 **(1)** Steamy fumes ALLOW Misty / white fumes **(1)** OR Sodium / Na **(1)** Effervescence / fizzing / bubbles **(1)** IGNORE dissolves / white solid OR Ethanoic acid / carboxylic acid and any strong acid **(1)** Fruity smell **(1)**	acidified potassium dichromate((VI)) / H^+ and $Cr_2O_7^{2-}$ white smoke	**(4)**

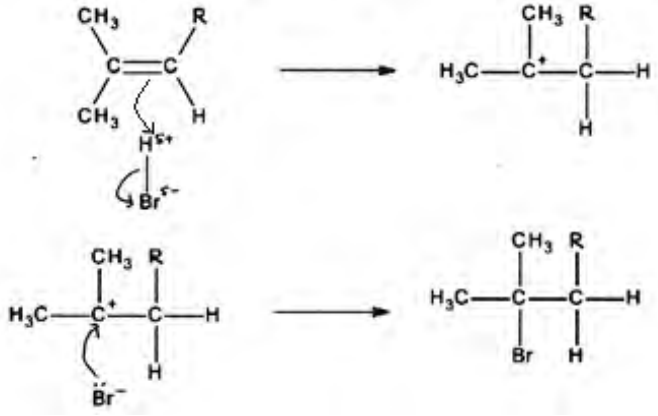
Question Number	Acceptable Answers	Reject	Mark
7(c)(i)	Limonene can be identified as there will be no peak / absorbance for OH (bond/group) **(1)** IGNORE Citronellol can be identified as there will be fewer C=C peaks / a weaker peak/absorbance for C=C (as it has one C=C and the other three compounds have two C=C) IGNORE stretching / wavelength / wavenumber The other three compounds / linalool, geraniol and citronellol will all have a peak/absorbance for OH and C=C /same functional groups so cannot be distinguished OR Fingerprint region will be different for all of them ALLOW Linalool and geraniol will both have a peak/absorbance for OH and two C=C/same functional groups so cannot be distinguished **(1)** IGNORE All 4 have a peak / absorbance for C=C	OH^-	**(2)**

Question Number	Acceptable Answers	Reject	Mark
7(c)(ii)	**First mark - reagents** Add potassium/sodium dichromate((VI)) **and** dilute sulfuric acid to both (and warm / heat) ALLOW Acidified dichromate((VI)) ions (and warm / heat) OR Acidified potassium/sodium dichromate((VI)) (and warm / heat) ALLOW correct formulae eg $Cr_2O_7^{2-}/H^+$ **(1)** **Second mark - observations** Geraniol - orange to green/blue **and** Linalool – no change /stays orange **(1)** **NOTE** M2 is conditional on mention of dichromate((VI)) in M1	Use of $KMnO_4$	**(2)**

Question Number	Acceptable Answers	Reject	Mark
7(d)(i)	(Raney) nickel / Ni / platinum / Pt palladium /Pd (catalyst)	Additional metals e.g. iron	**(1)**

Question Number	Acceptable Answers	Reject	Mark
7(d)(ii)	 (+2H_2) → ALLOW mark for just correct formula of product as displayed, structural, skeletal or any combination of these / $C_{10}H_{22}O$ / $C_{10}H_{21}OH$ IGNORE C–OH connectivity / conditions If more than one type of formula is given, all must be correct		**(1)**

Question Number	Acceptable Answers	Reject	Mark
7(d)(iii)	Correct answer with no working scores (3) marks Mass linalool in lavender oil = 2.55 x 70 / 100 = 1.785 g **(1)** Mol linalool = 1.785 / 154 = 0.01159 TE from mass linalool **(1)** **Alternative for first two marks** Mol linalool if pure = 2.55/154 = 0.016558 **(1)** Actual mol linalool = 0.016558 x 70 /100 = 0.01159 **(1)** Volume hydrogen = 2 x 0.01159 x 24.0 = 0.5564 /0.56 dm^3 OR 560 cm^3 ALLOW Volume hydrogen = 0.01159 x 24.0 = 0.27818 /0.278 dm^3 OR 278 / 280 cm^3 TE from mol linalool **(1)** IGNORE SF except 1 SF	Incorrect unit eg dm^3 mol^{-1} or dm^{-3} / missing unit	**(3)**

Question Number	Acceptable Answers	Reject	Mark
7(e)			**(4)**
	Dipole on HBr **(1)**	Full charges	
	Both curly arrows on first structure, arrow from C=C to H **and** arrow from H-Br bond to Br ALLOW Second curly arrow to just beyond Br **(1)**		
	Correct carbocation **(1)**	Partial charge on C	
	Curly arrow from Br^- arrow can come from anywhere on Br, including the charge, lone pair not needed **(1)**		
	ALLOW 4 marks for correct mechanism leading to the minor product **NOTE** If incorrect alkene is used, M1, M2 and M4 can still score		

(Total for Question 7 = 21 marks)