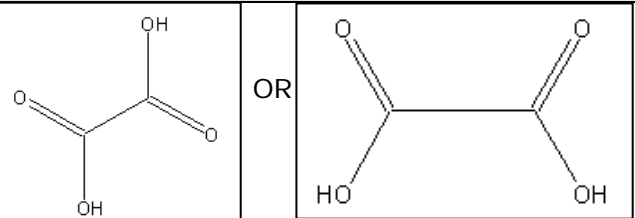
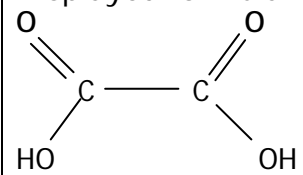




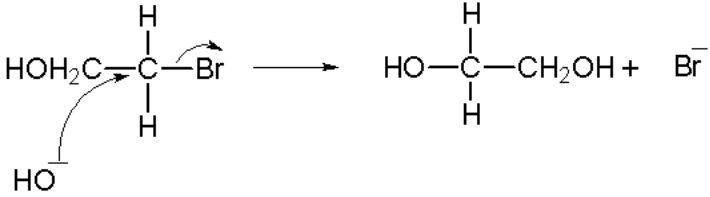
Question Number	Acceptable Answers	Reject	Mark
<b>1 (c)</b>	 <p>ALLOW the OH bond to be displayed</p> <p>ALLOW displayed formula as 'working out'</p> <p>ALLOW any orientation</p> <p>IGNORE bonds of different lengths or incorrect bond angles</p>	<p>Displayed formula</p>  <p>Just 'Structural formula'</p> <p>Bond from carbon clearly to the H of the OH</p>	<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>1 (d)</b>	<p>Both have OH / hydroxyl groups</p> <p>OR</p> <p>Both would produce steamy / misty /white <b>and</b> fumes /gas (of HCl)</p>	<p>Hydroxide ions</p> <p>White smoke</p> <p>Just 'both produce HCl'</p> <p>Both give the same products'</p>	<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>1 (e) (i)</b>	<p>(Strong) Peak at 1750-1700 (<math>\text{cm}^{-1}</math>) <b>(1)</b></p> <p>Peak(s) (either or both) at 2900-2700(<math>\text{cm}^{-1}</math>) <b>(1)</b></p> <p>ALLOW these if merged</p>	<p>peak at 3300-2500 (<math>\text{cm}^{-1}</math>)</p> <p>peak at 3750-3200 (<math>\text{cm}^{-1}</math>)</p>	<b>2</b>

Question Number	Acceptable Answers	Reject	Mark
<b>1 (e) (ii)</b>	<p>(Unreacted) ethanol</p> <p><math>\text{C}_2\text{H}_5\text{OH}</math> /displayed /skeletal</p> <p>IGNORE references to O-H bonding</p>	<p>Molecular formula</p> <p>Just "O-H in alcohol"</p> <p>Ethane-1,2-diol</p>	<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>1 (e) (iii)</b>	COOH <sup>+</sup> ALLOW CO <sub>2</sub> H <sup>+</sup> ALLOW CH <sub>3</sub> COO <sup>+</sup> ALLOW CH <sub>2</sub> COOH <sup>+</sup>  ALLOW the + sign wherever it is seen Also allow correct displayed, semi-displayed or structural formulae	COOH <sup>-</sup> or any other formula with – charge  CH <sub>3</sub> CO <sub>2</sub> H <sup>+</sup> CH <sub>3</sub> COOH <sup>+</sup> C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> <sup>+</sup>	<b>1</b>

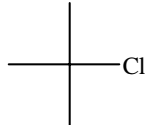
Question Number	Acceptable Answers	Reject	Mark
<b>1 (f) (i)</b>	 <p>One mark for curly arrow from hydroxide ion; (This arrow can be drawn from anywhere on the hydroxide ion) <b>(1)</b></p> <p>One mark for curly arrow from C-Br bond <b>(1)</b></p> <p>Correct products; <b>(1)</b></p> <p>If SN1 is shown, then intermediate with positive charge must be shown after loss of Br, followed by attack by hydroxide. This mechanism can score all 3 marks</p>	Carbon with δ-  Bond to H of OH	<b>3</b>

Question Number	Acceptable Answers	Reject	Mark
<b>1 (f) (ii)</b>	Mechanism: Nucleophilic <b>(1)</b>  Type: Substitution <b>(1)</b> ALLOW either way round  Just S <sub>N</sub> scores <b>(1)</b>  ALLOW nucleophile and phonetic spelling  IGNORE Heterolytic fission	Elimination  SN with elimination or other type of reaction  Homolytic fission	2

Question Number	Acceptable Answers	Reject	Mark
<b>1 (g)</b>	$\text{Ag}^+(\text{aq}) + \text{Br}^-(\text{aq}) \longrightarrow \text{AgBr}(\text{s})$ <p>Species (1)</p> <p>State symbols (1)</p> <p>ALLOW one mark for chemical equation with state symbols rather than ionic equation, e.g. <math>\text{AgNO}_3(\text{aq}) + \text{NaBr}(\text{aq}) \longrightarrow \text{AgBr}(\text{s}) + \text{NaN}_3(\text{aq})</math></p>	Spectator ions included	<b>2</b>

Question Number	Acceptable Answers	Reject	Mark
<b>1 (h)</b>	<p>Both silver chloride and silver bromide dissolve /give colourless solution in conc. ammonia (1)</p> <p>If the solid doesn't dissolve in dilute ammonia then it is silver bromide</p> <p>OR</p> <p>Add conc. sulfuric acid to the (solid) silver bromide and get red-orange bromine gas (1)</p>	Alternative tests which don't work eg displacement of bromine, use of organic solvent, leave in sunlight to see if bromine forms, add conc. sulfuric acid to halide solution.	<b>2</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2</b> <b>(a) (i)</b>	<p><b>X</b> = 2-chloro-2-methylpropane  ALLOW  <b>X</b> = 2,2-chloromethylpropane  <b>X</b> = 2-methyl-2-chloropropane  <b>X</b> = 2,2-methylchloropropane  <b>X</b> = 2-chloromethylpropane  <b>(1)</b></p> <p><b>Z</b> = 2-methylpropan-2-ol  <b>(1)</b>  ALLOW methylpropan-2-ol  ALLOW propane for propan</p> <p>IGNORE omission of (or extra) commas and hyphens  IGNORE spaces</p>	<p>2-methylchloropropane</p> <p>Hydroxy for -ol</p>	<b>2</b>

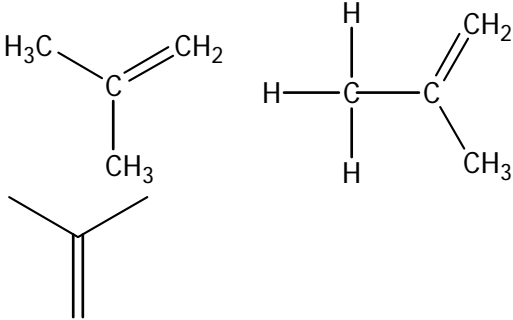
Question Number	Acceptable Answers	Reject	Mark
<b>2</b> <b>(a) (ii)</b>	 <p>ALLOW any angles</p>	Any other type of structure	<b>1</b>

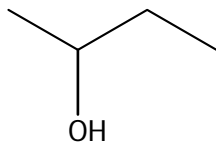
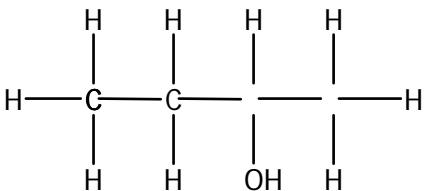
Question Number	Acceptable Answers	Reject	Mark
<b>2</b> <b>(a) (iii)</b>	Tertiary ALLOW recognisable abbreviations: 3 <sup>y</sup> /3 <sup>o</sup>		<b>1</b>

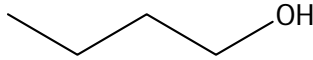
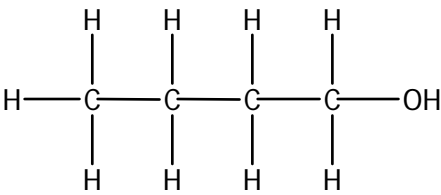
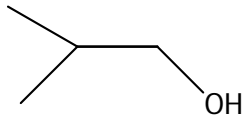
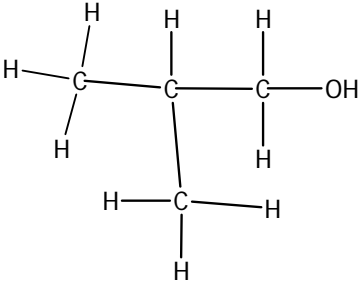
Question Number	Acceptable Answers	Reject	Mark
<b>2</b> <b>(b) (i)</b>	Nucleophilic <b>(1)</b> Substitution <b>(1)</b> S <sub>N</sub> 1 scores 1/2	S <sub>N</sub> 2	<b>2</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2</b> <b>(b)(ii)</b>	<p>Movement (ALLOW Transfer/donation)/ start and finish positions of an electron pair ALLOW two electrons for pair</p> <p>IGNORE bonded/unbonded for electrons</p> <p>IGNORE heterolytic bond breaking and bond formation</p>	electrons	<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2</b> <b>(b)(iii)</b>	<p>These marks are stand alone</p> <p>Trigonal (ALLOW triangular) planar/ planar with bond angles of <math>120^\circ</math> <b>(1)</b></p> <p>3 bond pairs (no lone pairs) of electrons <b>(1)</b></p> <p>ALLOW 3 pairs of electrons <b>around the central atom/carbon</b></p> <p>Arranged at <b>minimum</b> repulsion <b>(1)</b></p> <p>ALLOW <b>maximum</b> separation / distance apart</p> <p>IGNORE references to the positive charge</p>	<p>Bonds or 'areas of electron density' for pairs Just '3 pairs of electrons'</p> <p>Just 'repel'</p> <p>Repel as much as possible</p>	<b>3</b>

Question Number	Acceptable Answers	Reject	Mark
<b>2</b> <b>(b) (iv)</b>	<p>(Type of reaction:) elimination  ALLOW dehydrohalogenation  IGNORE nucleophilic</p> <p>Product: 2-methylpropene  ALLOW methylpropene  2-methylprop-1-ene  Methylprop-1-ene</p> <p>any correct formula e.g.  <math>(\text{CH}_3)_2\text{CCH}_2</math> ALLOW <math>\text{CH}_3\text{C}(\text{CH}_3)\text{CH}_2</math></p>  <p><b>(1)</b></p> <p>If a displayed formula or part displayed formula is used, all the atoms must be shown.</p>	2-methylprop-2-ene methylprop-2-ene	<b>2</b>

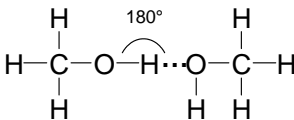
Question Number	Acceptable Answers	Reject	Mark
<b>2</b> <b>(c) (i)</b>	<p>If a displayed formula or part displayed formula is used, all the atoms must be shown.  If a carbon is <i>clearly</i> shown bonded to the H in OH, penalise once in (c)</p> <p><math>\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3</math>  ALLOW</p>  <p>OR</p> 		<b>1</b>

Question Number	Acceptable Answers	Reject	Mark
2 (c) (ii)	<p>CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH (1)</p> <p>ALLOW</p>  <p>or</p>  <p>(CH<sub>3</sub>)<sub>2</sub>CHCH<sub>2</sub>OH (1)</p> <p>ALLOW</p>  <p>OR</p>  <p>If 2 correct carboxylic acids are shown, 1 out of 2</p>	Aldehydes	2



Question Number	Acceptable Answers	Reject	Mark
3 (a) (i)	<p style="text-align: center;">H            .x xx            H.x C.x O .xH            .x xx            H</p> <p>Allow all dots / crosses, combinations of dots, crosses and other symbols like triangles</p> <p>Allow extra inner electrons around carbon and /or oxygen</p>	<p>Missing symbols</p> <p>Missing non-bonding electrons</p>	1

Question Number	Acceptable Answers	Reject	Mark
3 (a) (ii)	<p>Each mark is independent of the next unless the bond angle is greater than <math>119^\circ</math></p> <p><math>109^\circ / 109.5^\circ</math> (1)</p> <p><b>Minimum repulsion / maximum separation</b>            (between four bond pairs of electrons / bonds)            (1)</p> <p><math>104^\circ - 105^\circ</math> (1)</p> <p>(Two) lone pairs / non-bonding pairs (of electrons) repel more (than bonding pairs)/repel a lot (1)</p>	<p>Four bond pairs give tetrahedral shape</p>	4

Question Number	Acceptable Answers	Reject	Mark
3 (a) (iii)	 <p>Correct atoms in the hydrogen bond (O—H...O) (1)            Allow CH<sub>3</sub> groups not displayed, correct ethanol formulae.</p> <p>Hydrogen bond can be shown as dots horizontal or vertical dashes. If it is a bond-like line it must be labelled.</p> <p>Second mark dependent on correct atoms involved.</p> <p>O—H...O in straight line (within small tolerance) and <math>180^\circ</math> bond angle given in the correct place (1)</p>	<p>Hydrogen bond between methanol and water does not score</p>	2

Question Number	Acceptable Answers	Reject	Mark
3 (b) (i)	Any two from:  Bubbles/ fizzing / effervescence (of gas) forming (1)  Sodium /solid disappearing /dissolving (to form a clear colourless solution) (1)  White solid /precipitate forming (1)	Vigorous reaction  White solution/fumes form  Clear colourless solution forms alone	2

Question Number	Acceptable Answers	Reject	Mark
3 (b) (ii)	$\text{CH}_3\text{OH} + \text{Na} \rightarrow \text{CH}_3\text{O}^{(-)}\text{Na}^{(+)} + \frac{1}{2}\text{H}_2$  Allow multiples, NaOCH <sub>3</sub> as product, ethanol as CH <sub>3</sub> CH <sub>2</sub> OH/C <sub>2</sub> H <sub>5</sub> OH with sodium ethoxide as product,  Ignore state symbols and charges	Na <sup>+</sup> as reactant CH <sub>3</sub> O–Na  CH <sub>3</sub> NaO or NaCH <sub>3</sub> O	1

Question Number	Acceptable Answers	Reject	Mark
3 (c) (i)	Na <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> / K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> / Sodium / potassium dichromate((VI)) (1)  Allow recognisable spelling of potassium and dichromate  If name and formula given, both must be correct.  H <sub>2</sub> SO <sub>4</sub> / (Dilute / concentrated) sulfuric acid (1)  Second mark dependent on recognisably correct oxidizing agent  Allow acidified / H <sup>+</sup> and dichromate((VI)) / Cr <sub>2</sub> O <sub>7</sub> <sup>2-</sup> for 1 mark  Allow potassium manganate((VII)) and dilute sulfuric acid for 1 mark	Other oxidation numbers Potassium/sodium dichromate(VI) ions  Other acids e.g. hydrochloric, nitric, phosphoric  Other oxidation numbers	2

Question Number	Acceptable Answers	Reject	Mark
3 (c) (ii)	<p>Round-bottomed/pear shaped flask with heat Still head (1)</p> <p>Delivery tube and exit above/in (cooled) collection vessel (1)</p> <p>A condenser may be included Sealed apparatus (max. 1)</p>	<p>Reflux apparatus or reflux followed by distillation scores 0</p> <p>Conical flask Open still head</p>	2

Question Number	Acceptable Answers	Reject	Mark
3 (c) (iii)	<p><b>Mark independently</b></p> <p>(Permanent) dipole dipole/permanent dipole (forces) in ethanal (1)</p> <p><b>Ethanal higher because</b></p> <p>both compounds have (similar) London /van der Waals' /etc forces</p> <p>OR</p> <p>no (permanent) dipole dipole /permanent dipole (forces) in propane</p> <p>OR</p> <p>propane (only) has London /van der Waals' /etc forces (1)</p>	<p>Ethanal has hydrogen bonds loses <b>first mark only</b></p>	2

Question Number	Acceptable Answers	Reject	Mark
4(a)(i)	Effervescence / fizzing / bubbles (of colourless gas) (1) Mixture gets hot (1) White solid (ALLOW ppt) produced / sodium dissolves or disappears (1) Any two Ignore inferences unless incorrect		2

Question Number	Acceptable Answers	Reject	Mark
4(a)(ii)	$C_4H_9ONa$ / $C_4H_9O^-Na^+$ / structural or displayed formulae of any of the isomers: $CH_3CH_2CH_2CH_2ONa$ $(CH_3)_2CHCH_2ONa$ $(CH_3)_3CONa$ $CH_3CH(ONa)CH_2CH_3$	Structures showing a covalent bond between O and Na $C_4H_9NaO$ / $C_4H_9Na^+O^-$	1

Question Number	Acceptable Answers	Reject	Mark
4(b)	$  \begin{array}{c}  H \\    \\  H-C-H \\    \\  H \quad H \\    \quad   \\  H-C-C-C-H \\    \quad   \quad   \\  H \quad O \quad H \\    \\  H  \end{array}  $ <p>Do not penalise undisplayed <math>CH_3</math> or O-H (1)</p> <p>(2-)methylpropan-2-ol(1)</p> <p>Marks are stand alone</p>	Missing hydrogen atoms Skeletal formula	2

Question Number	Acceptable Answers	Reject	Mark
4(c)	$(CH_3)_2CHCH_2OH$ OR correct displayed formula OR semi-displayed formula <b>ALLOW</b> $CH_3CH(CH_3)CH_2OH$ <b>ALLOW</b> missing bracket round $CH_3$ in this version Ignore names	Missing hydrogen atoms Skeletal formula	1

Question Number	Acceptable Answers	Reject	Mark
4(d)(i)	$\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$ (1) OR correct displayed formula OR semi-displayed formula  Do not penalise missing bracket round OH Ignore names	Missing hydrogen atoms Skeletal formula	1

Question Number	Acceptable Answers	Reject	Mark
4(d)(ii)	O—H absorption / peak in 2-methylpropanoic acid / No O—H absorption / peak in Q  ALLOW C=O absorption / peak in 2-methylpropanoic acid / No C=O absorption / peak in Q  Ignore references to broad or sharp peaks and to the fingerprint region		1

Question Number	Acceptable Answers	Reject	Mark
4(e)	$\text{PCl}_5$ / $\text{PCl}_3$ / conc HCl / $\text{SOCl}_2$ / mixture of $\text{NaCl} + \text{H}_2\text{SO}_4$ / mixture of $\text{KCl} + \text{H}_2\text{SO}_4$ Ignore reference to concentration of $\text{H}_2\text{SO}_4$ OR Names	Hydrogen chloride Conc hydrogen chloride HCl $\text{PCl}_5(\text{aq})$ , $\text{PCl}_3(\text{aq})$ , $\text{SOCl}_2(\text{aq})$	1

Question Number	Correct Answer	Reject	Mark
4(f)(i)	White precipitate/ white solid		1

Question Number	Acceptable Answers	Reject	Mark
4(f)(ii) QWC	Water has 2 hydrogen bonds per molecule (on average) whereas ethanol only has 1 (1) <b>ALLOW</b> Water has more hydrogen bonds (per molecule) than ethanol  Needs more energy to break H bonds in water (so less soluble) / H bonding (ALLOW intermolecular forces) stronger in water (1)  Second mark dependent on first.  Ignore references to London, dispersion and van der Waals forces		2