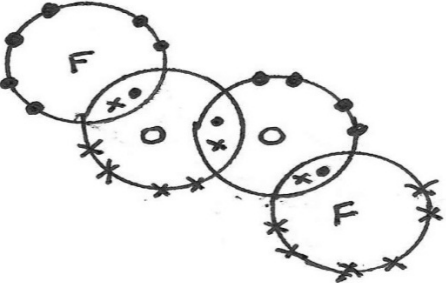


Question Number	Acceptable Answers	Reject	Mark
1(a)(i)	Ignore drawn shapes Shape is trigonal planar/ triangular planar (1) Bond angle 120(°) (1) Mark independently BUT no TE on incorrect shape	...pyramidal Just planar °C	(20)

Question Number	Correct Answer	Reject	Mark
1(a)(iii)	<p>M1</p> <pre> F F F—N→B—F F F </pre> <p>OR</p> <pre> F F F—N—B—F F F </pre> <p>OR</p> <p>Dot and cross diagram, allow all dots or crosses.</p> <p>IGNORE omission of non-bonding electrons on Fs.</p> <p>But no mark if dot and cross shown for N-B bond.</p> <p style="text-align: right;">(1)</p> <p>M2 Dative covalent (bond)</p> <p style="text-align: right;">(1)</p> <p>Mark independently</p>	No M1 if dative bond categorically from B to N	(2)

Question Number	Correct Answer	Reject	Mark
1(b)(i)	+2 ALLOW 2+		(1)

Question Number	Correct Answer	Reject	Mark
1(b)(ii)	$\text{OF}_2 + \text{H}_2\text{O} \rightarrow 2\text{HF} + \text{O}_2$ <p>Ignore state symbols even if incorrect</p> <p>Allow multiples</p>	H_2F_2	(1)

Question Number	Correct Answer	Reject	Mark
1(c)	Accept all dots OR all crosses 		(1)

Question Number	Acceptable Answers	Reject	Mark
2 (a)(i)	<pre> H H .x .x xx H.xC.xC.xSx.H .x .x xx H H </pre> <p>All Bonding electrons (1)</p> <p>Ignore any circles/bonds with electrons</p> <p>Two lone pairs on sulfur Dependent on eight electrons around sulfur (1) Accept all dots/crosses</p> <p>Fully correct methanethiol 1max</p>	missing Hs/Cs (-1)	2

Question Number	Acceptable Answers	Reject	Mark
2 (a)(ii)	<p>104.5 ($^{\circ}$) (accept 91 to 105)(1)</p> <p>(Four pairs/two bonding pairs and two non-bonding pairs of electrons in) minimum repulsion/maximum separation/as far apart as possible (tetrahedral arrangement) Ignore the number of pairs of electrons (1)</p> <p>And lone/non bonding pair(s) of electrons repel more (than bond pairs/CH bonds) (1)</p> <p>Mark independently</p>	<p>atoms...</p> <p>Linear shape (-1)</p> <p>...repel any sort of atoms</p>	3

Question Number	Acceptable Answers	Reject	Mark
2 (b)(i)	<p>Two pairs of electrons/two bonds (around the H atom)</p> <p>OR</p> <p>Can be shown on a diagram either with electrons or bonds (in approximate straight line) around the hydrogen (1)</p> <p>(Repel to) maximum separation/minimum repulsion/as far apart as possible (1)</p> <p>Dependent on first mark except:</p> <p>Allow: It has a linear shape due to maximum separation/minimum repulsion 1 max</p>	Linear shape on its own	2

Question Number	Acceptable Answers	Reject	Mark
2 (b) (ii)	<p>Sulfur is less electronegative (than oxygen)/not electronegative enough</p> <p>OR oxygen is more electronegative (than sulfur) / electronegative enough</p> <p>OR Hydrogen bonds can only occur between H and either N, O, or F due to the large difference in electronegativity</p>	<p>Bigger/higher rmm/atom/molecule alone</p> <p>Hydrogen not bonded to N, O, or F alone</p>	1

Question Number	Acceptable Answers	Reject	Mark
2 (c) (i)	<p>Temporary asymmetrical distribution/random arrangement of electrons/ charge (density)</p> <p>Ignore references to atoms/molecules</p> <p>OR instantaneous/temporary dipole (1)</p> <p>(these produce) induced dipoles</p> <p>OR description of induction (1)</p> <p>Mark independently</p> <p>Ignore references to atoms/molecules</p>	<p>Any mention of permanent dipoles = 0/2</p> <p>d+ and d- /$\delta+$ and $\delta-$ unless clearly temporary</p>	2

Question Number	Acceptable Answers	Reject	Mark
2 (c) (ii)	<p>Ethanethiol/sulfur has more electrons (so forces are stronger)</p> <p>Allow sulfur has an extra shell of electrons</p> <p>OR ethanol/oxygen has fewer/less electrons (so forces are weaker)</p> <p>Allow oxygen has one fewer shell of electrons</p>	<p>Larger charge cloud/larger electron cloud/more outer electrons on their own</p> <p>Any reference to size/radius/rmm unless with correct answer</p>	1

Question Number	Acceptable Answers	Reject	Mark
2 (d) (i)	Any one from: Bubbles (of gas) /fizzing /effervescence Sodium disappears/dissolves/gets smaller White solid forms Multiple answers: number correct minus number wrong to give a maximum of 1 and a minimum of 0 Ignore: sodium floats or sinks and/or heat given out and/or hydrogen produced	Sodium rushes about (i.e. any confusion with reaction of sodium with water) Flames Steam	1

Question Number	Acceptable Answers	Reject	Mark
2 (d) (ii)	$\text{Na} + \text{CH}_3\text{CH}_2\text{SH} \rightarrow \text{CH}_3\text{CH}_2\text{SNa} + \frac{1}{2}\text{H}_2$ Accept multiples Ignore charges on sodium salt/state symbols even if incorrect	H for hydrogen $\text{CH}_3\text{CH}_2\text{NaS}$	1

Question Number	Acceptable Answers	Reject	Mark
2 (e) (i)	$\text{C}_2\text{H}_5\text{Br} + \text{KOH} \rightarrow \text{C}_2\text{H}_5\text{OH} + \text{KBr} / \text{K}^+ + \text{Br}^-$ Accept ionic equation $\text{C}_2\text{H}_5\text{Br} + \text{OH}^- \rightarrow \text{C}_2\text{H}_5\text{OH} + \text{Br}^-$ Allow molecular formula of alcohol, $\text{C}_2\text{H}_6\text{O}$		1

Question Number	Acceptable Answers	Reject	Mark
2 (e) (ii)	Type – substitution (1) Mechanism – Nucleophilic (1) Accept words in either order. Both words may be given on either line. N.B. This is the only way to score 2 marks!		2

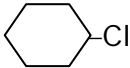
Question Number	Acceptable Answers	Reject	Mark
2 (e) (iii)	KSH /NaSH Allow KHS/NaHS or H_2S Ignore state symbols		1

Question Number	Acceptable Answers	Reject	Mark
2 (f)	<p>Sulfur dioxide/SO₂ (1)</p> <p>Causes acid rain (1)</p> <p>Allow effects of acid rain e.g. acid lakes/lake pollution/ crop or forest damage/limestone building damage/named metal which corrodes. [It is quite possible candidates will give details of oxidation of sulfur dioxide to sulfur trioxide and formation of sulfuric acid. Ignore any of this additional information.]</p> <p>Allow triggers asthma</p> <p>Ignore any reference to greenhouse gas/ global warming/any reference to sea pollution or sea creatures</p> <p>Second mark dependent on first mark except allow: If SO₂ not mentioned then, SO₃/H₂SO₄ causes acid rain for 1 mark</p>	<p>SO₃ CO₂</p> <p>Attacks ozone layer CO₂ causes acid rain</p>	2

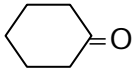
Question Number	Acceptable Answers	Reject	Mark
3(a)(i)	109 (°) / 109.5 (°) / 109° 28'		1

Question Number	Acceptable Answers	Reject	Mark
3(a)(ii)	<p>104 – 106 (°) (1)</p> <p>O atom has two lone pairs (and 2 bonding pairs) (1) This mark can be given independently of the first and third mark</p> <p>Lone pairs repel each other more than bonding pairs / angle is reduced to minimise repulsion (by lone pairs) / to maximise separation (of lone pairs) (1)</p> <p>Ignore 'bonds repel each other'</p> <p>Angle in (ii) must be smaller than in (i) for third mark to be given</p>	Lone pairs repel H atoms	3

Question Number	Acceptable Answers	Reject	Mark
3(b)(i)	<p>Any two from Fizzing / effervescence / bubbles (of gas) (1)</p> <p>Sodium dissolves / disappears / reduces in size (1)</p> <p>White solid /precipitate forms (1)</p> <p>Ignore identification of products even if incorrect.</p> <p>Ignore sodium melting / moving around / sinking / floating</p> <p>Ignore colourless solution forms</p> <p>Ignore temperature changes / sodium going on fire</p>	<p>Just "Hydrogen forms"/"gas forms"</p> <p>Fumes</p>	2

Question Number	Acceptable Answers	Reject	Mark
3(b)(ii)	$\text{C}_6\text{H}_{11}\text{OH} + \text{PCl}_5 \rightarrow \text{HCl} + \text{C}_6\text{H}_{11}\text{Cl} + \text{POCl}_3$ <p style="text-align: center;">(1) (1)</p> <p>(1) for HCl (1) for rest of the equation correct</p> <p>Cyclohexanol can be skeletal, $\text{C}_6\text{H}_{11}\text{OH}/$ $\text{C}_6\text{H}_{12}\text{O}$</p> <p>Accept 'PCl₃O' instead of POCl₃ Accept skeletal formula for $\text{C}_6\text{H}_{11}\text{Cl}$</p>  <p>Ignore state symbols</p>	<p>$\text{C}_5\text{H}_{11}\text{COH}$</p> <p>$\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{CHOH}$ Unless a bond is shown connecting C1 and C6</p>	2

Question Number	Acceptable Answers	Reject	Mark
3(b)(iii)	<p>White smoke / solid with ammonia Allow white fumes / dense white fumes / steamy white fumes OR White precipitate with silver nitrate</p> <p>Ignore reference to ammonia solution unless HCl is specifically bubbled into solution</p> <p>Ignore using an indicator to show gas is acidic with one of the above tests</p> <p>Ignore description of appearance of HCl before testing</p>	<p>Just steamy / misty fumes</p> <p>Just testing with an indicator</p> <p>Bleaches litmus</p>	1

Question Number	Acceptable Answers	Reject	Mark
3(b)(iv)			1

Question Number	Acceptable Answers	Reject	Mark
3(b)(v)	(Colour change from) Orange to green / blue / brown	blue- green green-blue yellow to green	1

Question Number	Acceptable Answers	Reject	Mark
3(c)	$\text{C}_6\text{H}_{10}^{(+)}$	$\text{C}_6\text{H}_{10}^-$ $(\text{CH}_2)_5\text{C}$ $\text{C}_5\text{H}_{10}\text{C}$ C_6H_{11} $(\text{CH})_5\text{OH}$ $\text{C}_2(\text{CH}_2)_3\text{O}$	1