



National
Qualifications
2026

2026 Chemistry

Advanced Higher

Question Paper Finalised Marking Instructions

These marking instructions have been prepared by examination teams for use by Qualifications Scotland appointed markers when marking external course assessments.

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General marking principles for Advanced Higher Chemistry

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

- (a) Marks for each candidate response must **always** be assigned in line with these general marking principles and the detailed marking instructions for this assessment.
- (b) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.
- (c) If a specific candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.
- (d) Where a candidate makes an error at an early stage in a multi stage calculation, credit should normally be given for correct follow on working in subsequent stages, unless the error significantly reduces the complexity of the remaining stages. The same principle should be applied in questions which require several stages of non-mathematical reasoning. The exception to this rule is where the marking instructions for a numerical question assign separate “concept marks” and an “arithmetic mark”. In such situations, the marking instructions will give clear guidance on the assignment of partial marks.
- (e) In many cases, marks can still be awarded for inaccurate or unconventional spelling or vocabulary as long as the meaning of the word(s) is conveyed. For example, responses that include ‘distilling’ for ‘distillation’, or ‘it gets hotter’ for ‘the temperature rises’, should be accepted.
- (f) If a correct answer and a wrong answer are present, it should be treated as a cancelling error and no marks should be given. For example, in response to the question, ‘State the colour seen when blue Fehling’s solution is warmed with an aldehyde’, the answer ‘red green’ gains no marks.
However, if a correct answer and additional information, which does not conflict, are present, the additional information should be ignored, whether correct or not. For example, in response to a question concerned with melting point, ‘State why the tube should not be made of copper’, the response ‘Copper has a low melting point and is coloured grey’ would **not** be treated as having a cancelling error.
- (g) Full marks are usually awarded for the correct answer to a calculation without working and the partial marks shown in the Detailed Marking Instructions are for use when working is given but the final answer is incorrect. An exception is when candidates are asked to ‘*Clearly show your working for the calculation*’, when full marks cannot be awarded for the correct answer without working.

(h) Significant figures.

This marking instruction only applies to correct final answers. If the data in a question is given to three significant figures, the final answer should also have three significant figures. However one fewer significant figure and up to two more significant figures is acceptable.

For example if a correct final answer is 8.16 J then 8.2 J, 8.158 J and 8.1576 J would also be acceptable. Answers out with this range would not be acceptable and one mark would not be awarded.

The use of a recurrence dot, eg $0.\dot{6}$, would imply an infinite number of significant figures and would therefore not be acceptable.

This marking instruction must only be applied a maximum of once per paper and cannot be applied if instruction (i) has already been applied in the paper.

(i) Units

This marking instruction only applies to correct final answers. In most questions units are not required. However, if the candidate writes units then they must be correct. The symbols L and l are both acceptable for litres.

An incorrect unit would not be acceptable, and one mark would not be awarded.

This marking instruction must only be applied a maximum of once per paper and cannot be applied if instruction (h) has already been applied in the paper.

(j) Intermediate rounding.

Ideally, calculated intermediate values should not be rounded. However, if the candidate has correctly rounded, the calculated intermediate values can have one significant figure fewer than the data given in the question, but no fewer, otherwise full marks may not be awarded and partial marking would apply.

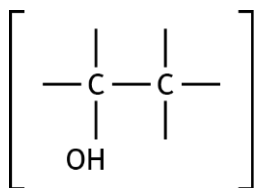
For example, if the data in a question is given to three significant figures, the intermediate value should have no fewer than two significant figures.

(k) If a structural formula is asked for, CH₃ is acceptable as a methyl group, and CH₃CH₂ and C₂H₅ are acceptable as an ethyl group.

If a name is asked for such as 3-methylhexane, then 3, methyl-hexane would be acceptable, ie ignore incorrect use of commas and dashes.

(l) When drawing structural formulae, a mark should only be awarded if the bonds point to the appropriate atoms.

The example below would be incorrect.



Marking instructions for each question

Section 1

Question	Answer	Mark
1.	C	1
2.	D	1
3.	C	1
4.	D	1
5.	A	1
6.	D	1
7.	B	1
8.	B	1
9.	A	1
10.	C	1
11.	B	1
12.	A	1
13.	C	1
14.	C	1
15.	B	1
16.	B	1
17.	A	1
18.	C	1
19.	A	1
20.	B	1
21.	D	1
22.	B	1
23.	A	1
24.	C	1
25.	B	1

Section 2

Question			Expected response	Max mark	Additional guidance												
1.	(a)		<table><tr><td> ↑↓ </td><td> ↑↓ </td><td> ↑↓ ↑↓ ↑↓ </td><td> ↑↓ </td><td> ↑↓ ↑↓ ↑↓ </td><td> ↑ </td></tr><tr><td>1s</td><td>2s</td><td>2p</td><td>3s</td><td>3p</td><td>4s</td></tr></table>	↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑↓ ↑↓ ↑↓	↑	1s	2s	2p	3s	3p	4s	1	All of the orbital boxes must be shown and clearly labelled.
↑↓	↑↓	↑↓ ↑↓ ↑↓	↑↓	↑↓ ↑↓ ↑↓	↑												
1s	2s	2p	3s	3p	4s												
	(b)		<table><tr><td>Quantum number</td><td><i>n</i></td><td><i>l</i></td><td><i>m_l</i></td><td><i>m_s</i></td></tr><tr><td>Value</td><td>4</td><td>0</td><td>0</td><td>+ ½</td></tr></table>	Quantum number	<i>n</i>	<i>l</i>	<i>m_l</i>	<i>m_s</i>	Value	4	0	0	+ ½	1	<i>l</i> must be subscript in <i>m_l</i>		
Quantum number	<i>n</i>	<i>l</i>	<i>m_l</i>	<i>m_s</i>													
Value	4	0	0	+ ½													
	(c)	(i)	(Electrons) promoted/excited (to higher energy levels). OR (Electrons) move to higher energy levels.	1													
		(ii)	Different (electron) transitions/energy gaps. OR A suggestion that there are more than 2 energy levels/subshells. OR A suitable diagram with explanation.	1	An answer that implies only 2 levels is not acceptable on its own. Direction of electron movement is not required but must be correct if given. An answer that suggests absorption only is not acceptable.												
		(iii) (A)	286(nm) Partial marking 1 mark may be awarded for $E = Lhc/\lambda$. OR $E = Lhf$ and $c = f\lambda$. OR Correct substitution into the above equation(s).	2	290/285.8/285.77 are also acceptable answers. Units not required but must be correct if given. There may be other acceptable answers based on correct intermediate rounding.												
		(iii) (B)	Longer wavelength. OR Shorter wavelength in potassium.	1													

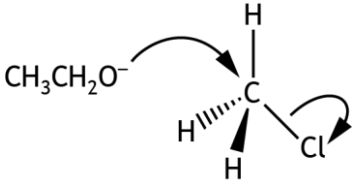
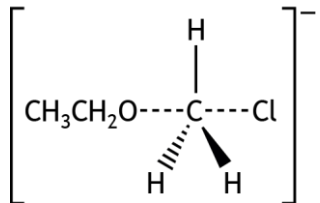
Question			Expected response	Max mark	Additional guidance
2.	(a)	(i)	(+)108 (J K ⁻¹ mol ⁻¹)	1	110/107.8 are also acceptable answers. Units not required but must be correct if given.
		(ii)	840 (K). Partial marking 1 mark may be awarded for $\Delta G = 0$. OR $T = \Delta H / \Delta S$. OR $\Delta H = (+)90.7$.	2	839.8/839.81 are also acceptable answers. If the candidate uses $\Delta S = 107.8$ then the acceptable answers are 841/841.4/841.37 ΔH must be +90.7 if working given. Units not required but must be correct if given. Allow correct follow through from (a)(i).
	(b)		0.07 (mg)	1	0.072/0.0720 are also acceptable. Units not required but must be correct if given.
	(c)		Absorbance/intensity measured (at a specific wavelength). OR The greater the concentration the greater the absorbance/intensity. (1) Compared to standard/reference of known concentration. OR Using a calibration graph. (1)	2	

Question			Expected response	Max mark	Additional guidance
3.	(a)	(i) (A)	Reaction 2 AND more negative/lower ΔG° . OR Reaction 1 and less negative/higher ΔG° .	1	
		(B)	(ΔG is) not standard conditions. OR ΔG° is determined under standard conditions. OR A statement which recognises that ΔG is at different temperatures/pressures/concentrations to ΔG° .	1	It must be clear that the differences described are between ΔG and ΔG° and not between Reaction 1 and Reaction 2.
		(ii) (A)	Hexacyanidoferrate(II)	1	Answer must be correctly spelled as shown.
		(ii) (B)	Electrons move to higher energy d orbitals. (1) Blue absorbed/435 - 480 nm absorbed/complementary colour (to yellow) absorbed. (1)	2	The first mark may not be awarded if the candidate refers to HOMO/LUMO. The second mark may not be awarded if there is any mention of emission.
	(b)	(i)	3.45×10^{-3} (moles)	1	3.4×10^{-3} / 3.446×10^{-3} / 3.4456×10^{-3} also acceptable answers. Unit is not required but if given must be correct. There may be other acceptable answers based on correct intermediate rounding.

Question			Expected response	Max mark	Additional guidance
3.	(b)	(ii)	1.72 (%). Partial marking 1 mark may be awarded for: 1.55×10^{-3} moles of $\text{Ag}^+/\text{AgNO}_3$ reacted or Cl^-/NaCl present in 5.27 g cheese. OR 0.0907 g NaCl present in 5.27 g cheese. OR Correct % by mass calculated from an incorrectly calculated mass of sodium chloride in 5.27g.	2	1.7/1.721/1.7206 are also acceptable answers. If the candidate uses 3.4×10^{-3} then the acceptable answers are 1.8/1.78/1.776/1.7761 If the candidate uses 3.446×10^{-3} then the acceptable answers are 1.7/1.73/1.725/1.7250 If the candidate uses 3.4456×10^{-3} then the acceptable answers are 1.7/1.73/1.726/1.7255 Unit is not required but if given must be correct. Allow follow through from (b)(i). There may be other acceptable answers based on correct intermediate rounding.

Question			Expected response	Max mark	Additional guidance
4.			This is an open-ended question. 1 mark: The candidate has demonstrated, at an appropriate level, a limited understanding of the chemistry involved. They have made some statement(s) that are relevant to the situation, showing that they have understood at least a little of the chemistry within the context. 2 marks: The candidate has demonstrated, at an appropriate level, a reasonable understanding of the chemistry involved. They make some statement(s) that are relevant to the situation, showing that they understand the context. 3 marks: The maximum available mark would be awarded to a candidate who has demonstrated, at an appropriate level, a good understanding, of the chemistry involved. The candidate shows a good comprehension of the chemistry of the situation and has provided a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the context. The answer does not need to be 'excellent' or 'complete' for the candidate to gain full marks.	3	Award 0 marks where the candidate has not demonstrated, at an appropriate level, an understanding of the chemistry involved. There is no evidence that they have recognised the area of chemistry involved, or they have not given any statement of a relevant chemistry principle. Award zero marks also if the candidate merely restates the chemistry given in the question.

Question			Expected response	Max mark	Additional guidance
5.	(a)	(i) (A)	Complexometric	1	
		(i) (B)	Hexadentate	1	
		(i) (C)	Non-bonding pairs/lone pairs of electrons donated (to the central ion). OR Dative (covalent) bonds.	1	0 marks if there is mention of calcium atom.
		(ii) (A)	Any one from: - be available in a high state of purity - be stable (when solid and in solution) - be soluble - have a reasonably high GFM	1	Does not absorb moisture from the air is not an acceptable response on its own.
		(ii) (B)	To determine the accurate/exact concentration.	1	To determine the known concentration on its own is not acceptable.
		(iii)	0.00269 (mol l ⁻¹)	1	0.0027, 0.002691, 0.0026913 are also acceptable answers. Units not required but if given must be correct. There may be other acceptable answers based on correct intermediate rounding.
	(b)		247 (mg l ⁻¹). AND Hard.	1	250/247.2/247.25 are also acceptable answers. Units not required but if given must be correct.

Question			Expected response	Max mark	Additional guidance
6.	(a)	(i)	H ₂	1	The word hydrogen on its own is not acceptable.
		(ii)	Ethoxide (ion)	1	
		(iii)	Correct curly arrows (1)  Correct transition state (1) 	2	Wedged bonds are not necessary. The structure of the nucleophile must be correct for the first mark. Transition state must have dashed bonds and square brackets with negative charge on outside as shown.
		(iv)	methoxyethane	1	Accept: 1-methoxyethane. Must be the systematic name.
	(b)	(i)	1.05 x 10 ⁻⁶ (mol l ⁻¹ s ⁻¹)	1	General marking principle (h) is suspended for this question. Units not required but if given must be correct.
		(ii)	7 x 10⁻⁴ (1) l mol⁻¹ s⁻¹ (1)	2	6.6/6.56 x 10⁻⁴ are also acceptable answers. Allow units in any order.
		(iii)	58.2 (kJ mol ⁻¹)	1	60/58/58.16/58.160 are also acceptable answers. Units not required but if given must be correct. There may be other acceptable answers based on correct intermediate rounding.

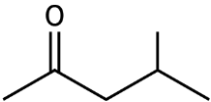
Question			Expected response	Max mark	Additional guidance
7.	(a)	(i)	Reduction	1	
		(ii) (A) (I)	(Carbon atom) has a partial positive (δ^+) charge/is electron deficient/less electronegative than the O.	1	
		(ii) (A) (II)	(Pi bond) requires less energy to break (than a sigma bond). OR (Pi bond) is higher in energy/less stable (than a sigma bond). OR (Pi bond) is weaker/easier to break (than a sigma bond).	1	The opposite statements referring to sigma bonds are also acceptable answers as long as sigma bond is stated.
		(ii) (B)	Donates a proton/hydrogen ion/ H^+	1	Donates hydrogen is not an acceptable answer.
	(b)		$ \begin{array}{ccccccc} & H & & CH_3 & & H & & O & & CH_3 \\ & & & & & & & & & \\ H & -C- & C- & C- & C- & O- & C- & H \\ & & & & & & & & & \\ & H & & H & & H & & & & CH_3 \end{array} $ OR Any other correct structural formula.	1	

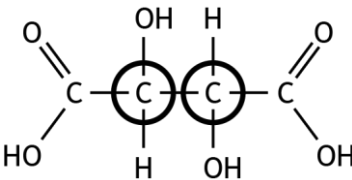
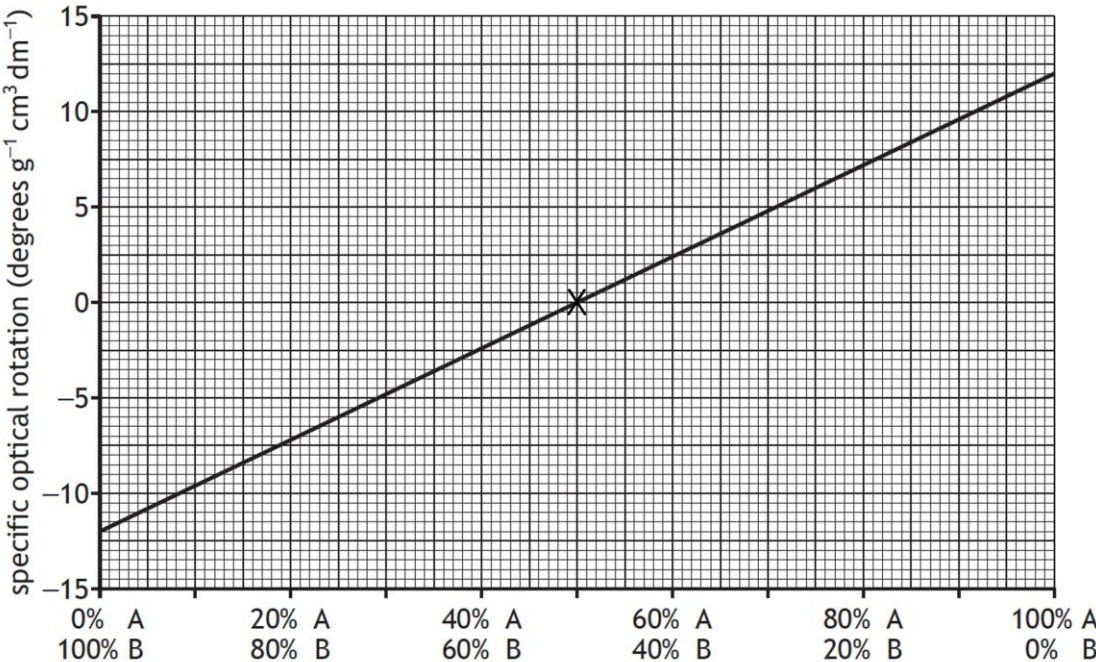
Question			Expected response	Max mark	Additional guidance
7.	(c)	(i)	methylpropan-1-ol	1	2-methylpropan-1-ol is also an acceptable answer.
		(ii)	Less steric hindrance. OR Fewer/smaller atoms around the carbon. OR More steric hindrance around the other carbon atom. OR Bulky groups around the other carbon atom. OR More/larger atoms around the other carbon atom.	1	An answer describing less steric hindrance is also acceptable.

Question			Expected response	Max mark	Additional guidance
8.	(a)	(i) (A)	Heating under reflux	1	
		(i) (B)	Anti-bumping granules	1	
		(ii)	The following 4 points: • hot water/solvent • minimum/small volume (of solvent) • cool • filter	2	2 marks awarded for all 4 points. 1 mark awarded for 2 or 3 points. 0 marks awarded for 1 point. The order must be correct for the process - dissolving in a minimum volume of hot solvent must be before cooling and then filtering must come after cooling. If there is mention of hot filtering then this must take place before cooling. Answers that do not mention dissolving the vanillin may be awarded a maximum of 1 mark.
		(iii)	0.47 (g). Partial marking 1 mark may be awarded for: 2.93 (g) (theoretical mass of vanillin). OR Correctly calculating 16% of an incorrect value for the theoretical mass of vanillin. OR 0.00308 (actual moles of vanillin). OR Correctly multiplying an incorrect number of moles of vanillin by 152.	2	0.5/0.469/0.4686 are also acceptable answers. Unit is not required but if given must be correct. There may be other acceptable answers based on correct intermediate rounding.

Question			Expected response	Max mark	Additional guidance
8.	(a)	(iv)	Lower melting point. OR Over a wider range/melting point not sharp. (1) Disruption in (intermolecular) bonding in the crystal lattice. OR Disruption/weakening of the crystal lattice. OR Weakening of (intermolecular) forces/van der Waals/H-bonds/LDFs between molecules. (1)	2	
	(b)	(i)	Electrophilic substitution	1	Substitution on its own is not an acceptable answer.
		(ii)	Acidified (potassium) permanganate. OR Acidified (potassium) dichromate. OR Hot copper(II) oxide.	1	MnO_4^- and $\text{Cr}_2\text{O}_7^{2-}$ are also acceptable answers but must be acidified/$\text{H}^+/\text{H}_3\text{O}^+$ Hot CuO is also an acceptable answer. Hot copper oxide on its own is not an acceptable answer.

Question			Expected response	Max mark	Additional guidance
9.			This is an open-ended question. 1 mark: The candidate has demonstrated, at an appropriate level, a limited understanding of the chemistry involved. They have made some statement(s) that are relevant to the situation, showing that they have understood at least a little of the chemistry within the context. 2 marks: The candidate has demonstrated, at an appropriate level, a reasonable understanding of the chemistry involved. They make some statement(s) that are relevant to the situation, showing that they understand the context. 3 marks: The maximum available mark would be awarded to a candidate who has demonstrated, at an appropriate level, a good understanding, of the chemistry involved. The candidate shows a good comprehension of the chemistry of the situation and has provided a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the context. The answer does not need to be 'excellent' or 'complete' for the candidate to gain full marks.	3	Award 0 marks where the candidate has not demonstrated, at an appropriate level, an understanding of the chemistry involved. There is no evidence that they have recognised the area of chemistry involved, or they have not given any statement of a relevant chemistry principle. Award zero marks also if the candidate merely restates the chemistry given in the question.

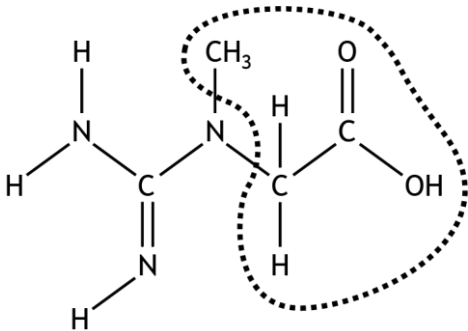
Question			Expected response	Max mark	Additional guidance
10.	(a)	(i)	$\text{OOCCH(OH)CH(OH)COO}^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq}).$ OR $\text{O}^-\text{OCCH(OH)CH(OH)COO}^-(\text{aq}) + \text{H}_3\text{O}^+(\text{aq}).$ OR $(\text{OOCCH(OH)CH(OH)COO})^{2-}(\text{aq}) + \text{H}_3\text{O}^+(\text{aq}).$ OR $(\text{CH(OH)COO})_2^{2-}(\text{aq}) + \text{H}_3\text{O}^+(\text{aq}).$ OR $(\text{CH(OH)COO}^-)_2(\text{aq}) + \text{H}_3\text{O}^+(\text{aq}).$	1	State symbols are not required but if given must be correct. H^+ is not acceptable for H_3O^+ .
		(ii)	0.00302 (mol l ⁻¹). Partial marking 1 mark may be awarded for: $\text{pH} = \frac{1}{2}\text{pK}_a - \frac{1}{2}\log_{10}c.$ OR Correct rearrangement/substitution of $\text{pH} = \frac{1}{2}\text{pK}_a - \frac{1}{2}\log_{10}c.$ OR $\log_{10}c = -2.52.$ OR Correctly calculated concentration from an incorrectly calculated value for $\log_{10}c.$	2	0.0030/0.003020/0.0030200 Unit not required but must be correct, if given.
	(b)	(i)		1	
		(ii) (A)	Separating funnel	1	
		(ii) (B) (I)	$K = \frac{[\text{tartaric acid(MIBK)}]}{[\text{tartaric acid(aq)}]}$	1	Must be an uppercase K. Both state symbols are required. Must have square brackets.

Question			Expected response	Max mark	Additional guidance
10.	(b)	(ii) (B) (II)	0.00367 (mol)	1	0.0037/0.003675/0.0036749 are also acceptable answers. Allow follow through from part (B)(I). Unit not required but must be correct, if given.
		(ii) (C)	Use a higher number of extractions with a smaller volume of MIBK. OR Correct description/example using 50 cm ³ of MIBK.	1	Any suggestion that more than 50 cm ³ of MIBK is used would not be awarded the mark.
	(c)	(i)	 Both carbon atoms circled.	1	
		(ii) (A)	 Half box tolerance.	1	

Question			Expected response	Max mark	Additional guidance
10.	(c)	(ii) (B)	10.8 (°). Partial marking 1 mark may be awarded for: 4° (correct specific rotation from graph). OR Correctly calculating an observed rotation using an incorrect specific rotation read from the graph.	2	11 is also an acceptable answer. General marking principle (h) is suspended for this question. Unit not required but must be correct if given.

Question			Expected response	Max mark	Additional guidance
11.	(a)	(i)	Active site	1	
		(ii)	Covalent/sigma bond (to enzyme)	1	
	(b)	(i)	Antagonist	1	
		(ii) (A)	Hydrolysis	1	
		(ii) (B)	C ₉ H ₁₀ O ₃	1	Any order.

Question			Expected response	Max mark	Additional guidance										
12.	(a)		$C_4N_3O_2H_9$. Partial marking 1 mark may be awarded for: Calculating moles of each element (C=3.05, N=2.29, O=1.53, H=6.9). OR Multiplying incorrect moles by an appropriate factor to get ratio.	2	Any order. Working must be shown. Rounding of an incorrect ratio is only acceptable if it is rounded within +/- 0.1										
	(b)	(i)	131	1											
		(ii)	$[CH_3]^+$. OR $^+CH_3$.	1	Positive charge must be shown on ion fragment. If no bracket + charge must be on the C atom.										
	(c)	(i)	Vibrate/bend/stretch	1											
		(ii)	<table border="1"><thead><tr><th>Bond responsible for peak</th><th>Wave number (cm⁻¹)</th></tr></thead><tbody><tr><td>O-H</td><td>2798</td></tr><tr><td>C=O</td><td>1700</td></tr><tr><td>C-H</td><td>1449</td></tr><tr><td>C-N</td><td>1242</td></tr></tbody></table>	Bond responsible for peak	Wave number (cm ⁻¹)	O-H	2798	C=O	1700	C-H	1449	C-N	1242	1	All must be correct.
Bond responsible for peak	Wave number (cm ⁻¹)														
O-H	2798														
C=O	1700														
C-H	1449														
C-N	1242														
	(d)		(All) peaks are singlets. OR No splitting/multiplets.	1	No effect (on splitting) is acceptable. Any suggestion that there is only one peak in the spectrum would not be an acceptable answer.										

Question			Expected response	Max mark	Additional guidance
12.	(e)		 OR Any other correct structural formula.	1	

[END OF MARKING INSTRUCTIONS]