

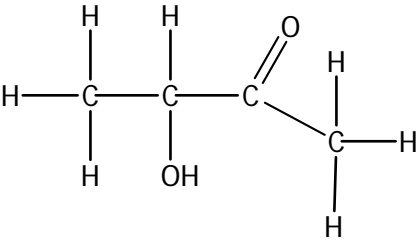
Question Number	Acceptable Answers	Reject	Mark
19(a)(i)	$\begin{array}{rcc} \text{C} & : & \text{H} & : & \text{O} \\ \text{Mole ratio / mol} & \frac{54.5}{12} & : & \frac{9.1}{1} & : & \frac{36.4}{16} \\ & & & & & \text{(1)} \\ & = & 4.5417 & : & 9.1 & : & 2.275 \\ & = & 1.996 & : & 4 & : & 1 \\ & = & 2 & : & 4 & : & 1 \\ & & & & \text{C}_2\text{H}_4\text{O} & & \text{(1)} \end{array}$ <p>Correct empirical formula of C₂H₄O, with or without working, scores (2)</p>		2

Question Number	Acceptable Answers	Reject	Mark
19(a)(ii)	<p>mark:</p> <p>Any mention of 44 or of doubling C₂H₄O (1)</p> <p>Second mark:</p> <p>Any mention of 88 in the context of the mass spectrum eg mentions 'molecular ion' / M⁺ / heaviest peak / peak furthest to the right / annotation at 88 on the mass spectrum itself / highest $\frac{m}{z}$ value (1)</p>	<p>88 obtained just by adding up the relative atomic masses in C₄H₈O₂ scores (0) for 2nd scoring point</p>	2

Question Number	Acceptable Answers	Reject	Mark
19(b)	<p>(Peak at 3500 cm⁻¹) O—H (1) Allow OH</p> <p>(Peak at 1700 cm⁻¹) C=O (1)</p> <p>Penalise extra extension bond on an otherwise correct answer once only (eg —O—H and —C=O scores (1))</p> <p>IGNORE any names for the bonds suggested even if incorrect</p>	<p>—O—H / —OH</p> <p>C—O / —C=O / CO</p>	2

Question Number	Acceptable Answers	Reject	Mark
19(c)(i)	<p>First mark: (X is neutral) so not a (carboxylic) acid (1)</p> <p>IGNORE "X doesn't have a charge as it is neutral" / "X is not an alkali" / "X is not a base"</p> <p>Second mark: (X does not react with Tollens') so is not an aldehyde / is a ketone (1)</p> <p>Third mark: (X reacts with H⁺ / Cr₂O₇²⁻ so) is an alcohol / contains an OH (group) / contains R—OH / contains hydroxyl (group) (1)</p> <p>IGNORE 'not an acid' if this is deduced solely from the H⁺ / Cr₂O₇²⁻ information</p> <p>Fourth mark: a primary or a secondary (alcohol) both needed OR (X is) not tertiary (alcohol) (1)</p> <p>Mark each point separately</p> <p>NOTE: 'X is a primary or a secondary alcohol' scores both the third and fourth marks</p> <p>ALLOW Correct formulae for the functional groups, instead of their names</p>	<p>X is an aldehyde scores (0) for this scoring point / X is not a ketone scores (0) for this scoring point</p>	4

Question Number	Acceptable Answers	Reject	Mark
19(c)(ii)	(primary or secondary) alcohol and ketone NOTE BOTH names are required here	Just 'hydroxyl for 'alcohol' and/or 'C=O /carbonyl' for ketone/	1

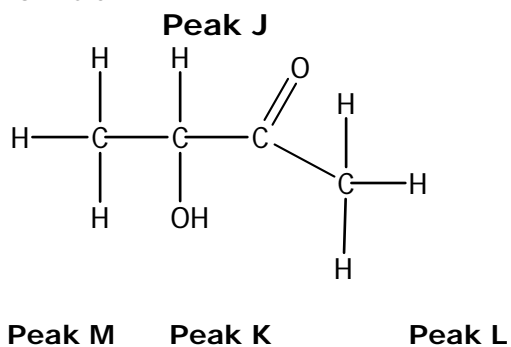
Question Number	Acceptable Answers	Reject	Mark
19(d)	<p>MARKING ADVICE Check answer for the suggested structure of X. If the correct structure is shown</p> <div style="text-align: center;">  </div> <p>Mark answer according to the following. However if no structure for X is shown or an incorrect structure for X is proposed, mark answer according to "COMMENTS" scheme below</p> <p>MARKS CAN BE AWARDED FROM SUITABLY ANNOTATED FORMULAE FOR X.</p> <p>First mark:</p> <p>Four different H / hydrogen / proton environments (1)</p> <p>Any five from following seven points:</p> <p>Either Application of the (n+1) rule to peak J (which is a quartet / splits into four) or application of the (n+1) rule peak M (which is a doublet / splits into two) (1)</p> <p>Any mention to explain no splitting for peak L as there is no H is attached to the adjacent carbon (1)</p> <p>Peak L (CH₃) next to C=O (1)</p> <p>Peak M (CH₃) next to CH (1)</p> <p>Peak K OH (1)</p> <p>Peak J (CH) next to CH₃ (1)</p> <p>Any one correct δ value quoted within ± 0.2 of the following chemical shifts: 1.4(M) or 2.2(L) or 3.7(K) or 4.2(J) (ppm) (1)</p>	<p>Just 'four different chemical environments'</p> <p>If any incorrect chemical shift OR A RANGE of chemical shifts is quoted, this scoring point is not available</p>	7

Final mark

(Compound **X** is) $\text{CH}_3\text{CH}(\text{OH})\text{COCH}_3$
NO other compound allowed.

ACCEPT

any unambiguous formula, e.g. displayed formula



ACCEPT

3-hydroxybutan-2-one

(1)