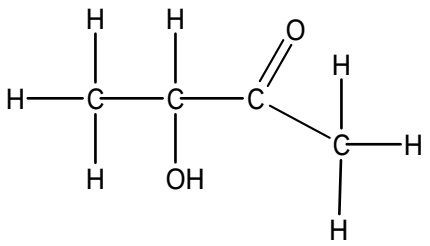
Question Number	Acceptable Answers	Reject	Mark
19(a)(i)	C : H : O Mole ratio / mol $\frac{54.5}{12}$: $\frac{9.1}{1}$: $\frac{36.4}{16}$ **(1)** = 4.5417 : 9.1 : 2.275 = 1.996 : 4 : 1 = 2 : 4 : 1 C_2H_4O **(1)** Correct empirical formula of C_2H_4O, with or without working, scores **(2)**		**2**

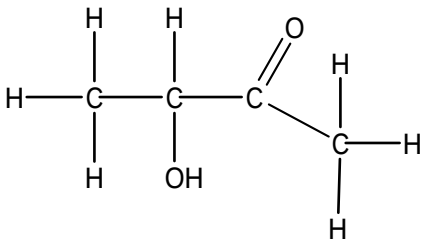
Question Number	Acceptable Answers	Reject	Mark
19(a)(ii)	**mark:** Any mention of **44** or of doubling C_2H_4O **(1)** **Second mark:** Any mention of **88 in the context of the mass spectrum** eg mentions 'molecular ion' / M^+ / heaviest peak / peak furthest to the right / annotation at 88 on the mass spectrum itself / highest $\frac{m}{z}$ value **(1)**	**88** obtained **just** by adding up the relative atomic masses in $C_4H_8O_2$ scores **(0)** for 2nd scoring point	**2**

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

Question Number	Acceptable Answers	Reject	Mark
19(c)(i)	**First mark:** (**X** is neutral) so not a (carboxylic) acid **(1)** **IGNORE** **"X** doesn't have a charge as it is neutral" / "**X** is not an alkali" / "**X** is not a base" **Second mark:** **(X** does not react with Tollens') so is **not** an aldehyde / is a ketone **(1)** **Third mark:** (**X** reacts with H^+ / $Cr_2O_7^{2-}$ so) is an alcohol /contains an OH (group) / contains R—OH / contains hydroxyl (group) **(1)** **IGNORE** 'not an acid' if this is deduced **solely** from the H^+ / $Cr_2O_7^{2-}$ information **Fourth mark:** a primary or a secondary (alcohol) **both needed** **OR** (**X** is) not tertiary (alcohol) **(1)** **Mark each point separately** **NOTE:** **'X** is a primary or a secondary alcohol' scores both the third and fourth marks **ALLOW** Correct formulae for the functional groups, instead of their names	**X** is an aldehyde scores **(0)** for this scoring point / **X** is not a ketone scores **(0)** for this scoring point	**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)	**MARKING ADVICE** Check answer for the suggested structure of X. If the correct structure is shown  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 **MARKS CAN BE AWARDED FROM SUITABLY ANNOTATED FORMULAE FOR X.** **<u>First mark:</u>** Four different H / hydrogen / proton environments **(1)** **<u>Any five from following seven points</u>:** **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)** Any mention to explain **no** splitting for peak **L** as there is no H is attached to the adjacent carbon **(1)** Peak **L** (C**H**$_3$) next to C=O **(1)** Peak **M** (C**H**$_3$) next to CH **(1)** Peak **K** O**H** **(1)** Peak **J** (C**H**) next to CH_3 **(1)** 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)**	**Just** 'four different **chemical** environments' If any incorrect chemical shift **OR A RANGE** of chemical shifts is quoted, this scoring point is not available	**7**

	Final mark (Compound **X** is) $CH_3CH(OH)COCH_3$ **NO** other compound allowed. **ACCEPT** any unambiguous formula, e.g. displayed formula **Peak J**  **Peak M** **Peak K** **Peak L** **ACCEPT** 3-hydroxybutan-2-one **(1)**		