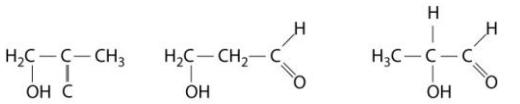
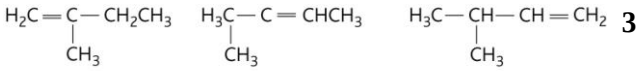
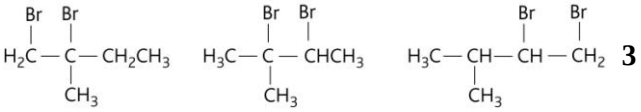
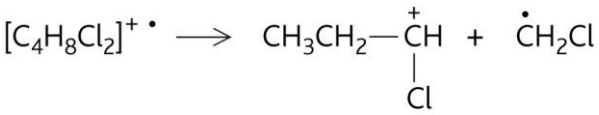
Answers to examination-style questions

Answers	Marks	Examiner's tips
1 a) **X** (O–H) (alcohols) **Y** C=O	**2**	Accept carbonyl group instead.
A: 	**1** **3**	These cannot be carboxylic acids since the peak is for OH alcohols.
b) 	**3**	
	**3**	
Splitting is 6 : 3 : 1	**1**	This must be written on its own. If you put it under a structure then it must be the correct structure (the middle one).
6 singlet	**1**	If the 6 : 3 : 1 is missing then you cannot get the splitting marks. Also the splitting must refer to the correct peak.
3 doublet	**1**	
1 quartet	**1**	
2 a) i) 3 peaks M/Z = 126, 128 and 130	**3**	You can show which Cls are in each peak so you will demonstrate that there are 3 peaks. Correct M/Z will be worth 1 mark.
ii) 	**3**	Each of these species is worth one mark since you have to give the molecular ion and the equation.
b) i) optical; equal mixture of enantiomers; optically inactive plane polarised light; rotated in opposite/different directions	**5**	
ii) planar carbocation/intermediate / attack from either side equally likely	**2**	

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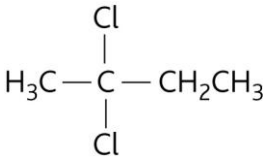
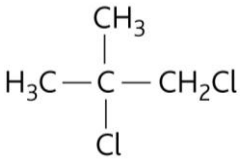
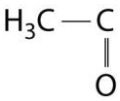
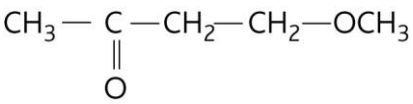
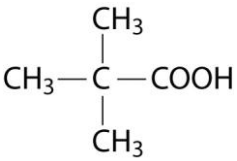
c) i) 2 peaks ratio 6 : 2 or 3 : 1 doublet quartet	**4**	You may find it helpful to draw the structure out before you look at the neighbouring Hs and determine the splitting pattern.
ii) **S**: 	**2**	You must use the numbers given in the question. Don't just keep trying look at the 3s. These usually refer to the Hs in a CH_3.
T: 		
3 a) i) 	**4**	Accept $RCOCH_3$
ii) $H_3C—O$		Accept $ROCH_3$
iii) CH_2CH_2		Remember it is the (N+1) rule for splitting where N = neighbours.
iv) 		You can write this on the line, i.e. $CH_3COCH_2CH_2OCH_3$.
b) i) OH in acids	**2**	Accept carboxylic acid.
ii) 		

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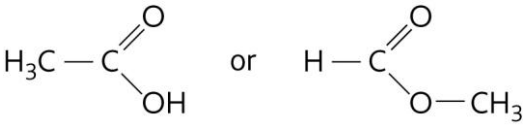
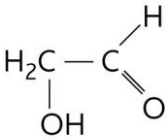
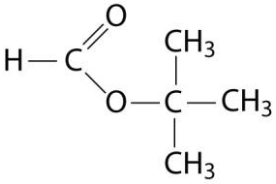
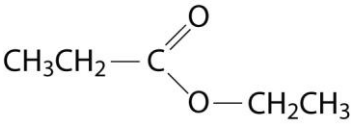
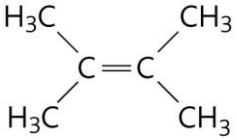
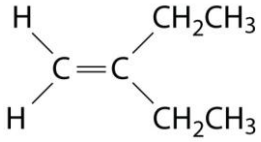
4 a) **C**: 	**2**	The absorption is for C=O.
D: 		The absorption is for OH alcohols.
b) **E**: 	**2**	Remember a quartet and a triplet is an ethyl group. Singlets mean there are no neighbouring H's to split the peak.
F: 		
c) **I**: 	**2**	The absorption in the IR means that both must have a C=C. The fact that neither exhibits E–Z isomerism means that the molecules have 2 of the same group on one end of the molecule (at least).
J: 		

Answers to examination-style questions

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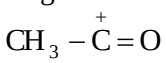
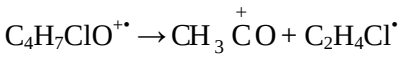
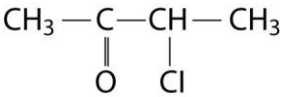
5 a) **X** is methyl propanoate	**1**	
b) Spectrum 2 **Y** is $CH_3COOCH_2CH_3$ accept either of these two options: at δ 3.7 – 4.1 **(1)** spectrum of **X** should have integration of 3 and is a singlet **(1)** or at δ 2.1 – 2.6 **(1)** spectrum of **X** should have integration of 2 and is a quartet **(1)**	**4**	Answers must relate to stated integration values.
6 a) C=O	**1**	You could say carbonyl group.
b) **i)** Cl has 2 isotopes **ii)** Fragmentation:  Equation: 	**3**	Must show the ion, if the ion is wrong then do not award the equation mark either. The isotopes of Cl are ^{35}Cl and ^{37}Cl.
c) **i)** $CDCl_3$ or CCl_4 **ii)** $Si(CH_3)_4$	**2**	There must be no Hs in the solvent or that would interfere with the spectrum.
d)	**1**	Both these numbers must be correct for the mark.
e) 	**1**	

Number of adjacent, non-equivalent protons	1 (given)	0	3