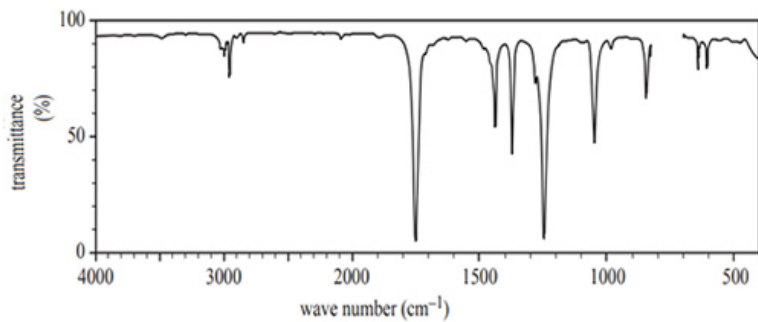


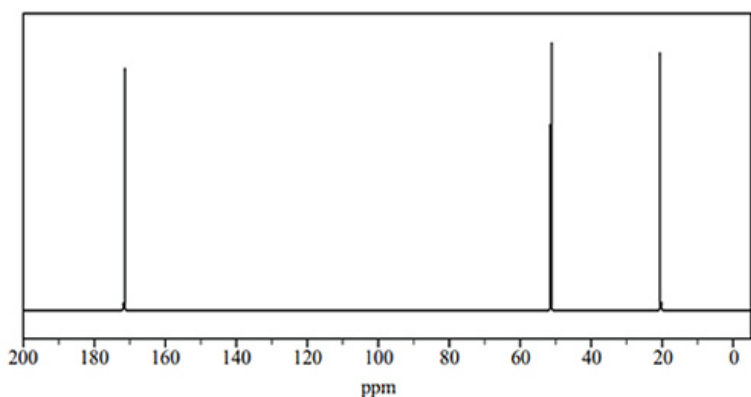
Spectroscopy (2018 NHT)

1) The following two spectra were obtained for a pure organic substance, Compound W.

Infra-red spectrum



¹³C NMR spectrum



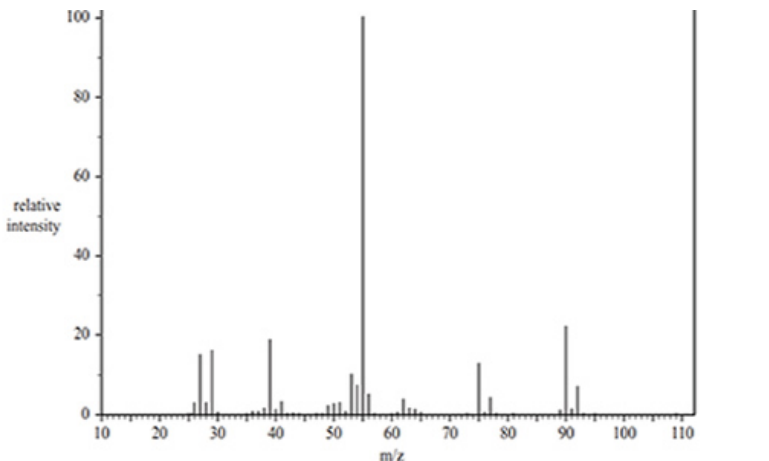
Solution will appear here

The formula of Compound W that is consistent with the spectra above is

- A. $\text{CH}_2(\text{OH})\text{CH}_2\text{CH}_2\text{OH}$
- B. $\text{CH}_3\text{CH}_2\text{COOH}$
- C. $\text{CH}_3\text{COOCH}_3$
- D. CH_3COCH_3

Solution

2) The mass spectrum shown above is for a molecule with the molecular formula $\text{C}_4\text{H}_7\text{Cl}$. Which species is responsible for the base peak?

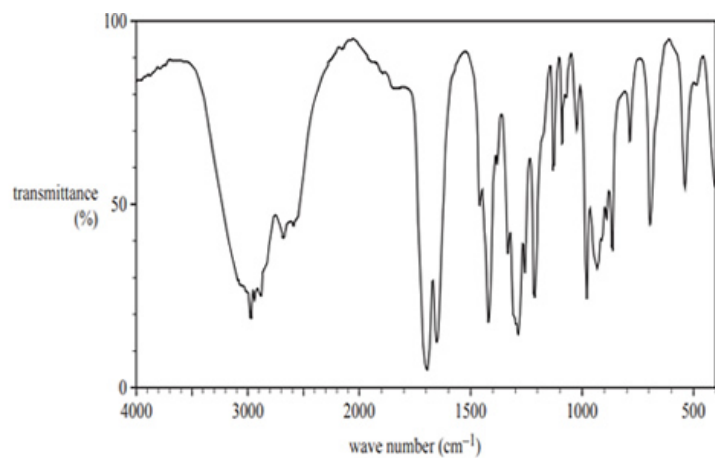


Solution will appear here

- A. $\text{C}_4\text{H}_7\text{Cl}^+$
- B. $\text{C}_3\text{H}_4\text{Cl}^+$
- C. C_3H_5^+
- D. C_4H_7^+

Solution

3) A student investigated an organic substance, Compound Y, with the molecular formula C_5H_8O

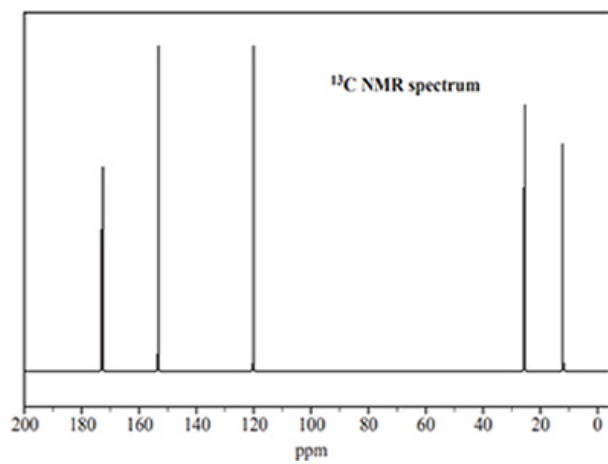


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The infra-red spectrum of Compound Y is shown above. On the spectrum, circle two peaks and identify the bond(s) responsible for each peak.

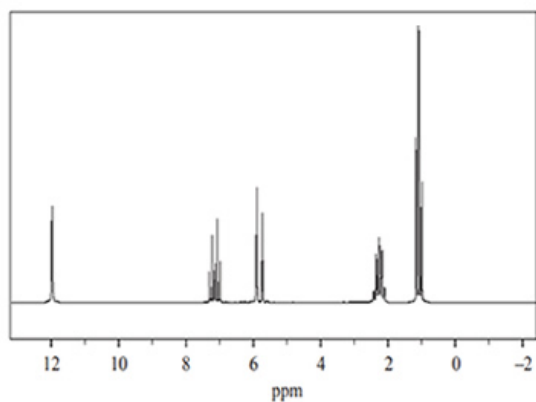
Solution

4) A sample of Compound Y was further analysed using ^{13}C NMR and 1H NMR. The spectra are shown below.



Solution will appear here

1H NMR spectrum



¹H NMR data

Chemical shift (ppm)	Relative peak area	Peak splitting
1.1	3	triplet (3)
2.3	2	pentet (5)
5.8	1	doublet (2)
7.1	1	quartet (4)
12	1	singlet (1)

- a) Use the information provided in the ¹³C NMR spectrum to identify the number of different carbon environments for Compound Y.
- b) For the signal at 2.3 ppm in the ¹H NMR spectrum, identify what specific information is provided by
- the relative peak area
 - peak splitting
- d) Draw the structural formula of Compound Y.

Solution