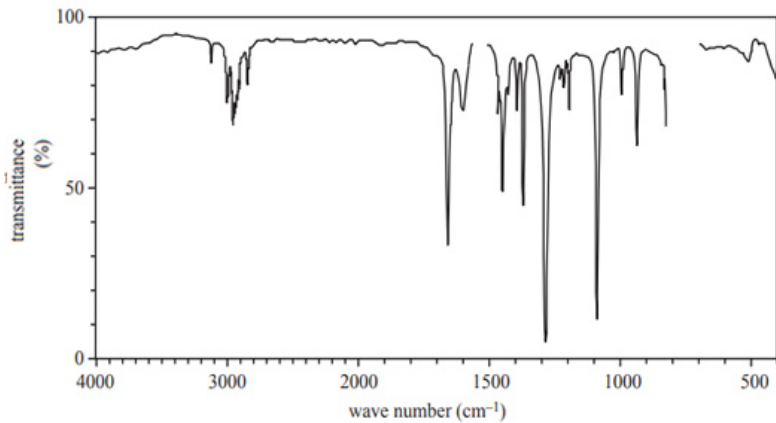


Spectroscopy (2020 VCE)

1) An unknown organic compound has a molecular formula of C_4H_8O . The compound is non-cyclic and contains a double bond. The infra-red (IR) spectrum of the molecule is shown below



Solution will appear here

a. What does the region $3100\text{--}4000\text{ cm}^{-1}$ indicate about the bonds in C_4H_8O ? Give your reasoning.

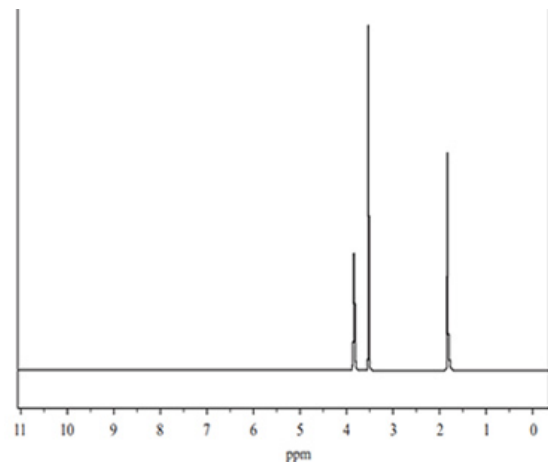
Solution

b. The ^{13}C NMR spectrum of the unknown compound has four distinct peaks. Draw two possible structural formulas of the unknown compound using the information provided.

Solution will appear here

Solution

c. The high-resolution 1H NMR spectrum of the unknown compound has three single peaks, as shown below.



Solution will appear here

Chemical shift (ppm)	Relative peak area
1.82	3
3.53	3
3.85	2

Refer to the ^1H NMR spectrum and the table of spectrum information provided above. Identify three pieces of information about the unknown compound and indicate how each would assist in determining its structure.

[Solution](#)

d. $\text{C}_3\text{H}_6\text{O}$ can exist as a ketone or as a primary alcohol. Explain how the principles of IR spectroscopy and ^1H NMR spectroscopy lead to different spectra for the ketone and primary alcohol isomers of $\text{C}_3\text{H}_6\text{O}$, which can then be used to differentiate between the two molecules.

[Solution](#)