

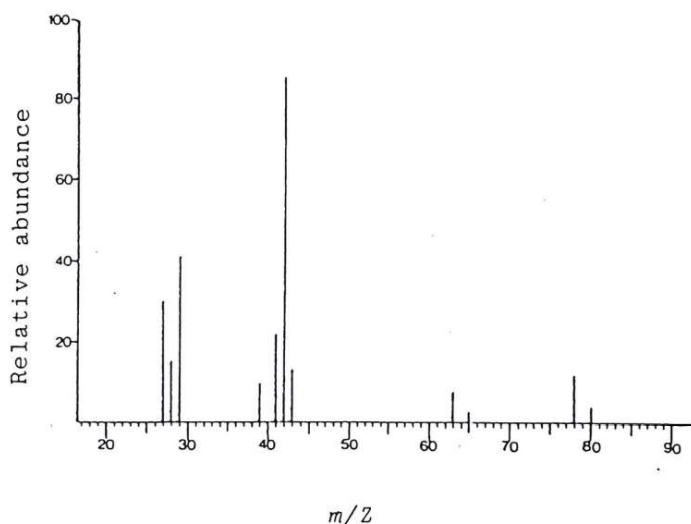
MEASUREMENT AHL (HL only)

Please ensure that you have also completed the Core (SL & HL) questions

1. An unknown organic compound, Z, was investigated using a variety of analytical techniques.

Upon reaction with aqueous silver nitrate, compound Z produced a white precipitate. This suggests that chlorine is present.

(a) The mass spectrum of compound Z is shown below.



(i) Explain how the peaks at 80 and 78 m/z suggest the presence of a chlorine atom.

[2]

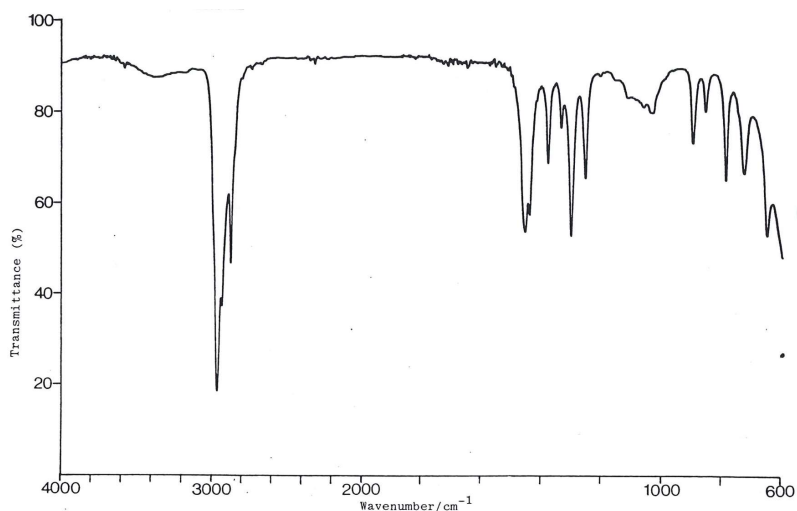
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(b) The infrared (IR) spectrum of compound X is shown below.



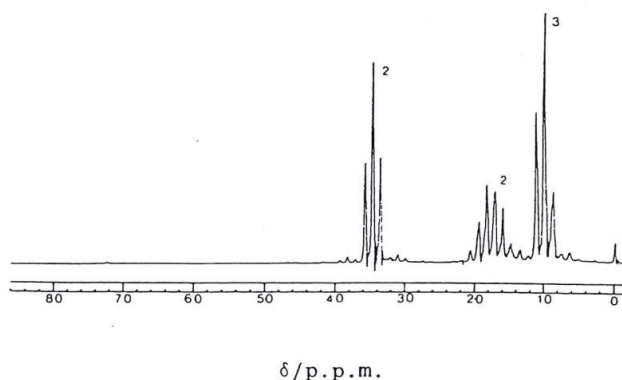
(i) Explain what the IR spectrum tells you about the bonds in compound Z (using section 26 of the data booklet).

[1]

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(c) The $^1\text{H-NMR}$ spectrum of compound Z is shown below:



(i) Explain, in detail, the splitting pattern seen in the $^1\text{H-NMR}$ spectrum and deduce the full structural formula of compound Z.

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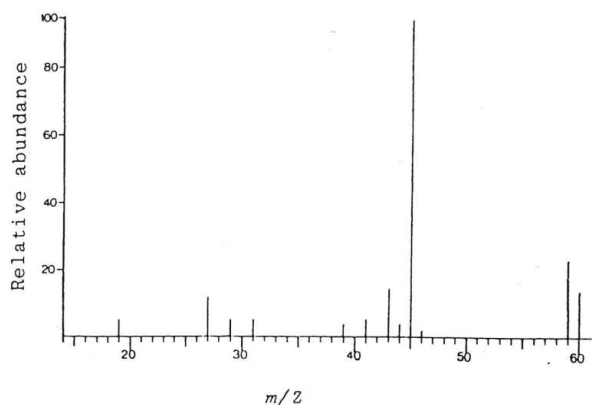
(ii) Return to the mass spectrum in (a) and identify the species responsible for the peaks at 80 and 78 m/z .

[1]

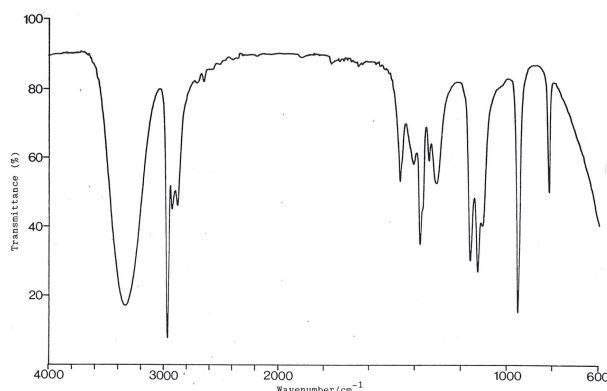
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2. An unknown organic compound, Y, was investigated using a variety of analytical techniques.

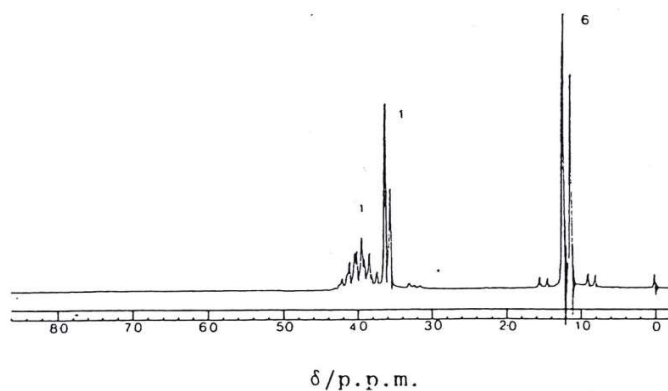
Mass spectrum of Y



IR Spectrum of Y



¹H-NMR spectrum of Y



(a) Deduce the full structural formula of compound Y. Explain the information that you use from each spectrum, including the splitting pattern seen in the ¹H-NMR spectrum.

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Total Marks 16 (24 minutes)