

AS level Chemistry A

H032/02 Depth in chemistry

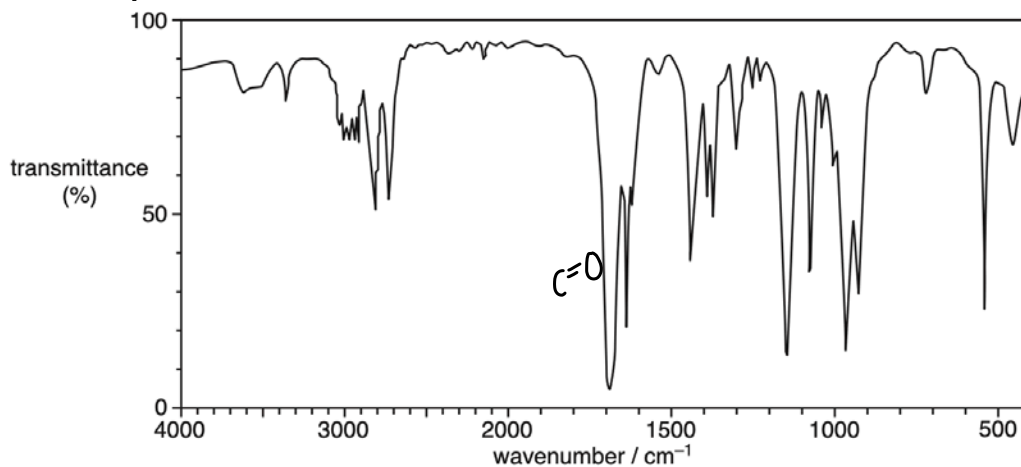
Question Set 13

1. Compound **F** is a trans stereoisomer which is a useful intermediate in organic synthesis.

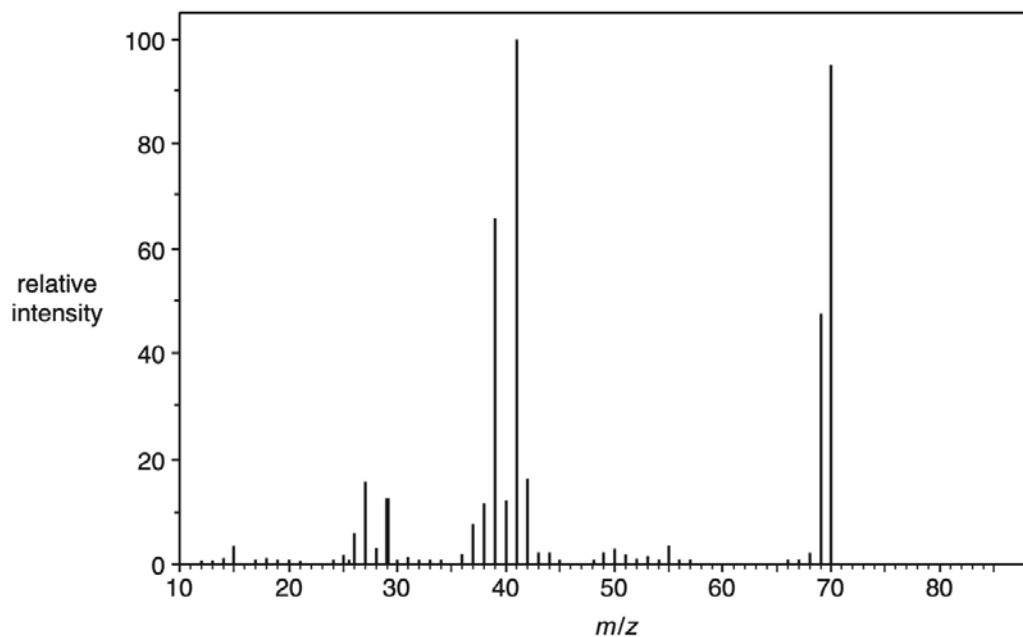
The results of elemental and spectral analysis of compound **F** are shown below.

Percentage composition by mass: C, 68.6 %; H, 8.6 %; O, 22.8 %.

Infrared spectrum



Mass spectrum



In the mass spectrum, the peak with the greatest relative intensity is caused by the loss of a functional group from the molecular ion of compound **F**.

Determine the structure of compound **F**.

Explain your reasoning and show your working.

[6]

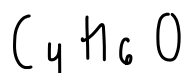
- absorption peak at $1630 - 1820 \text{ cm}^{-1}$ shows $\text{C}=\text{O}$ bond.
- mass spectrum shows peak with largest m/z value at 70
 \therefore molecular ion = 70 \rightarrow $M_r = 70$

empirical formula:

$$C: 68.6 \div 12 = 5.7166 \div 1.425 = 4.0116 \approx 4$$

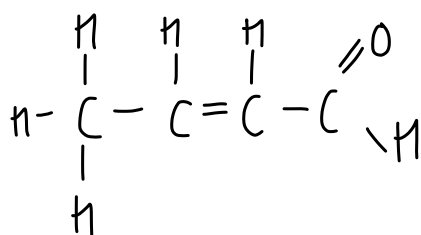
$$H: 8.6 \div 1 = 8.6 \div 1.425 = 6.03509 \approx 6$$

$$O: 22.8 \div 16 = 1.425 \div 1.425 = 1$$

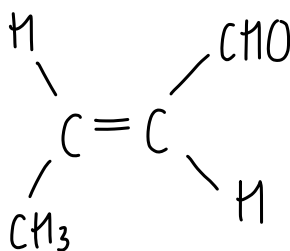


$$Mr = (12 \times 4) + (6 \times 1) + 16 = 70 \quad \therefore \text{empirical formula} = \text{molecular formula}$$

trans - stereoisomer = alkene



structure of F:



trans isomer so
groups with greatest
priority are on
opposite sides

Peak at 41 due to $C_3H_5^+$

Total Marks for Question Set 7: 6

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