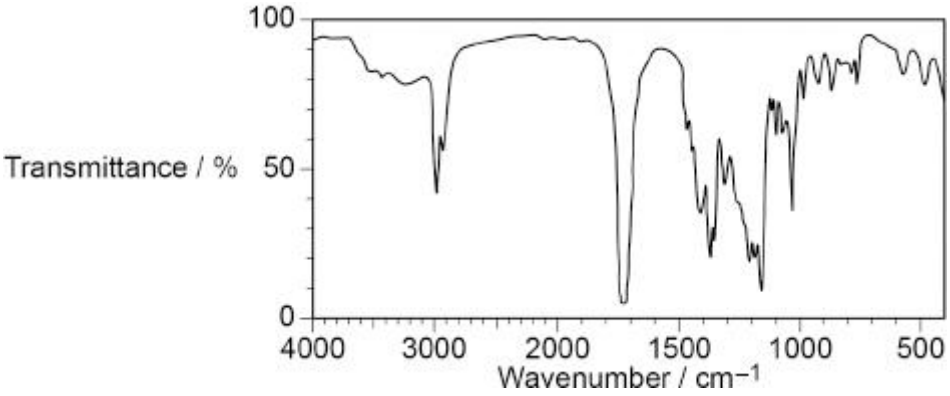
Name of the Student:_____
Max. Marks : 17 Marks **Time : 17 Minutes**

Q1.

This question is about compound **Z**, with molecular formula $C_7H_{12}O_3$

Figure 1 shows the infrared spectrum of **Z**.

Figure 1

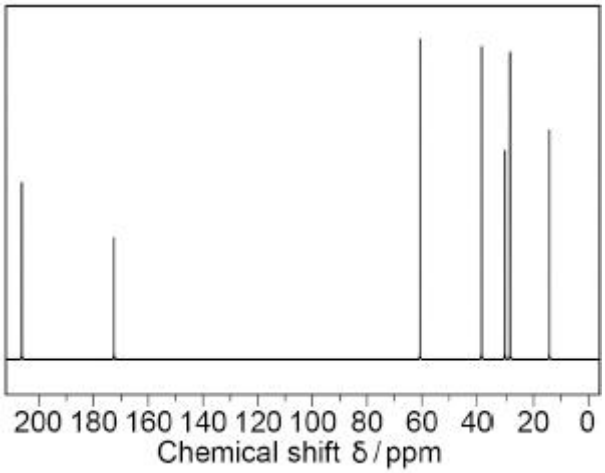


(a) Identify the bond that causes the absorption at 1725 cm^{-1}

_____

Figure 2 shows the ^{13}C NMR spectrum of **Z**.

Figure 2



(1)

(b) How many different carbon environments are there in a molecule of **Z**?

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	5	6	7	8
Tick ✓ **one** box				

(1)

(c) State the type of carbon environment that causes the peak at □ = 174 ppm

Use **Table C** in the Data Booklet to help you answer this question.

_____

(1)

(d) the table below shows data from the ^{1}H NMR spectrum for compound **Z**.

Chemical shift □ / ppm	4.10	2.60	2.56	2.19	1.26
Integration ratio	2	2	2	3	3
Splitting pattern	quartet	triplet	triplet	singlet	triplet

Explain what can be deduced from the splitting patterns and chemical shift values for the peaks at □ = 4.10 ppm and at □ = 1.26 ppm

Deduce the part of the structure of **Z** that causes the peaks at □ = 4.10 ppm and □ = 1.26 ppm

Use **Table B** in the Data Booklet to help you answer this question.

Peak at □ = 4.10 ppm _____

_____

_____

Peak at □ = 1.26 ppm _____

_____

_____

Part of structure

(5)

(e) Deduce the part of the structure of **Z** that causes the peak at □ = 2.19 ppm

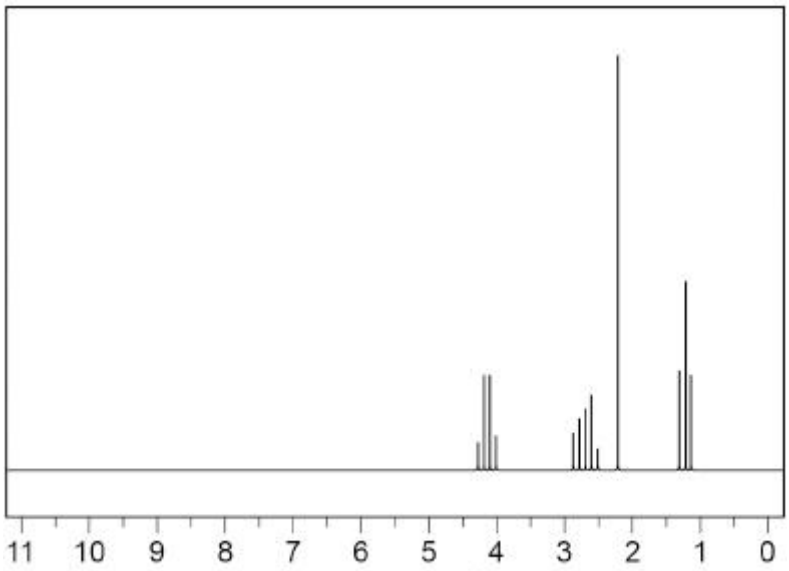
Part of structure

(1)

Figure 3 shows the ^{1}H NMR spectrum of compound **Z**.

Figure 3

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(f) Suggest why it would be difficult to determine the structure of **Z** using the spectrum in **Figure 3**, without the information in the table in part (d).

_____

_____

_____

_____

(1)

(g) Deduce the structure of **Z**.

(1)

(Total 11 marks)

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Q2.

This question is about compound **X** with the empirical formula C_2H_4O

Figure 1 shows the infrared spectrum of **X**.

Figure 2 shows the ^{13}C NMR spectrum of **X**.

The ^{1}H NMR spectrum of **X** shows four peaks with different chemical shift values.
The table below gives data for these peaks.

Figure 1

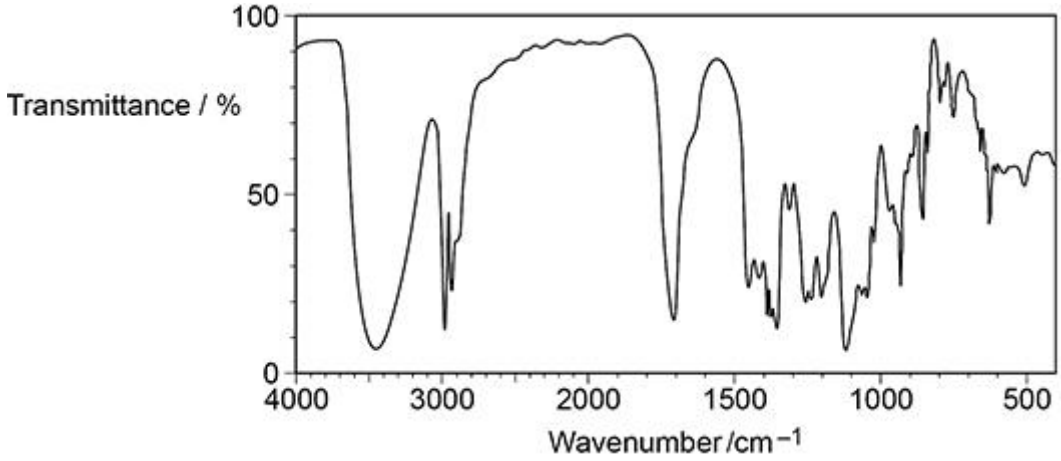
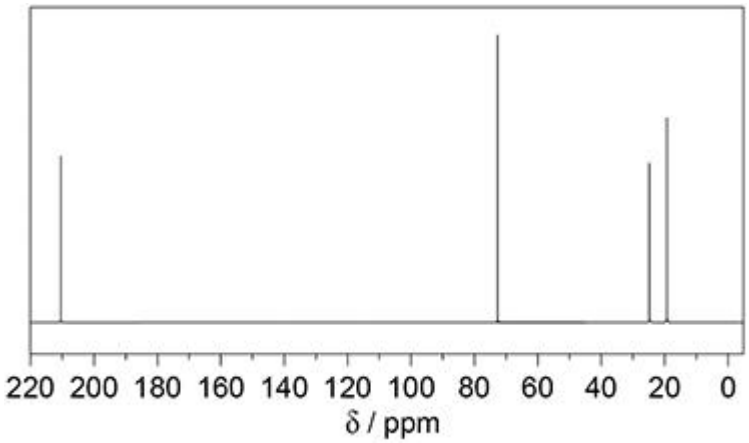


Figure 2



Chemical shift δ / ppm	3.9	3.7	2.1	1.2
Splitting pattern	quartet	singlet	singlet	doublet
Integration value	1	1	3	3

Show how information from **Figure 1**, **Figure 2** and the table can be used to deduce the structure of compound **X**.

_____

_____

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(Total 6 marks)

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