

AQA – Nuclear Magnetic resonance spectroscopy – A2 2023 Chemistry P2

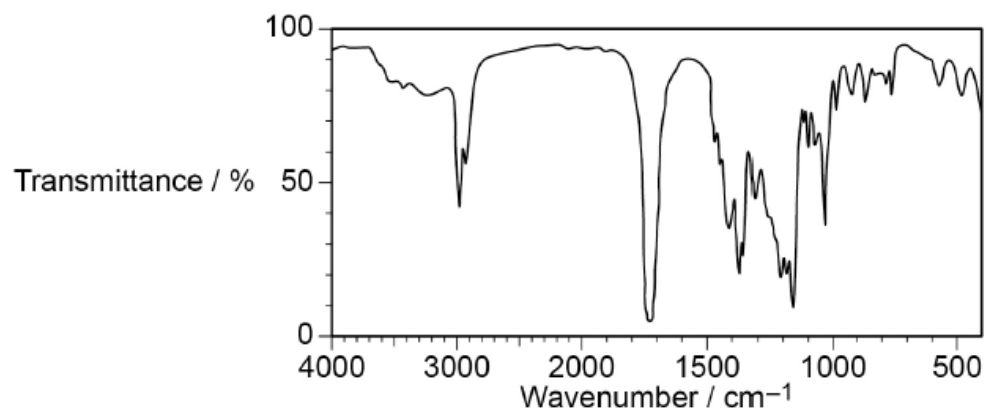
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This question is about compound **Z**, with molecular formula $C_7H_{12}O_3$

Figure 7 shows the infrared spectrum of **Z**.

Figure 7



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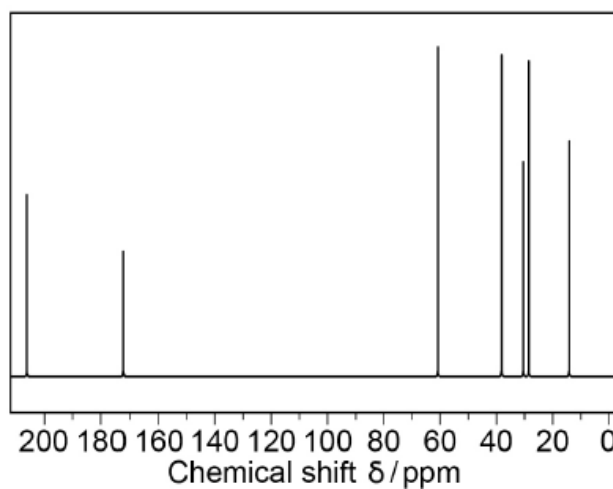
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Identify the bond that causes the absorption at 1725 cm^{-1}

[1 mark]

Figure 8 shows the ^{13}C NMR spectrum of **Z**.

Figure 8



0 5 . 2 How many different carbon environments are there in a molecule of **Z**?

[1 mark]

	5	6	7	8
Tick (✓) one box				

0 5 . 3 State the type of carbon environment that causes the peak at $\delta = 174$ ppm

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

[1 mark]

0 5 . 4 Table 2 shows data from the ^1H NMR spectrum for compound **Z**.

Table 2

Chemical shift δ / 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 $\delta = 4.10$ ppm and at $\delta = 1.26$ ppm

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

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

[5 marks]

Peak at $\delta = 4.10$ ppm _____

Peak at $\delta = 1.26$ ppm _____

Part of structure

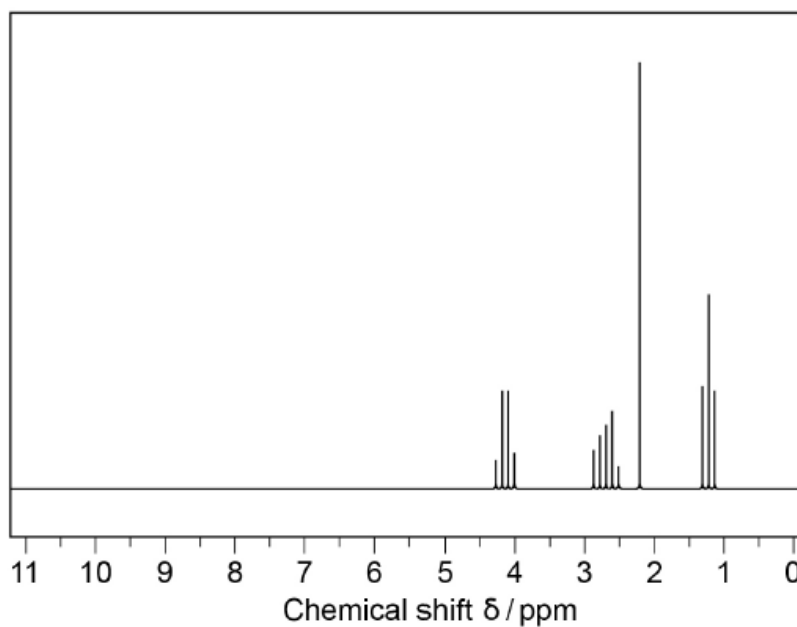
0 5 . 5 Deduce the part of the structure of **Z** that causes the peak at $\delta = 2.19$ ppm

[1 mark]

Part of structure

Figure 9 shows the ^1H NMR spectrum of compound **Z**.

Figure 9



0 5 . 6

Suggest why it would be difficult to determine the structure of **Z** using the spectrum in Figure 9, without the information in Table 2 on page 13.

[1 mark]

0 5 . 7

Deduce the structure of **Z**.

[1 mark]