Spectroscopy (MCQ)

1.   Which isomer of $C_6H_{12}O_2$ produces the smallest number of peaks in its ^{13}C NMR spectrum?

A

B

C

D
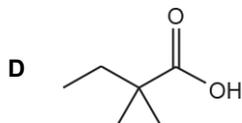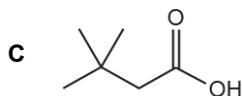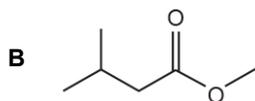
Your answer ☐   **[1]**

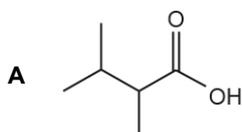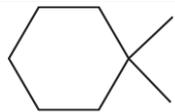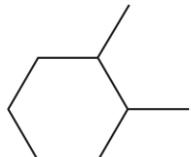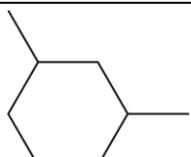**2.**   Which compound shows 4 peaks in its carbon-13 NMR spectrum?

A	
B	
C	
D	

Your answer ☐   **[1]**

3.   A compound produces the ^{13}C NMR spectrum below.
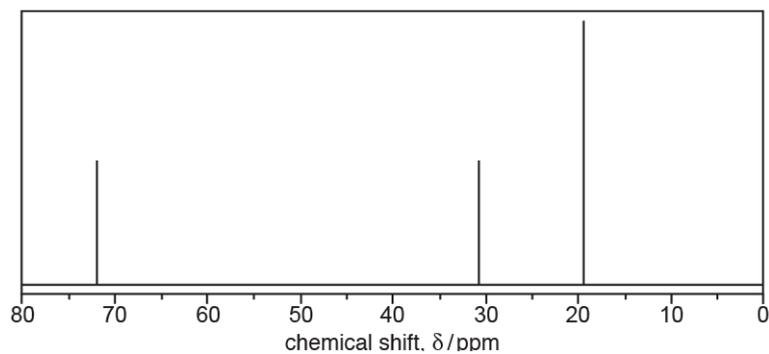
Which compound could have produced this spectrum?

A   Propane
B   2-Methylbutane
C   2-Methylpropan-1-ol
D   2-Methylpropan-2-ol

Your answer ☐   **[1]**

4.   What is the number of peaks in the ^{1}H NMR spectrum of $HOOCCH_2CHOHCH_2COOH$?

A   3
B   4
C   5
D   6

Your answer ☐   **[1]**

5.   Which compound is used as a standard for NMR chemical shift measurements?

A $Si(CH_3)_4$
B $CDCl_3$
C D_2O
D CCl_4

Your answer ☐   **[1]**

6. The compound below is analysed by ^{1}H NMR spectroscopy.
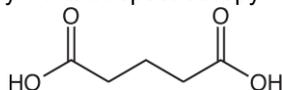
How many peaks are observed in the ^{1}H NMR spectrum?

A   5
B   4
C   3
D   2

Your answer   ☐   **[1]**
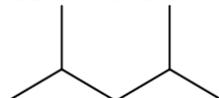
7. How many peaks are observed in the ^{13}C NMR spectrum of 1,3-dimethylbenzene?

A   3
B   4
C   5
D   6

Your answer   ☐

[1]

8. The skeletal formula of a hydrocarbon is shown below.

How many peaks would be seen in a ^{1}H NMR spectrum of this hydrocarbon?

A.   2
B.   3
C.   5
D.   7

Your answer   ☐

[1]

9. The structure of molecule **Z** is shown below.
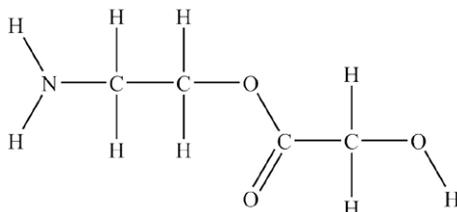
Which of the following statements is / are true?

1: The carbon-13 NMR spectrum of **Z** shows four peaks
2: The proton NMR spectrum of **Z** shows five peaks
3: The proton NMR spectrum of **Z** run in D_2O shows three peaks

A. 1, 2 and 3
B. Only 1 and 2
C. Only 2 and 3
D. Only 1

Your answer ☐

[1]

END OF QUESTION PAPER

Mark scheme – Spectroscopy (MCQ)

Question			Answer/Indicative content	Marks	Guidance
1			**C**	1 (AO2.2)	
			Total	**1**	
2			**B**	1 (AO 2.5)	**Examiner's Comments** Most candidates correctly selected B as the compound that would show four peaks in the ^{13}C NMR spectrum. Many candidates annotated the structures, indicating the different carbon environments with a circle. This proved a good strategy. Common incorrect responses included C and D which were seen in roughly equal proportions.
			Total	**1**	
3			**C**	1 (AO 2.5)	**Examiner's Comments** Many candidates identified that 2-methylpropan-1-ol (C) produced the ^{13}C NMR spectrum show. The majority of successful responses included diagrams showing the structures of the compounds to choose from. The most frequently seen incorrect response was D.
			Total	**1**	
4			**B**	1	**ALLOW** 4 (This is the number of peaks in the NMR spectrum) **Examiner's Comments** Many candidates correctly identified that the ^{1}H NMR spectrum would contain 4 peaks and selected B. In most cases candidates arrived at this answer by drawing out the structure and labelling the environments. A common distractor was A (3 peaks) which presumably arose from candidates assuming that the C–H and O–H protons in the centre of the structure were equivalent.
			Total	**1**	
5			**A**	1	**Examiner's Comments** Candidates found this question more challenging than anticipated. While many correctly chose A, a significant proportion of candidates selected C.

			Total		1	
6			C		1	**ALLOW** 3 (This is the number of peaks in the NMR spectrum) **Examiner Comments** This was well answered on the whole, with some candidates failing to include the peak associated with the −COOH part of the molecule. The common incorrect answer was D.
			Total		1	
7			**C**		1	
			Total		1	
8			B		1	
			Total		1	
9			A		1	
			Total		1	