

Name: _____

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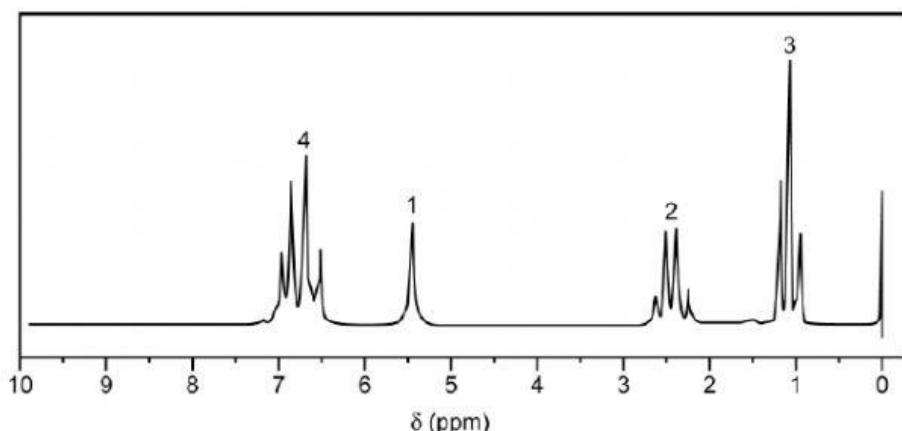
NMR Spectroscopy

1 (a) An aromatic compound **D**, of M_r 122, is a possible sex attractant for insects. It has the following composition by mass: C, 78.7%; H, 8.2%; O, 13.1%.

What is the molecular formula of **D**? Calculate and choose the correct answer from the option given below.

- A. $C_8H_{10}O$
- B. $C_{10}H_8O$
- C. $C_6H_{10}O$
- D. $C_{10}H_6O$

(b) The NMR spectrum of **D** is shown below.



Use the spectrum and explanation below to deduce the structure for **D**. Choose the correct answer from the option given below.

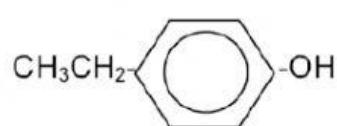
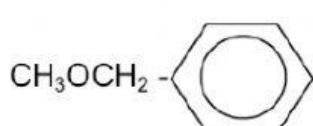
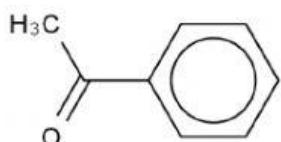
Triplet at $\delta 1$ is due to CH_3 next to a CH_2 .

Quartet at $\delta 2.5$ is due to CH_2 next to a CH_3 .

Peak at $\delta 6.8$ is due to 4 aryl hydrogen.

Singlet at $\delta 5.5$ is due to OH group of phenol.

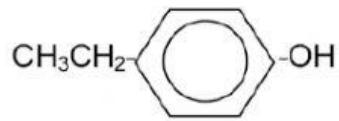
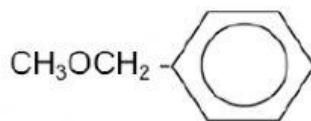
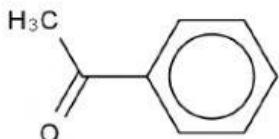
The structure of **D** is _____.



(c) Explain what effect you would expect the addition of a small amount of D_2O to have on the NMR spectrum of **D**.

(d) An isomer of **D** shows no effect on the NMR spectrum on adding D_2O .

Choose the structure of the isomer from the list given and suggest how its NMR spectrum would differ from that of D.



2 The NMR spectrum of cysteine, $H_2NCH(CH_2SH)CO_2H$, shows five absorptions.

After shaking a solution of cysteine with a few drops of D_2O , the NMR spectrum shows only **two** absorptions, **E** and **F**, shown below.



(i) Identify the **two** types of protons responsible for the absorptions **E** and **F**.

E

F

(ii) State and explain the splitting patterns of the absorptions **E** and **F**.

E

F