

Name of the Student: _____

Max. Marks : 12 Marks

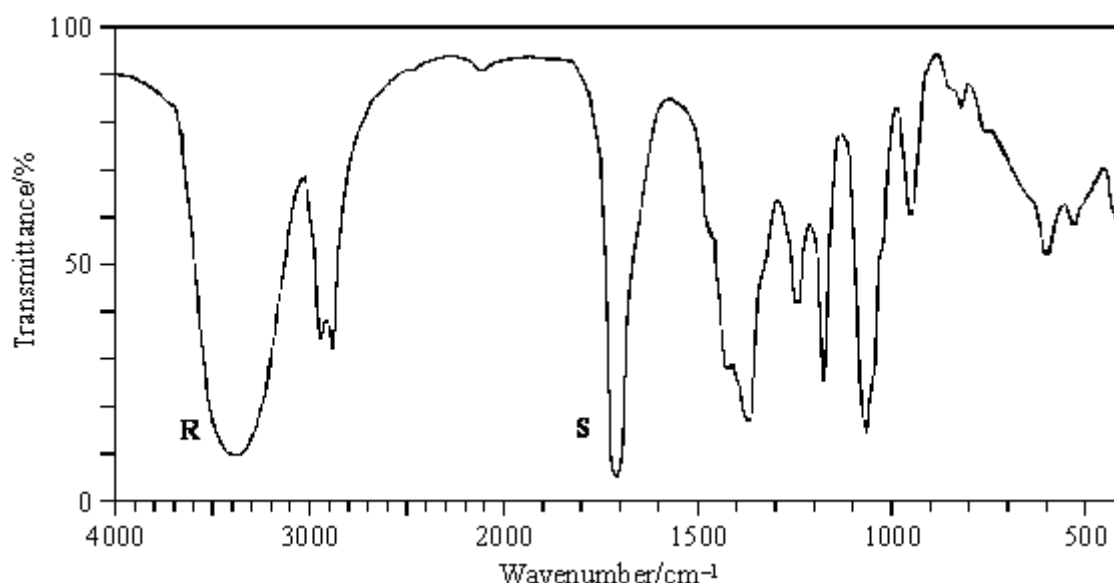
Time : 12 Minutes

Q1.

Spectral data for use in this question are provided below the Periodic Table (first item on the database).

Compound **Q** has the molecular formula $C_4H_8O_2$

(a) The infra-red spectrum of **Q** is shown below.



Identify the type of bond causing the absorption labelled **R** and that causing the absorption labelled **S**.

R _____

S _____

(2)

(b) **Q** does not react with Tollens' reagent or Fehling's solution. Identify a functional group which would react with these reagents and therefore cannot be present in **Q**.

(1)

(c) Proton n.m.r. spectra are recorded using a solution of a substance to which tetramethylsilane (TMS) has been added.

(i) Give two reasons why TMS is a suitable standard.

Reason 1 _____

Reason 2 _____

- (ii) Give an example of a solvent which is suitable for use in recording an n.m.r. spectrum. Give a reason for your choice.

Solvent _____

Reason _____

(4)

- (d) The proton n.m.r. spectrum of **Q** shows 4 peaks.

The table below gives δ values for each of these peaks together with their splitting patterns and integration values.

δ/ppm	2.20	2.69	3.40	3.84
Splitting pattern	singlet	triplet	singlet	triplet
Integration value	3	2	1	2

What can be deduced about the structure of **Q** from the presence of the following in its n.m.r. spectrum?

- (i) The singlet peak at $\delta = 2.20$

- (ii) The singlet peak at $\delta = 3.40$

- (iii) Two triplet peaks

(3)

- (e) Using your answers to parts (a), (b) and (d), deduce the structure of compound **Q**.

(1)

(Total 11 marks)

Q2.

How many peaks will be observed in the low-resolution proton n.m.r. spectrum of $(\text{CH}_3)_2\text{CHCOO}(\text{CH}_2)_3\text{CH}_3$?

- A 4
- B 5
- C 6
- D 7

(Total 1 mark)