

Name of the Student: _____

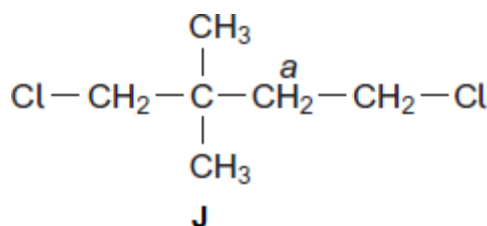
Max. Marks : 26 Marks

Time : 26 Minutes

Q1.

N.m.r. spectroscopy can be used to study the structures of organic compounds.

- (a) Compound
- J**
- was studied using
- ^1H
- n.m.r. spectroscopy.



- (i) Identify a solvent in which
- J**
- can be dissolved before obtaining its
- ^1H
- n.m.r. spectrum.

(1)

- (ii) Give the number of peaks in the
- ^1H
- n.m.r. spectrum of
- J**
- .

(1)

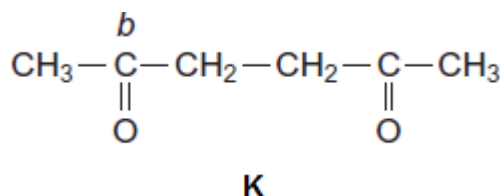
- (iii) Give the splitting pattern of the protons labelled
- a*
- .

(1)

- (iv) Give the IUPAC name of
- J**
- .

(1)

- (b) Compound
- K**
- was studied using
- ^{13}C
- n.m.r. spectroscopy.



- (i) Give the number of peaks in the
- ^{13}C
- n.m.r. spectrum of
- K**
- .

(1)

- (ii) Use **Table 3** on the Data Sheet to suggest a δ value of the peak for the carbon labelled *b*.

(1)

- (iii) Give the IUPAC name of **K**.

(1)

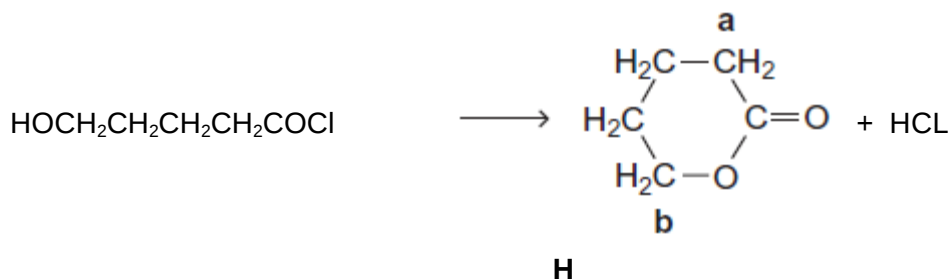
(Total 7 marks)

Q2.

This question is about some isomers of $\text{C}_5\text{H}_8\text{O}_2$

- (a) Compound **H** is a cyclic ester that can be prepared as shown.

On the structure of **H**, two of the carbon atoms are labelled.



- (i) Name and outline a mechanism for this reaction.

Use **Table C** on the Data Sheet to give the ^{13}C n.m.r. δ value for the carbon atom labelled **a** and the δ value for the carbon atom labelled **b**.

[illegible]

(7)

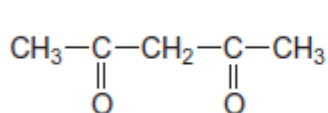
- (ii) $\text{HOCH}_2\text{CH}_2\text{CH}_2\text{CH}_2\text{COCl}$ can also react to form a polyester in a mechanism similar to that in part (i).

Draw the repeating unit of the polyester and name the type of polymerisation involved.

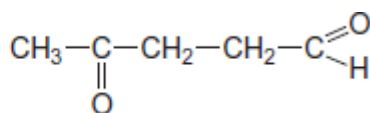
(2)

- (b) State how you could distinguish between compounds **J** and **K** by a simple test-tube reaction.

State how you could distinguish between **J** and **K** by giving the number of peaks in the ^1H n.m.r. spectrum of each compound.



J



K

(5)

- (c) Draw the structure of each of the following isomers of $\text{C}_5\text{H}_8\text{O}_2$.
Label each structure you draw with the correct letter **L**, **M**, **N**, **P** or **Q**.

L is methyl 2-methylpropenoate.

M is an ester that shows E-Z stereoisomerism.

N is a carboxylic acid with a branched carbon chain and does **not** show stereoisomerism.

P is an optically active carboxylic acid.

Q is a cyclic compound that contains a ketone group and has only two peaks in its ^1H n.m.r. spectrum.

