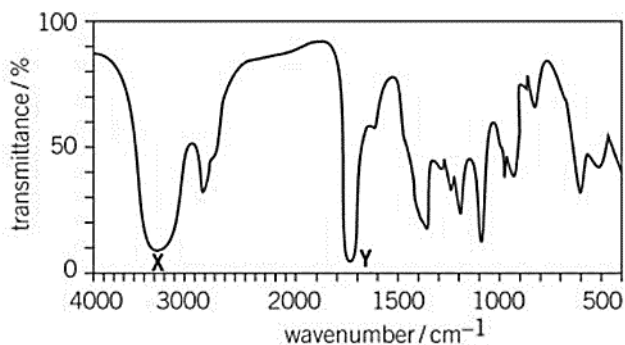


CHAPTER 16 ORGANIC ANALYSIS

- 1 (a) The infra-red spectrum of compound A, $C_3H_6O_2$, is shown below.



Identify the functional groups which cause the absorptions labelled X and Y.

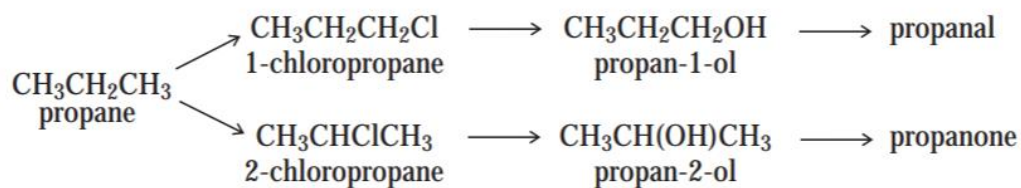
Using this information draw the structures of the three possible structural isomers for A. (5 marks)

X = _____

Y = _____

3 possible **structural isomers**:

- 2 Consider the following scheme of reactions.



- (a) State the type of structural isomerism shown by propanal and propanone.

.....
(1 mark)

- (b) A chemical test can be used to distinguish between separate samples of propanal and propanone.

Identify a suitable reagent for the test.

State what you would observe with propanal and with propanone.

Test reagent

Observation with propanal

Observation with propanone

(3 marks)

- (c) State the structural feature of propanal and propanone which can be identified from their infrared spectra by absorptions at approximately 1720 cm^{-1} .
You may find it helpful to refer to **Table 1** on the Data Sheet.

.....

(1 mark)

- (d) The reaction of chlorine with propane is similar to the reaction of chlorine with methane.

- (d) (i) Name the type of mechanism in the reaction of chlorine with methane.

.....

(1 mark)

- (d) (ii) Write an equation for each of the following steps in the mechanism for the reaction of chlorine with propane to form 1-chloropropane ($\text{CH}_3\text{CH}_2\text{CH}_2\text{Cl}$).

Initiation step

.....

First propagation step

.....

Second propagation step

.....

A termination step to form a molecule with the empirical formula C_3H_7

.....

(4 marks)

- (e) High resolution mass spectrometry of a sample of propane indicated that it was contaminated with traces of carbon dioxide.

Use the data in the table to show how precise M_r values can be used to prove that the sample contains both of these gases.

Atom	Precise relative atomic mass
^{12}C	12.00000
^1H	1.00794
^{16}O	15.99491

.....

.....

.....

(2 marks)

- 3 The table below shows the structures of three isomers with the molecular formula $\text{C}_5\text{H}_{10}\text{O}$

<p>Isomer 1</p>	(E)-pent-3-en-2-ol
<p>Isomer 2</p>	pentanal
<p>Isomer 3</p>	

- (a) Complete the table by naming Isomer 3.

(1 mark)

(b) State the type of structural isomerism shown by these three isomers.

.....
(1 mark)

(c) The compound (Z)-pent-3-en-2-ol is a stereoisomer of (E)-pent-3-en-2-ol.

(c) (i) Draw the structure of (Z)-pent-3-en-2-ol.

(c) (ii) Identify the feature of the double bond in (E)-pent-3-en-2-ol and that in (Z)-pent-3-en-2-ol that causes these two compounds to be stereoisomers.

.....
(1 mark)

(d) A chemical test can be used to distinguish between separate samples of Isomer 2 and Isomer 3.

Identify a suitable reagent for the test.

State what you would observe with Isomer 2 and with Isomer 3.

Test reagent

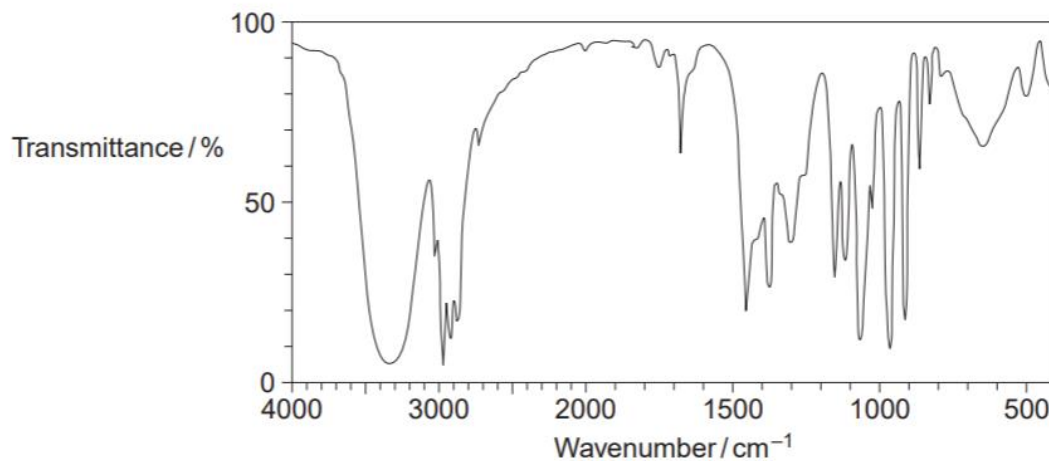
Observation with Isomer 2

.....

Observation with Isomer 3

.....
(3 marks)

(e) The following is the infrared spectrum of one of the isomers **1**, **2** or **3**.



(e) (i) Deduce which of the isomers (**1**, **2** or **3**) would give this infrared spectrum. You may find it helpful to refer to **Table 1** on the Data Sheet.

.....
(1 mark)

(e) (ii) Identify two features of the infrared spectrum that support your deduction. In each case, identify the functional group responsible.

Feature 1 and functional group

.....
.....
.....

Feature 2 and functional group

.....
.....
.....

(2 marks)