

Seat No.	
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**B.Sc. (Part-III) (Semester-V) (CBCS) Examination, October - 2023****CHEMISTRY****Organic Chemistry (Paper-X)****Sub. Code : 79683****Day and Date : Wednesday, 25- 10 - 2023****Total Marks :40****Time :10.30 a.m. to 12.30 p.m.**

- Instructions :**
- 1) All questions are compulsory.
  - 2) Figures to the right indicate full marks.
  - 3) Spectroscopic chart is allowed.

**Q1)** Select most correct alternative among those given below and rewrite the sentences. [8]

- a) In the electromagnetic spectrum, which region has the longest wavelength?
  - i) Ultraviolet
  - ii) Infrared
  - iii) Visible
  - iv) X-ray
- b) Which type of Spectroscopy is particularly useful for studying molecular vibrations?
  - i) UV-Vis Spectroscopy
  - ii) X-ray Spectroscopy
  - iii) IR Spectroscopy
  - iv) NMR Spectroscopy
- c) In UV-Visible spectroscopy, which type of electronic transition is responsible for the absorption of visible light?
  - i)  $n \rightarrow \sigma^*$
  - ii)  $n \rightarrow \pi^*$
  - iii)  $\sigma \rightarrow \sigma^*$
  - iv)  $\pi \rightarrow \pi^*$
- d) The shift of absorption band to shorter wavelength is called as \_\_\_\_\_.
  - i) bathochromic shift
  - ii) hypochromic shift
  - iii) hyperchromic shift
  - iv) hypsochromic shift
- e) Which nucleus is commonly used in NMR spectroscopy?
  - i) Hydrogen ( $^1\text{H}$ )
  - ii) Carbon ( $^{12}\text{C}$ )
  - iii) Oxygen ( $^{16}\text{O}$ )
  - iv) Nitrogen ( $^{14}\text{N}$ )
- f) In a proton NMR spectrum, how many signals would you expect for a compound with the molecular formula  $\text{C}_4\text{H}_{10}$ ?
  - i) 3
  - ii) 2
  - iii) 4
  - iv) 5

**P.T.O.**

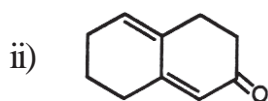
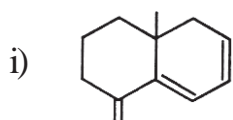
- g) In mass spectrometry, ions are separated based on their\_\_\_\_\_
- |                         |                  |
|-------------------------|------------------|
| i) Charge-to-mass ratio | ii) Charge alone |
| iii) Mass alone         | iv) Size         |
- h) Molecular weight is determined by using\_\_\_\_\_
- |                      |                       |
|----------------------|-----------------------|
| i) NMR Spectroscopy  | ii) IR Spectroscopy   |
| iii) UV Spectroscopy | iv) Mass Spectroscopy |

**Q2)** Attempt any two of the following: [20]

- a) Explain the fundamental modes of vibrations in IR Spectroscopy.
- b) i) Explain the terms:
- 1) Bathochromic shift
  - 2) Hypsochromic shift
- ii) Explain the phenomenon of spin-spin coupling, with examples.
- c) i) State and explain Beer Lambert Law and name the terms involved in its expression.
- ii) Draw a neat labeled diagram of Mass Spectrometer and explain its working.

**Q3)** Attempt any four of the following: [12]

- a) Calculate the  $\lambda_{\max}$  value of following compounds by using Woodward fieser rule



- b) Write a note on McLafferty rearrangement.
- c) Deduce the structure of the compound using following spectral data  
 MF:  $C_2H_6O$   
 IR :  $3300\text{ cm}^{-1}$   
 PMR :  $\delta$  1.2 (triplet, 3H);  $\delta$  3.7 (quartet, 2H);  $\delta$  5.2 (singlet, 1H)
- d) Applications of Mass Spectroscopy.
- e) Write a note on Chemical Shift.

## SPECTROSCOPIC VALUES

## A) Woodward and fieser rules for Dienes and Enones

Nature of Dienes	$\lambda_{\text{max}}$
Acyclic and Heteroannular dienes	214 nm
Homoannular dienes	253nm
<b>Addition of each substituents</b>	
-R( alkyl, including part of carbocyclic ring)	+ 5 nm
-OR (alkoxy)	+ 6 nm
-Cl, -Br	+ 5 nm
-OCOR (acyloxy)	--
-CH=CH- additional conjugation	+ 30 nm
If one double bond is exocyclic to one ring	+ 5 nm
If exocyclic to two rings simultaneously	+10 nm

B) Rules for  $\alpha, \beta$  unsaturated aldehydes and ketones:

<p style="text-align: center;"><b>B   <math>\alpha</math></b></p> <p><b>Ketones</b>   <math>\text{---C=C---C=O}</math></p> <p style="margin-left: 100px;">         </p>	
Acyclic or 6-ring cyclic	215 nm
5- ring cyclic	202 nm
<p><b>Aldehydes</b>   <math>\text{---C=C---C=O}</math></p> <p style="margin-left: 100px;">        H</p>	207 nm
<p><b>Acid/Ester</b>   <math>\text{CH---O---C---R}</math></p> <p style="margin-left: 100px;">  </p> <p style="margin-left: 100px;">O</p>	197 nm

CHEMICAL SHIFTS OF PROTONS $\delta$ in ppm			
Proton	$\delta$ ppm	Proton	$\delta$ ppm
$\text{H}_3\text{C}-\text{R}$	0.9	$-\text{C}-\text{CH}_2-\text{C}-$	1.4
$\text{H}_3\text{C}-\text{C}=\text{C}$	1.7	$-\text{C}-\text{CH}_2-\text{C}(=\text{O})-\text{OR}$	2.2
$\text{H}_3\text{C}-\text{C}(=\text{O})-\text{R}$	2-2.7	$-\text{C}-\text{CH}_2-\text{C}=\text{C}$	2.3
$\text{H}_3\text{C}-\text{S}-$	2.1	$-\text{C}-\text{CH}_2-\text{S}-$	2.5
$\text{H}_3\text{C}-\text{Ar}$	2.3	$-\text{C}-\text{CH}_2-\text{N}-$	2.5
$\text{H}_3\text{C}-\text{N}-\text{R}$	2.3	$-\text{C}-\text{CH}_2-\text{Ar}$	2.7
$\text{H}_3\text{C}-\text{C}(=\text{O})-\text{Ar}$	2.6	$-\text{C}-\text{CH}_2-\text{OR}$	3.4
$\text{H}_3\text{C}-\text{N}-\text{Ar}$	3.0	$-\text{C}-\text{CH}_2-\text{I}$	3.2
$\text{H}_3\text{C}-\text{O}-\text{R}$	3.3	$-\text{C}-\text{CH}_2-\text{Br}$	3.5
$\text{H}_3\text{C}-\text{O}-\text{C}(=\text{O})-\text{R}$	3.7	$-\text{C}-\text{CH}_2-\text{Cl}$	3.6
$\text{H}_3\text{C}-\text{O}-\text{Ar}$	3.8	$-\text{C}-\text{CH}_2-\text{OH}$	3.6
$\text{Ar}-\text{H}$	7.3	$-\text{C}-\text{CH}-\text{C}-$	1.5
$\text{R}-\text{C}(=\text{O})-\text{H}$	9.0-10.0	$-\text{C}-\text{CH}-\text{C}(=\text{O})-\text{R}$	2.5
$\text{R}-\text{C}(=\text{O})-\text{OH}$	10.5-12	$-\text{C}-\text{CH}-\text{N}-$	2.8
$\text{R}-\text{OH}$	0.5-4.5	$-\text{C}-\text{CH}-\text{Ar}$	3.0

