



DQ-003-2016007

Seat No. _____

B. Sc. (Sem. VI) (CBCS) (W.E.F. 2019) Examination

April - 2022

Chemistry : C - 602

(Organic Chemistry & Spectroscopy) (New Course)

Faculty Code : 003

Subject Code : 2016007

Time : $2\frac{1}{2}$ Hours]

[Total Marks : 70

- Instructions :**
- (1) Total five questions, all are compulsory.
 - (2) The figure to the right side indicate the marks of the sub questions.
 - (3) All questions carry equal 14 marks.

- 1 (a) Answer the following questions : 4
- (1) Write the structure of Pyrimidine.
 - (2) How many hetero atoms are present in Pyrazole?
 - (3) Write the structure of barbituric acid.
 - (4) Which hetero atoms are present in morpholine?
- (b) Answer the questions : (any one) 2
- (1) Give synthesis of 2-amino thiazole.
 - (2) Give one synthesis of Dioxane.
- (c) Answer in brief : (any one) 3
- (1) Give synthesis of pyrimidine from diethyl malonate.
 - (2) Give any three methods of preparation of Thiophene.
- (d) Answer in detail : (any one out of two) 5
- (1) Give one reaction each of Nitration, sulphonation, halogenation, oxidation and reduction for pyridine.
 - (2) Write Nitration, Sulphonation and Acetylation reaction for Furan, Thiophene and Pyrrole.

- 2 (a) Answer the following questions : 4
- (1) Write the structure of Thyroxin.
 - (2) Write structure of Carbendazin.
 - (3) α - amino acid + $\text{Cu}^{+2} \xrightarrow{\Delta} \underline{(A)}$
(2 mole)
 - (4) Write structure formula of RDX.
- (b) Answer the questions : (any one) 2
- (1) Give synthesis of Baygon.
 - (2) Give synthesis of Parathion.
- (c) Answer in brief : (any one) 3
- (1) Give synthesis method of Glycylalanine.
 - (2) Explain Erlenmeyer Azlactone method.
- (d) Answer in detail : (any one) 5
- (1) Explain constitution of Thyronine.
 - (2) Explain chemical properties of Amino acids
(any five)
- 3 (a) Answer the following questions : 4
- (1) Write structure of Levulinic acid
 - (2) Complete it : $\text{C}_{10}\text{H}_{16}\text{O} \xrightarrow[\text{KHSO}_4]{\Delta} \underline{(A)}$
 - (3) What is Fragment ion ?
 - (4) What is Radical ion ?
- (b) Answer the questions : (any one) 2
- (1) Give Ozonolysis of citral.
 - (2) Give uses of mass spectroscopy.
- (c) Answer in brief : (any one) 3
- (1) Give synthesis of Geranic acid by Reformatsky reaction.
 - (2) Explain FAB Technique of mass spectroscopy.
- (d) Answer in detail : (any one) 5
- (1) Give synthesis of α -Terpineol.
 - (2) Explain McLafferty Rearrangement.

- 4 (a) Answer the following questions : 4
- (1) Which solvent is used in NMR spectroscopy?
 - (2) How many types of proton present in $\text{CH}_2 = \text{CHBr}$?
 - (3) How many NMR signal would you expected in 1, 2-Cis dimethyl cyclopropane?
 - (4) Define "Coupling Constant J".
- (b) Answer the questions : (any one) 2
- (1) Give structural formula of compound which give rise to only two NMR signal.
 - (2) Define Geminal proton and Vicinal proton.
- (c) Answer in brief : (any one) 3
- (1) Discuss importance of TMS in NMR spectroscopy.
 - (2) Distinguish the stereoisomers of 1, 3, - dibromo 1, 3 - dimethyl cyclobutane by NMR spectra with structure.
- (d) Answer in detail : (any one) 5
- (1) Explain Enantiometric and Diastereomeric proton by NMR spectra.
 - (2) Explain factors effecting on chemical shift in NMR spectroscopy.
- 5 (a) Answer the following questions : 4
- (1) Give no. of signal and δ_{PPM} value of Acetelene.
 - (2) Give no. of signal in m-zyline.
 - (3) Give structure formula of compound which gives only one NMR signal (i) $\text{C}_7\text{H}_5\text{N}$.
 - (4) Give no. of signal and splitting of each signal : $\text{CH}_3\text{C}(\text{Br}) = \text{CH}_2$
- (b) Answer the questions : (any one) 2
- Give structural formula from following data :
- (1) M.F. = $\text{C}_5\text{H}_6\text{O}_3$
 - (i) a Quintet $\delta = 1.6$ 2H
 - (ii) b Triplet $\delta = 2.7$ 2H

- (2) M. F. = $C_3H_6Br_2$
 (i) a Triplet $\delta = 3.4$ 4H
 (ii) b Quintet $\delta = 1.5$ 2H

(c) Give Answer : (any one) 3

- (1) Give No. of signal, splitting and δ_{PPM} value (Approximately) of $CH_3COOCH_2CH_3$
 (2) Assign the structural formula from following NMR data :

- M. F. = $C_8H_{14}O_1$
 (i) a multiplet $\delta = 2.73$ 2H
 (ii) b doublet $\delta = 1.2$ 12H

(d) Answer any one : 5

- (1) Assign the structural formula from following data :

M. F : $C_{10}H_{12}O_2$
 IR : 3050, 2970, 1745, 1608, 1550, 1495 cm^{-1}
 NMR :

- a Singlet $\tau = 2.7$ δ_{PPM} (16.50 square)
 b Triplet $\tau = 5.8$ δ_{PPM} (6.20 square)
 c Triplet $\tau = 7.07$ δ_{PPM} (6.7 square)
 d Singlet $\tau = 7.98$ δ_{PPM} (10.20 square)

- (2) Assign the structural formula from following data :

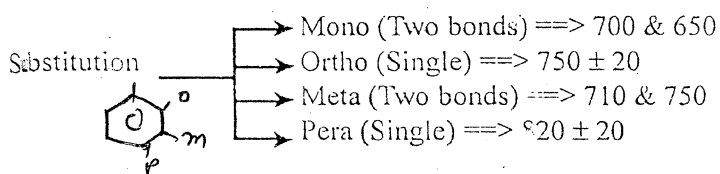
M. F. : C_9H_9NO
 IR : 3030, 2975, 2270, 1590, 1530, 1385, 1210 and 840 cm^{-1}
 NMR :

- (i) a Triplet $\delta = 1.2$ PPM 3H
 (ii) b Doublet $\delta = 7.5$ PPM 2H
 (iii) c Doublet $\delta = 7.8$ PPM 2H
 (iv) d Quardet $\delta = 2.3$ PPM 2H

IR-Data

Type of Vibration	Frequency(cm^{-1})	Intensity
[1] Hydrocarbon :-		
<u>C-H Stretching vibration</u>		
(a) Alkane Stretch vib $\xrightarrow{\text{CH}_3/\text{CH}_2}$	2990-2850	a,s
(b) Alkene Stretch vib $\xrightarrow{>\text{C}=\text{CH}_2}$	3100-3000	m
(c) Alkyne Stretch vib $\xrightarrow{-\text{C}\equiv\text{C}-\text{H}}$	3300	S.V.
(d) Aromatic Stretch vib $\xrightarrow{\text{Ar}-\text{H}}$	3030	m
[2] C-H Bending Vibration :-		
(a) (i) CH_3 - Bending $\longrightarrow$	1450	s
(ii) CH_2 - Bending $\longrightarrow$	1465	m
(iii) CH - Bending $\longrightarrow$	1340	vv
(b) Isopropyl $\begin{array}{c} \text{CH}_3 \\ \\ -\text{CH} \\ \\ \text{CH}_3 \end{array}$ $\longrightarrow$	1375 1385	Doublet s
(c) Tert-butyl $-\text{C}(\text{CH}_3)_3 \longrightarrow$	1365 1390	
(d) Alkene bending vib $\longrightarrow$	1420-690	m
(e) Alkene Cis $\begin{array}{c} \text{H} \quad \text{H} \\ \diagdown \quad \diagup \\ \text{C}=\text{C} \end{array} \longrightarrow$	690 Trans 970	
(f) Alkyne bending vib $\longrightarrow$	630	s
CH_2 Roking (More then four CH_2 group) $\longrightarrow$	720 & 625	m
[3] C-C Multiple Bond :-		
(a) $\text{C}=\text{C}$ Alkene stretch vib $\longrightarrow$	1680-1600	m, v
(b) $\text{C}\equiv\text{C}$ Alkyne stretch vib $\longrightarrow$	2250-2100	m, v
(c) $\text{C}=\text{C}$ Aromatic ring scatalat vib $\longrightarrow$	1600,1580 1500,1450	m
[4] C=O Carbonyl group		
(a) (i) $\text{C}=\text{O}$ Acid $\longrightarrow$	1700	(s)
(ii) O-H(Stretch) $\begin{array}{c} \text{C}-\text{OH} \\ \\ \text{Acid} \\ \text{O} \end{array}$ broad $\longrightarrow$	2700-3200	(v)
(b) Ketone $\longrightarrow$	1715	(s)
(c) (i) Aldehyde $\longrightarrow$	1745	(s)
(ii) C-H Strech vib $\begin{array}{c} \text{CHO} \\ \longrightarrow \end{array}$	2820 2750	Doublet (s)
(d) (i) Ester $\longrightarrow$	1750-1735	
(ii) Aromatic or unsaturated $\longrightarrow$	1730-1715	(s)
(e) Acid Halide $\longrightarrow$	1800	(s)
(f) Anhydride $\longrightarrow$	1810 1760	Doublet (s)

Type of Vibrartion	Frequency(cm^{-1})	Intensity
[5] CONH_2 Amide :		
(i) $\text{C}=\text{O}$ Stretch Vib $\longrightarrow$	1650	(s)
(ii) Due to NH_2 Group also at $\longrightarrow$	3400	s
[6] C-O		
(i) Alconols, Acids, Anhydrides $\longrightarrow$	1300-1000	m
(ii) Ether $\longrightarrow$ $\xrightarrow{\text{R-O-R}}$	1200-1100	m
(iii) Ester $\longrightarrow$ $\xrightarrow{\text{COOR}}$	1245 1045	Doublet m
[7] O-H		
(i) Free -OH $\xrightarrow{\text{(Alcohola,Phenls)}}$	3650-3600	(s)
(ii) H-bonded $\xrightarrow{\text{(Inter -Molecular)}}$	3500-3200	(m)
(iii) Carboxyls Acid (Broad) $\longrightarrow$	3400-2700	(w)
[8] N-H (Amine)		
(i) Primary amine $\rightarrow \text{NH}_2$ Free $\Longrightarrow$	3500 3400	Doublet (m)
(ii) N-H bending $\longrightarrow$	1650-1550	m
(iii) Secndry amine $\xrightarrow{=\text{NH}}$	3500-3100	m
[9] C-N		
Stretch vib Aromatic $\longrightarrow$	1350-1200	m
Aliphatic $\longrightarrow$	1200-1000	m
$\text{C}=\text{N} \longrightarrow$ Amines of oximes $\longrightarrow$	1690-1640	(w)
$\text{C}\equiv\text{N} \longrightarrow$ Nitriles $\longrightarrow$	2260-2240	(m)
[10] NO_2 Nitrogroup $\longrightarrow$	1550-1350	(s)
$\text{S-H} \rightarrow$ Mercaptans $\longrightarrow$	2550	m
$\text{S}=\text{O} \longrightarrow$ (i) Sulfoxides $\xrightarrow{\text{SO,Cl}}$	1050	(s)
(ii) Sulfones,Sulfony,Chlorides $\xrightarrow{\text{SO,Cl}}$	1375-1300	(s)
(ii) Sulfats,Sulfonmides $\text{Ar-SO}_2\text{NH}_2 \longrightarrow$	1200-1140	(s)
[11]		
$\text{C-F} \longrightarrow$ Floride $\longrightarrow$	1400-1000	(s)
$\text{C-Cl} \longrightarrow$ Chloride $\longrightarrow$	800-600	s
$\text{C-Br} \longrightarrow$ Bromide $\longrightarrow$	617	s
$\text{C-I} \longrightarrow$ Iodide $\longrightarrow$	500	s



N.M.R. CHEMICAL SHIFTS

Type	In δ ppm	Type of Proton	Chemical Shifts in δ p.p.m.
Primary	→	R- $\underline{\text{CH}_3}$	0.9 (1.0)
Secofidary	→	R ₂ - $\underline{\text{CH}_2}$	1.3 (1.5)
Tertiary	→	R ₂ - $\underline{\text{CH}}$	1.5 (1.8)
Vinylic	→	C = C- $\underline{\text{H}}$	4.6 - 5.9
Acetytinic	→	C $\equiv$ C- $\underline{\text{H}}$	2-3
Aromatic	→	Ar- $\underline{\text{H}}$	7-8
Benzylic	→	 -C- $\underline{\text{H}}$ → Ar- C- $\underline{\text{H}}$	2.2-3
Allylic	→	C = C- $\underline{\text{CH}_3}$	1.7
Flourides	→	$\underline{\text{H}}\text{C}-\text{F}$	4-4.5
Chlorides	→	$\underline{\text{H}}\text{C}-\text{Cl}$	3-4
Bromides	→	$\underline{\text{H}}\text{C}-\text{Br}$	2.5-4
Iodides	→	$\underline{\text{H}}\text{C}-\text{I}$	2-4
Alcohols	→	$\underline{\text{H}}\text{C}-\text{OH}$	3.4-4
Ethers	→	$\underline{\text{H}}\text{C}-\text{OR}$	3.3-4
Esters	→	R- $\overset{\text{H}}{\underset{\text{O}}{\text{C}}}-\text{OCH}_3 \rightarrow \text{RCOO} \cdot \underline{\text{CH}_3}$	3.7-4.1
Acids	→	$\underline{\text{H}}\text{C}-\text{COOH}$	2.6-3
Carbonyl compounds	→	$\underline{\text{H}}\text{C}-\text{C}=\text{O}$	2-2.7
Carboxylic	→	R- COOH	10-12
Aldehyde	→	R- $\underline{\text{CH}}\text{O}$	9-10
Hydroxylic	→	R- $\underline{\text{OH}}$	1-5.5 (depend on H-bond)
Phenolic	→	Ar- $\underline{\text{OH}}$	4-12
Enolic	→	C = C- $\underline{\text{OH}}$	15-17
Amino	→	R- $\underline{\text{NH}_2}$	1-5
CYN.	→	$\underline{\text{CH}}-\text{CN}$	2.7