



HAE-003-001607

Seat No. _____

B. Sc. (Sem. VI) (CBCS) Examination

June / July - 2017

C - 602 : Chemistry

(Organic Chemistry & Spectroscopy)

Faculty Code : 003

Subject Code : 001607

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

[Total Marks : 70

- Instructions :**
- (1) This paper contains three questions. All questions are compulsory.
 - (2) Question No. 1. Carries 20 marks.
 - (3) Question No. 2 & 3 carry 25 marks each.

1 Answer the following questions : 20

1. Give evidence for the presence of two $>C=C<$ group in Citral.
2. Write the structure of p-cymene.
3. Complete : Alanine + $HNO_2 \rightarrow$
4. Write the structure of tyrosine.
5. The IUPAC name of _____ is isopropoxy phenyl N-methyl carbamate.
6. Write the structure of cyclonite.
7. Complete : Diphenylmethane + $Br_2 \rightarrow$
8. Complete : Anthracene + excess H_2SO_4 (at $80^\circ C$) \rightarrow
9. Complete : Diphenylmethane + CrO_3 + $CH_3COOH \rightarrow$
10. What is conformational analysis ?
11. Give the number of pmr signals and their multiplicity in Acetone.

12. What information is obtained from the intensity of a signal in NMR spectroscopy ?
13. What does the following signal in NMR spectra indicate: Singlet at δ 11.5 ppm ?
14. What is the ratio of the intensity of split signal in a quartet in NMR spectroscopy ?
15. What is a base peak in Mass spectrometry ?
16. What does the following signal indicate 2H quartet and 3H triplet ?
17. What is coupling constant ?
18. What information is obtained from chemical shift ?
19. ' C^{13} is NMR active while C^{12} is NMR inactive' - Why ?
20. Predict the NMR spectrum for tert-butylchloride.

2 (A) Answer Any Three of the following : **6**

- (a) Give the synthesis and uses of Parathion.
- (b) Give the synthesis of citral from geranic acid.
- (c) Give the synthesis of amino acids by Gabriel Phthalimide synthesis.
- (d) Give any two methods for the synthesis of diphenyl.
- (e) Write a short note on isoelectric point and Zwitter ions.
- (f) Explain with an example isoprene rule.

(B) Answer Any Three of the following : **9**

- (a) Give the synthesis of Terebic acid.
- (b) Give the synthesis of polypeptides by Bergman Method.
- (c) Give the synthesis of Musk ketone and Musk xylene.

- (d) Explain the synthesis of Anthracene by phthalic anhydride and benzene.
- (e) Give energy diagram indicating the energy changes during rotation about C₂-C₃ bond in n-butane.
- (f) Complete the following :
 - i. Citral + Ag₂O →
 - ii. 6HCHO + 4NH₃ →
 - iii. Anthracene + Air (V₂O₅) →

(C) Answer Any Two of the following : 10

- (a) Give the synthesis α-terpineol.
- (b) Write a short note on colour reactions of proteins.
- (c) Explain electrophilic substitution reactions of Naphthalene.
- (d) Explain conformational analysis of cyclohexane.
- (e) Give the synthesis of Thyroxine.

3 (A) Answer Any Three of the following : 6

- (a) Give the number of pmr signals and their multiplicity in acetyl acetone.
- (b) Sketch the NMR spectra of anisole.
- (c) How will you distinguish between methyl formate and acetic acid by NMR spectroscopy ?
- (d) What does a distinct peak at M-15 indicate in mass spectra ?
- (e) Explain cleavage of C-C bond in carbonyl compounds.
- (f) Name the main components of a mass spectrometer.

(B) Answer Any Three of the following : 9

- (a) Why TMS is used as a reference compound ?
- (b) Explain: Aromatic Protons absorb downfield while acetylenic protons absorb upfield.

- (c) Explain the rules of fragmentation in mass spectrometry.
- (d) Write a short note on Mc Lafferty rearrangement.
- (e) Determine structural formula from the following data :

Molecular Formula : $C_9H_{12}O$

NMR : (a) Doublet δ 1.7 (6H)

(b) Septet δ 3.45 (1 H)

(c) Complex δ 7.3 (5H)

- (f) Determine the molecular structure for the following from the data:

Molecular formula : C_8H_6

IR Spectral Data : 3300, 3040, 2100, 1605, 1579, 1500, 750, 700 cm^{-1}

NMR Spectral Data :

(a) Singlet δ 2.3 (1H)

(b) Complex δ 7.4 (5H)

(C) Answer Any Two of the following : 10

- (a) Explain with a neat diagram, NMR instrumentation technique.
- (b) Write a short note on important features of Mass Spectra of alkanes.
- (c) Determine the structural formula from the following data :

Molecular Formula : $C_9H_{10}O_2$

IR : 3030, 2930, 1670, 1598, 1258, 1020, 833 cm^{-1}

NMR :

(a) Singlet δ 2.5 (3H)

(b) Singlet δ 3.9 (3H)

(c) Complex δ 7.5 (4H)

- (d) Determine the structural formula from the following data :

Molecular Formula : C_7H_9N

IR : 3440_(d), 3010, 2945, 2829, 1620, 1600, 1510, 1451, 1270, 810 cm^{-1}

NMR Spectral Data :

- (a) Singlet δ 2.3 (3H)
 - (b) Singlet δ 1.5 (2H)
 - (c) Complex δ 7.2 (4H)
- (e) Determine the molecular structure for the following from the data :


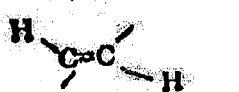
Molecular formula : $C_{11}H_{16}$

IR Spectral Data : 3035, 2980, 2890, 1605, 1580, 1450, 1390, 1365, 834 cm^{-1}

NMR Spectral Data :

- (a) Singlet δ 1.0 (27.5 squares)
- (b) Singlet δ 2.8 (9.2 squares)
- (c) Complex δ 7.4 (12.4 squares)

Spectral Data

Infra - Red Data		
Alkene (stretching)	-C-H	2850-2960(v)
Alkene	=C-H	3100-3200(m)
Alkyene	=C-H	3200-3300(s)
Aromatic	ArC-H	3010-3100(m)
Aromatic ring	C=C	1500-1600(v) (two to three)
Alkene	>C=C<	1610-1680(v)
Alkyene	-C≡C-	2100-2260(s)
Alkene (Bending)	-C-H	1340(w)
	-C(C ₂ H ₃) ₃	1430-1470(m) & 1380-1385(s)
	-C(CH ₂) ₃	1365 (s)
Aldehyde	-C-H	2820-2000(w) & 2650-2760(s)
Aldehyde	C=O	1740-1720(s)
Ketone	C=O	1725-1710(s)
Carboxylic acid	C=O	1725-1705(s)
Ester	C=O	1750-1730(s)
Amide	C=O	1670-1640(s)
Anhydride	C=O	1810-1860(s) & 1740-1790
Alcohols, Ethers, esters		
Carboxylic acids, Anhydride	C-O	1300-1000(s)
Alcohols, phenols :		
Free	O-H	3650-3600(sh)
bonded	O-H	3500-3200(b)
Carboxylic acids free		
Free	O-H	3500-3650(m)
H-bonded	O-H	2500-3200(b)
amines (stretch)	N-H	3300-3500(m)
Bnding	-N-H	1640-1550(m)
Nitrile	-C≡N	2210-2280(s)
Ether	-O-	1070-1150(s)
Alkene bending		-690(s)
disubstituted Cis.		
disubstituted Trans.		960-970(s)
Aromatic substitution :		
Type C-H out of plane bending		
No. of adjacent H atom.		range cm
5		750(s) & 700(s)
4		750
3		780
2		830
1		850

NMR Data : Chemical Shift

Types of proton		Chemical shift in δ ppm
Primary	R-CH ₃	0.9
Secondary	R ₂ -CH ₂	1.3
Tertiary	R ₃ -CH	1.5
Vinylic	C=C-H	4.6-5.9
Acetylinic	C \equiv C-H	2.3
Aromatic	Ar-H	6-8.5
Benzylic	Ar-C-H	2.2-3
Allylic	C=C-CH ₂	1.7
Fluorides	H-C-F	4-4.5
Chlorides	HC-Cl	3.4
Bromides	HC-Br	2.5-4
Iodides	HC-I	2.4
Alcohols	HC-OH	3.4-4
Ethers	HC-OR	3.3-4
Esters	R-COO-CH	3.7-4.1
Acids	HC-COOH	2-2.6
Carbonyl comp.	HC-C=O	2-2.7
Aldehyde	R-CHO	9-10
Hydroxylic	R-OH	1-5.5
Phenolic	Ar-OH	4-12
Carboxylic	R-COOH	10.5-12
Amino	R-NH ₂	1.5