



JB-003-1016007

Seat No. _____

B. Sc. (Sem. VI) (CBCS) (W.E.F. 2016) Examination

August - 2019

Chemistry : C-602

(Organic Chemistry & Spectroscopy)

Faculty Code : 003

Subject Code : 1016007

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

[Total Marks : 70

Instructions : (1) This paper contains five questions. All questions are compulsory.

(2) Figures to the right indicate full marks.

- 1 (a) Answer the following questions : 4
- (1) Prove that α -terpineol contains -OH alcoholic group at the 8th position.
 - (2) Write the structure of p-cymene
 - (3) The IUPAC name of _____ is 2-isopropoxy phenyl N-methyl carbamate
 - (4) Write the structure of RDX.
- (b) Answer any **one** of the following questions : 2
- (1) Give the synthesis of citral from geranic acid.
 - (2) Give the synthesis of PETN.
- (c) Answer any **one** of the following questions : 3
- (1) Write the chemical reaction for oxidation of α -terpineol.
 - (2) Give the synthesis and uses of parathion and musk xylene
- (d) Answer any **one** of the following questions : 5
- (1) Give the synthesis α -terpineol.
 - (2) Explain the constitution of Citral.

- 2 (a) Answer the following questions : 4
- (1) Complete: Alanine + $\text{HNO}_2 \rightarrow$
 - (2) Write the structure of tyrosine.
 - (3) Write the structure of hippuric acid.
 - (4) What are essential amino acids ?
- (b) Answer any **one** of the following questions : 2
- (1) Complete the following :
 - (i) Thyroxin + $\text{H}_2/\text{Pd} \rightarrow$
 - (ii) Thyroxin + $4\text{KOH} \rightarrow$
 - (2) Write a short note on isoelectric point and Zwitter ions
- (c) Answer any **one** of the following questions : 3
- (1) Give the synthesis of glycylalanine by Sneathan Method.
 - (2) Give the synthesis of phenylalanine by Erlenmeyer Azlactone method
- (d) Answer any **one** of the following questions : 5
- (1) Write a short note on colour reactions of proteins.
 - (2) Give the synthesis of Thyroxin.
- 3 (a) Answer the following questions : 4
- (1) Complete : Naphthalene + conc H_2SO_4 (at 80°C) \rightarrow
 - (2) Complete : Diphenylmethane + CrO_3 + $\text{CH}_3\text{COOH} \rightarrow$
 - (3) Mass spectra is a plot of relative abundance against _____ ratio.
 - (4) Draw the chair conformations for mono methyl cyclohexane.

- (b) Answer any one of the following questions : 2
- (1) Write the reaction of diphenyl with a mixture of conc HNO_3 + conc H_2SO_4 .
 - (2) State any two conditions required for Mc Lafferty rearrangement.
- (c) Answer any **one** of the following questions : 3
- (1) Write the chemical reaction for the synthesis of Anthracene from phthalic anhydride and benzene.
 - (2) Write a short note on important features of Mass Spectra of alkanes.
- (d) Answer any **one** of the following questions : 5
- (1) Explain electrophilic substitution reactions of Naphthalene.
 - (2) Explain relative energies and stability of different conformation of cyclohexane.
- 4 (a) Answer the following questions : 4
- (1) What information is obtained from intensity of PMR signal?
 - (2) What is coupling constant?
 - (3) What information is obtained from the value of chemical shift?
 - (4) ' C^{13} is NMR active while C^{12} is NMR inactive'
- Why?

- (b) Answer any **one** of the following questions : 2
- (1) Give the number of PMR signals and their multiplicity in methylacetate.
 - (2) How will you distinguish between methyl formate and acetic acid by NMR spectroscopy?
- (c) Answer any **one** of the following questions : 3
- (1) Why TMS is used as a reference compound?
 - (2) 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 (1H)
(c) Complex δ 7.3 (5H)
- (d) Answer any **one** of the following questions : 5
- (1) Explain with a neat diagram, NMR instrumentation technique.
 - (2) What are shielded protons and deshielded protons? Explain with suitable examples.
- 5 (a) Answer the following questions : 4
- (1) Give the characteristic IR absorption frequencies for $-C \equiv N$ of nitriles and $>C=O$ of anhydrides.
 - (2) What does the following signal in NMR spectra indicate : Singlet at δ 9.5 ppm?
 - (3) Give the number of PMR signals and their multiplicity in Acetylacetone.
 - (4) Predict the NMR spectrum for tert-butylchloride.

(b) Answer any **one** of the following questions : 2

- (1) Give the structural formula of the compound with molecular formula $C_6H_3F_3$ giving NMR signal :
3H triplet at δ 7.8 ppm
- (2) Give the structural formula of the following compounds giving only one NMR signal
(i) C_5H_{12} (ii) $C_8H_{18}O$

(c) Answer any **one** of the following questions : 3

- (1) Determine the molecular structure for the following from the given 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)
- (2) 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)

(d) Answer any **one** of the following questions :

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(1) Determine the molecular structure for the following from the given 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)

(2) Determine the molecular structure for the following from the data: Molecular formula : $C_8H_8O_2$

IR Spectral Data : 3400, 2950, 2880, 1605, 1715, 1450, 1304, 1065, 810 cm^{-1}

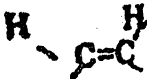
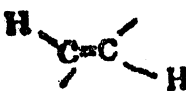
NMR Spectral Data :

(a) Singlet τ 7.7 (3H)

(b) Singlet τ -1.5 (1H)

(c) Complex τ 2.6 (4H)

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 ₅) ₃	1430-1470(m) & 1380-1385(s)
	-C(CH ₃) ₃	1365 (s)
Aldehyde	-C-H	2820-2000(w)&2850 2760(s)
Aldehyde	C=O	1740-1720(s)
Ketone	C=O	1725-1710(s)
Carboxylic acid	C=O	1725-1700(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	3330-3500(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≡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