



Seat No. _____

Third Year B. Sc. (Sem. V) (CBCS) Examination

March - 2022

Chemistry : C - 502

(Organic Chemistry & Spectroscopy)

(Old Course)

Faculty Code : 003

Subject Code : 001506

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

[Total Marks : 70

Instructions : (1) All three questions are compulsory.

(2) All questions of Que. 1 carry 1 mark each.

(3) Que. No. 2 and 3 carry 25 marks each.

(4) The figures on right side indicate the marks of the questions.

1 Answer the following questions :

20

(1) Complete the reaction : Coniine $\xrightarrow[\text{distillation}]{\text{HI, 300}^\circ\text{C}}$?

(2) Define polysaccharides.

(3) Write name and formula of reagents used in Hofmann rearrangement.

(4) Write method of preparation of Sodamide.

(5) Complete the reaction : $\text{LiH} + \text{AlCl}_3 \longrightarrow ?$

(6) Write the structure of veratric acid.

(7) Define epimer.

(8) Saccharine is _____ times more sweet than sugar.

- (9) Name the hetero atoms present in thiazole.
- (10) Pyrimidine is _____ membered ring system.
- (11) Point group of H₂O is _____.
- (12) What is the range of far IR region ?
- (13) CH₄ possesses _____ point group of symmetry.
- (14) What is the range of visible region in electromagnetic region ?
- (15) Define : Identity (E).
- (16) Bathochromic shift is also known as _____ shift.
- (17) Write range of finger print region in IR spectroscopy.
- (18) Define transmittance.
- (19) Define inversion center 'i' in symmetry.
- (20) Which material is used for prism in IR spectroscopy ?

2 (a) Answer any **three** of the following : **6**

- (1) Write one application of Bischler Napierksky reaction.
- (2) Write use of chrysoidin G dye.
- (3) Write and explain reaction of fructose with HCN.
- (4) Write note on Zeisel's method to determine -OCH₃ group.
- (5) Write synthesis of Dioxane.
- (6) Write any one method of preparation of imidazole.

(b) Answer any **three** of following : **9**

- (1) Write only mechanism of Fries rearrangement.
- (2) Explain step up reaction.
- (3) Write synthesis of Papaverine.
- (4) Write synthesis of Dulcin.
- (5) Write method of preparation of oxazin (morpholine).
- (6) Write note on mutarotation.

(c) Answer any **two** briefly of the following : **10**

- (1) Explain Arndt Eistert reaction with mechanism.
- (2) Prove : Nicotine is α -pyridile- β -pyrrolidine alkaloid.
- (3) Prove : Glucose possesses pyranose ring structure.
- (4) Write synthesis of Ibuprofen and p-anisyl urea.
- (5) Write synthesis of Pyrazole and Pyridazine.

3 (a) Answer any **three** of following : **6**

- (1) Calculate theoretical number of vibrational degree of freedom in Acetylene (C_2H_2) and Water (H_2O).
- (2) Explain chromophere in UV spectra.
- (3) For NH_3 molecule prove $C_3 \times \sigma Va \neq \sigma Va \times C_3$.
- (4) Explain Fermi resonance.
- (5) Explain β -carotene is coloured.
- (6) Give names of symmetry elements.

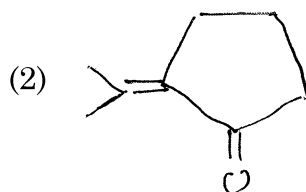
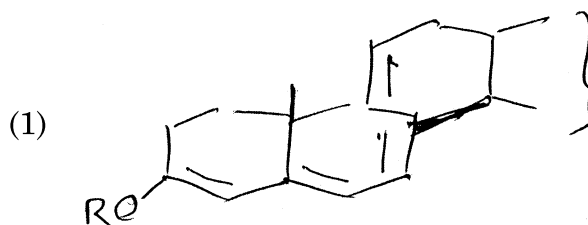
(b) Answer any **three** of following : **9**

- (1) Distinguish ethanol and acetone by IR spectra.
- (2) Explain $\pi \rightarrow \pi^*$ electronic transition in UV.
- (3) Construct multiplication table of C_{2h} point group.
- (4) Write note on overtone and vibration coupling.
- (5) Explain factors affecting UV absorption band in carbonyl compound.
- (6) Give difference between C_n and S_n .

(c) Answer any **two** briefly of the following :

10

- (1) Explain factors affecting IR spectroscopy.
- (2) What is point group ? Construct multiplication table for C_3V point group.
- (3) Write point group of following molecules :
 - (1) BF_3
 - (2) $CHCl_3$
 - (3) o-dichloro benzene
 - (4) m-dichloro benzene
 - (5) p-dichloro benzene
- (4) Calculate λ_{max} of following structure :



- (5) Assign the structure of compound having following characteristics :

M.F. C_8H_7N

I.R. :

3030(m), 2910(m), 2230(s), 1605(s), 1560(m),
1450(s), 830(s) cm^{-1} .

Spectral Data

U.V. :

Empirical rules for Dienes :

	(A) Homoannular $\lambda = 253 \text{ nm}$	(B) Heteroannular $\lambda = 215 \text{ nm}$
Increments for double bond extending conjugation	30 nm	30 nm
Exocyclic double bond	5	5
Alkyl substitution or ring residue.	5	5
Homocyclic Diene Components	39	39
Polar Groups :		
- OCOCH ₃	0	0
- OR	6	6
- Cl, - Br	5	5
- NR ₂	60	60

(C) Simple Diene :

Parent $\lambda = 217 \text{ nm}$

Polar Groups :

Alkyl subst for ring

Residue	5 nm
-Cl, - Br	17
-OH	5
-OR	5
-NR ₂	60
-SR	30

(D) Empirical Rules for Enones and

Dienones :

(a) $Z = C$

- (1) 6 membered ring or acyclic
- (2) 5 membered ring

λ
215
202

(b) Z = H	207
(c) Z = OH or OR	193
(d) Acyclic dienone	245
Increment for :	
Double bond extending conjugation	30
Alkyl group of ring residue	α 10
	β 12
γ or higher	18
Exocyclic double bond position	5
Homocyclic diene component	39

Polar Groups	α	β	γ	δ' other
-Cl	15	12	—	—
-OH	35	30	50	50
-OR	35	30	17	31
-NR ₂	—	93	—	—
-O	—	75	—	—
-NHCOR	—	95	—	—
-OCOCH ₂	6	6	—	6
-SR	—	85	—	—
-Br	25	30	—	—
-NO ₂	—	95	—	—

(c) Empirical Rules for Benzoyl Derivative :

Parent Chromophor : mm

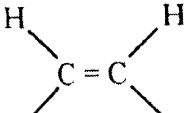
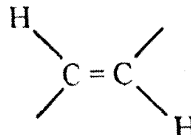
Z = alkyl or ring residue 246

Z = H 250

Z = -OH or -OR 230

Increment for each substituent : Q M R

Alkyl or ring residue	3	3	10
-OH; -OCH ₃ , -OR	7	7	25
-O	11	20	78
-Cl	0	0	0
-Br	2	2	15
-NH ₂	13	13	58
-NHCOCH ₂	20	20	45
-NHCH ₃	-	-	73
-N(CH ₂) ₃	20	20	85
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)	
Alkene (Bending)	-C-H	(two to three)	
Alkene	>C=C<	1610-1680(v)	
Alkyene	-C=C ²	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 (8)	
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	3330-3500(m)
Bonding	-N-H	1640-1550(m)
Nitrile	-C≡N	2210-2280(s)
Ether	-O-	1070-1150(s)
Alkene bending disubstituted Cis.		-690 (s)
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	