

B.Sc. Semester - 6 (CBCS) Examination
May/June-2021 (NEW COURSE)
Organic Chemistry and Spectroscopy (Core)

Time: 1:30 Hours**Marks: 42****Instructions:**

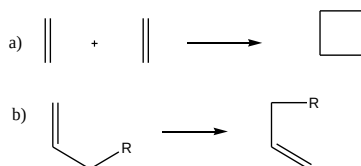
1. Figures to the right indicate marks.
2. There are five questions in the question paper.
3. Answer any three of the following questions.

Q. 1 (A) Answer the following question. (04)

- (1) How many vibrations are possible for CO₂ molecule? Draw each and justify number of vibrations observed practically based on IR selection rule.

Q.1 (B) Answer the following questions. (Any two) (10)

- (1) Explain relative basicity of pyridine, pyrrole and aliphatic amines.
- (2) Answer the following.
 - I. Sketch π -Molecular orbitals of butadiene. Define nodes and symmetry of all the orbitals and identify HOMO and LUMO orbitals in ground and excited states.
 - II. Identify and give full name with induction only of the type of pericyclic reaction/rearrangement based on σ -bonds.



- (3) Write application of IR in chemical analysis, chemical reactions, H-bonding, tautomerism, and stereochemistry In General.

Q. 2 (A) Answer the following question. (04)

- (1) Write only reaction of Haworth reaction for preparation of Naphthalene.

Q. 2 (B) Answer the following questions. (Any two) (10)

- (1) Give Synthesis of (I) PETN from Acetaldehyde (II) Musk xylene from m-xylene
- (2) Explain constitution of Citral in detail.
- (3) Deduce constitution of a Nitrogen containing organic compound having Mol.Wt 87 gm/mole from the spectral data given.

UV: No absorption above 220

IR: 3400(s), 3325(s), 2955-2870(m), 1625(s), 1005, 815 cm⁻¹

NMR: 1) singlet $\delta=0.87$ (9H), 2) Singlet $\delta=1.0$ (2H), 3) Singlet $\delta=2.38$ (2H)

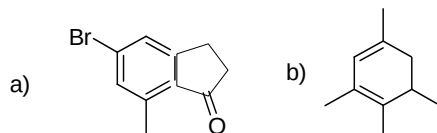
Q. 3 (A) Answer the following question. (04)

- (1) Give synthesis and use of carbendazim.

Q. 3 (B) Answer the following questions. (Any two)

(10)

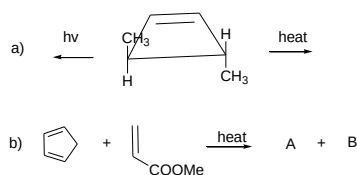
- (1) Write reactions only for the methylation method for the determination of pyranose ring of glucose.
- (2) a) Write reaction steps of Kiliani synthesis of D-Glucose from D-Arabinose.
b) Write reduction reaction of Fructose and name the obtained products.
- (3) Calculate $\lambda_{\max}$ for the following system.



Q. 4 (A) Answer the following question.

(04)

- (1) Draw constitution of the products for the following reactions and write name and stereochemical feature if any.



Q. 4 (B) Answer the following questions. (Any two)

(10)

- (1) Write any five methods for preparation of pyrrole.
- (2) Write any five chemical properties (reaction) of anthracene.
- (3) Write reactions for the Osazone formation from Glucose and Fructose.

Q. 5 (A) Answer the following question.

(04)

- (1) Deduce constitution of the compound with Mol. Formula $C_9H_{12}O_2$:

IR: 3335, 2960, 1615, 1498, 1455, 1057, 1026, 743, 697 cm^{-1}

NMR: a) Quintet $\delta=1.88$ (2H), b) Triplet $\delta=2.56$ (2H), c) Triplet $\delta=2.75$ (2H), d) Singlet $\delta=3.35$ (1H), e) Singlet $\delta=7.15$ (5H)

Q. 5 (B) Answer the following questions. (Any two)

(10)

- (1) a) Explain Chromophore and auxochrome giving example of Nitroaniline.
b) Give difference between Bathochromic and Hypsochromic shifts.
- (2) Give synthesis of Terpenylic acid from ethyl acetoacetate.
- (3) Explain factors affecting band position of Carbonyl group in IR.

SPECTRAL DATA

U.V.

Empirical rules for Dienes:

	(A) homoannular $\lambda = 253$ nm	(B) heteroannular $\lambda = 253$ nm
Exocyclic double bond	5	5
Alkyl substitution or ring residue	5	5
Polar Groups:		
-Cl, -Br	5	5

(C) Simple Diene:

Parent $\lambda = 217$ nm

Polar Groups	
Alkyl substitution or ring residue	5
-Cl, Br	17
-OR	5

(D) Empirical rules for Enone and Dienones:

(a) $Z=C$

(1) 6 membered ring or acyclic	215
(2) 5 membered ring	202

(e) Empirical rules for Benzoyl derivatives:

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
Br	15		

Infra Red Data

Alkane (stretching)	-C-H	2960-2850
Alkene	=C-H	3200-3100
Aromatic	Ar-C-H	3100-3010
Aromatic Ring	C=C	1600-1500
Alkane (bending)	-C-H	1380-1385
Aldehyde	>C=O	1740-1720
Ketone	>C=O	1725-1710

Alcohols, ethers, esters, carboxylic acids, anhydride	C-O	1300-1000
Alcohols, Phenols:		
Free	-OH	3650-3600
H-bonded	-OH	3500-3200
Carboxylic acid		
Free	-OH	3500-3650
H-bonded	-OH	2500-3200
Amines		
stretching	-N-H	3330-3500
bending	-N-H	1640-1550
Nitrile	-C≡N	2280-2210
Ether	-O-	1150-1070
Alkene bending		
disubstituted cis		690
disubstituted trans		960-970
Aromatic substitution: C-H out of plane bending		2000-1650

NMR		
Type	Type of proton	Chemical shifts (approximate) in δ ppm
Primary	R-CH ₃	0.9-1.0
Secondary	R ₂ -CH ₂	1.3-1.5
Tertiary	R ₃ -CH	1.5-1.8
Vinylic	C=C-H	4.6-5.9
Alcohols	HC-OH	3.4-4.0
Ethers	HC-OR	3.3-4.0
Esters	R-COO-CH ₃	3.7-4.1
Acids	HC-COOH	2.6-3.0
Carbonyl Compounds	HC-C=O	2.0-2.7
Carboxylic acid	R-COOH	10.0-12.0
Aldehyde	R-CHO	9.0-10.0
Hydroxylic	R-OH	1.0-5.5
Phenolic	Ar-OH	4.0-12.0
Enolic	C=C-OH	15.0-17.0
Amino	R-NH ₂	1.0-5.0
Cyano	HC-CN	2.6-2.8
