Total No. of Questions: 4 *Total No. of Pages: 04*

SECOND YEAR (B.Sc. Blended)
CHM401: Chemistry: Structure & Properties
(Semester IV)

Program: B.Sc. Blended
Program Specific: B.Sc. Blended (Chemistry)
Course Type: DSC
Paper: I

Credits: 2
Time: 2 Hours
Max. Marks: 30
SET: A

Instructions to the candidate:

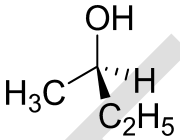
1) *All questions are compulsory.*
2) *Figures to the right indicate full marks.*
3) *Draw a well labelled diagram wherever necessary.*

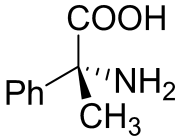
Q1) Answer the following. **[5 X 1= 5]**

a) Define enantiomers.
b) Give one example of a polar molecule.
c) Name the reaction whose intermediate is detected by EPR.
d) Define chromophore.
e) What is the selection rule for Raman Spectroscopy?

Q2) Answer any FIVE of the following. **[5 X 2 =10]**

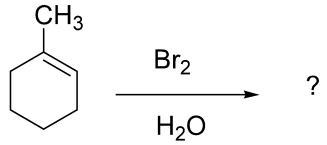
a) What is the point group of a 1,2-dichlorobenzene molecule?
b) Identify R/S configuration of:

i) 

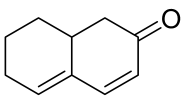
ii) 

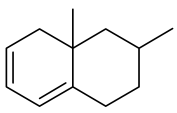
c) Calculate degrees of freedom of water and carbon dioxide molecules.
d) Differentiate between fluorescence and phosphorescence.
e) Discuss Markovnikov's rule. Give a suitable example.
f) Predict the products in the following reactions:

i) 

ii) 

g) Calculate λ_{max} of the following compounds:

i) 

ii) 

Q3) Answer any TWO of the following. **[2 X 5 = 10]**

a) Write a short note on Geometric isomers.
b) Calculate the moment of inertia of the diatomic molecule having rotational constant $10cm^{-1}$.
c) Hückel's rule of aromaticity.
d) Calculate the energy in erg per mole of a wavenumber 120 cm^{-1}.
Given: Plank's constant (h) = 6.626×10^{-27} erg.s ; Avogadro number (N) = 6.022×10^{23},
Velocity of light (c) = 2.998×10^{10} cm s^{-1}.

Q4) Answer any ONE of the following. **[5 X 1 = 5]**

a) Determine the position of hot band, fundamental band, first overtone and second overtone where the equilibrium frequency is 2990 cm^{-1} and anharmonicity constant is 0.017.
b) Draw schematic rotational vibrational spectrum of a diatomic molecule.

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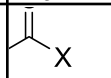
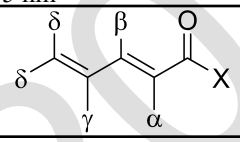
Annexure

Data sheet for UV, IR & NMR Spectroscopy

Dienes	Homoannular cisoid	Heteroannular transoid
Base values	λ = 215nm	λ = 214 nm λ =217 nm (acyclic)
Double bond extending conjugation	+ 30 nm	+ 30 nm
Alkyl substituent	+ 5 nm	+5 nm
Exocyclic double bond	+ 5 nm	+5 nm
Conjugated Carbonyl compounds	 OR 	
Base Values:		
Six mem. ring or acyclic enone	λ = 215 nm	
X = H	λ = 208 nm	
X = OH, OR	λ = 193 nm	
Double bond extending conjugation	+ 30 nm	
Exocyclic double bond	+ 5 nm	
Alkyl substituent	α = 10nm, β = 12 nm, γ or higher = 18 nm	

IR: Functional group absorption ranges:

1) C – Cstr: 1300 -1110 cm^{-1}

2) C = Cstr: 1690-1630 cm^{-1}

3) C = O str: 1715 cm^{-1}

4) O – Hstr: 3650 – 3300 cm^{-1}

5) C – H str: 2950-2800 cm^{-1}

6) =C – H str: 3100 – 3010 cm^{-1}

Point group identification