Total No. of Questions : 6]

SEAT No. :

PC4110

[Total No. of Pages : 4

[6336]-1001
First Year M.Sc.
(Physical Chemistry/Inorganic Chemistry/Analytical Chemistry/ Organic Chemistry/Drug Chemistry)
CHE-501 : PHYSICAL CHEMISTRY-I
(2023 Credit Pattern) (Semester-I)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Figures to the right side indicate full marks.***
5) ***Use of logarithmic table, calculator is allowed.***
6) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ kcal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	96487 C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) a) Answer the following (Any four) **[8]**

i) What is Laplacian operator? Give its significance.

ii) Define reversible and Irreversible process.

iii) What is zero point energy? Give its equation for simple harmonic oscillator.

iv) Explain clausius inequality.

v) What are the physical significance of Helmholtz free energy.

b) Calculate the wavelength of the light emitted when an electron in a one dimensional box of length 5 nm makes a transition from n = 7 state to n = 6 state. **[3]**

Q2) a) Attempt any three of the following. **[9]**

i) What are the conditions of well behaved wave function? Which of the following function is well behaved.

1) $\psi(x) = x$

2) $\psi(x) = e^{-ax}$

ii) What is expectation value of linear momentum $\langle Px \rangle$ for a particle in 1D box for n=1?

iii) Which of the following gives functions as Eigen functions for the operator $\frac{d^2}{dx^2}$?

$f(x) = \frac{1}{x}$ and log x.

iv) What are the drawbacks of classical mechanics?

b) If $\hat{A}$ and $\hat{B}$ are two operators such that $[\hat{A}, \hat{B}]=1$, show that $[\hat{A}, \hat{B}^2]=2\ \hat{B}$. **[3]**

Q3) a) Attempt any two of the following. **[8]**

i) Show that,

1) $\left(\frac{dP}{dS}\right)_V = -\left(\frac{dT}{dV}\right)_S$

2) $\left(\frac{dV}{dT}\right)_P = -\left(\frac{dS}{dP}\right)_T$

ii) Show that, $S\,dT - V\,dp + \Sigma\, n_i d\,\mu_i = 0$

iii) Give the equation of Gibb's free energy. Describe the variation of Gibb's free energy with respect to change in pressure.

b) Attempt any two of the following. **[4]**

i) For the reaction at 298k, $2A + B \rightarrow C$

$\Delta H = 400\ J\ mol^{-1}, \quad \Delta S = 0.2\ JK^{-1}\ mol^{-1}$

Determine the temperature at which the reaction would be spontaneous.

ii) Six moles of an ideal gas expand isothermally and reversibly from a volume of 1 dm^3 to a volume of 10dm^3 at 27ºC. What is the maximum work done?

iii) Find the entropy of mixing per mole when 3 moles of N_2 and 2 moles of O_2 mixed assuming ideal behavior.

SECTION - II

Q4) a) Solve any 4 among the following: **[8]**

i) Plot $\frac{1}{[A]_t}$ vs time for the second order reaction.

ii) What is stirling approximation? Find 75!

iii) Draw Lineweaver Burk plot.

iv) What is diffussion controlled reaction?

v) What is grand cannonical ensemble?

b) For a chain reaction $A \xrightarrow{k_1=5.0_s^{-1}} B \xrightarrow{k_1=0.3_s^{-1}} C$ find the time required for B to reach to its maximum concentration. **[3]**

Q5) a) Answer any three of the following : **[9]**

i) What is non competitive enzyme inhibition?

ii) Derive an expression for the formation of methane from the following reaction sequence.

$$CH_3CHO \xrightarrow{k_1} \dot{C}H_3 + CHO\dot{}$$

$$CHO\dot{} \xrightarrow{k_2} CO + \dot{H}$$

$$\dot{H} + CH_3CHO \xrightarrow{k_3} CH_3C\dot{O} + H_2$$

$$\dot{C}H_3 + CH_3CHO \xrightarrow{k_4} CH_4 + CH_3C\dot{O}$$

$$CH_3C\dot{O} \xrightarrow{k_5} \dot{C}H_3 + CO$$

$$\dot{C}H_3 + \dot{C}H_3 \xrightarrow{k_6} C_2H_6$$

iii) Discuss the following conditions in explosion reactions

$k_{term} = k_{branch}$, $k_{term} > k_{branch}$, $k_{term} < k_{branch}$

iv) Discuss the kinetics of parallel reactions

b) Calculate the rotational partition function of OH radical at 27ºC. If the bond distance is 0.971 Aº **[3]**

Q6) a) Solve any two of the following. **[8]**

i) Derive an expression for the translational partition function.

ii) From the expression of partition function, derive an expression to determine E and H.

iii) With the help of Collision theory, derive an expression for Z_{AB}.

b) Solve any two. **[4]**

i) Calculate the value of exponential factor for a first order reaction if its half life is 10min at 25ºC (Given E_0=98.6 kJ/mol)

ii) Calculate the fractional population of the first excited state if ΔE=500J/mol and temperature is 50ºC.

iii) Find W for 20 molecules distributed among the energy levels of E_1, E_2, E_3 & E_4 as 9, 6, 3 & 2 respectively.

Total No. of Questions : 6]

SEAT No. : ____

PC4111

[Total No. of Pages : 3

[6336]-1002

M.Sc.- I(Physical/Inorganic/Analytical Chemistry)

CHEMISTRY

CHE-502 : Inorganic Chemistry - I

(2023 Credit Pattern) (Semester - I) (4 Credits)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answers to the two sections shall be written separetely in two answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of calculator and character tables is allowed.***

SECTION - I

Q1) a) Attempt the following. **[8]**

i) Define and explain plane of symmetry.

ii) Define an abelian point group.

iii) Sketch and explain any two symmetry operations of SO_3 molecule.

iv) Prove that $i \times i = E$ using matrices.

b) Identify the point groups of the following. **[3]**

i) $SOCl_2$

ii) H_2S

Q2) a) Attempt any one of the following. **[6]**

i) Using matrix multiplication table find the product of the following.

1) $C_2^y \times \sigma^{xy}$

2) $i \times \sigma^{xz}$

ii) Assign the point groups to the following molecules and justify your answer.

1) $VOCl_3$

2) trans - ClCHCHCl

P.T.O.

b) Attempt any two of the following. **[6]**

i) State and explain symmetry operations of H_2S molecule.

ii) Using orthogonality theorem derive the character table for C_2h point-group.

iii) Construct the multiplication table for NH_3 molecule.

Q3) Attempt any two of the following. **[12]**

a) Enlist and explain all symmetry elements of $XeOF_4$ molecule.

b) Find out the raducible representations considering σ - bond as a basis of representation for BH_3 molecule and find which orbitals are offered for σ - bonding. (Given : Character table for D_3h).

c) Find out the resultant SALC of Big irreducible representation which operates on σ_1 orbital of $AuCl_4^{-1}$ - ion.

D_4h	E	$2C_4$	C_2	$2C_2'$	$2C_2''$	i	$2S_4$	σh	$2\sigma v$	$2\sigma d$
Big	1	–1	1	1	–1	1	–1	1	1	–1

Character table for D_3h:

D_3h	E	$2C_3$	$3C_2$	σh	$2S_3$	$3\sigma v$
A_1'	1	1	1	1	1	1
A_2'	1	1	–1	1	1	–1
E'	2	–1	0	2	–1	0
A_1''	1	1	1	–1	–1	–1
A_2''	1	1	–1	–1	–1	1
E''	2	–1	0	–2	1	0

SECTION - II

Q4) a) Answer the following. **[8]**

i) What are electron rich hydrides? Explain with examples.

ii) Borazine is called inorganic benzene, explain with structure.

iii) Solutions of alkali metals in ammonia act as good reducing agents, explain.

iv) Give any two applications of p-N compounds.

b) Explain the use of zeolites as molecular sieves. **[3]**

Q5) a) Answer any one of the following. **[6]**

i) Give an account of carbon nano tubes.

ii) Explain the structure and bonding in:

1) Diamond

2) BrF_5

b) Answer any two of the following. **[6]**

i) Give an account of saline hydrides.

ii) Write a note on xenon-oxygen compounds.

iii) Give synthesis, reactions and properties of organomagnesium compounds.

Q6) a) Answer any one of the following. **[6]**

i) Give an account of oxyacids and oxoanions of phosphorous.

ii) Draw the structures of following:

1) $(Si_2O_7)^{6-}$

2) B_2H_6

3) S_2N_2

4) Dibenzo-14-crown-4

5) N_2O_5

6) XeF_2

b) Answer any two of the following. **[6]**

i) Give the synthesis and chemical reactions of dihydrogen.

ii) Write a note on nitrogen activation.

iii) Give an account of Pseudohalogen compounds.

Total No. of Questions : 3]

SEAT No. : ____

PC4112

[Total No. of Pages : 2

[6336]-1003

M.Sc.- I (Organic/Drug Chemistry)

CHEMISTRY

CHEOD-502 MJ : Inorganic Chemistry - I

(2023 Credit Pattern) (Semester - I)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of calculators and character table is allowed.***

Q1) a) Attempt the following. **[8]**

i) Define order of group and order of class.

ii) Find out the point group when symmetry elements are : E, C_2, σ_n, *i*.

iii) What are commutative and non-commutative operations?

iv) Define centre of inversion & find the centre of inversion of CO_2 molecule.

b) Find out the associative symmetry operations of S_3. **[3]**

Q2) a) Attempt any one of the following. **[6]**

i) Prepare a group multiplication table for C_3V point group considering the conditions. Find whether it is an abelian or non-abelian group.

ii) Define plane of symmetry. Explain the various types of planes of symmetry in benzene molecule.

b) Attempt any two of the following. **[6]**

i) Explain the proper axis of rotation present in CO and SO_3 molecules.

ii) Identify whether centre of inversion is present or absent in : CCl_4 and $POCl_3$.

iii) Find the product of symmetry operations

1) $C_2^x . C_2^y$

2) $C_2^z . \sigma_n^{xy}$

P.T.O.

Q3) Answer the following (Any two) **[12]**

a) Explain the symmetry operations of PCl_5 molecule. Prepare a list of symmetry elements and classify it into appropriate point group.

b) Using orthogonality theorem derive the character table for C_2h point group and assign the Mulliken symbols to the irreducible representations.

c) Find out normal modes of vibrations in following using their structures and appropriate formulae : CO_2, BCl_3, PBr_5.

Total No. of Questions : 8]

SEAT No. :

PC4113

[Total No. of Pages : 6

[6336]-1004

M.Sc. - I (Organic Chemistry and Drug Chemistry)

ORGANIC CHEMISTRY-I

CHE-503 MJ : Organic Reaction Mechanism, Stereochemistry and Reagents

(2023 Credit Pattern) (Semester-I) (Credits-4)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answer to the two sections should be written in separate answer book.***

SECTION-I

Q1) Attempt the following: **[5]**

a) Define cryptates.

b) Define aromatic compound with suitable example.

c) Define carbenes.

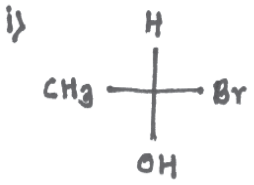
d) Define stereoselective reaction with suitable example.

e) Comment on optical activity of cis-decalin.

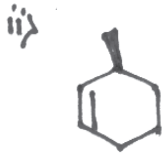
Q2) a) Attempt any two of the following. **[6]**

i) Assign R/S configuration to the following compounds.

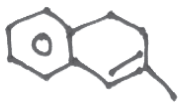
i)

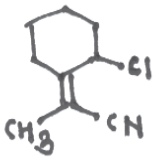


ii)



ii) Assign E/Z configuration to the following compounds.

i) 

ii) 

iii) What are carbon free radicals? Give any two methods for the generation of carbon free radicals.

b) Write notes on any two of the following. **[4]**

i) Inclusion compounds.

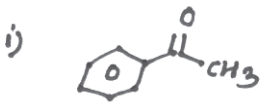
ii) Quasi aromatic compounds.

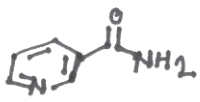
iii) Structure and methods of generation of ketenes.

Q3) Attempt any five of the following. **[10]**

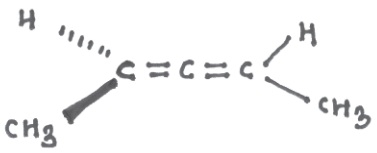
a) Comment on stability of the following.

b) Assign Re/Si face labels to the following.

i) 

ii) 

c) Comment on optical activity of the following with justification.

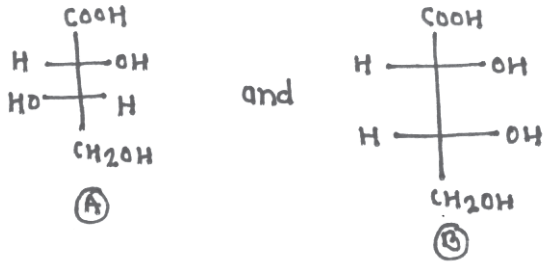


d) Write the mechanism of reaction involving nitrene intermediate.

e) Explain optical activity of spiranes with suitable examples.

f) Write a note on EDA complexes.

g) Give the stereochemical relationship between (A) and (B).



Q4) a) Attempt any two of the following. **[6]**

i) Label the stereocentres and calculate number of stereoisomers.

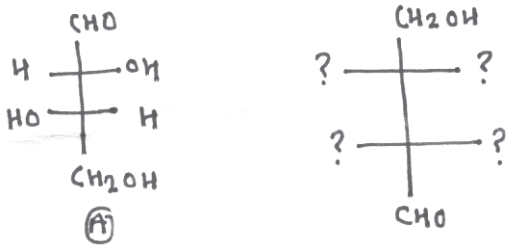
ii) Explain annulenes with suitable examples.

iii) Assign Pro-R and Pro-S labels to H_A and H_B.

b) Attempt any one of the following. **[4]**

i) Explain stereochemical aspects of syn and anti addition reactions.

ii) Write equivalent structure of compound A. assign R/s configuration to chiral centres.



SECTION-II

Q5) Attempt the following: **[5]**

a) What is PDC? Draw its structure.

b) Draw the structure of benzyne intermediates.

c) What is classical carbocation?

d) Electrophilic substitution reaction of pyridine occurs at C_3 position expalin.

e) Give an application of Wolff-Kishner reduction.

Q6) a) Attempt any two of the following. **[6]**

i) Give two applications of CAN with suitable examples.

ii) Explain S_N2 reaction with stereochemical aspects.

iii) Explain cine and tele substitution with suitable examples.

b) Write notes on any two of the following. **[4]**

i) Rosen mund reduction.

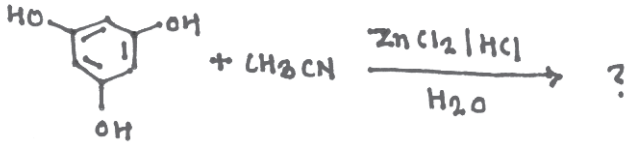
ii) Participation of σ-bond in NGP

iii) Chichibabin reaction.

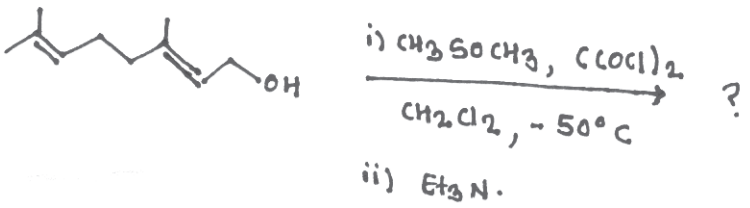
Q7) Attempt any five of the following. **[10]**

a)

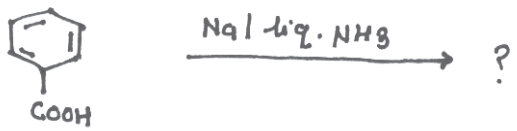
b)


HO
OH
OH
+ CH3CN
ZnCl2 | HCl
H2O
?

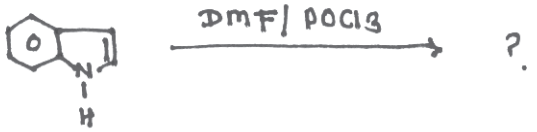
c)


OH
i) CH3SOCH3, (COCl)2
CH2Cl2, -50°C
ii) Et3N.
?

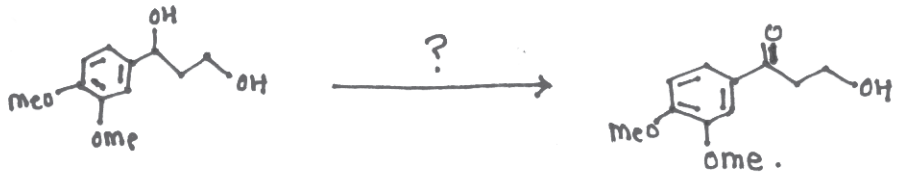
d)


COOH
Na | liq. NH3
?

e)


O
N
H
DMF | POCl3
?

f)


OH
meo
OH
ome
?
O
meo
OH
ome.

g)


O2N
O
CHO
NaBH4
?

Q8) a) Attempt any two of the following. **[6]**

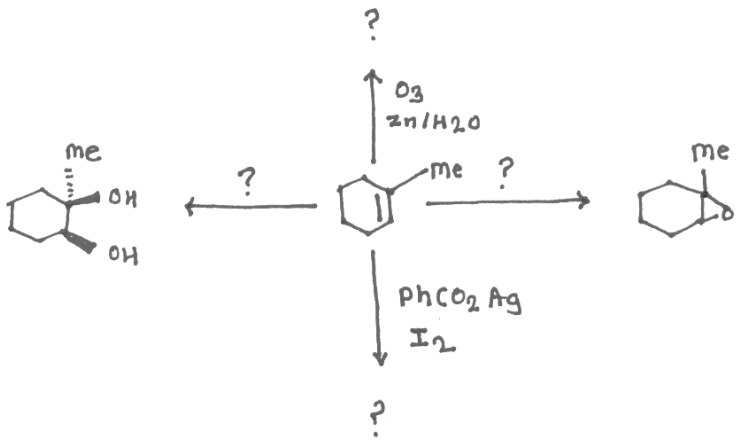
i) Explain participation of 'N' and 'S' atom in NGP.

ii) Explain Reimer -Tiemann raction with examples.

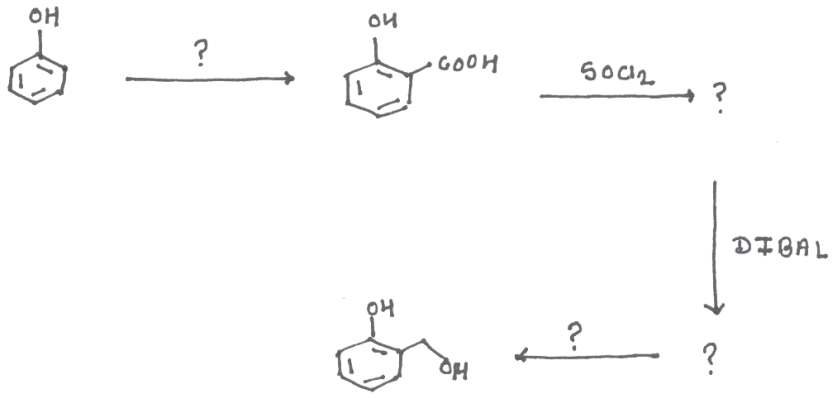
iii) Give application of peracid and HIO_4 in organic synthesis.

b) Attempt any one of the following. **[4]**

i) Suggest the reagents products for following conversion.



ii) Suggest the reagents/produsts for following conversion.



Total No. of Questions : 4]

SEAT No. :

PC4114

[Total No. of Pages : 4

[6336]-1005

M.Sc. - I (Physical Chemistry/Inorganic Chemistry/Analytical Chemistry)

ORGANIC CHEMISTRY-I

CHEPIA-503 MJ : (Aromaticity, Stereochemistry and Reagents)

(2023 Credit Pattern) (Semester-I)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) Attempt the following: **[5]**

a) Which of the following compound is aromatic?

b) Define enantiomer.

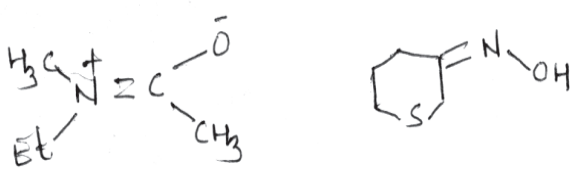
c) What is pro-chirality?

d) Write the formula Wilkinson's catalyst.

e) How will you convert alkynes into trans-alkene?

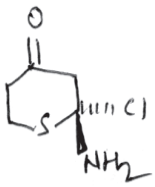
Q2) a) Attempt any two of the following. **[6]**

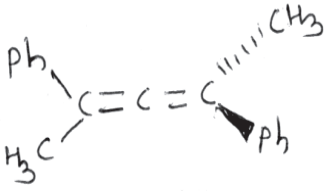
i) Assign E/z configuration to the following compounds.



P.T.O.

ii) Assign R/s configuration to the following compounds.

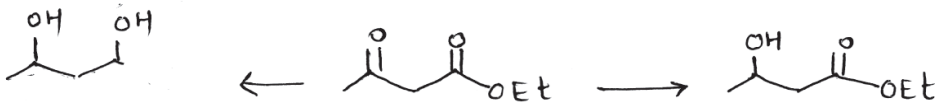




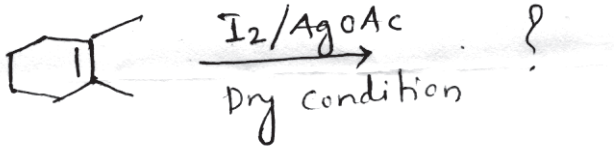
iii) Comment on aromaticity of [16]-Annulene.

b) Attempt any two of the following. **[4]**

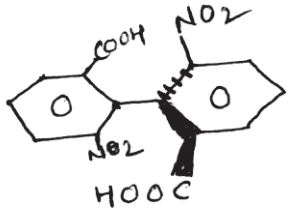
i) Suggest the reagents for following transformation.



ii) Predict the product/s of the following reaction.



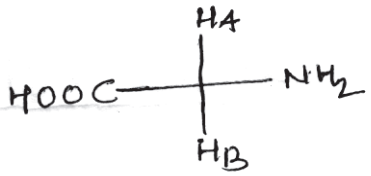
iii) Comment the optical activity of the following compound.



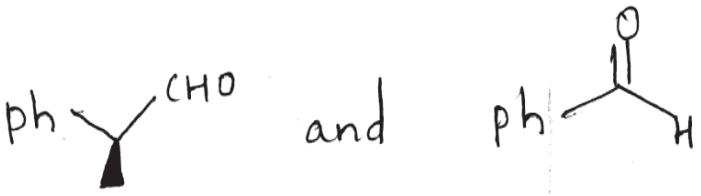
Q3) Attempt any five of the following. **[10]**

a) Comment on stability of cyclo-butadiene.

b) Assign Pro-R and Pro-S tables to the H_A & H_B

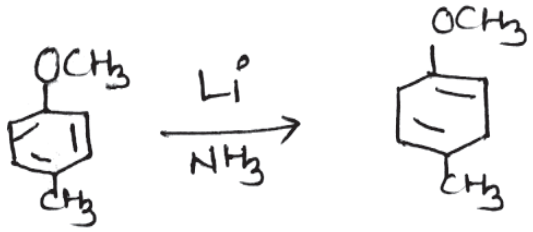


c) Assign Re/Si lables to the following.



d) Explain stereochemical aspect involved in E_2 reaction.

e) Write the mechanism for the following reaction.



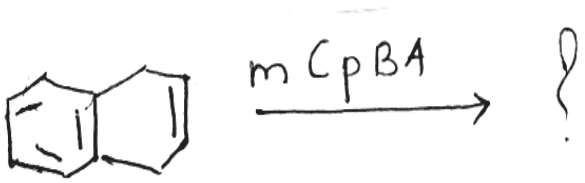
f) Write any one application of $NaBH_4/CeCl_3$.

g) Why pentalene and heptalene are unstable compounds?

Q4) a) Attempt any two of the following. **[6]**

i) Write note on helical compounds.

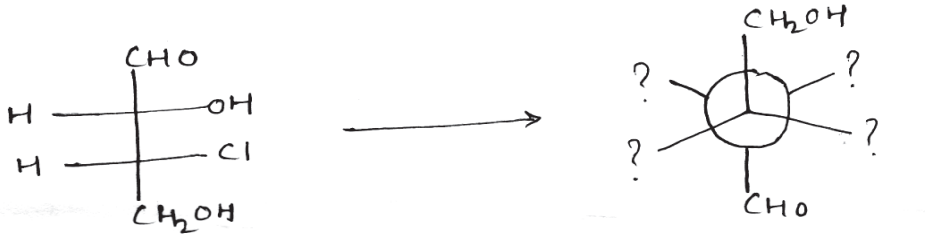
ii) Predict the product and write the suitable mechanism.



iii) What is DIBAL? Write any two applications of it.

b) Attempt any two of the following. **[4]**

i) Convert Fischer projection formula to Newman projection as shown below.



ii) Write a note on stereo-specificity.

iii) Write any one application of Lindlar catalyst and TEMPO.

Total No. of Questions : 3]

SEAT No. : ____

PC4115

[Total No. of Pages : 2

[6336]-1006

First Year M.Sc. (Physical Chemistry/Inorganic Chemistry/ Analytical Chemistry/Organic Chemistry/Drug Chemistry)

CHE-507(A) MJ : CHEMICAL MATHEMATICS

(2023 Credit Pattern) (Semester - I)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicates full marks.***
3) ***Use of Logarithmic table, calculator is allowed.***

Q1) a) Solve the following any four. **[8]**

i) $A=\begin{bmatrix} 0 & 3 \\ -1 & 4 \end{bmatrix}$, $B=\begin{bmatrix} 4 & 3 \\ -1 & 0 \end{bmatrix}$ then what is A – B and A + B?

ii) What is null and diagonal matrix?

iii) Solve $y = 2x^2 + 4x$, $\frac{dy}{dx}$ =?

iv) What do you mean by maximum & minimum point?

v) Solve $\int (4x^3 + 3x + 2)\,dx = ?$

b) If $A=\begin{bmatrix} 2 & 0 & -3 \\ 1 & 2 & 4 \\ 3 & 2 & -1 \end{bmatrix}$ find A^{-1}. **[3]**

Q2) a) Attempt any three of the following: **[9]**

i) Differentiat x^x w.r.t. x.

ii) Evaluate the following integrals $\int \log x\,dx$.

iii) Find the maxima and minima of $(x – 1)(x – 2)^2$.

iv) Differentiate w.r.t. x, $y = 4x^3 + 6x + 7$.

b) Find out whether the following equation is an exact or inexact $(xy + 2x)\,dx + (x^2 + 2y)\,dy = 0$. **[3]**

P.T.O.

Q3) a) Attempt any two of the following. **[8]**

i) Find the inverse of the following matrix using minor, cofactor and Adjoint $A = \begin{bmatrix} 1 & 0 & -1 \\ 2 & 3 & -2 \\ 0 & 1 & 3 \end{bmatrix}$

ii) 1) Find $u \times v$ where $u = (2, -2, 3)$, $v = (5, 2, -2)$.

2) Given $A = \begin{bmatrix} 1 & 3 \\ 4 & -3 \end{bmatrix}$, $B = \begin{bmatrix} 2 & -4 \\ 0 & 2 \end{bmatrix}$ what is $A^T - 2B^T = ?$

iii) 1) Find out determinant of A, $A = \begin{bmatrix} 3 & 1 & -1 \\ 2 & 0 & 1 \\ 3 & 2 & -5 \end{bmatrix}$.

2) Find the angle between u and v. $u = (2, -1, 2)$, $v = (1, 2, -4)$.

b) Solve any two. **[4]**

i) Solve $\int \left(4x^3 + 3x + 5\right) dx$.

ii) $y = xe^{-5x}$ find $\frac{dy}{dx} = ?$

iii) If $f(x, y) = 2x^3y + 3x - 2y^2$ find fx and fy.

Total No. of Questions : 3]

SEAT No. : ____

PC4116

[6336]-1007

[Total No. of Pages :2

M.Sc. -I(Organic/Drug chemistry/Physical Chemistry/Inorganic Chemistry/Analytical Chemistry)

CHEMISTRY

CHE- 507 (B)MJ : Chemistry of Nanomaterials

(2023 Credit Pattern) (Semester- I)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***

Q1) a) Answer the following. **[8]**

i) What is Schottky defect?

ii) What is band gap of material? Draw a diagram for band gap of Insulator material.

iii) What are stoichiometric compounds?

iv) What do you mean by sub Grain boundaries?

b) What are stacking Faults? Explain significance. **[3]**

Q2) a) Answer any one of the following. **[6]**

i) What do you mean by Gas sensor? Explain principle and applications of metal oxide nanosensors.

ii) Explain the applications of nanomaterials in medicinal and pollution control strategies.

b) Attempt any two of the following. **[6]**

i) Explain in short about Fuel cells.

ii) Discuss general characteristics of nano materials.

iii) What are nano coatings? Explain applications of nano coatings?

P.T.O.

Q3) a) Answer any one of the following. **[6]**

i) What is nano catalysis? Explain applications of nano catalysis in photo catalysis.

ii) Explain synthesis of nanomaterials by _____

1) Combustion method

2) Solgel method

b) Answer any two of the following. **[6]**

i) Define bottom up and Top down approach.

ii) Write a short note on biosensors.

iii) What are Fullerenes? Explain importance of Fullerenes in catalysis.

Total No. of Questions : 4]

SEAT No. :

PC4117

[Total No. of Pages : 2

[6336]-1008

M.Sc. - I (Organic/Drug Chemistry/Physical/Inorganic) CHEMISTRY

CHE-507(C) MJ : Analytical Chemistry

(2023 Credit Pattern) (Semester - I)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

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

Q1) Answer the following : **[5]**

a) What is ionisation in mass spectrometry?

b) Write in brief principle of mass spectrometry.

c) What is CFR?

d) What is laboratory accreditation?

e) Give the significance of MSDS in laboratory practice.

Q2) a) Attempt any two of the following : **[6]**

i) Explain thermal ionisation in mass spectrometry.

ii) Write a note on disposal of hazardous material.

iii) Describe validation of analytical methods.

b) Attempt any two of the following : **[4]**

i) Calculate the resolution in mass spectrum of a peak that is centred at 246 amu and has a peak width at 6% of the peak height that is 0.53 amu.

ii) Explain the term risk assessment.

iii) Give the management of oxygen displacing gases.

P.T.O.

Q3) Attempt any five of the following : **[10]**

a) What is the principle of quadrapolar analyzer in mass spectrometry?

b) Explain toxic gases with suitable example.

c) Draw safety symbol of oxidizing and flammable material.

d) Describe the safe working with organic solvents.

e) What is electronic records?

f) What is SOP?

g) Draw the basic diagram of mass spectrometer.

Q4) a) Attempt any two of the following : **[6]**

i) Explain the Fourier-transform mass spectrometry.

ii) Give the classification of fires.

iii) Write a note on laboratory emergencies.

b) Attempt any one of the following : **[4]**

i) Explain the principle and working of inductively coupled plasma-mass spectrometry.

ii) Write a note on quality assurance.

Total No. of Questions : 3]

SEAT No. : ____

PC4118

[6336]-1009

[Total No. of Pages :2

M.Sc. - I (Physical Chemistry/Inorganic Chemistry)/Analytical Chemistry)

CHEPIA-507(D) MJ : BASIC ORGANIC CHEMISTRY

(2023 Credit Pattern) (Semester- I)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) a) Answer the following (Any Four): **[8]**

i) Explain the term catenane s with suitable example.

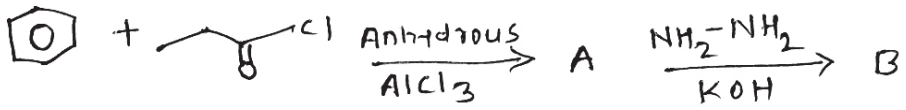
ii) Hydrolysis of β - chlorodiethyl sulphide is 1,000 times faster than β- chlorodiethyl ether.

iii) Write a short note on Meisenheimer complex.

iv) Give any two methods for the generation of carbene.

v) What is SN^2 reaction?

b) Identify the product A & B. **[3]**



Q2) a) Attempt any three of the following: **[9]**

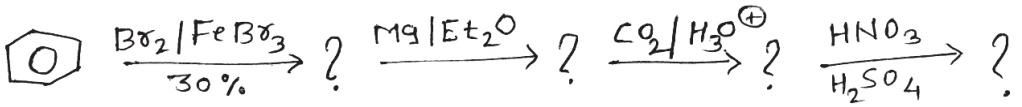
i) Explain structure, stability and Methods for the generation of Nitrenes.

ii) Explain Vilsemeter - Haack reaction with Mechanism.

iii) Comment on NGP by alkenes.

iv) What are crown ether's? Explain their applications in phase transfer catalysis.

b) Complete the following reaction sequence. **[3]**



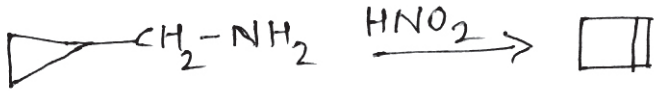
P.T.O.

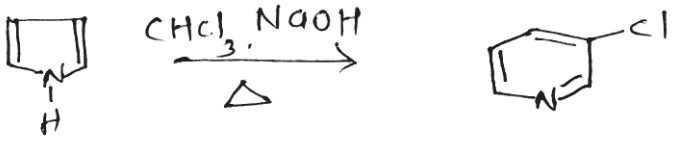
Q3) a) Attempt any two of the following. **[8]**

i) What is SNi reaction? Explain it's stereochemistry with suitable example.

ii) Write the Mechanism of Wolff rearrangement involving ketene intermediate.

iii) Suggest the Mechanism.

1) 

2) 

b) Attempt any two of the following. **[4]**

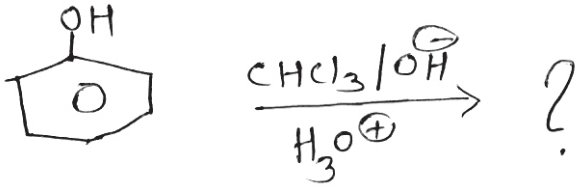
i) Write a short note on IPSO substitution.

ii) Define the term's

1) Benzyne

2) Arhenium ion

iii) Predict the product for the following reaction.



Total No. of Questions : 3]

SEAT No. :

PC4119

[6336]-1010

[Total No. of Pages :2

M.Sc. -I (Organic Chemistry and Drug Chemistry)

ORGANIC CHEMISTRY

CHEOD-507 (D)MJ : Organic Reactions and Reagents

(2023 Credit Pattern) (Semester- I)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) a) Answer the following (Any four): **[8]**

i) Explain Bergman cyclization.

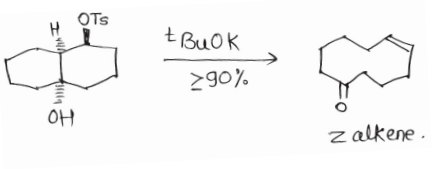
ii) Tertairy nitroalkanes (R_3C - NO_2) fails to undergo Nef reaction. Explain.

iii) β - hydroxy esters are prepared by organozinc reagents and not by organo magnesium reagents. Explain.

iv) Explain the stability of sulphur.

v) How will convert organic acids into ketones by using organo lithium reagents.

b) Suggest the mechanism for following reaction. **[3]**



Q2) a) Attempt any THREE of the following: **[9]**

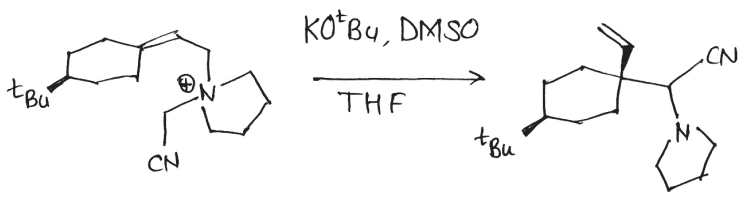
i) Write a note on Mistunobu reaction.

ii) Discuss the Shapiro reaction.

iii) Write a note on Wittig Horner reaction.

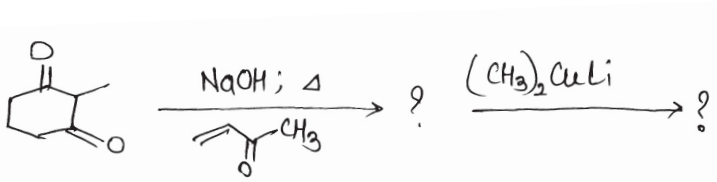
iv) Discuss the preparation and application of organo zinc reagents.

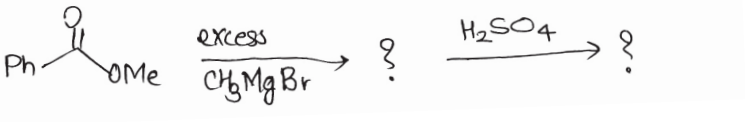
b) Suggest the Mechanism for following reaction. **[3]**

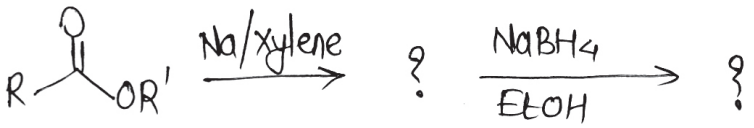


P.T.O.

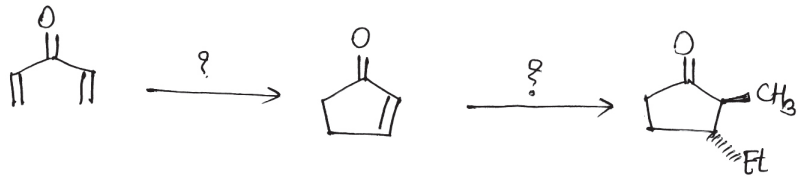
Q3) a) Predict the product with mechanism (Any two) **[8]**

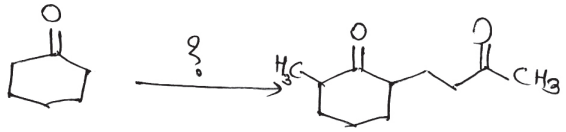
i) 

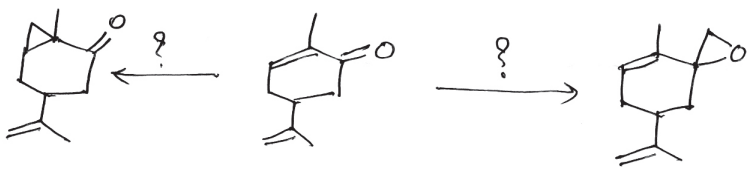
ii) 

iii) 

b) Suggest the reagents for following conversions (Any two): **[4]**

i) 

ii) 

iii) 

Total No. of Questions : 8]

SEAT No. :

PC4120

[Total No. of Pages : 4

[6336]-1011

M.Sc. -I (Organic/Drug Chemistry) / (Physical Chemistry/Inorganic Chemistry/Analytical Chemistry)

CHEMISTRY

CHE-508 MJ : Research Methodology

(2023 Credit Pattern) (Semester - I)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All Questions are Compulsory.***
2) ***Answer of the two sections should be written in separate answer books.***
3) ***Figures to the right indicates full marks.***

SECTION - I

Q1) Attempt the following. **[5]**

a) Write the name of any one plagiarism detection tool.

b) Write the full form of ANOVA.

c) What do you mean by scientific research?

d) List the components of review paper.

e) Write the full form of MSDS.

Q2) a) Attempt any two of the following. **[6]**

i) Write a note on research ethics.

ii) Explain Intellectual property rights.

iii) Explain laboratory safety.

b) Attempt any two of the following. **[4]**

i) Explain interdesciplenary research.

ii) Discuss in brief about disposal of liquid chemical waste.

iii) Explain the use of Scopus for Literature survey.

P.T.O.

Q3) Attempt any five of the following. **[10]**

a) What do you mean by chemical hazard? Give suitable example.

b) Give name of any two automatic reference managing tools.

c) What is abstract in research paper?

d) What are different components of research paper?

e) What are the Criteria to select a good journal?

f) What do you mean by science direct?

g) Explain monograph.

Q4) a) Attempt any two of the following. **[6]**

i) Discuss quantitative and qualitative research.

ii) Discuss chemspider.

iii) Define h-index, g-index and i-10 index.

b) Attempt any two of the following. **[4]**

i) Explain cover letter.

ii) What do you mean by VGC-CARE List?

iii) Explain the use of Sci-finder in research.

SECTION - II

Q5) Attempt the following. **[5]**

a) Define citescore.

b) Write the full form of CAS number.

c) What is hypothesis in research?

d) Define impact factor.

e) Define correlation and regression.

Q6) a) Attempt any two of the following. **[6]**

i) Discuss theoretical and experimental research.

ii) Discuss the use of chemistry software for drawing chemical structure.

iii) Discuss Literature survey in detail.

b) Attempt any two of the following. **[4]**

i) Explain Beilstein system.

ii) Explain the term research design.

iii) What is Grammerly software?

Q7) Attempt any five of the following. **[10]**

a) Explain recycling and re use of chemical waste.

b) What is criteria of good research?

c) What are the steps involved in selection of research topic?

d) Enlist the name of any two research publishers.

e) Discuss chemometrics.

f) Explain exponential fit.

g) Write the steps involved in online submission of manuscripts.

Q8) a) Attempt any two of the following. **[6]**

i) What are different methods of presentation of research work?

ii) Discuss dead stock maintenance.

iii) Discuss research objectives.

b) Attempt any one of the following. **[4]**

i) Discuss research methodology.

ii) Explain result and discussion section of research paper.

Total No. of Questions : 8]

SEAT No. :

PC4121

[Total No. of Pages : 5

[6336]-2001

First Year M.Sc. (Physical/Inorganic/Analytical Chemistry)

CHE-551-MJ : PHYSICAL CHEMISTRY - II

(Credit 2023 Pattern) (Semester - II)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) *Answer of two sections should be written in separate answer books.*
2) *All questions are compulsory.*
3) *Figures to the right side indicate full marks.*
4) *Use of logarithmic table, and non-programmable calculator is allowed.*
5) *Neat diagrams must be drawn wherever necessary.*

Physico-Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 1023$ J K^{-1} molecule^{-1} $\times 10^{-23}$
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J/s Js
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ kcal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-24}$ kg
11.	Bohr magneton	βe	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	βn	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	me	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) Answer the following : **[5]**

a) What are hot bands?

b) What is polarizability ellipsoid?

c) Define depolarisation ratio.

d) Classify molecule according to its moment of inertia.

i) C_6H_6

ii) H_2O

e) Calculate the number of fundamental vibrations in:

i) H_2O_2

ii) CCl_4

Q2) a) Answer any two: **[6]**

i) Explain the classical theory of Raman effect.

ii) Derive the equation for the first overtone in vibrational spectroscopy.

iii) What is fortrat diagram? Explain its utility in electronic spectroscopy.

b) Answer any two: **[4]**

i) Calculate the population of vibrational energy level, V=1 at 35ºC if the energy separation between, V=0 and V=1 state is 1980cm^{-1} and population of the ground state energy level is 50000.

ii) The rotational constant for ^{14}N ^{16}O is 6.8245 cm^{-1} calculate the value of J corresponding to the most intense line at 25ºC.

iii) The vibrational spectrum of HCl has $\overline{w_e} = 3239.62\ cm^{-1}$ and $\overline{w_e x_e} = 23.198\ cm^{-1}$. Calculate the vibrational energy level where dissociation takes place.

Q3) a) Answer any two: **[6]**

i) Give two applications of Mossbauer spectroscopy in detail.

ii) Symmetric stretching vibration of CO_2 is IR inactive but Roman active. Explain why?

iii) What is zero point energy? Explain its significance.

b) Answer any two: **[4]**

i) Calculate the wavelength of light in nm whose energy is 400 kJ $mole^{-1}$.

ii) Calculate the positions of fundamental mode of vibration and first overtone of a molecule if the vibrational frequency and anharmonicity constant are $200cm^{-1}$ and 3.5×10^{-3} respectively.

iii) The vibrational frequency of $^{12}C^{16}O$ is 2143-43 cm^{-1}. Estimate the frequency of $^{13}C^{16}O$ assuming the force constant remains the same.

Q4) a) Answer any two: **[6]**

i) Explain the effect of isotopic substitution on microwave spectra of linear diatomic molecule.

ii) Explain Birge-Sponer extrapolation method to determine bond dissociation, energy of a diatomic molecule.

iii) Explain the working of photoelectron spectroscopy.

b) Solve any one: **[4]**

i) Calculate the saparation between Rayleigh line and first stokes line in rotational roman spectrum of $^{1}H^{35}Cl$ molecule if the bond length is 1.275 Å

ii) The first line in the rotational spectrum of $^{12}C^{16}O$ molecule is 3.84235 cm^{-1}. Determine the bond length of the molecule.

SECTION - II

Q5) Solve the following : **[5]**

a) Define decay constant.

b) What is Giger Nuttals law?

c) What is rad?

d) Give the preparation method ^{14}C isotope.

e) What are chemicals used in the Fricke solution?

Q6) a) Solve any two: **[6]**

i) Derive an expression for the determination of decay constant where the daughter nuclei are unstable.

ii) Explain the mass distribution in nuclear fission.

iii) Discuss the radiometric titrations with suitable example.

b) Solve any two. **[4]**

i) Calculate the time by which the activity of the radioisotope reduces 65% of its activity in 4 years.

[Half life : 5.24 years]

ii) Complete the following equation:

1) $^{249}_{99}Es + ^{1}_{0}n \rightarrow ^{161}_{64}Gd + ^{87}_{35}Br + ?$

2) $^{235}_{92}U + n \rightarrow ^{95}_{42}M_o + ^{139}_{57}La + 2n + ?$

iii) Calculate linear absorption coefficient of lead which reduces its activity by 65% when passing through a thick plate of 2mm thickness.

Q7) a) Solve any two: **[6]**

i) Discuss the variation of fission energy and barrier energy with atomic mass.

ii) How surface area is determined using radioactivity?

iii) Discuss the szillard-chalmer reaction.

b) Solve any two: **[4]**

i) The activity of a substance drops to $\frac{L}{30}$ of its initial value in 7.5 hr. Find its half life period.

ii) Find the molecular and mass absorption coefficients of benzene (Given: density of benzene = 0.879 9/cm^3 Linear absorption coefficient of benzene = 0.06014 cm^{-1})

iii) 10 g of sample absorbs 10 J of energy. Calculate the dose absorbed in rad.

Q8) a) Solve any two. **[6]**

i) Write a note on radiolysis of water.

ii) Discuss the industrial application of friction & wearout.

iii) Explain the energy spectrum for fragments of ^{235}U fission by thermal neutrons.

b) Solve any one. **[4]**

i) A 15ml of sample of a saturated solution containing 3mg/L of labelled $PbSO_4$ has an activity of 1500 cpm. The solution was shaken with 29 of precipitated $PbSO_4$ and filtered. The filtrate gives an activity of 900 cpm. All activities are net and free from background. Surface area of one formula entity of $PbSO_4$ is 16.4×10^{-18} cm^2. Calculate the surface are of 29 of precipitate.

ii) 1 g of a sample containing unknown amount of Cr was irradiated for 1 day in a neutron flux of 2×10^{12} neutron cm^{-2} S^{-1}, when the sample was measured for ^{51}Cr activity 30 min after irradiation, it gave 40,000 c/s. The natural abundance of ^{50}Cr is 4.35%. Calculate the Cr content of the sample. (Given : σ of ^{50}Cr is 15.9 b, half life of ^{51}Cr is 27.7 days.)

Total No. of Questions : 4]

SEAT No. : [ ]

PC4122

[Total No. of Pages : 3

[6336]-2002

F.Y.M.Sc. (Organic Chemistry/Drug Chemistry)

CHEOD - 551 MJ : PHYSICAL CHEMISTRY - II

(2023 Credit Pattern) (Semester - II)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic table, and non programmable calculator is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ kcal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-24}$kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

Q1) Attempt the following. **[5]**

a) Write the condition of moment of inertia along three co - ordinate axes for CH_3OH molecule.

b) Calculate the theoretical number of vibrational degrees of freedom in CH_4.

c) Give selection rules for vibrational - rotational Raman spectra.

d) Draw a neat lebelled Birge - Sponer diagram.

e) What is the principle of Mössbauer spectroscopy.

Q2) a) Answer any two of the following. **[6]**

i) Sketch and explain the vibrational modes of H_2O molecule. Which of these modes of vibration are IR active?

ii) Sketch and explain the rotational Raman spectrum of rigid diatomic molecule.

iii) State and explain Frank - Condon principle.

b) Solve any two of the following. **[4]**

i) Calculate force costant for $^{1}H^{35.5}Cl$ as it shows absorption band at 2890 cm^{-1}.

ii) In the $^{57}Fe^{*}$. Mössbauer experiment, the source of 4.38×10^{12} MHz is moved toward absorber at a velocity of 2.42×10^{-3} ms^{-1}. Find the shift in frequency of the source for this sample.

iii) The spacing between first stoke line and first antistokes line is 12B in N_2. Show by plotting the spectrum.

Q3) a) Answer any two of the following. **[6]**

i) State the selection rule for non - rigid rotator and derive an expression for internuclear distances of non - rigid diatomic molecule.

ii) Distinguish Harmonic and an - harmonic oscillators in terms of selection rule, zero point energy and energy level diagram.

iii) Give an account of ultraviolet photoelectron spectroscopy.

b) Solve any two of the following. **[4]**

i) Calculate the most probable transition, if the rotational spectrum of CO show series of equidistance lines spaced 3.84235 cm^{-1} at 27ºC.

ii) Find the position of the first antistokes and stokes line of N_2 having equilibrium vibrational frequency 2359.6 cm^{-1}, if the molecule is irradiated with 405 nm radiation.

iii) Calculate the energy of light in J $mole^{-1}$ whose wavelength is 285.2 nm.

Q4) a) Answer any two of the following. **[6]**

i) Outline the effect of isotopic substitution on the rotational spectra of molecules.

ii) Sketch and explain the polarizability ellipsoid for the different vibrational modes of the CO_2 molecule.

iii) Write a note on quadrupole shift in Mössbauer spectroscopy.

b) Solve any one of the following. **[4]**

i) The rotational spectrum of $^{1}H^{79}Br$ shows a series of equidistance lines spaced at 0.7070 cm^{-1} apart. Evaluate bond length of the molecule.

ii) The fundamental vibrational frequency and an harmonicity constant of a molecule are 1558 cm^{-1} and 0.003. Find the vibrational energy level at convergence limit and dissociation energy of the molecule.

Total No. of Questions : 6]

SEAT No. : ____

PC4123

[Total No. of Pages : 5

[6336]-2003

M.Sc. - I (Chemistry/Physical Chemistry/Inorganic Chemistry/ Analytical Chemistry)

INORGANIC CHEMISTRY - II

CHE-552-MJ : Coordination and Bioinorganic Chemistry

(Credit 2023 Pattern) (Semester - II)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of calculator is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***

SECTION - I

Q1) a) Attempt any four of the following : **[8]**

i) Calculate the degeneracy of the following terms/configurations

1) $^4A_{2g}$ 2) eg^3

ii) State Hunds rule for arranging k.s. terms and thereby arrange the following terms according to increasing order of energy.

5_H, 3_S, 3_P, 2_D, 4_G, 2_I

iii) $KMno_4$ shows dark purple color. Explain.

iv) Define the terms

1) Magnetic moment

2) Molar magnetic succeptibility

v) What is Hole formalism? What is its significance?

b) Explain the phenomenon of phosphoressence with suitable example.**[3]**

P.T.O.

Q2) a) Answer the following (Any one) **[6]**

i) The microstate table for d^2 configuration and find out the possible term symbol for it.

ii) Assign the spin multiplicities to the state arising for eg^2 & $t2g^2$ configuration when infinitely strong field is relaxed to strong field using Bethe's method of descending symmetry, corelation table and direct product.

b) Attempt <u>any two</u> of the following : **[6]**

i) Give the ground state term symbol for the following ions

1) Ni^{2+} [z = 28]

2) Ce^{3+} [z = 58]

3) Co^{3+} [z = 27]

ii) Predict the expected electronic transitions in $(Fe\ cl_4)^{2-}$ ion.

iii) Write a note on temperature dependence of paramagnetism.

Q3) a) Answer the following (Any one) **[6]**

i) Calculate the position of second absorption band for $[Ni(H_2O)_6]^{2+}$ ion if the first and third electronic transition occurs at 14900 cm^{-1} and 34400 cm^{-1} respectively. The interelectronic repulsion parameter for complex and free ion are 827 cm^{-1} and 1040 cm^{-1} respectively. Also calculate $10D_9$, Nephelauxetic ratio β. Comment on nature of metal ligand bonding.

ii) Find out the splitting of 4_G term in weak octahedral ligand field.

Given : Character table for 'o' point group.

b) Attempt <u>any two</u> of the following : **[6]**

i) Explain which of the following complex will show orbital contribution to the observed magnetic moment.

Justify your answer

1) $[Fe\ F_6]^{3-}$ 2) $[Cocl_4]^{2-}$

ii) Discuss the factors affecting on band intensities.

iii) Describe in brief 'orgel diagram' for 'F' ground state term.

SECTION - II

Q4) a) Answer the following : (any four) **[8]**

i) What is the two electron transfer metalloenzyme? Write the reaction of it.

ii) What are the oxidation state of Fe and Co found in biological systems?

iii) Give the functions of calcium in biological system?

iv) What is chelate effect? Which are the donor atoms in EDTA?

v) Explain in brief Irving - Williams series.

b) Explain the ATP-driven uptake of ferric enterobactin in E-coli. **[3]**

Q5) a) Answer <u>any one</u> of the following : **[6]**

i) Describe mechanism of cellular uptake of cis-platin.

ii) Explain with the help of scheme ATP - dependent export of $3Na^+$ and $2k^+$ ion's by $Na^+ – k^+$ ATPase.

b) Answer <u>any two</u> of the following : **[6]**

i) Write a note on Vitamin B_{12}.

ii) Explain the use of metals and metal complexes in medicine.

iii) Write a note on calmodulin.

Q6) a) Answer <u>any one</u> of the following : **[6]**

i) What is zinc-finger protein? Explain the zinc-binding domains in nucleic-acid binding proteins.

ii) What is dioxygen transport? Explain different types of oxygen transport metalloenzymes?

b) Attempt <u>any two</u> of the following : **[6]**

i) How do ligand and steriochemistry can tune the redox potential of the metal? Explain with suitable example.

ii) With the help of example show metal ion's affects the pka of ligand.

iii) What is enterobactin? Explain the structure of $[Fe(ent)]^{3–}$.

Direct Product

1. **Group of the form G x i or G x σh**

   The g, u, or ',' additions to the IR symbol in this group satisfy
   g x g = u x u = g, g x u = u, 'x' = "x"=

2. **Product of the form A x A, B x B, A x B**

   For all groups:
   Letter Symbol: A x A =A, B x B = A , A x B = B
   Subscript: 1 x 1 = 1, 2 x 2 = 1, 1 x 2 = 2
   Except for the B representations of D_2 and D_2 where
   B x B = B, and 1 x 2 = 3, 2 x 3 = 1, 3 x 1 = 2

3. **Products of the forms: A x E, B x E:**

   (a) For all groups A X E_k = E_k irrespective of the suffix on A.
   (b) For all groups except D_4h, D_4d, S_8:
   B x E_1= E_2, B x E_2 = E_1
   irrespective of the suffix on B (If the group has only one B representative put E_1=E_2=E)
   (c) For D_4h:
   B X E_1 = E_3, E x E_2 = E_3, B x E_3 =E_3, B x E_2 = E_2, B x E_3 = E_1
   Irrespective of the suffix on B:
   (d) For D_4d, S_8:
   B x E_1= E_3, B x E_2 =E_2, B x E_3 = E_1
   Irrespective of the suffix on B:

4. **Products of the form E x E:**

   (For groups which have A, B, or E symbols without suffixes put A_1 = A_2 = A, etc in the equation below)
   (a) For Oh, O, T_3, D_6h, D_2, C_6v, C_6h, C_6, S_6, D_2d, D_2h, D_3, C_2, C_3h, C_3:
   E_1 x E_1 =E_2 x E_2= A_1+ A_2+ B_2; B_1 x E_2 = B_1 + B_2+ E_1
   (b) For D_4h, D_4, C_4v,C_4h,C_4,S_4,D_2d:
   E x E = A_1 + A_2 + B_1 + B_2.
   (c) For D_6d:
   E_1 x E_1 = E_3 x E_3 = A_1 + A_2+ Eg
   E_2 x E_2 = E_4 x E_4 = A_1 + A_2+ Eg
   E_3 x E_3= A_1 + A_1+ B_1 + B_2
   E_1+ E_2= E_4 + E_3 =E_1+E_3,E_1 x E_3 = E_3 x E_1= E_2+ E_1,
   E_1+ E_4= E_2 + E_3 =E_3+E_3,E_2 x E_3 = E_3 x E_4= E_1+ E_3,
   E_1+ E_3= B_4 +B_2+E4, E_2 x E_4 = B_1+ B_2 + E_2,
   (d) D_5d, D_2h, D_3, C_3v, C_3h, C_3:
   E_1 x E_1 = A_1 + A_2 + E_2 , E_2 x E_2 = A_1 + A_2 + E_1
   E_1 x E_2 = E_1 + E_2
   (e) For D_4d,S_8
   E_1x E_1= E_3 x E_3 = A_1 + A_2 + E_2
   E_2 x E_2 = A_1 + A_2 + B_1+ B_2
   E_1 xE_2 = E_2 x E_3= E_1 + E_3, E_1 x E_3 = B_1 + B_2 + E_2

5. **Product involving the T (or F) representation of Oh, O, Td:**

   A_1 x T_1= T_1, A_1 x T_2= T_2, A_2 x T_1 = T_2, A_2 x T_2 = T_1'
   E x T_1= E x T_2= T_1 + T_2,
   T_1 x T_1 = T_2 x T_2 = A1+ B + T_1 + T_2
   T_1 x T_2 = A_2 + E+ T_1+ T_2.

6. **To Complete result for O are**

O	A_1	A_2	E	T_1	T_2
A_1	A_1	A_2	E	T_1	T_2
A_2	A_2	A_1	E	T_2	T_1
E	E	E	$A_1 + A_2 + E$	$T_1 + T_2$	$T_1 + T_2$
T_1	T_1	T_2	$T_1 + T_2$	$A_1 + E + T_1 + T_2$	$A_2 + E + T_1 + T_2$
T_2	T_2	T_1	$T_1 + T_2$	$A_2 + E + T_1 + T_2$	$A_1 + E + T_1 + T_2$

Character Table for O rotational group

O	E	$6C_1$	$3C_2(=C_4^2)$	$8C_3$	$6C_2$		
A_1	1	1	1	1	1		$x^2+y^2+z^2$
A_2	1	-1	1	1	-1		$(2z^2-x^2-y^2,$
E	2	0	2	-1	0		$x^2-y^2)$
T_1	3	1	-1	0	-1	$(R_x,R_y,R_z);(x,y,z)$	(xy,xz,yz)
T_2	3	-1	-1	0	1		

Correlation table for group Oh

Oh	O	Td	D_4h	D_2d	C_{4V}	C_2v	D_3d	D_3	C_2h
A_1g	A_1	A_1	A_1g	A_1	A_1	A_1	A_1g	A_1	Ag
A_2g	A_2	A_2	B_1g	B_1	B_1	A_2	A_2g	A_2	Bg
Eg	E	E	A_1g+B_1g	A_1+B_1	A_1+B_1	A_1+A_2	Eg	E	Ag+ Bg
T_1g	T_1	T_1	A_2g+E_g	A_2+E	A_2+E	$A_2+B_1+B_2$	A_2g+Eg	A_2+E	Ag+ 2Bg
T_2g	T_2	T_2	B_2g+Eg	B_2+E	B_2+E	$A_1+B_1+B_2$	A_1g+Eg	A_1+E	2Ag+Bg
A_1u	A_1	A_1	A_1u	B_1	A_2	A_2	A_1u	A_1	Au
A_2u	A_2	A_1	B_1u	A_1	B_2	A_1	A_2u	A_2	Bu
Eu	E	E	A_1u+B_1u	A_1+B_1	A_2+B_2	A_1+A_2	Eu	E	Au+ Bu
T_1u	T_1	T_2	A_2u+Eu	B_2+E	A_1+E	$A_1+B_1+B_2$	A_2u+Eu	A_1+E	Au+ 2Bu
T_2u	T_2	T_1	B_2u+Eu	A_2+E	B_1+E	$A_2+B_1+B_2$	A_1u+Eu	A_1+E	2Au+Bu

Total No. of Questions : 8]

SEAT No. : ____

PC4124

[Total No. of Pages : 7

[6336]-2004

First Year M.Sc. (Organic & Drug Chemistry)

ORGANIC CHEMISTRY - II

CHE - 553 MJ : Pericyclic Reactions, Molecular Rearrangements Photochemistry and Organic Spectroscopy

(2023 Credit Pattern) (Semester - II)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

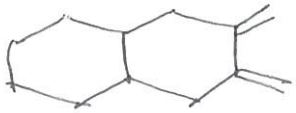
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answer to the two sections should be written in separate answer books.***

SECTION - I

Q1) Answer the following. **[5]**

a) The order of reactivity of following diene in Diel's - Alder reaction is

i) 

ii) 

iii) 

b) Draw G.S. and E.S. HOMO of 1, 3, 5 heptatriene.

c) Write the reaction conditions for [1, 3] carbon shift, if reaction is photochemical.

d) What intermediate is formed in favorskii rearrangement?

P.T.O.

Q2) a) Attempt any two of the following. **[6]**

i) Using FMO approach, predict whether cycloaddition reaction is thermally or photochemically allowed.

ii) Draw a correlation diagram for photochemical cyclisation of 1, 3 - butadiene to cyclobutene.

iii) With help of FMO approach, explain whether suprafacial [1, 3] - C shift is thermally or photochemically allowed.

b) Answer any two of the following. **[4]**

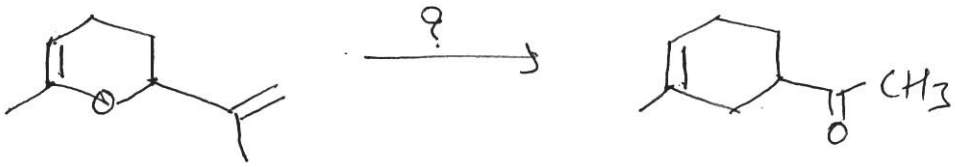
i) Explain Beckmann rearrangement with suitable example.

ii) Explain Wolff-rearrangement with suitable example.

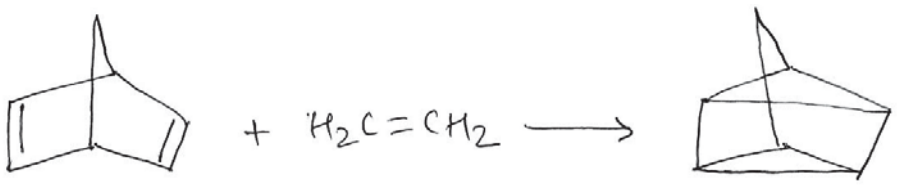
iii) In Bayer - Villiger oxidation t-butyl group migrates in preference to methyl group. Explain.

Q3) a) Answer any two of the following. **[6]**

i) Write the appropriate conditions for the following Pericyclic conversion and justify your answer.



ii) Indentify the type of following reaction. Justify your answer.

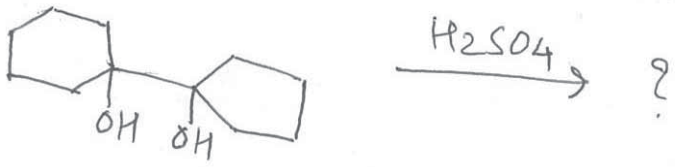


iii) Write a note on 'Ene reaction'.

b) Predict the product and justify your answer (any two). **[4]**

i) 

ii) 

iii) 

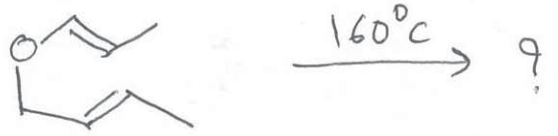
Q4) a) Answer any two of the following. **[6]**

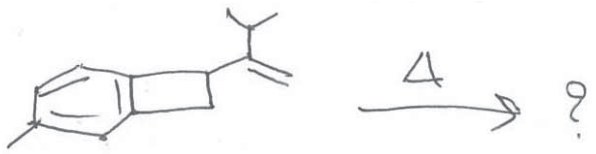
i) Explain Lossen rearrangement with suitable example.

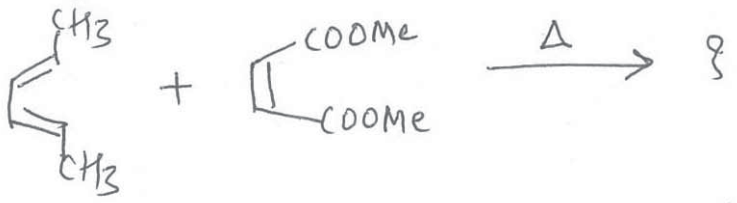
ii) Write short note on Benzil - Benzillic acid rearrangement.

iii) Explain Dakin Oxidation with suitable example.

b) Predict the product and justify your answer (any two). **[4]**

i) 

ii) 

iii) 

SECTION - II

Q5) Answer the following. **[5]**

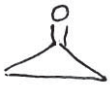
a) How many sets of protons are present in the following molecule?

b) Define Chemical shift.

c) Assign IR absorption values 1710, 1740 and 1818 cm^{-1} for following compounds.

i) 

ii) 

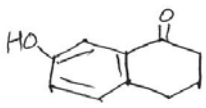
iii) 

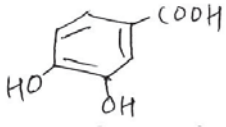
d) Write one example of Norish - II reaction.

e) Write reaction of 2-methyl acetophenone with maleic anhydride.

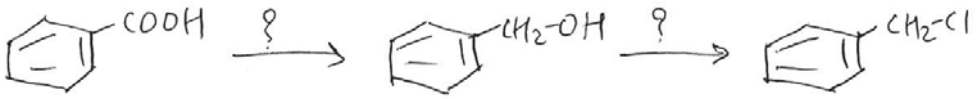
Q6) a) Answer any two of the following. **[6]**

i) Calculate the λmax for the following compounds.

1) 

2) 

ii) How will you monitor the following reaction using IR spectroscopy? Suggest the reagents.



iii) Deduce the structure from the following CMR spectral data.

M.F. C_3H_7NO

CMR : 168(s), 35(t) and 22(q)

b) Write short note on any two of the following. **[4]**

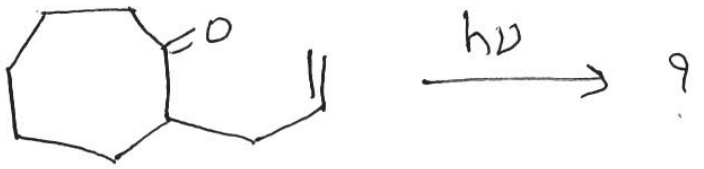
i) Jablonski diagram

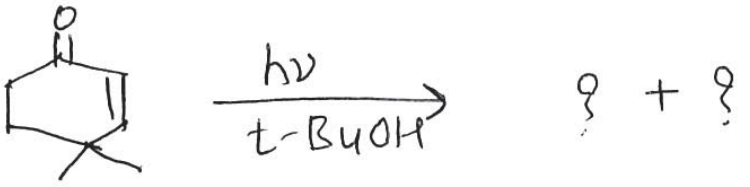
ii) Barton reaction

iii) Photo - enolization

Q7) a) Predict the product/s indicating mechanism in any two of the following. **[6]**

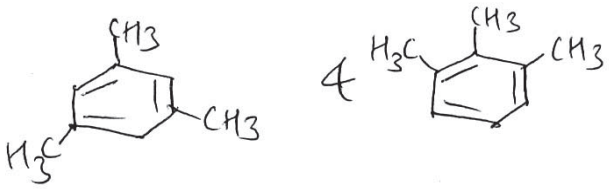
i) 

ii) 

iii) 

b) Answer any two of the following. **[4]**

i) How will you distinguish the following compounds by CMR?



ii) Write short note on photoisomerization of benzene.

iii) An organic compound C_3H_6O shows IR bands at 1720 cm^{-1} and 2720 cm^{-1}. Find out the structure of the compound.

Q8) Deduce the structure of any four of the following compounds using spectral data and justify your answer. **[10]**

a) MF : $C_6H_{10}O_3$

IR : 1740 and 1710 cm^{-1}

PMR : δ 1.28 (t, J = 7Hz, 30mm)

δ 2.21 (s, 30mm)

δ 3.24 (s, 20mm)

δ 4.20 (q, J = 7Hz, 20mm)

b) MF : C_7H_5ClO

IR : 3000, 2700, 1700, 1600, 1500, 700cm^{-1}

PMR : δ 9.92 (s, 1H)

δ 7.83 (d, J = 6.5Hz, 2H)

δ 7.52 (d, J = 6.5 Hz, 2H)

c) MF : $C_8H_{15}NO$

IR : 1715 cm^{-1}

PMR : δ 1.08 (d, J = 7Hz, 6H)

δ 2.45 (t, J = 5Hz, 4H)

δ 2.8 (t, J = 5Hz, 4H)

δ 2.93 (Sept, J = 7Hz, 1H)

d) MF : $C_{12}H_{10}$

UV : λ max 242 nm

IR : 1600, 1480 cm^{-1}

PMR : Multiplet at 7.4δ (22 mm)

e) MF : $C_9H_{12}O$

IR : No bands above 3100 and in 2000 - 1650 cm^{-1} region.

PMR : δ 1.15 (t, J = 7.5 Hz, 3H)

δ 3.5 (q, J = 7.5 Hz, 2H)

δ 4.4 (s, 2H)

δ 7.2 (s, 5H)

f) MF : $C_4H_7BrO_2$

UV : Transparent above 210 nm

IR : 3300 - 2700 cm^{-1}, 1720 cm^{-1}

PMR : δ 1.08 (t, J = 7Hz, 3H)

δ 2.07 (m, 2H)

δ 4.22 (t, J = 7Hz, 1H)

δ 10.07 (s, exchangeable with D_2O, 1H)

✪ ✪ ✪

Total No. of Questions : 4]

SEAT No. : ____

PC4125

[Total No. of Pages : 4

[6336]-2005

M.Sc. - I (Physical / Inorganic / Analytical Chemistry)

ORGANIC CHEMISTRY - II

CHE PIA - 553 MJ : Molecular Rearrangement and Organic Spectroscopy

(Credit 2023 Pattern) (Semester - II)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) Answer the following. **[5]**

a) In Beckmann Rearrangement, anti groups migrates preferentially, explain.

b) Write the name of any one rearrangement reaction which gives isocyanate intermediate.

c) Distinguish the following pair by IR Spectroscopy.

d) How many ^{13}C NMR signals are present in proton decoupled spectrum of following compound?

e) Explain the chemical shift of underlined proton.

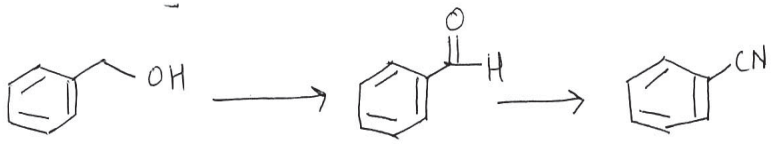
$$\underset{2.5\delta}{\underline{H}} - C \equiv C - CH_3$$

P.T.O.

Q2) A) Answer any two of the following. **[6]**

a) Write a short note on curtius rearrangement.

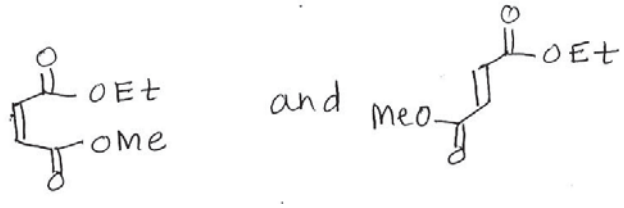
b) How will you moniter the following reaction sequence by IR.



c) Explain Pascal's triangle.

B) Answer any two of the following. **[4]**

a) How will you distinguish the compounds given below by PMR.



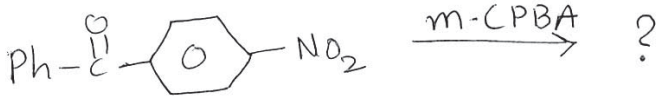
b) Arrange the following compounds in order of increasing absorption frequency of their carbonyl groups. Justify your answer.

C_6H_5CHO C_6H_5COCl $C_6H_5COCH_3$

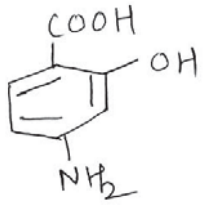
c) In Baeyer - Villiger rearrangement, t - butyl group migrates in preference to methyl group. Why?

Q3) Answer any five of the following. **[10]**

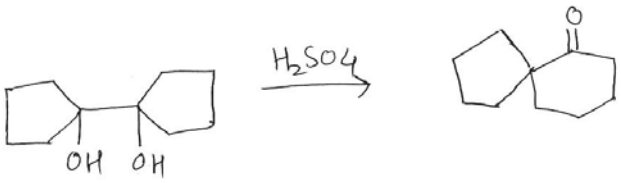
a) Predict the product of following reaction.



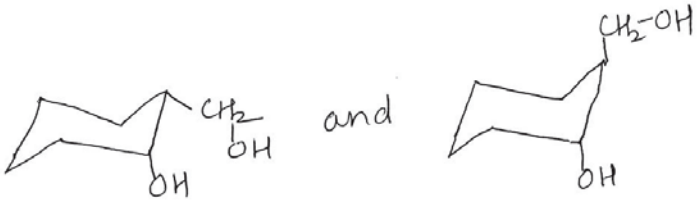
b) Calculate λ max of following aromatic compound.



c) Suggest the mechanism.



d) Which of the following compounds do you expect to have higher – OH frequency in CCl_4 solution and why?



e) Acetylenic protons absorb at higher field than olefinic protons.

f) Write short note on Favorskii rearrangement.

g) Explain migratory aptitude in Pinacol - Pinacolone rearrangement.

Q4) A) Answer any two of the following. **[6]**

a) Deduce the structure using following spectral data and justify your answer.

M.F. : $C_7H_4O_3NCl$

UV : 255 (ε = 12000)

IR : 1770, 1530, 1330, 850 cm^{-1}

PMR: δ = 8.03 (2H, d = 8Hz)

8.13 (2H, d = 8Hz)

b) Deduce the structure using following spectral data and justify your answer.

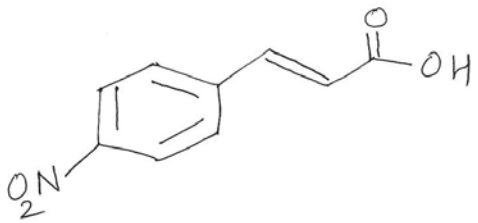
M.F. : $C_4H_8O_2$

IR : 1740 cm^{-1}

CMR: δ = 24.2 (q)
20.2 (q)
60.4 (t)
170.7 (s)

c) Assign the chemical shifts for the following structure.

^1H NMR : δ = 6.86 (d, J = 17 Hz, 1H)
7.87 (d, J = 8.0 Hz, 2H)
8.08 (d, J = 8.0 Hz, 2H)
8.11 (d, J = 17 Hz, 1H)
12.3 (bs, exch. 1H)



B) Answer any one of the following. **[4]**

a) Predict the structure using given spectral data and justify your answer.

M.F. : $C_{12}H_{14}O_2$

UV : 272

IR : 1720, 1625, 1600, 1510 cm^{-1}

PMR : δ = 1.25 (t, J = 7Hz, 3H), 2.4 (s, 3H),
4.1 (q, J = 7Hz, 2H), 6.29 (d, J = 18Hz, 1H)
7.1 (d, J = 8Hz, 2H), 7.5 (d, J = 8Hz, 2H)
7.8 (d, J = 18Hz, 1H)

b) Write a short note on Fries rearrangement.

✪ ✪ ✪

Total No. of Questions : 3]

SEAT No. : ____

PC4126

[Total No. of Pages : 1

[6336]-2006

M.Sc. - I (Organic/Drug Chemistry)/(Physical Chemistry/Inorganic Chemistry/Analytical Chemistry)

CHEMISTRY

CHE-561(A) MJ : Organometallic Compounds and Inorganic Reaction Mechanism

(2023 Credit Pattern) (Semester - II)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logtable and calculator is allowed.***

Q1) a) Answer the following : **[8]**

i) Name the types of inorganic chemical reactions.

ii) Define reductive elimination reaction with suitable example.

iii) Calculate the total valance electron count in the following complexes. State whether they obey 18 or 16e^- rule.

1) $Fe_3(CO)_{12}$ 2) $[Fe(CO)_5]$

iv) Why carbonyl ligand is called π-acceptor ligand? Explain.

b) Draw and describe the catalytic cycle for Wackers process. **[3]**

Q2) a) Answer <u>any one</u> of the following : **[6]**

i) Discuss the role of solvent in octahedral substitution reaction.

ii) Explain the mechanism of innersphere electron transfer reactions with suitable example.

b) Answer <u>any two</u> of the following : **[6]**

i) Predict the product in the following reaction

$\left[pt(NH_3)_4\right]^{2+} \xrightarrow[cl]{} [A] \xrightarrow[cl]{} [B]$ explain the isomer from in the product [B].

ii) Discuss the methods for synthesis of binary carbonyl complexes.

iii) Arrange the M-CO according to decreasing order of CO stretching frequency. M – CO, M_2 – CO & M_3 – CO. Justify your answer.

P.T.O.

Q3) a) Answer any one of the following : **[6]**

i) Calculate the metal-metal bond, electron count and structure of the following organometallic compounds.

1) $[\eta^2 - CpMo\ (CO)_2]_2$

2) $\left(\eta^4 - C_4H_4\right)_2 Fe_2(CO)_3$

ii) Draw and describe the catalytic cycle for Monsanto process of acetic acid synthesis.

b) Answer <u>any two</u> of the following : **[6]**

i) Explain the structure and bonding in cis-ferrocene.

ii) Explain cis-trans isomerisation in metal complexes with suitable example.

iii) What do you mean by acid and base hydrolysis. Explain with suitable example.

x x x

Total No. of Questions : 4]

SEAT No. :

PC4127

[Total No. of Pages : 2

[6336]-2007

M.Sc. - I (Physical Chemistry/Inorganic Chemistry/Analytical Chemistry)/ (Organic/Drug Chemistry)

CHEMISTRY

CHE-561(B) MJ : Material Characterization Techniques

(2023 Credit Pattern) (Semester - II) (Major Elective) (2 Credits)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of calculater/log table is allowed.***

Q1) Answer the following : **[5]**

a) Give the relation between wavelength of X ray radiation(λ) and acceleration voltage of electrons(V)

b) Enlist the different types of lenses used in SEM

c) What are K_α and K_β X rays?

d) Give any two imaging modes in TEM.

e) What is the selection rule for electron transection between two shells?

Q2) a) Answer <u>any two</u> of the following : **[6]**

i) Explain wavelength dispersive spectroscopy.

ii) Explain sample preparation in TEM.

iii) Explain Weiss and Miller indices.

b) Answer <u>any two</u> of the following : **[4]**

i) Enlist the analyzing crystals used in WDS.

ii) Sketch a neat labelled diagram of a X ray tube.

iii) Explain selected area diffraction.

P.T.O.

Q3) Answer any five of the following : **[10]**

a) What acceleration potential is needed to obtain X ray of 0.5nm.

b) Explain field emission gun used in TEM.

c) Give any two applications of XRD.

d) Sketch a neat labeled diagram of Si(Li) detector used in X ray spectroscopy.

e) Calculate the interplanar distance in sample of iran when incident X rays of 0.154 nm were diffracted by an angle of 43.5°.

f) Give any two points of difference between SEM and TEM.

g) State the applications of XRF.

Q4) a) Answer any two of the following : **[6]**

i) Explain system aberrations in XRD.

ii) Explain how lipographic contrast is used in SEM for image analysis.

iii) Explain encitation of a characteristic X ray photon or an Auger electron by a high energy X ray photon or electron.

b) Answer any one of the following : **[4]**

i) Explain the construction and working of a X ray diffractometer with the help of a neat labeled diagram.

ii) Explain the different components of a SEM with the help of a block diagram.

Total No. of Questions : 4]

SEAT No. : ____

PC4128

[Total No. of Pages : 2

[6336]-2008

M.Sc. - I (Physical Chemistry/Inorganic Chemistry/Analytical Chemistry)/ (Organic/Drug Chemistry)

CHEMISTRY

CHE-561(C) MJ : Green Chemistry

(2023 Credit Pattern) (Semester - II) (2 Credits)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) Answer the following : **[5]**

a) What do you mean by Green Chemistry?

b) Define super critical carbon dioxide.

c) What is mean by click Chemistry?

d) Write the formula for calculation of percente Economy.

e) Define solid-phase synthesis.

Q2) a) Answer any two : **[6]**

i) Explain the ultrasonic synthesis of Simmon-Smith Reaction.

ii) Write the solventless process for the Reformatsky Reaction.

iii) Write a note on Environmentally Green Solvent.

b) Answer any two **[4]**

i) What is importance of renewable raw material in Green Synthesis?

ii) Explain Green synthesis of Adipic Acid.

iii) Write the advantages of reactions by using water as a solvent.

P.T.O.

Q3) Answer any five of the following : **[10]**

a) Why Claisen Rearrangement gives 100% atom Economy?

b) Write the applications of phase-transfer catalysis in Green Synthesis.

c) Write the advantages of polymer supported reagents in organic synthesis.

d) Explain microwave oxidation of alcohols.

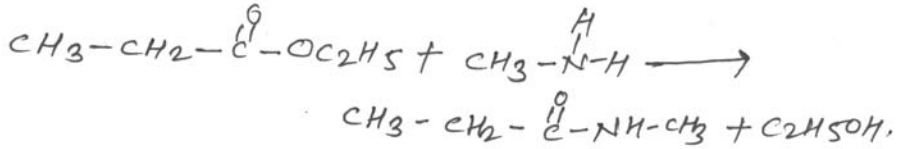
e) Write a note on metallocene catalysis.

f) What is mean by combinatorial Green Chemistry?

g) Give the Green Synthesis of Ibuprofen.

Q4) a) Answer any two of the following : **[6]**

i) Calculate the % atom economy for the following Reaction.



ii) Give the applications of green chemistry in sustainable development.

iii) Write a note on microwave assisted Diels-Alder Reaction.

b) Answer any one of the following : **[4]**

i) Enlist the twelve principles of Green Chemistry.

ii) Enlist the points to be considered while planning of Green synthesis.

Total No. of Questions : 4]

SEAT No. : [ ]

PC4129

[Total No. of Pages : 3

[6336]-2009

First Year M.Sc. (Organic/Drug Chemistry)

CHEOD-561(D) MJ : NUCLEAR AND RADIATION CHEMISTRY

(2023 Credit Pattern) (Semester - II)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic table and non-programmable calculator is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ kcal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-24}$kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

Q1) Answer the following : **[5]**

a) Define Auger effect.

b) What do you mean by δ-ray track.

c) Define fission energy.

d) Give the prepration of sulphur - 35.

e) Define Ficks first law of Diffusion.

Q2) a) Solve any two : **[6]**

i) What are general characteristics of radioactivity.

ii) Explain Neutron evaporation.

iii) Explain the radiometric titration with suitable example.

b) Solve any two **[4]**

i) For the radio active isotope ^{131}I the time required for 50% disintegration is 8 days. What is the time required for 90% disintegration of 5.5 gms of ^{131}I?

ii) Calculate the mass absorption coefficient for 1MeV γ-radiation for $Ca_3(PO_4)_2$ (a^{μ}, values O = 1.69, P = 3.17, Ca = 4.22).

iii) What are the modes of interaction of γ-ray with matter?

Q3) a) Solve any two : **[6]**

i) Discuss Neutron Energy distribution of the prompt delayed neutrons.

ii) Discuss the application of radioisotopes on tracers in reaction mechanism.

iii) Explain the Fricke Dosimeter.

b) Solve any two **[4]**

i) The half life of ^{22}Na is 2.6 years 89% of it decays by β^+ emission and the rest by EC. Calculate

1) the partial decay constant and

2) the half lives for each mode of decay

ii) In the fission of $^{235}_{92}U$ the end stable products are $^{94}_{40}Zr$ and $^{140}_{58}Ce$ what are the primary fragments?

iii) Find the molecular and mass absorption coefficients of benzene (Given density of benzene = 0.879 gm/cm^3 linear absorption coefficient of benzene = 0.06014 cm^{-1})

Q4) a) Solve any two **[6]**

i) Discuss the application of radioisotopes in assessing the volume of blood in a patient.

ii) Explain the concept of radiolysis of water.

iii) Discuss fission cross section and Thresholds in Nuclear fission.

b) Solve any one **[4]**

i) A 20 ml sample of saturated solution containing 4 mg/l of labelled $PbSO_4$ has an activity of 1600 c/min. The solution was shaken with 1gm of precipitated $PbSO_4$ and filtered. The filtrate was found to given 900 c/min. All activities are net and free from background give the surface area of one formula entity of $PbSO_4$ to be 18.4×10^{-16} cm^2. Find the surface area of 1 gm of precipitate sample.

ii) Find the biologically effective dose in severts and in rem for a radiation dose of 0.6 by due to

1) α-particle

2) thermal neutrons and

3) γ-radiations given RBE value for (1), (2) and (3) 10, 2.5 and 1 respectively.

Total No. of Questions : 4]

SEAT No. :

PC4130

[Total No. of Pages : 3

[6336]-2010

M.Sc. - I

PHYSICAL, INORGANIC AND ANALYTICAL CHEMISTRY

CHEPIA-561(D) MJ : Pericyclic Reactions and Photochemistry

(2023 Credit Pattern) (Semester - II) (2 Credits)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) Answer the following : **[5]**

a) Enlist the types of pericyclic reactions.

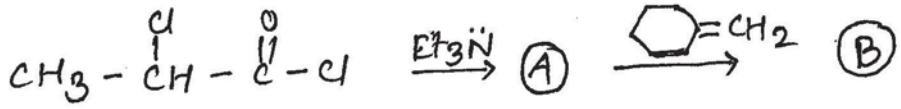
b) What is mean by C_2 symmetry in π-molecular orbital.

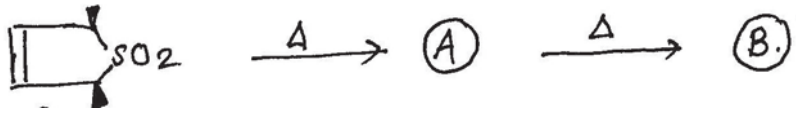
c) Define luminiscence.

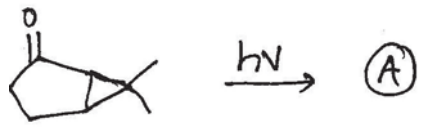
d) What is triplet state in photochemistry?

e) What is disrotatory motion?

Q2) a) Predict the product/s and explain the mechanism (Any two) **[6]**

i) 

ii) 

iii) 

b) Answer the following (Any two) **[4]**

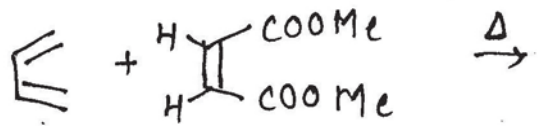
i) Draw the π-molecular orbitals of $CH_3 - CH = CH - CH = CH - CH_3$.

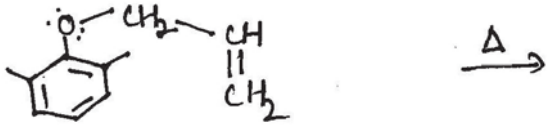
ii) Explain photoreductive dimerisation.

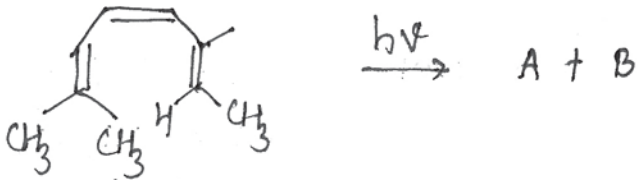
iii) Explain photolysis of acetone.

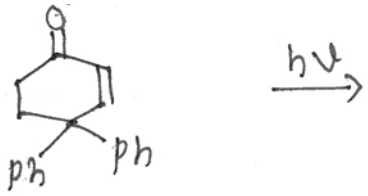
P.T.O.

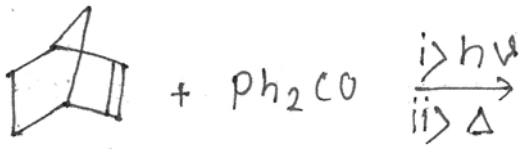
Q3) Predict the product with justification (Any five) **[10]**

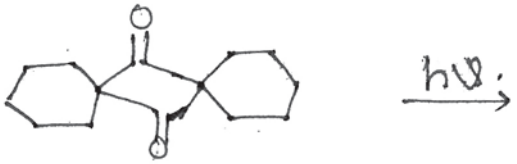
a) 

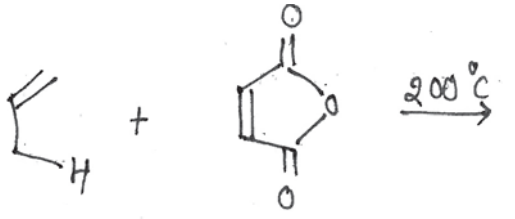
b) 

c) 

d) 

e) 

f) 

g) 

Q4) a) Answer the following (Any Two) **[6]**

i) Write short note on Norrish type I reaction.

ii) Write short note on 1, 3 dipolar cycloaddition.

iii) Write short note on Photoenolisation.

b) Answer the following (Any one) **[4]**

i) Explain Jablonskii diagram of photochemical reactions.

ii) Explain with the help of FMO approach whether [1,5] sigmatropic shift is thermally or photochemically allowed?

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Total No. of Questions : 6]

SEAT No. :

PC4131

[Total No. of Pages : 3

[6336]-3001
M.Sc. - II
PHYSICAL CHEMISTRY
CHP-601 MJ : QUANTUM AND SOLID STATE CHEMISTRY
(2023 Credit Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer book.***
2) ***All question are compulsory.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logarithmic table, calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1)	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2)	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3)	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4)	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5)	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6)	Gas Constant	R	$= 8.314 \times 10^{7}$ ergK^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7)	Faraday Constant	F	$= 96487$ C equiv^{-1}
8)	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9)	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10)	1 amu		$= 1.673 \times 10^{-27}$ kg
11)	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12)	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13)	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) a) Attempt any four of the following. **[8]**

i) State the postulates of Quantum mechanics.

ii) Define Hermitian operator. Give example.

iii) What is Pauli's exclusion principle?

iv) Give the conditions for an operator to be linear.

v) What is regular and inverted multiplet?

b) Derive the expression for linear momentum operator ($\hat{p}x$). **[3]**

Q2) a) Attempt any three of the following. **[9]**

i) What is commutative operator? Give one example.

ii) Construct the energy operator for H_2^+ ion and state the terms involved in it.

iii) Obtain the Spectroscopic term symbol for the configuration $2p'2d'$ and $1s'\,2s'$.

iv) Give the various steps involved in the application of variation theorem.

b) Which of the following are Eigen function of $\frac{d^2}{dx^2}$? Give Eigen value **[3]**

i) $\cos x$

ii) $6e^x$

iii) $\sin x$

Q3) a) Attempt any two of the following **[8]**

i) Apply the perturbation method to the system of He atom to calculate its energy.

ii) Derive $\left[\hat{M}^2, \hat{M}\pm\right] = 0$ for the operators $\hat{M}\pm$.

iii) Write a note on Hartree-fock self consistent method for multi electron system.

b) Attempt any one of the following. **[4]**

i) Show that $\left[\hat{L}_x, \hat{L}_y\right] = i\hbar\hat{L}_z$ for a set of angular momentum operators $\hat{L}_x$, $\hat{L}_y$ and $\hat{L}_z$.

ii) State whether each of the following entities is an operator or a function. Justify.

1) $\hat{A}\hat{B}$

2) $\hat{A}\,f(x)$

3) $f(x)\,\hat{A}$

4) $\hat{B}\hat{A}\,f(x)$

SECTION - II

Q4) a) Attempt any four of the following: **[8]**

i) Define defect and give its classification.

ii) State the advantages of growing crystals by pulling method.

iii) Give the factors affecting rates of Solid-Solid reaction.

iv) Define 'Colour centres'. What are different types of colour cetres?

v) What is ferrimagnetism?

b) Distinguish between plastic and elastic deformations. **[3]**

Q5) a) Answer any three of the following : **[9]**

i) Discuss Czochralski method to grow crystal from melts.

ii) Draw the various α - t plots for the decomposition of single solid.

iii) State and explain Kirkendall effect.

iv) Explain photoconductivity in ionic crystals.

b) Discuss gel growth method to grow crystal from solution. **[3]**

Q6) a) Attempt any two of the following. **[8]**

i) Derive the expression for Frankel defects in a crystal at a given temperature.

ii) Derive the expression $E_0 = \frac{E_c + E_v}{2}$ for an intrinsic semiconductor.

iii) Discuss the kinetic rate law for deceleratory solid phase decomposition reaction.

b) Attempt any one of the following. **[4]**

i) Calculate mean free time for an electron in a semiconductor crystal having drift mobility 625 cm^2/volt sec.

ii) A certain alkali halide ($A^+ X^-$) with molecular weight 74.6 has the NaCl structure. If the interionic distance $A^+ — X^-$ is 0.32 nm, calculate the density of the salt for the 0.1% Frankel defects.

■■■■

Total No. of Questions : 6]

SEAT No. : [ ]

PC4132

[Total No. of Pages : 3

[6336]-3002
M.Sc. - II
PHYSICAL CHEMISTRY
CHP-602 MJ : Polymer Chemistry
(2023 Credit Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All Questions are compulsory.***
2) ***Answer to the two sections should be written in separate answer book.***
3) ***Figures to the right indicate full marks.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Use of logarithmic table, calculator is allowed.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ kcal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	96487 C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) a) Answer the following (Any 4): **[8]**

i) Distinguish between Homopolymer and copolymer.

ii) Define monomer reactivity ratio.

iii) Define polydispersity and Degree of polymerization.

iv) Explain copolymerization.

v) Explain osmotic pressure.

b) Differentiate thermoplastic and thermosetting polymers. **[3]**

Q2) a) Attempt any three of the following. **[9]**

i) Explain sedimentation equilibrium method.

ii) Describe classification of polymer with examples.

iii) Write a note on entropy of mixing of polymer solutions.

iv) Explain the term meight average molecular weight of polymer.

b) If the degree of polymerization of polyethylene is 4000. Calculate molecular weight of polyethylene. **[3]**

Q3) a) Attempt any two of the following. **[8]**

i) Explain light scattering method for molecular weight determination of polymer solution.

ii) Derive and explain copolymer equation.

iii) Explain characterization of polymers.

b) Attempt any two of the following. **[4]**

i) Discuss the molecular forces in polymer.

ii) State any two assumptions of Krig baum theory.

iii) Explain depression in freezing point.

SECTION - II

Q4) a) Answer the following (Any 4): **[8]**

i) Define conducting polymer with example.

ii) What is Rubber elasticity?

iii) Explain the phenomenon of plastic process.

iv) What is Vulcanization?

v) What is meant by thermoplastic polymer?

b) Describe the process of compression molding. **[3]**

Q5) a) Attempt any three of the following. **[9]**

i) Explain the effect of radiation on polymer.

ii) Distinguish between melting point and glass transition temperature.

iii) Discuss mechanical properties of crystalline polymers.

iv) Explain block copolymerization.

b) Write a note on viscoelasticity. **[3]**

Q6) a) Attempt any two of the following. **[8]**

i) Distinguish between textile and fabric properties of polymer.

ii) Describe conduction mechanism in conducting polymer.

iii) Explain reinforcement and carbon blocks.

b) Attempt any two of the following. **[4]**

i) Explain configuration of polymers.

ii) Write a note on wet spinning process.

iii) Discuss the viscous flow phenomenon in polymer.

Total No. of Questions : 3]

SEAT No. : [ ]

PC4133

[Total No. of Pages : 2

[6336]-3003
M.Sc. - II
PHYSICAL CHEMISTRY
CHP-603 MJ: Nuclear and Radiation Chemistry
(2023 Credit Pattern) (Semester - III)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic table, calculator is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.023 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-16}$ erg s
			$= 6.626 \times 10^{-34}$ J/s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equivalent^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.187 \times 10^{3}$ erg
			$= 4.187$ J
10.	1 amu		$= 1.673 \times 10^{-22}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

Q1) a) Answer the following (Any 4) **[8]**

i) What is inelastic scattering in nuclear reactions.

ii) Explain fertile and fissile nuclear isotopes.

iii) What is magic numbers?

iv) Enlist two applications of RBS.

v) Explain organic scintillators with examples.

b) Describe different types of nuclear reactions. **[3]**

Q2) a) Attempt any three of the following. **[9]**

i) Explain regeneration & breeding of fissile matter.

ii) Discuss nuclear shell model.

iii) Explain channeling effect.

iv) Describe photomultiplier tube.

b) If no. of uranium atoms fissioning per two seconds are 6.24×10^{17}. Find the power generated in MW. **[3]**

(Given: energy released per fission = 200 MeV).

Q3) a) Attempt any two of the following. **[8]**

i) Discuss compound nucleus theory.

ii) Explain collective and unified model of Nuclei.

iii) Describe reactor fuel materials.

b) Attempt any two of the following. **[4]**

i) Draw the schematic diagram of PIXE analysis.

ii) Explain semi conductor detector.

iii) What is the use of control rods in nuclear reactor.

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Total No. of Questions : 3]

SEAT No. : ____

PC4134

[Total No. of Pages : 2

[6336]-3004
M.Sc. - II
PHYSICAL CHEMISTRY
CHP-610 (A) MJ : Photochemistry
(2023 Criedit Pattern) (Semester - III) (Elective) (Option - A)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic table, calculator is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1)	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2)	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3)	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4)	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5)	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6)	Gas Constant	R	$= 8.314 \times 10^{7}$ ergK^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7)	Faraday Constant	F	$= 96487$ C equiv^{-1}
8)	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9)	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10)	1 amu		$= 1.673 \times 10^{-27}$ kg
11)	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12)	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13)	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

Q1) a) Answer the following (any 4): **[8]**

i) State the Stark -Einstein law.

ii) Define triplet state and write the characteristics of triplet state.

iii) Which are the electronic transition in organic molecule? arrange the transition in the ascending order of their energy.

iv) What is population inversion?

v) Define the following

1) Oscillator strength.

2) Singlet electronic state

b) Expain the Dark phase reaction in photosynthesis. **[3]**

Q2) a) Attempt any three of the following : **[9]**

i) Explain p-type delayed fluorescence.

ii) Explain the Nd: YAG laser

iii) Describe Nano second flash photolysis

iv) Explain Q switching method of amplification of laser.

b) Give the General features of photophysical and photochemical processes **[3]**

Q3) a) Attempt any two of the following. **[8]**

i) Describe photophysical kinetics of unimolecular process.

ii) Explain with construction and working the process of flash photolysis.

iii) Discuss the charge transfer and energy transfer mechanism in quenching by added substance.

b) Attempt any two of the following. **[4]**

i) Classify the electronic orbitals in organic molecule in bonding molecular orbital, Antibonding molecular orbital and non-bonding molecular orbital.

ii) Discuss the phenomenon of static quenching.

iii) What is pulsed laser?

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Total No. of Questions : 3]

SEAT No. : ____

PC4135

[Total No. of Pages : 2

[6336]-3005
M.Sc.-II
PHYSICAL CHEMISTRY
CHP-610(B) MJ : Physicochemical Methods of Analysis
(2023 Credit Pattern) (Semester - III) (Elective) (Option - B)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All Questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logarithmic table, calculator is Allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ kcal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	96487 C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

Q1) a) Attempt any four of the following : **[8]**

i) Explain the term thermal analysis.

ii) Define the terms K.E of ejected electron and Fermi energy level.

iii) Define absorptive edge state it's use.

iv) How are x - ray produce? Which is the most useful portion of the x - ray region for chemical analysis?

v) Define the term binding energy and work function used in ESCA.

b) Explain electron probe x - ray microanalysis technique. **[3]**

Q2) a) Attempt any 3 of the following: **[9]**

i) What are the advantages of x - ray radioactive source.

ii) Describe with an example neutralization thermometric titration.

iii) Explain spectral splitting observed in ESCA technique.

iv) Discuss the application of DTA technique.

b) Calculate the short-wavelength cut off the lamp when an accelerating potential in an x - ray tube is 15.5 KV. **[3]**

Q3) a) Attempt any two of the following: **[8]**

i) State the principle of thermometric titration. Explain thermometric titration curve for exothermic and endothermic reaction.

ii) What is meant by EXAFS? Give two application of x - ray absorption.

iii) Describe retarding potential analyser used in ESCA.

b) Attempt any two of the following. **[4]**

i) What is meant by thermal analysis?

ii) Explain x - ray fluorescence.

iii) Draw a neat labelled diagram of an ESCA spectrometer.

Total No. of Questions : 3]

SEAT No. :

PC4136

[Total No. of Pages : 2

[6336]-3006
M.Sc. - II
PHYSICAL CHEMISTRY
CHP-610 (C) MJ : Special Topics in Physical Chemistry
(2023 Credit Pattern) (Semester-III) (Elective) (Option-C)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) *All questions are compulsory.*
2) *Figures to right indicate full marks.*
3) *Use of logarithmic table, calculator is allowed.*
4) *Neat diagrams must be drawn wherever necessary.*

Physico - Chemical Constants

1)	Avogadro Number	N	$= 6.022 \times 10^{23}$ mol^{-1}
2)	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3)	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4)	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5)	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6)	Gas Constant	R	$= 8.314 \times 10^{7}$ ergK^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7)	Faraday Constant	F	$= 96487$ C equiv^{-1}
8)	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9)	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10)	1 amu		$= 1.673 \times 10^{-27}$ kg
11)	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12)	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13)	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

Q1) a) Attempt the following (Any 4) **[8]**

i) What are nano aerogel? Give examples.

ii) What are smart material? Give examples.

iii) Discuss any two size dependent properties of nanoparticles.

iv) Explain carbon nanotubes.

v) Explain electrochemical adorption of hydrogen storage.

b) Write a note on semiconductor nanoparticles. **[3]**

Q2) a) Attempt the following. (any 3) **[9]**

i) Discuss the storage of hydrogen in carbon nanotubes.

ii) Give an account of semiconductor nanocrystals.

iii) Explain chemisorption in hydrogen storage.

iv) How are nanoparticles used in cosmetics and sunscreen.

b) What are shape memory alloys? Give examples. **[3]**

Q3) a) Attempt the following. (any 2) **[8]**

i) Write short notes on smart polymers.

ii) Explain piezodetric materials with examples.

iii) Discuss the properties of nanoparticles.

b) Attempt the following. (any 2) **[4]**

i) What are the uses of smart windows and smart glasses?

ii) Give the applications of nanomaterials.

iii) Write a short note on smart ceramics.

Total No. of Questions : 6]

SEAT No. :

PC4137

[Total No. of Pages : 3

[6336]-3007
M.Sc. II
INORGANIC CHEMISTRY
CHI-601-MJ : Organometallic and Homogeneous Cataysis
(2023 Credit Pattern) (Semester-III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Neat diagram must be drawn wherever necessary.***

SECTION - I

(Organomctallic)

Q1) a) Answer the following. **[8]**

i) What is schrock carbene?

ii) What is rate of Fluxionality?

iii) Find the value of 'n' in the following.

1) $Fe(CO)_n$

2) $Os_3(CO)_n$

iv) Draw the structure of Zeise's salt and what is the oxidation state of metal?

b) Give the typical reactions of (η^6 - arene) metal derivatives. **[3]**

Q2) a) Answer any one of the following. **[6]**

i) Give an account of synthesis, bonding, properties and applications of alkene complexes.

ii) Explain in brief fluxional behaviour of organometalic compounds.

b) Answer any two of the following. **[6]**

i) Give the classification of σ-bonded hydrocurbyls.

ii) Give the synthesis and properties of cyclopentadienyl complexes.

iii) What is synergic bonding? Explain with example.

P.T.O.

Q3) a) Answer any one of the following. **[6]**

i) List the general methods for preparation of transition metal alkyls. Explain any one in detail.

ii) For the following molecules give the oxidation state of metal, total valence electron [TVE] No. of M-M bonds if any and 18 e^- count.

1) $Ir_4[CO]_{12}$

2) $CO_2[CO]_8$

3) $Mn_2[CO]_{10}$

[Atomic No IR = 77, CO = 27, Mn = 25]

b) Answer any two of the following. **[6]**

i) Draw the structure of ferrocene in it's different form and comment on their difference.

ii) Give the classification of sigma complexes.

iii) Explain bonding in metallic carbonyls.

SECTION - II

(Homogeneous Catalysis)

Q4) a) Answer the following. **[8]**

i) Which chiral ligant is used for synthesis of L-DOPA. Draw its structure.

ii) Homogeneous catalyst is tailor made. Explain.

iii) Define the term cone angle and bite angle.

iv) Discss chemoselectivity with suitable example.

b) What is biphasic catalysis? Discuss any one biphasic method in detail. **[3]**

Q5) a) Answer any one of the following: **[6]**

i) Discuss Suzuki coupling reaction with the help of catalytic cycle.

ii) Give an account of metallocene based catalyst for polymerization of propylene.

b) Answer any two of the following. **[6]**

i) Discuss in brief migratory insertion reaction.

ii) Differentiate between homogeneous and heterogeneous catalysts.

iii) Describe Tollman catalytic cycle for hydrogenation of olefins.

Q6) a) Answer any one of the following. **[6]**

i) What is metathesis reaction? Which catalysts used for it? Discuss various types of metathesis reactions.

ii) Discuss the mechanism of epoxidation reaction using catalytic cycle.

b) Answer any two of the following. **[6]**

i) Cativa process is superior than Monsanto process, Explain.

ii) Differentiate between LDPE and HDPE.

iii) Discuss β-hydride elimination reaction, with suitable example.

■■■■

Total No. of Questions : 6]

SEAT No. :

PC4138

[Total No. of Pages : 3

[6336]-3008

M.Sc. - II (Inorganic Chemistry)

CHEMISTRY

CHI-602 MJ : Inorganic Reaction Mechanism and Photochemistry and Reaction of Coordinated Ligand

(2023 Credit Pattern) (Semester-III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***Answers to the two sections should be written in separate answer books.***

SECTION-I

Q1) a) Attempt the following. **[8]**

i) Kinetic stability of a complex is determinal by which factor?

ii) What is group transfer reaction?

iii) List out main characteristics of inner sphere mechanism.

iv) Which of the following octahedral substitution reaction is faster why?

$$\left[NiCl\left(NH_3\right)_5\right]^- + H_2O \rightarrow \left[Ni\left(H_2O\right)\left(NH_3\right)_5\right]^{2+} + ClO$$

$$\left[NiCl\left(NH_3\right)_5\right]^+ + NH_2O \rightarrow \left[Ni\left(NH_3\right)_5\right]^{2+} + ClO$$

b) Describe the mechanism for halogenation of coordinated nitrogen atom with example. **[3]**

P.T.O.

Q2) a) Attempt any one of the following. **[6]**

i) What do you mean by base hydrolysis. Explain it with suitable example?

ii) Discuss the mechanism of structural isomerism in octahedral complexes with suitable example?

b) Attempt any two of the following. **[6]**

i) Arrange the following metal complexes according to the increasing order of their rate equation.

$$cis\left[Co(en)_2Cl_2\right], cis-\left[Co(NH_3)_4Cl_2^-\right]^-, cis-\left[Co(trienCl_2)\right]^-$$

Justify your answer.

ii) Discuss the trans effect with suitable example?

iii) Give the classification of inorganic reaction mechanism.

Q3) a) Attempt any one of the following. **[6]**

i) Discuss the mechanism of inner sphere electron transfer reaction with the help of cobalt.

ii) Explain Marcus equation in detail.

b) Answer any two of the following. **[6]**

i) Complete the following innersphere electron transfer reaction.

1) $\left[Cr(H_2O)_6\right]^{2+} + \left[Co(NH_3)_5H_2O\right]^{+3} \rightarrow ? + ?$

2) $\left[Cr(H_2O)_6\right]^{2} + \left[Co(NH_3)_5(RCOO)\right]^{-2} \rightarrow ? + ?$

Explain which reaction is faster

ii) Discuss the role of spectator ligand in substitution of square planer complexes.

iii) Nucleophillic substitution in square planer complexes take place with retention of configuration. Explain.

SECTION-II

Q4) a) Attempt the following. **[8]**

i) What do you mean by quantum yeild in photochemical reaction.

ii) What is oxidative addition? Which metal center favour oxidative addition.

iii) What are the applications of excited state outersphere electron transfer reaction.

iv) List out the reaction of coordinated ligands.

b) What do you mean by prompt and delayed reactions. Explain with suitable example. **[3]**

Q5) a) Attempt any one of the following. **[6]**

i) Discuss in brief kinetic template effect involving reaction between one donor atom and one on donor atom.

ii) Explain in detail Chelate ring modifying reactions.

b) Answer any two of the following. **[6]**

i) Give an account of photochemical reactions of Co(III) complexes.

ii) Explain solvolysis of coordinated phosphorus atom

iii) Methyl migration and Co inseration reactions.

Q6) a) Attempt any one of the following. **[6]**

i) Describe the mechanism of alkylation of coordinating sulphur.

ii) Discuss the Chelate ring forming reaction predominantly involving thermodynamic template effect.

b) Write a note on (Any two) **[6]**

i) Reductive elimination reaction

ii) Importance of Photochemistry

iii) Solute-solvent interactions.

Total No. of Questions : 3]

SEAT No. : ____

PC4139

[Total No. of Pages : 2

[6336]-3009

S.Y.M.Sc.

INORGANIC CHEMISTRY

CHI-603MJ: Bioinorganic Chemistry

(2023 Credit Pattern) (Semester - III)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat and labelled diagrams wherever necessary.***

Q1) a) Answer the following. **[8]**

i) Why transition metals are involved in enzymatic reaction?

ii) What is Znf (zinc finger nuclease)?

iii) What is blue and nonblue proteins? Give suitable example?

iv) Enlist the oxidation states of Manganese accessible in biology.

b) Why tyrosinase enzyme is called mixed function catalyse? Explain with suitable example. **[3]**

Q2) a) Attempt any one of the following. **[6]**

i) Explain the following actions of alkyl cobalamine.

1) One electron redox reaction

2) Co-C band Cleavage

ii) Explain the Mutase activity of coenzyme B_{12}

b) Attempt any two of the following. **[6]**

i) Which metallo enzyme is responsible for removal of H_2O_2? Discuss it's active site, structure and function.

ii) What is Reiske Protein? Mention oxidation states at Fe centres.

iii) Give an account of Galactose oxidase in detail?

P.T.O.

Q3) a) Attempt any one of the following. **[6]**

i) Explain structure function & Reactions of plastocyanin.

ii) What are structurally important components of Mo containing enzymes?

b) Write note on any two. **[6]**

i) Antagonism

ii) Methylcobalamine as cofactor

iii) Enzyme Azurin

ⓘⓘⓘⓘ

Total No. of Questions : 6]

SEAT No. : ____

PC4140

[Total No. of Pages : 3

[6336]-3010
M.Sc. II
INORGANIC CHEMISTRY - IV
CHI-610(A) MJ : Physical Methods in Inorganic Chemistry
(2023 Credit Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicates full marks.***
3) ***Write each section in separate answer book.***
4) ***Use of Logarithm table and calculators are allowed.***

SECTION - I

(Thermal and Spectroscopic Tehcniques)

Q1) a) Answer the following: **[8]**

i) State the selection rules for ESR and NMR techniques.

ii) What is the principle of DTA?

iii) Briefly explain the application of TGA in material characterization.

iv) Draw the following crystallographic planes:

1) [110]

2) [002]

b) What is hyperfine structure? Predict the number of lines and their relative intensities in the ESR spectrum of CD_3 radical. **[3]**

Q2) a) Attempt any one of the following: **[6]**

i) Explain the principle and working of DSC technique. Discuss it's application in polymer analysis.

ii) What is chemical shift? Explain the ^{19}F-NMR spectra of HPF_2 molecule.

Given : 1) $J_{^{19}F-^{1}H} > J_{^{19}F-^{31}P}$

2) $J_{^{19}F-^{31}P} > J_{^{19}F-^{1}H}$

P.T.O.

b) Attempt any Two of the following. **[6]**

i) What is the principle of TPD technique?Discuss any two applications of TPD technique.

ii) Derive Bragg's equation in XRD.

iii) Discuss the principle and working of Fluorescence spectroscopy in brief.

Q3) a) Attempt any one of the following. **[6]**

i) Explain the principle and working of FT-IR spectroscopy. Discuss any two applications of FT-IR spectroscopy.

ii) Discuss the instrumentation and working of TGA technique.

b) Attempt any two of the following. **[6]**

i) Calculate the percentage of $MgCO_3$ and $CaCO_3$ in 40 mg of limestone sample that exhibits thermogram showing weight of 30 mg at 500°C and 18 mg at 900°C.

(Given : At. Wt. Ca = 40.08, Mg = 24.31, C = 12.01, O = 15.99).

ii) An XRD pattern shows peak at 2θ values of 20°, 30° and 40°. Calculate the interplaner spacing for the first peak. The wavelength of the X - ray used is 1.54 A°.

iii) Differentiate between DTA and DSC techniqeus.

SECTION - II

(Material Characterization Techniqeus and Analytical Techniques)

Q4) a) Answer the following: **[8]**

i) What is the priciple of SEM and how does it differ from TEM?

ii) Briefly explain the role of EDX in elemental analysis.

iii) Discuss the principle of BET method.

iv) Give any two applications of cyclic voltammetry.

b) In a BET experiment, the monolayer volume of adsorbed gas is $2cm^3/g$ and the cross-sectional area of nitrogen is 0.162 nm^2. Calcualte the BET surface area of the sample. **[3]**

Q5) a) Attempt any one of the following: **[6]**

i) Discuss the principle, instrumentation and applications of X-ray photoelectron spectroscopy (XPS).

ii) Discuss the working and applications of TEM.

b) Attempt any two of the following. **[6]**

i) Describe the instrumentation and working of cyclic voltammetry.

ii) Explain the principle of the UV-DRS technique. Discuss it's applications.

iii) Differentiate between SEM and TEM techniques.

Q6) a) Attempt any one of the following. **[6]**

i) Discuss the principle, instrumentation and applications of Flame photometry.

ii) Describe the working and applications of SEM in Material analysis.

b) Answer any two of the following. **[6]**

i) In a cyclic voltammetry experiment, a peak current of 50 μA is observed at a scan rate of 0.1 V/s. Calculate the expected peak current at a scan rate of 0.02 V/s.

ii) Discuss the advantages and disadvantages of TEM technique.

iii) What are secondary electrons in SEM? What information they provide about sample's suraface?

Total No. of Questions : 6]

SEAT No. : ____

PC4141

[Total No. of Pages : 3

[6336]-3011
M.Sc. II
INORGANIC CHEMISTRY-IV
CHI-610(B) MJ : Magneto-Chemistry & Inorganic Polymers
(Credit2023 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat diagrams must be drawn whenever necessary.***
3) ***Use of calculator is allowed.***

SECTION - I

(Magneto - Chemistry)

Q1) a) Attempt the following: **[8]**

i) What are ferromagnetic materials? Give one example.

ii) Define magnetic susceptibility & give its unit.

iii) Write formula for determination of magnetic moment in lanthanides.

iv) What is anisotropy in magnetic susceptibility?

b) Explain the experimental magnetic moment of the following ions **[3]**

i) V^{2+} $\mu_{expt.}$ = 2.4 to 2.5 BM

ii) Ti^{3+} $\mu_{expt.}$ = 1.7 to 1.8 BM

Q2) a) Attempt any one of the following: **[6]**

i) Explain magnetic properties of transition metal complexes in cubic and axially symmetric crystal fields.

ii) Write Van-Vleck equation. Explain its significance.

b) Answer any two of the following **[6]**

i) Enlist applications of magnetic materials.

ii) Compare low spin & high spin crossover.

iii) Write a short note on molecular & signal chain-magnets.

P.T.O.

Q3) a) Attempt any one of the following. **[6]**

i) Explain in brief Faraday's method.

ii) What are mixed valence compounds? Classify them & comment on their magnetic behaviour.

b) Answer any two of the following. **[6]**

i) Define magnetic properties & types of magnetic substances.

ii) What is spin canting? Explain with suitable example.

iii) Explain magnetic properties of lanthanides & actinides.

SECTION - II

(Inorganic Polymers)

Q4) a) Attempt the following: **[8]**

i) What is inorganic benzene? Draw its structure.

ii) Explain homopolar inorganic polymer with example.

iii) Give properties & preparation of carborundum.

iv) Define polyphosphazene & give its one application.

b) Discuss in brief polymeric compounds of sulphur. **[3]**

Q5) a) Attempt any one of the following: **[6]**

i) Explain preparation, properties and applications of boron nitride.

ii) Discuss about catalytic role of inorganic polymers.

b) Attempt any two of the following. **[6]**

i) Give comparison between natural & synthetic polymers.

ii) Explain biological & medical applications of metal containing polymers.

iii) Discuss about polysiloxanes.

Q6) a) Attempt any one of the following. **[6]**

i) Explain synthesis & reactions of coordination polymers.

ii) Give a brief account for polymer of aluminium & phosphorous nitride.

b) Answer any two of the following. **[6]**

i) Give difference between addition & condensation polymers.

ii) What is chain depolymerization? Explain with example.

iii) Explain about polysilanes.

Total No. of Questions : 6]

SEAT No. :

PC4142

[Total No. of Pages : 3

[6336]-3012
M.Sc. - II
ORGANIC CHEMISTRY
CHO-601-MJ : Organic Reaction Mechanism and Stereochemistry
(Credit 2023 Pattern) (Semester-III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer book.***

SECTION - I

Q1) a) Answer the following. (any 4) **[8]**

i) Explain secondary isotope effect with suitable example.

ii) Which of the following is more acidic? Justify

iii) Explain the significance of reaction constant (rho).

iv) Give stork enamine synthesis.

v) Give any two methods of preparation of carbanions.

b) Write a short note on Mannich reaction. **[3]**

Q2) a) Attempt any three of the following. **[9]**

i) Predict the sign of Hammett σ (sigma) Constant for following substituents: m - NO_2, p - CF_3, P - OCH_3.

ii) Explain trapping of intermediates evidences to determine reaction mechanism.

iii) Explain bose catalysed halogenation of ethyl methyl ketone.

iv) Write a short note on Robinson annulation.

b) The pKa of a p - chlorobenzoic acid is 3.98, pKa of benzoic acid is 4.19. Calculate σ (sigma) for p - Cl group. **[3]**

P.T.O.

Q3) a) Attempt any two of the following: **[8]**

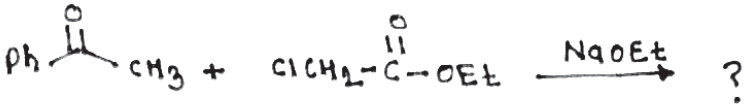
i) Explain the importance of non-linear Hammett plots.

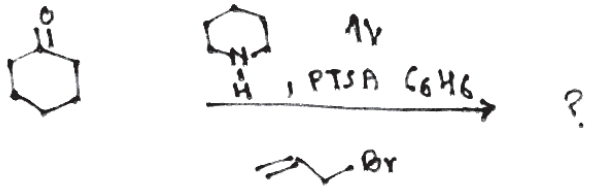
ii) How cross-over experimet helps to decide the reaction mechanism? Explain with suitable example.

iii) Write a short on benzoin condensation with mechanism.

b) Predict product of the following reactions (Any two) **[4]**

i) 

ii) 

iii) 

SECTION - II

Q4) a) Answer the following (Any four): **[8]**

i) Give any two methods for preparation of fused ring system.

ii) Explain resolution by formation of diastereomers.

iii) Draw the various conformations of cyclooctane.

iv) Why trans-4-t butyl cyclohexane carboxylic acid is stronger than its cis derivative?

v) Explain Van-Arkel rule.

b) Draw conformational structures of compound (I) and (II). Discuss their stability **[3]**

Q5) a) Attempt any three of the following: **[9]**

i) Explain Bredt's rule with suitable example.

ii) Explain the term "Optical purity" with example.

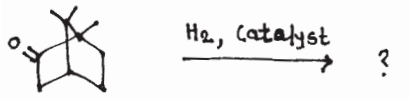
iii) Draw the stable conformation of trans -1, 3-di-t butyl cyclohexane. Why it is more stable than its cis-isomer?

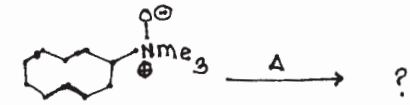
iv) Explain the terms "I strain" with examples.

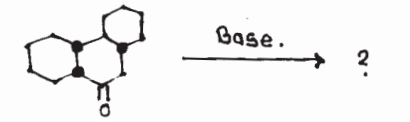
b) Explain the difference of reactivities for solvation of cis and trans - 4 - t butyl cyclohexyl tosylate with the help of energy profile diagram. **[3]**

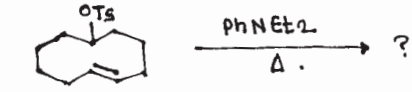
Q6) a) Predict the products in any four of following with stereochemistry. **[8]**

i) 

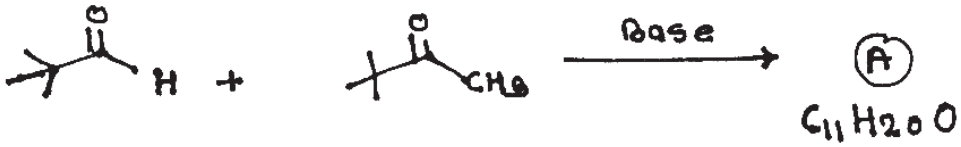
ii) 

iii) 

iv) 

v) 

b) How would you determine the stereochemistry of the following reaction using PMR data given below: **[4]**



A:1.1 (S, 9H), 1.17 (S, 9H), 6.4 (d, 15Hz, 1H), 7.0 (d, 15Hz, 1H).

■■■■

Total No. of Questions : 6]

SEAT No. : ____

PC4143

[Total No. of Pages : 6

[6336]-3013
M.Sc.-II
ORGANIC CHEMISTRY
CHO - 602 - MJ : Advanced Spectroscopic Methods in Structure Determination
(Credit 2023 Pattern) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 70***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicates full marks.***
3) ***Answer to the two sections should be written in the separate answer books.***

SECTION - I

Q1) a) Attempt any four of the following. **[8]**

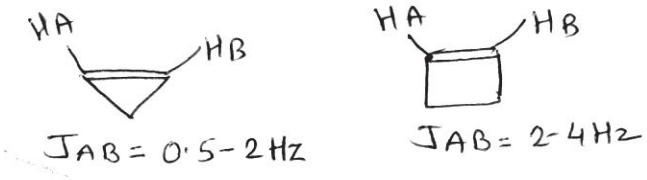
i) Distinguish following pairs by PMR spectroscopy.

ii) Distinguish following pairs by CMR spectroscopy.

iii) Distinguish following pairs by mass spectrometry.

P.T.O.

iv) Explain the coupling constants observed in the following compounds



v) Explain benefits of DEPT over APT. technique.

b) Acetone-d_6 shows septet (1:3:6:7:6:3:1) in 13C NMR. Explain **[3]**

Q2) a) Deduce the structure using given spectral data (Any 3) **[9]**

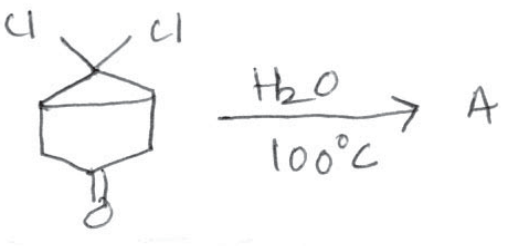
i) M. wt = 69
IR (cm^{-1}): 2240, 2941
PMR (δ) : 2.72 (Septer, J=6.7Hz, 1H)
1.33 (doublet, J = 6.7Hz, 6H)

ii) MF : $C_5H_{10}O_2$
PMR (δ) : 4.1 (s, 4H), 1.5 (s, 6H)
CMR (δ) : 25 (q, strong), 68 (t, strong), 95(s)

iii) MF : $C_7H_6N_2O_5$
PMR (δ) : 4.12 (s, 11.8 mm)
7.25 (d, J = 8 Hz, 4mm)
8.47 (dd, J = 8 and 2 Hz, 3.8mm)
8.72 (d, J = 2Hz, 4mm)

iv) MF : C_6H_8O
CMR (δ) : 30 (t), 41 (t), 129 (d), 145(d), 198 (s)

b) Predict the struture of the product for the following reaction and justify.**[3]**



M+ 128 and 130
Vmax (cm^{-1}) : 3500,1600,1500
PMR (δ) : 5.4 (brs, ^1H)
6.8 (d, J = 7Hz, 2H)
7.1 (d, J = 7Hz, 2H)

Q3) a) Write short notes on (any 2) **[8]**

i) Factors affecting geminal coupling.

ii) Lanthanide shift reagents.

iii) Chemical ionization and MALDI techniques.

b) Attempt any two of the following. **[4]**

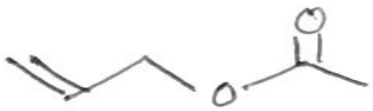
i) How will you verify that a particular signal arises from the proton of the – OH/–NH or – SH group.

ii) Importance of isotopic peaks in Ms.

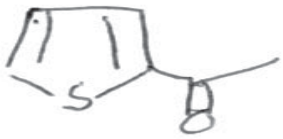
iii) Discuss off resonance technique.

SECTION - II

Q4) a) Write the genesis or the ions. (any 4) **[8]**

i)  100,58,57,43,42,41

ii) Butanamide 87,71,57,44,43

iii)  126,111,83,39

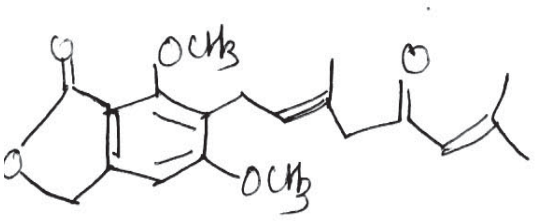
iv)  85,84,57,42

v) P-chlorobenzophenone 218,216,141,139,105,77

b) A compound with molecular formula C_7H_8S shows the following peaks in its mass spectrum. Dedure the structuce of the compound and Justify your answer. $\frac{m}{z}$ = 124,109,91,78,77,65,51. **[3]**

Q5) a) Attempt any two of the following. **[8]**

i) Assign the following Signals to different protons in compound X. Use the decoupling experiment and NOE. Justify your assignments.



Decouplin experiment

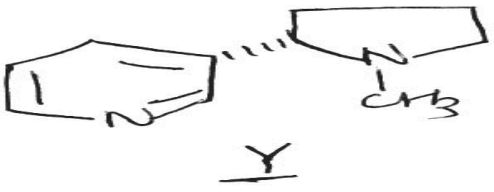
Irradiation at	Charge at
1.79	5.26 (m) → (t) 6.6Hz
5.26	3.47 (d) → (s)

NOE experiment :-

Irradiation at	Enhancement at
3.91	6.64 by 15%

1.79 (d, 1.2Hz, 3H)
1.85 (s, 3H)
2.13 (s, 3H)
3.02 (s,2H)
3.47 (d, 6.6Hz,2H)
3.91 (s,3H)
4.07 (s,3H)
5.19 (s,2H)
5.26 (m, 1H)
6.08 (s, 1H)
6.64 (s, 1H)

ii) Assign the signals to different carbons of the compound ɣ and explain your answer.



Y

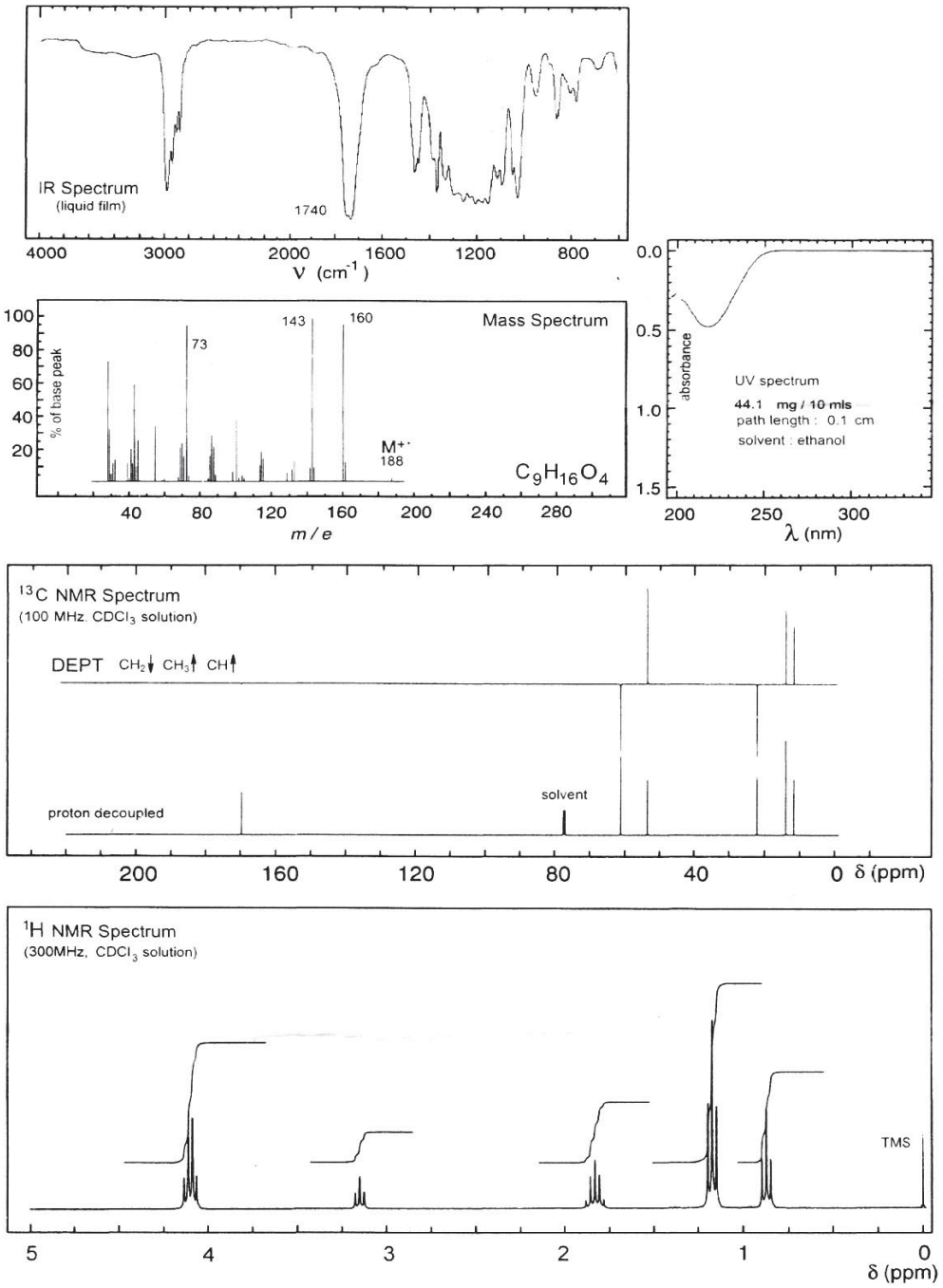
22.6 (t), 35.2 (t), 40.3(q)
57.0 (t), 68.9 (d), 123.6(d),
134.9(d), 138.9(s), 148.5 (d)
149.5(d)

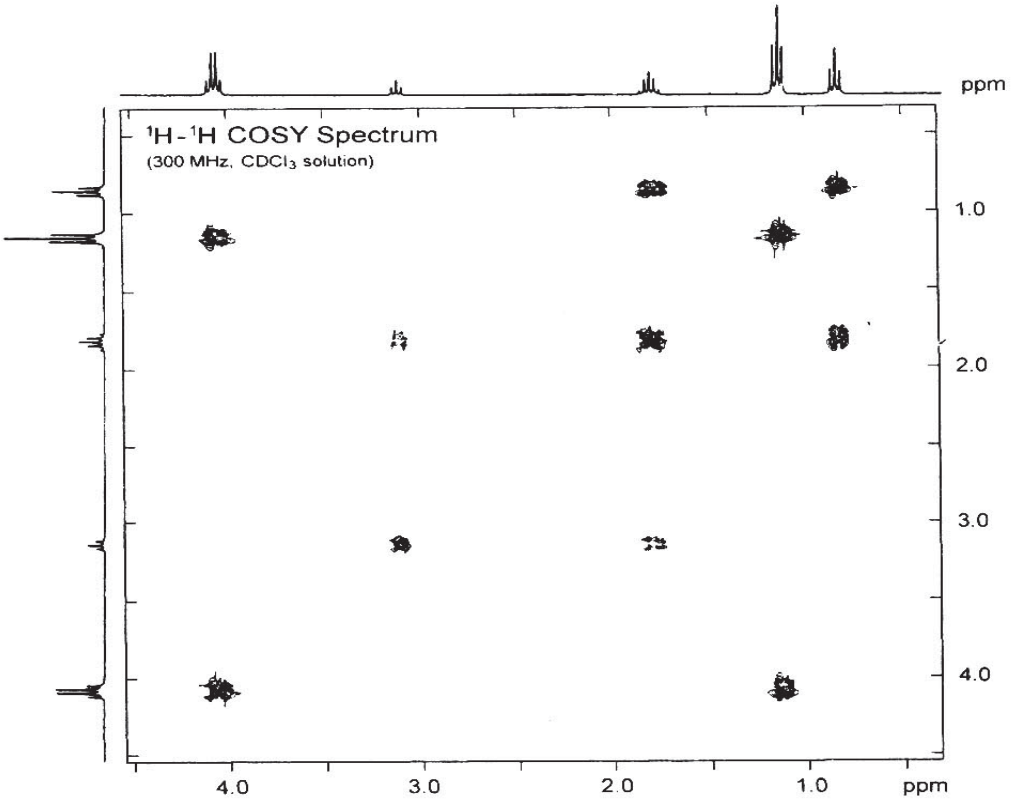
iii) Write a note on rearrangements in Ms.

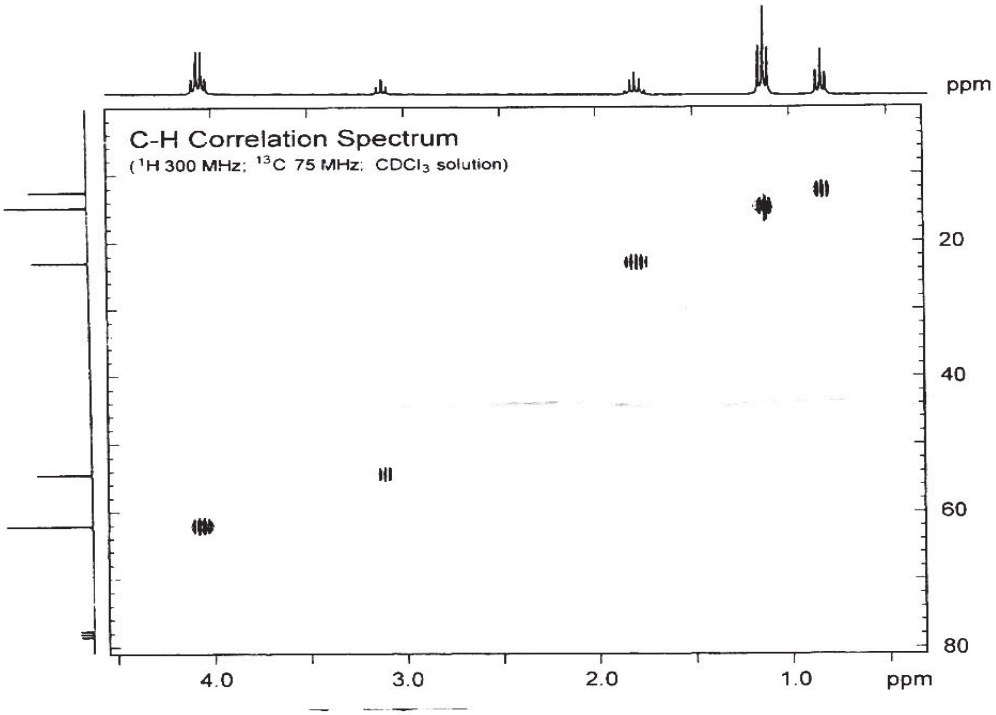
b) Discuss the use of 2D-NMR techniques in structure determination. **[4]**

Q6) a) 1-Bromo-1-fluoroethane shows dq in its ^{19}F NMR and dd and dq in ^{1}H NMR. Explain. **[3]**

b) You are provided the spectra of a compound on the adjacent page. Analyze these spectra and arrive at a structure consistent with the data. Justify your structure. **[9]**




ppm
^{1}H-^{1}H COSY Spectrum
(300 MHz, $CDCl_3$ solution)
1.0
2.0
3.0
4.0
4.0
3.0
2.0
1.0
ppm


ppm
C-H Correlation Spectrum
(^{1}H 300 MHz; ^{13}C 75 MHz; $CDCl_3$ solution)
20
40
60
80
4.0
3.0
2.0
1.0
ppm

* * *

Total No. of Questions : 3]

SEAT No. :

PC4144

[Total No. of Pages : 3

[6336]-3014

M.Sc. - II (Organic Chemistry)

CHO-603 MJ : HETEROCYCLIC CHEMISTRY

(2023 Credit Pattern) (Semester-III)

Time : 2 Hours] *[Max. Marks : 35*

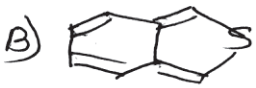
Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) a) Answer the following. (Any four) **[8]**

i) Name the following heterocycles by systematic Hantzsch-Widman nomenclature system.

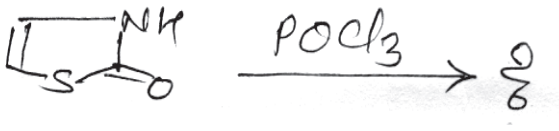
A) 

B) 

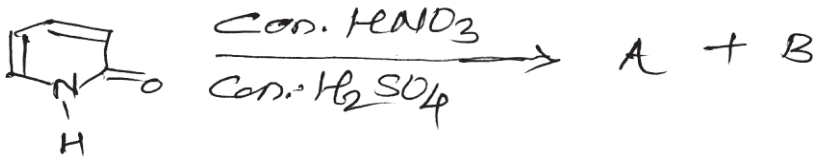
ii) 3-formyl indole does not show aldehydic properties as like 4-formyl indole, why?

iii) N-methyl imidazole has lower boiling point than imidazole, why?

iv) Predict the product for the following reaction.



v) Write the products for the following reaction.



b) Pyridine does not polymerised in presence of acid but pyrrole does, why? **[3]**

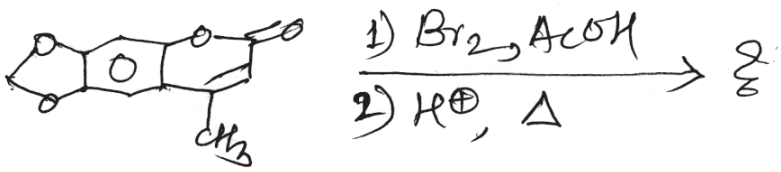
P.T.O.

Q2) a) Attempt any three of the following. **[9]**

i) Write the basicity order for the following compounds. Justify your answer.

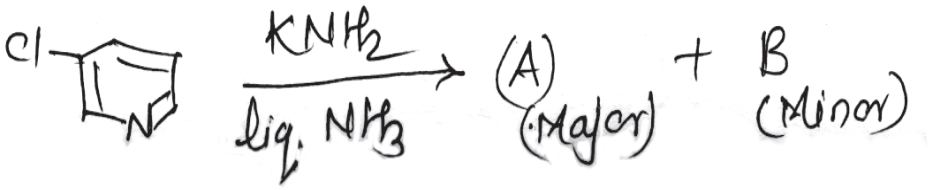
ii) Quinoline undergoes nucleophilic substitution at 2 & 4 position while isoquinoline undergoes at 1-position.

iii) Predict the product for the following reaction.



iv) Furan undergoes Drels-Alder reaction but benzofuran does not, explain.

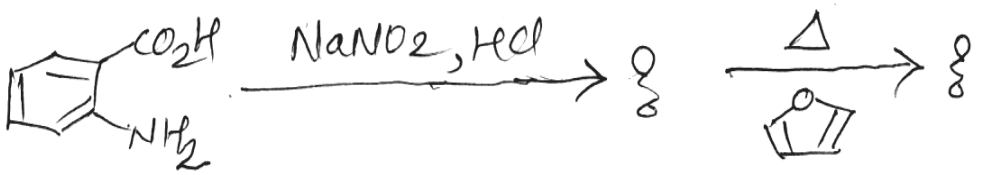
b) Predict the product with mechanism for the following. **[3]**



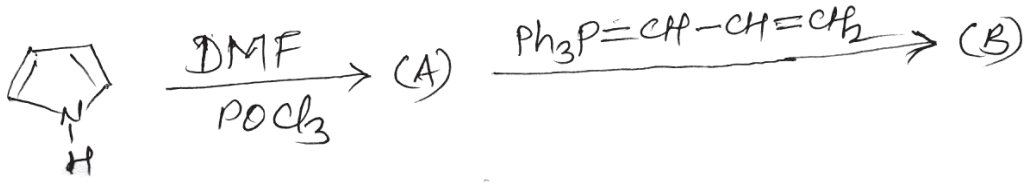
Q3) a) Attempt any two of the following. **[8]**

i) Furan undergo ring opening on treatment with H_2SO_4, but furoic acid undergo sulphonation at 5-position by treatment with H_2SO_4, explain.

ii) Predict the products for the following reaction.

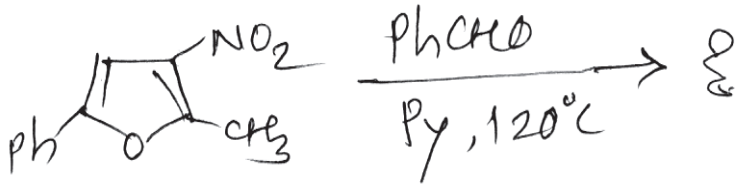


iii) Complete the following reaction sequence. Write the suitable mechanism & predict the product.



b) Attempt any two of the following. **[4]**

i) Predict the product for the following reaction.



ii) Write a short note on Hinsberg thiophene sysnthesis.

iii) Write the products for the following reaction sequence.

Total No. of Questions : 3]

SEAT No. : ____

PC4145

[Total No. of Pages : 2

[6336]-3015

M.Sc. - II

ORGANIC CHEMISTRY - II

CHO-610 (A) MJ : Synthetic Methods in Organic Chemistry

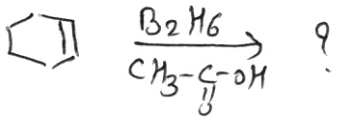
(2023 Credit Pattern) (Semester - III)

Time : 2 Hours] ***[Max. Marks : 35***

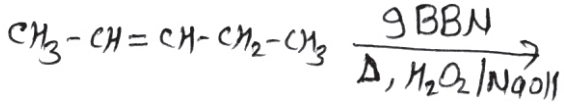
Instructions to the candidates:

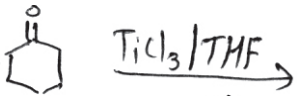
1) ***All questions are compulsory.***
2) ***Figures to the right indicates full marks.***

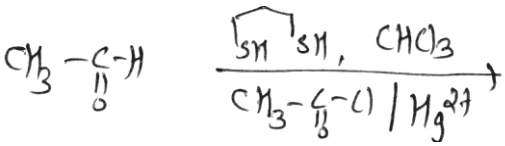
Q1) a) Predict the product of the following (Any Four): **[8]**

i) 

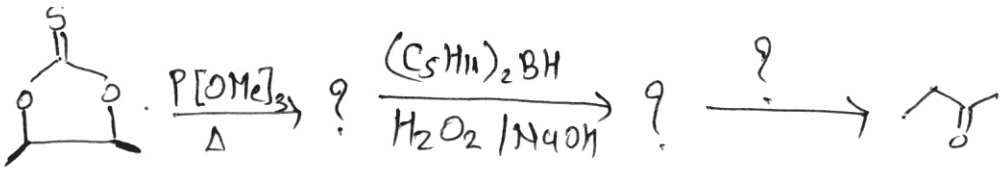
ii) 

iii) 

iv) 

v) 

b) Complete the following reaction sequence with possible mechanism. **[3]**



P.T.O.

Q2) a) Answer the following (any 3): **[9]**

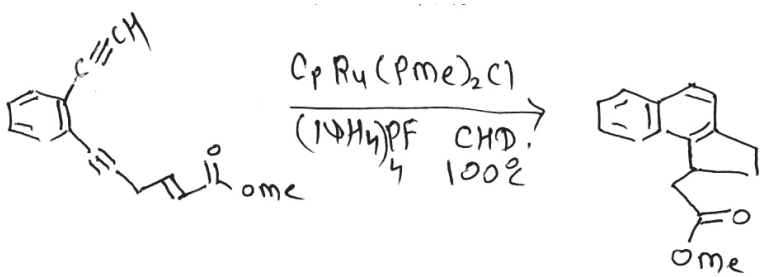
i) Why exo - tert are favored while endo-tert are disfavored reaction?

ii) Use of Thexyl borane for organic synthesis.

iii) Advantages of Tebbe olefination over witting olefination.

iv) Use of organotin compound in organic synthesis.

b) Suggest the correct mechanism of the following reaction. **[3]**

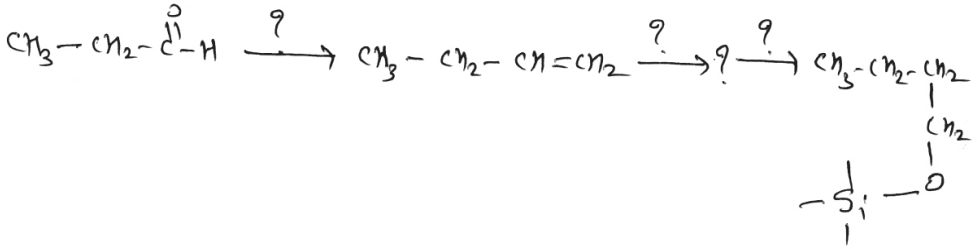


Q3) a) Attempt any two of the following. **[8]**

i) Explain the Baldwins rule with suitable example.

ii) Trimethyl silyl chloride is used as protecting group for alcohol. Explain with suitable example.

iii) Complete the following reaction sequence with correct explanation.



b) Attempt any two of the following. **[4]**

i) Grignard reagent show umpolung activity.

ii) Optically active 2 - butanol can be prepared using hydroboration approach.

iii) Explain Boord olefination.

Total No. of Questions : 3]

SEAT No. :

PC4146

[Total No. of Pages : 2

[6336]-3016

M.Sc. - II

ORGANIC CHEMISTRY

CHO-610 (B)MJ : Carbohydrates & Chiron Approach

(2023 Credit Pattern) (Semester-III)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) a) Answer the following. (Any four) **[8]**

i) Draw $^{1}C_{4}$ & $^{4}C_{1}$ conformation of D-mannose.

ii) Give the reaction sequence for conversion of glucose to osazone.

iii) Write the retrosynthetic analysis of (s) propanediol.

iv) Explain oxidative cleavage of benzylidene acetals.

v) Explain Anomeric effect with suitable example.

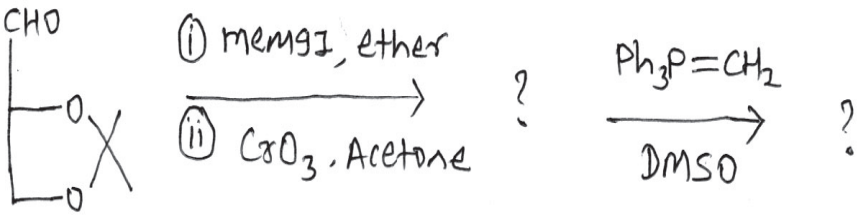
b) How will you convert D-mannitol in to R-Epichlorohydrin **[3]**

Q2) a) Attempt any three of the following. **[9]**

i) D-(+)-Glucose & D-(+) mannose can be distinguished on the basis of products formed by the reaction with Br_2/H_2O, Explain.

ii) Write a short note on mutarotation.

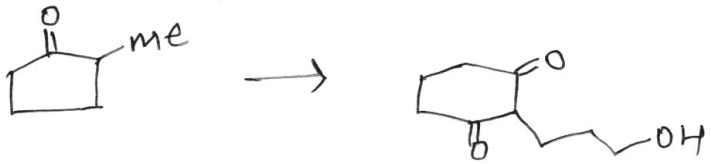
iii)



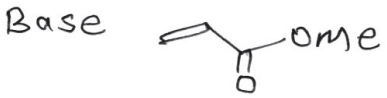
iv) Explain the role of fluorenylmethoxycarbonyl (FMOC) group in carbohydrate synthesis.

P.T.O.

b) Arrange the reagents sequentially with mechanism. **[3]**



$H_3O^{\oplus}$; $LiAlH_4$; Trcl, Pÿ ; MCPBA ; Swern oxidation;



Q3) a) Attempt any two of the following. **[8]**

i) Give the reaction sequence for the conversion of aldohexose to aldopentose.

ii) Write the synthesis of shikimic acid from D-Arabinose

iii) Explain the concept of Anomeric effect with suitable example.

b) Attempt any two of the following. **[4]**

i) Predict the product

D-mannitol $\xrightarrow[H^{\oplus}]{\text{Acetone}}$? $\xrightarrow[\text{Benzene}]{Pb(OAC)_4}$?

ii) Explain the concept of chiral templates.

iii) Write a synthesis of L(+)-Alanine from 2-Amino-2-deoxy-D-glucose.

Total No. of Questions : 3] **SEAT No. :**

PC4147 **[Total No. of Pages : 2**

[6336]-3017
M.Sc.-II (Organic Chemistry)
CHEMISTRY
CHO - 610(C) MJ : Medicinal Chemistry
(2023 Credit Pattern) (Semester - III)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***

Q1) a) Answer the following (Any four) **[8]**

i) What is need of drug?

ii) Give definition for QSAR.

iii) Explain passive immunization.

iv) What is intercalating agents?

v) Give definition for hit identification.

b) Explain historical development of medicinal chemistry. **[3]**

Q2) a) Attempt any three of the following. **[9]**

i) Give principles and effect's of vaccination.

ii) Explain drug receptor interactions.

iii) Give factor's affecting the solubility of drug design.

iv) Write a note on : beta lactam antibiotics.

b) Give mechanism of action and limitations of sulphonamides. **[3]**

P.T.O.

Q3) a) Attempt any two of the following. **[8]**

i) What is SAR? Explain it's importance in drug design.

ii) Explain effect of pH on solubility of acidic & basic drug.

iii) Explain drug development process with examples.

b) Attempt any two of the following. **[4]**

i) What are tetracyclins?

ii) Explain pharmokinetics in drug.

iii) What are the advantages of CADD method?

* * *

Total No. of Questions : 6]

SEAT No. :

PC4148

[6336]-3018

[Total No. of Pages : 3

M.Sc. -II
ANALYTICAL CHEMISTRY
CHA-601 MJ : Thermal and Extraction Techniques in Analytical Chemistry
(2023 Credit Pattern) (Semester-III)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logtable and calculator are allowed.***
4) ***Answers to two sections should be written on separate answer sheets.***

Section - I

Q1) a) Answer the following. (any 4) **[8]**

i) What is the Principle of differential thermal analysis? Give typical DTA plot?

ii) Define term Heat flux DSC and compensated DSC.

iii) Explain Dielectric thermal analysis.

iv) Give importance of glass transition temperature of polymers.

v) Define terms heat capacity and enthalpy of reaction.

b) Explain simultaneous TG-DTA give its any two applications. **[3]**

Q2) a) Attempt any three of the following. **[9]**

i) Draw and explain instrumentation of TPIA.

ii) Explain how TGA is used in Qualitative as well as Quantitative analysis.

iii) Explain study of high alumina cement in DTA.

iv) Draw and explain factors affecting thermal analysis with regard to

1) Type and material used in crucible
2) Atmosphere
3) Rate of change of heat

b) The thermal curve of 125.7 mg sample that contained a mixtured $CaC_2O_4.H_2O$ (mol. wt 146.12 g) and thermally stable Salt has mass loss of 6.95 mg of sample corresponding to vapourization of water. Determine the percentage of CaC_2O_4 in sample. **[3]**

P.T.O.

Q3) a) Attempt any two of the following. **[8]**

i) Write a note on TA-Infrared.

ii) How the DSC plot nature changes from base line if heating rate charged.

iii) Explain detection and identification of evolved gas by ECeA.

b) Attempt any two of the following. **[4]**

i) Enlist thermal methods of simultaneous analysis.

ii) How it is possible to differentiate techniques DTA and DSC.

iii) How sample characteristics affects thermomechanical analysis.

SECTION - II

Q4) a) Answer any four of the following. **[8]**

i) Define Distribution Ratio & distribution Coefficient.

ii) Enlist factors affecting SPE.

iii) Write five stages of SPE.

iv) What is headspace SPME?

v) What is pressurized fluid extraction?

b) Determine the separation factor for the two metals A + B when metal 'A' was 85% extracted into organic phase and metal 'B' was 15% extracted under similar conditions of pH and equal volumes of aqueous and organic solvent. **[3]**

Q5) a) Answer any three of the following: **[9]**

i) Describe automation & online SPE with diagram.

ii) Explain in detail:

1) Batch extraction

2) Continuous extraction

iii) Draw schematic diagram of pressurised MAE and explain its working.

iv) Explain in detail purge & trap technique.

b) A metal chelate has a distribution ratio of 5.98 for extraction from aqueous solution at pH = 3 into methyl ethyl ketone. Calculate number extractions necessary using 25 ml portion of organic solvent to the extent 99.9% of the metal from 50 ml of a sample. **[3]**

Q6) a) Attempt any two of the following. **[8]**

i) Describe theoretical considerations relating to the pressurized fluid extraction.

ii) Describe membrane micro extraction.

iii) Discuss types of SPE media.

b) Attempt any two of the following: **[4]**

i) What is direct immersion SPME?

ii) What is SDME?

iii) Write short note on soxhelt extraction.

■■■■

Total No. of Questions : 6]

SEAT No. :

PC4149

[Total No. of Pages : 3

[6336]-3019

M.Sc. - II

ANALYTICAL CHEMISTRY

CHA-602 MJ : Advanced Chromatographic Methods of Chemical Analysis

(2023 Pattern) (Semester-III) (Credit Pattern)

Time : 3 Hours] *[Max. Marks : 70*

Instructions to the candidates:

1) ***Answer to the two sections must be written on two separate answer books.***
2) ***All questions are compulsory.***
3) ***Figures to the right indicate full marks.***
4) ***Use of logtable and calculator is allowed.***

SECTION-I

Q1) a) Answer any four of the following. **[8]**

i) What is partition coefficient? Give equation for it.

ii) What is HETP? Give equation for HETP.

iii) What are supercritical fluids? Give the names of any two supercritical fluids.

iv) What is total ion current?

v) What is universal detector? Give example of universal detector in GC.

b) A mixture acetone, methanol and ethanol was analysed by gas chromatographic method. The peaks are observed at 4.25, 5.92 and 6.86 min respectively having peak areas 1856, 2390 and 1345 mV min. Calculate percentage of each component in the mixture. **[3]**

P.T.O.

Q2) a) Attempt any three of the following. **[9]**

i) Write note on plate theory of chromatography.

ii) Explain construction and working of FID.

iii) What are volatile organic compounds? Give the principle of purge and trap GC-MS method for the detection of volatile organic compounds.

iv) What is selected ion monitoring in GC-MS? Explain with suitable example.

b) Mixture of two substances was analysed by gas chromatography. Column of 300 cm length and He gas is used as mobile phase. Retention time was obtained from chromatogram and it was observed at 13.22 and 19.33 min having peak base of 1.90 and 1.22 min respectively. Calculate column resolution, average number of plates in the column and plate height. **[3]**

Q3) a) Attempt any two of the following. **[8]**

i) What is supercritical fluid chromatography? Explain advantages and disadvantages of SCF chromatography over GC and HPLC.

ii) Explain interfaces in GC-MS method.

iii) Draw block diagram of GC and explain the function of each component.

b) Attempt any two of the following. **[4]**

i) Give the equation for partition coefficienc (k) and selectivity factor (α) and meaning of the terms used in both equations.

ii) What are capillary columns? Give types of capillary columns.

iii) What is m/z ratio? What is the use of m/z ratio in chemical analysis?

SECTION-II

Q4) a) Answer any four of the following. **[8]**

i) What is Scavanger column in HPLC

ii) Explain principle of size exclusion chromatography.

iii) Distinguish between isocratic and gradient elution.

iv) Why refractive index detector is considered as universal detector in HPLC.

v) Give application of LCMS.

b) Describe working of six-loop value injector in HPLC. **[3]**

Q5) a) Attempt any three of the following. **[9]**

i) Enlist different methods of HPLC analysis. How a method of HPLC is chosen on the basis of nature of sample components?

ii) Distinguish between pre and post column derivatisation.

iii) What is elutropic series? How it is helpful for selecting mobile phase for HPLC experiment.

iv) Deccribe construction and working of PDA detector.

b) With a flow rate of 1ml/min, a peak has retention time 2-6 min on a column with 7900 theoretical plates. What is the maximum length for 5% peak broadening if either a 0.25 mm I.d, or a 0.18mm T.D. capillary is used. **[3]**

Q6) a) Attempt any two of the following. **[8]**

i) Explain high pressure and low pressure gradient elution with suitable diagram.

ii) Give any four applications of LC-MS. Describe analysis of drug metabolite using LC-MS.

iii) Describe chemically modified silica phases with example.

b) Attempt any two of the following. **[4]**

i) Why HPLC column should not be stored in water after completing experiment.

ii) What is linear dynamic range and noise of a detector?

iii) What is isocratic elution? Describe effect of flow rate on retention time of compound

Total No. of Questions : 3]

SEAT No. :

PC4150

[Total No. of Pages : 2

[6336]-3020

M.Sc. -II

ANALYTICAL CHEMISTRY

CHA - 603 MJ : Applied Electro - Analytical Techniques

(2023 Credit Pattern) (Semester - III) (2 Credit)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of logtable & Calculator is allowed.***

Q1) a) Attempt any four of the following. **[8]**

i) Write Nernst equation for general reversible redox reaction & explain the terms involved in it.

ii) Explain the role of supporting electrolyte in polarographic analysis.

iii) When & how dissolved oxygen interfere in polarographic analysis?

iv) Discuss the different steps involved in electrochemical stripping voltammetry.

v) Explain the voltage swept program applied in cyclic voltammetric experiment.

b) Attempt/Solve the following. **[3]**

i) Calculate the diffusion current that would expected from the reduction of 4.0×10^{-3} M pb^{2+}. The diffusion coefficient for pb^{2+} is 1.0×10^{-6} $cm^{2/s}$.The mercury drop characteristics are m=1.95 mg/s and t=3.97 sec.

ii) An unknown solution containing pb^{2+} gives a diffusion current of 7.13 μA with the same drop characteristics as used in (i) What is the concentration of pb^{2+} in this Solution?

P.T.O.

Q2) a) Attempt any three of the following. **[9]**

i) Draw the ideal cyclic voltammogram and explain the analytical importance of cathodic peak current and anodic peak current.

ii) Draw the construction of saturated calomel electrode. Write its electrode reaction and electrode representation.

iii) What is diffusion current? Explain the factors that affect the magnitude of diffusion current on polarogram.

iv) With schematic diagram explain the application of hydrodynamic voltammetry as a detector for liquid chromatography.

b) Solve the following. **[3]**

For determination of unknown concentration of silver ion in the silvernitrate solution following cell is constructed which shows potential difference of 0.445 V at 25^{o} C.

$$^{\oplus}Ag \; 1\, AgNO_3\,(aAg^{+} = \text{Unknown}) \parallel KCl_{(sat)}\; Hg_2C1_2 / \; Hg^{\ominus}$$

Determine the unknown concentration of silver icon in silver nitrate solution.

(Given : Ecal=0.245 V & E° Ag=0.799 V)

Q3) a) Attempt any two of the following. **[8]**

i) What is stripping voltammetry? Explain the analytical working of anodic and cathodic stripping.

ii) What is working electrode used in polarographic analysis? Draw its schematic representation. Explain its advantages and disadvantages.

iii) Draw the schematic representation of glass membrane electrode. What is alkaline error in glass electrode? How does it eliminated?

b) Attempt any two of the following. **[4]**

i) Explain the application of cyclic voltammetry for determination of 'n' (number of electron involved) value of a redox recaction.

ii) Explain the importance and purpose of the pulse voltammetric methods.

iii) Explain the analytical applications of the pulse voltammetry.

Total No. of Questions : 3]

SEAT No. :

PC4151

[Total No. of Pages : 2

[6336]-3021

M.Sc. (Part - II)

ANALYTICAL CHEMISTRY

CHA-610-MJ : Analytical Methods to Examining Water and Soil

(Credit 2023 Pattern) (Semester - III)

Time : 2 Hours] *[Max. Marks : 35*

Instructions to the candidates:

1) ***All quesitons are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of log table and calculator is allowed.***

Q 1) A) Attempt any four of the following : **[8]**

a) What are organotin compounds? What are their uses?

b) Mention four types of organic pollutants in water.

c) Give the principle of determination of nitrite by colorimetric method.

d) What are weighing errors? Give on example.

e) What is oxidant requirement of waste water sample.

B) Ammonia from water sample is determined by micro-kjeldahl method. 100ml water sample was distilled in 100ml 0.01m HCl and then titrated against 0.01m NaOH and it required 62.2 ml NaOH for complete neutralization. 100 ml 0.01m HCl was titrated against 0.01m NaOH and it required 100 ml NaOH for complete neutralization. Calculate ammonia content in 1000 ml water sample. (mol.wt NH_3 = 17g). **[3]**

Q2) A) Answer any three of the following : **[9]**

a) What is oxidant demand of waste water sample? How ozone demand is determined by batch method?

b) Write note on emerging water pollutants.

c) Discuss microwave assisted digestion of water sample for metal ion estimation.

d) Explain, how easily oxidizable organic carbon from soil sample is determined?

P.T.O.

B) Nitrite from water sample was determined by colorimetric method. Standard sample of water containg 10 microgram NO_2^- in 1000ml showed absorbance 0.423. 10ml water sample is diluted to 50ml. It showed absorbance 0.240. Calculate microgram of nitrite in 1000ml water sample. **[3]**

Q3) A) Attempt any two of the following : **[8]**

a) Discuss method for the determination of extractable boron from soil sample.

b) Explain method for the determination of dissolved oxygen by iodometric method.

c) Discuss in detail estimation of phosphate by molybdate -$SnCl_2$ - Clorometric method.

B) Attempt any two of the following : **[4]**

a) What is biochemical oxygen demand? Explain its importance to decide water quality.

b) What is salinity of water sample? How it is determined?

c) Define term BoD.

Total No. of Questions : 3]

SEAT No. : [ ]

PC4152

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[6336]-3022

M.Sc. - II

ANALYTICAL CHEMISTRY

CHA-610(B)MJ: Clinical Analytical Chemistry

(2023 Credit Pattern) (Semester - III)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***Q.1 to Q.3 are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of log tables & calculators are allowed.***

Q1) a) Answer the following (any 4) **[8]**

i) Write a short note on time of collection of blood specimens.

ii) Why 24 hr urine is collected for clinical Analysis?

iii) Draw the structure of β carotene.

iv) Write the principle of analysis of benzodiazepines from urine sample.

v) Give deficiency symptoms of vitamin B-1.

b) Explain in detail the determination of creatinine from blood sample. **[3]**

Q2) a) Attempt any three of the following. **[9]**

i) Explain determination of vitamin C from biological sample by 2,6 dichlorophenol indophenol method.

ii) Explain colorimetric method for the determination of serum phosphate level.

iii) Discuss in detail the method for Quantification of Methotrexate in human plasma by liquid chromatography tandem mass spectrometry.

iv) Give principle and procedure for estimation of serum cholesterol.

b) Blood glucose level was analysed by enzymatic method. 100 microliter 1.8g/l glucose standard is treated with coloring agent displayed absorbance of 0.260. Similarly 100 µlit. blood sample is treated; displayed absorbance of 0.220. Calculate concentration of glucose in g/lit. **[3]**

P.T.O.

Q3) a) Attempt any two of the following. **[8]**

i) Explain in detail the principle & procedure of simultaneous determination of Tacrolimus in whole blood by ultrafast LC-MS/MS.

ii) Discuss the detailed principle & procedure for determination of urea in urine by direct colorimetry.

iii) State the principle and write the detailed procedure for determination of serum tocopherol by spectrophotometry by dipyridyl method.

b) Attempt any two of the following. **[4]**

i) Give the mechanism by which Na_2 EDTA & Oxalate avoid coagulation of blood.

ii) What are vitamins? Give classification of vitamins.

iii) Give the principle of Therapeutic Drug Monitoring of Lacosamide.

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Total No. of Questions : 3]

SEAT No. : ____

PC4153

[Total No. of Pages : 2

[6336]-3023
M.Sc.-II
ANALYTICAL CHEMISTRY
CHA - 610(C) MJ : Forensic Analytical Chemistry
(2023 Credit Pattern) (Semester - III)

Time : 2 Hours] ***[Max. Marks : 35***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Use of scientific calculater is allowed.***

Q1) a) Attempt any four of the following. **[8]**

i) What are amphetamines?

ii) Discuss the origin of drugs.

iii) Write the Chen's test.

iv) What is fire investigation?

v) Write the structures of THC & CBD.

b) A sample of drug containing cathinone (A). methcathinone (B) and mescaline (C) was analysed by TLC and the distances travelled by solvent, A, B & C were 8.5 cm, 2.5 cm, 3.8cm and 4.5cm respectively calculate the R_f value of A,B, and C. **[3]**

Q2) a) Attempt any three of the following. **[9]**

i) What are schedule I drugs?

ii) Discuss any two aqueous test reagents.

iii) Write a note on vapour phase detection.

iv) Explain the chemistry of colour formation.

P.T.O.

b) A sample of heroin was analysed by liquid chromatography and it gave the following. **[3]**

observations:-

C_s = 4.5 µg/ml P_x=6.5 mAUmin, A_x = 7.5 mAUmin

P_s = 3.5 mAUmin, A_s = 6.7 mAUnim.

Calculate the concentration of heroin in the sample.

Q3) a) Attempt any Two of the following. **[8]**

i) Discuss the physical & physiological effects of -

1) Phentermine 2) Phenylpropanolamine

ii) Describe the effect of alcohol on driving.

iii) Explain the identification of cannabis by TLC.

b) Attempt any two of the following. **[4]**

i) What are micro crystal techniques?

ii) What are opiates?

iii) Write the name and structure of psychoactive forms of THC.

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