Total No. of Questions :6]

SEAT No. :

P1922

[Total No. of Pages : 3

[5323]-1001

M.Sc.

PHYSICAL CHEMISTRY

CHP - 110 : Fundamentals of Physical Chemistry - I

(2013 Pattern) (Semester - I) (Credit System) (Old 5 Credits)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answers 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.*
4) *Use of logarithmic table/calculator is allowed.*
5) *Neat diagrams must be drawn wherever necessary.*

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt the following: **[10]**

a) Give the relation between Gibb's free energy and the equilibrium constant. Explain its significance.

b) Show that, $C_{v,m} = 3R$ using equipartition theorem where $C_{v,m}$ is molar specific heat and R is the gas constant.

c) What is the physical significance of ΔG?

d) Sketch wavefunctions and probability densities for a particle in one dimensional box upto n=4.

e) Give the expression for rotational partition function and explain the terms involved.

Q2) Attempt any two of the following: **[10]**

a) Explain the experimental evidence for Heisenburg's uncertainty principle.

b) What are colligative properties? Derive the expression for elevation in boiling point.

c) Explain Bose-Einstein statistics.

d) What is meant by zero point energy? Write a note on simple harmonic oscillator.

Q3) Solve any one of the following **[5]**

a) The moment of inertia of oxygen molecule is 1.9373×10^{-46} kg.m^2. Calculate its rotational partition function at 30°c and 1 bar.

b) When Lithium is irradiated with light of wavelength 250 nm, the photoelectrons ejected have kinetic energy 3.0×10^{-19}J. Calculate the threshold frequency of metallic lithium.

SECTION - II

Q4) Attempt the following: **[10]**

a) For a general reaction, $2A+B \rightarrow 3C$, write the rate law expression.

b) For a given enzyme catalyzed reaction, reaction rate constant of formation of product is 1.32×10^{-3} s^{-1} and initial concentration of enzyme is 0.35 M. Evaluate V_{max}.

c) State the principle of microscopic reversibility.

d) Explain the term steric factor.

e) What is steady state approximation.

Q5) Attempt any two of the following: **[10]**

a) Derive the rate expression for the third order reaction with equal initial concentration of reactants.

b) Write the postulates of collision theory of biomolecular reactions and show that $k = Z_{AB}.e^{-Ea/R\Gamma}.P.$

c) Write short note on 'Lineweaver - Burk plot'.

d) For a given first order opposed reaction, $A \rightleftarrows B$ show that, $k_A = \frac{x_e}{a.t}.\text{In}\left[\frac{x_e}{x_e - x}\right]$ where, a=initial concentration of A; x_e=equilibrium concentration and x=amount of 'A' consumed at time 't'.

Q6) Solve any one of the following. **[5]**

a) Calculate the frequency factor for a reaction having a rate constant 4.0×10^{-7} units at 227°c, if the energy of activation is 100 $kJmol^{-1}$.

b) In a reaction, the decrease in reactant concentration is 15% in 15 minutes and 30% in 30 minutes. Calculate the order of reaction and rate constant.

Total No. of Questions : 6]

SEAT No. :

P1923

[Total No. of Pages : 2

[5323]-1002

M.Sc. - I

INORGANIC CHEMISTRY

CHI - 130 : Molecular Symmetry and Chemistry of P- Block Elements (2013 Pattern) (Old - 5 Credit) (Semester - I)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answers to the two sections must be written in separate answer books.***
3) ***Figures to the right side indicate full marks.***
4) ***Use of logarithmic tables and calculators is allowed.***

SECTION - I

Q1) Answer the following. **[10]**

a) Define symmety operation and symmetry elements.

b) List out the symmetry elements of chlorobenzene and its point group.

c) What is an abelian group? Illustrate with example.

d) Find the order of group and number of classcs in PCl_5.

e) Give all associative operations in S_6 axis.

Q2) Attempt any two of the following. **[10]**

a) Give the matrices for C_2^z and σ_h^{xy}. Find out its product. Give metrix for improper axis of rotation.

b) Derive the character table for C_2V point group.

c) Explain all symmetry elements of NH_3.

d) For H_2O moleule, E, $C_2^2, \sigma_v^{xz}, \sigma_v^{yz}$ are the symmetry elements. Divide them into appropriate classes using similarity transfromation.

P.T.O.

Q3) Attempt any one of the following. **[5]**

a) Find out normalized SALC using projection operator E^1 operates on σ_1 orbital of CO_3^{2-}.

D_3h	E	$2C_3$	$3C_z$	σ_h	$2\sigma_3$	$3\sigma_v$
E^1	2	–1	0	2	–1	0

b) Fill in the missing entries in the following table. Justify answer.

D_2	E	C_2^z	C_2^x	C_2^y
-	1	1	1	1
A_2	-	1	–1	–1
-	1	-	1	–1
B_2	1	-	–1	1

SECTION - II

Q4) Answer the following. **[10]**

a) Give the classification of boron hydrides with examples.
b) The alkali metal solutions in ammanic are good reducing agents why?
c) What is inorganic benzene? Give its reactions.
d) Hydrosilylation reaction.
e) What are carbides?

Q5) Attempt any two of the following.

a) Write a note on fullerene and its metal complexes. **[10]**
b) Oxyacids of sulphur.
c) What are phosphonitrilic compands? How they are prepared? Give their applications.
d) Write a note on aluminositricates.

Q6) Complete the following reactions. **[5]**

a) $LiAlH_4 + SiCl_4 \longrightarrow ?$

b) $SiH_4 + 4RO_4 \longrightarrow ? + 4H_2 \uparrow$

c) $CH_2 = CH_2 + SiH_4 \longrightarrow$

d) $4LiH + SiCl_4 \longrightarrow 4LiCl + ?$

e) $3NH_4Cl + BCl_3 \xrightarrow[C_6H_5Cl]{\Delta} ?$

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Total No. of Questions : 6]

SEAT No : ____

P 1924

[Total No. of Pages :4

[5323]-1003
M.Sc. - I
ORGANIC CHEMISTRY
CHO - 150 : Organic Reaction Mechanism and Stereochemistry
(2013 Pattern) (Semester-I)

Time : 3 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

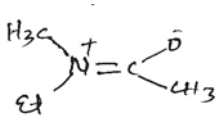
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

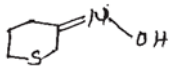
SECTION-I

Q1) Attempt any three of the following: **[9]**

a) Discuss carbene and its reactivity.

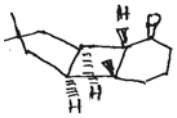
b) Assign E/z configurational labels to the following compounds.

i) 

ii) 

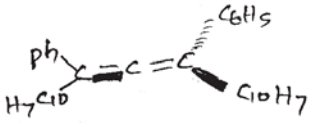
c) Label the stereocentres and calculate the no. of stereoisomers in the following

i) 

ii) 

d) Assign P/S configurational labels to the following.

i) 

ii) 

P.T.O.

Q2) Explain the following (any four): **[8]**

a) Factors affecting basicity.

b) Stereo selective reactions.

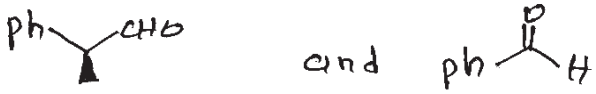
c) Pyrolytic elimination.

d) Vilsmeier - Haak reaction.

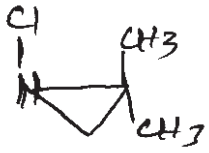
e) Inclusion compounds.

Q3) Solve any four of the following: **[8]**

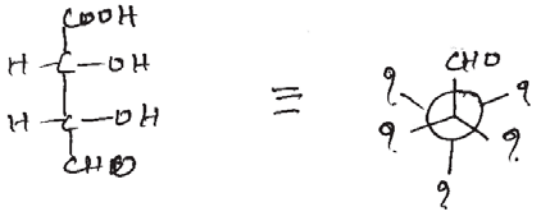
a) Assign 'Si' and 'Re' faces in the following.



b) Comment on the optical activity of the following compound.

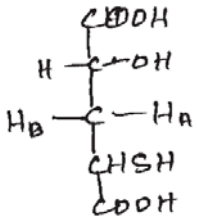


c) Convert Fischer projection to Newman projection as shown.

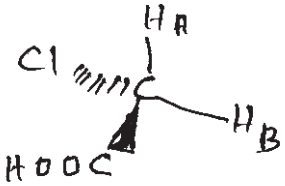


d) Assign Pro-R and Pro-S labels to H_A and H_B.

i)

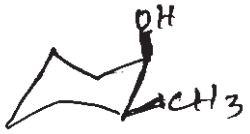


ii)



e) Give the stereochemical relationship between the following compounds.

i)



ii)

SECTION-II

Q4) Attempt <u>any three</u> of the following: **[9]**

a) Describe in brief hydrogenation of aromatic rings.

b) What is SRNI mechanism? Explain with suitable example.

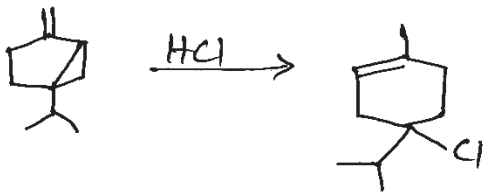
c) Trans-2-chlorocyclohexanol gives epoxy cyclohexane in high yield on reaction with a base, how ever the cis-isomer does not react this way. Explain.

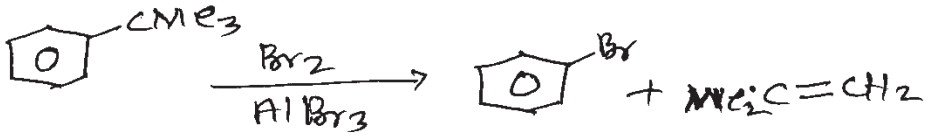
d) Explain hyperconjugation with suitable example.

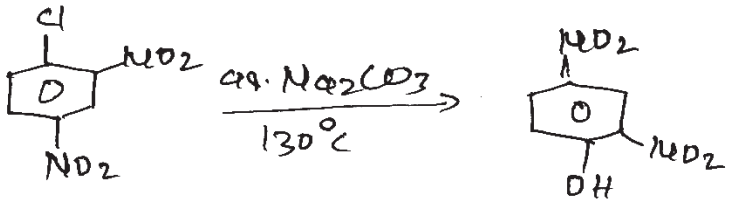
e) Give examples of ambident nucleo phile.

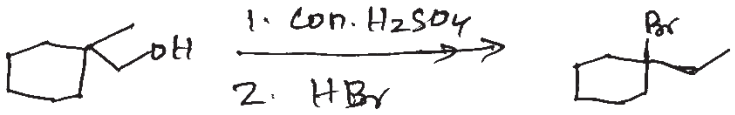
Q5) Suggest the mechanism (Any four): **[8]**

a) $H_2C=CH-CF_3 \xrightarrow{HBr} Br-CH_2-CH_2-CF_3$

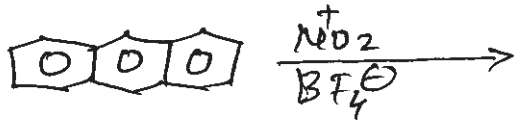
b) 

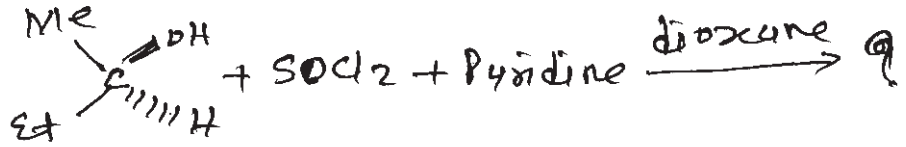
c) 

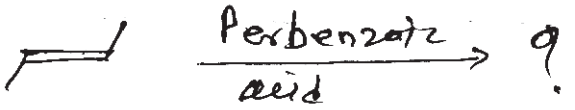
d) 

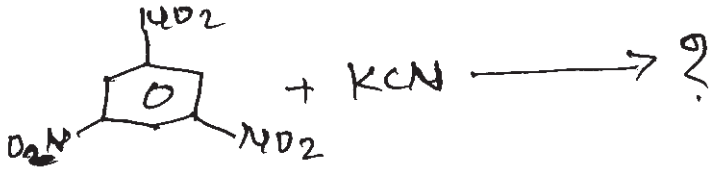
e) 

Q6) Predict the products <u>any four</u>: **[8]**

a) 

b) 

c) 

d) 

e) 

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Total No. of Questions :6]

SEAT No. :

P1925

[Total No. of Pages : 2

[5323]-1004
M.Sc.-I
CHEMISTRY
CHA-190 : Safety in Chemical Laboratory and Good Laboratory Practices
(2013 Pattern) (Semester-I) (Old 5 Credit)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer to the two sections should be written in seperate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagram must be drawn wherever necessary.***

SECTION-I

Q1) Attempt the following : **[10]**

a) Define allergen and give its two examples.

b) Give the importance of material safety data sheet.

c) What is the first aid for contact of chemicals on skin and eyes.

d) Mention the objective of fire drill.

e) What is the role of eye wash unit and safety shoes.

Q2) Answer any two of the following : **[10]**

a) Explain in brief 'Good House Keeping'.

b) Write a note on globally harmonized system for safety data sheet.

c) Give an brief account of safety in chemical laboratory.

d) Write a note on personnel protective equipments.

Q3) Answer any one of the following : **[5]**

a) Enlist the various hazards and explain any one of it in detail.

b) Write a note on different types of fire extinguisher.

P.T.O.

SECTION-II

Q4) Attempt the following : **[10]**

a) What are the safety measures for mercury spillage.

b) Define fire and give its types.

c) What is stock register forchemicals?

d) Comment on losses in accidents.

e) Define Hazardous and non hazardous waste.

Q5) Answer any two of the following : **[10]**

a) Write a short note on inventory management.

b) Explain ISO and NABL accreditation.

c) Define the laboratory standards and explain the identification of Hazards.

d) Explain Instrument validation and reagent certification.

Q6) Answer any one of the following : **[5]**

a) What is mixed waste? Explain the method for its disposal.

b) What is SOP? Explain its implementation in chemical laboratory.

Total No. of Questions : 6]

SEAT No. :

P1880

[Total No. of Pages : 3

[5323]-101
M.Sc.
PHYSICAL CHEMISTRY
CHP - 110 : Fundamentals of physical Chemistry - I
(2014 Pattern) (Semester - I) (New) (4 - Credits)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answers 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.***
4) ***Use of Logarithmic table / calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

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			=	6.626×10^{-34} J s
4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19}C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19}J
			=	8065.5 cm^{-1}
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			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

Q1) Attempt the following: **[10]**

a) Enthalpy can not be the criteria for spontanity? Discuss briefly.

b) What are state and path functions?

c) Show that $dA = -Pdv - SdT$, where A is Helmholtz's function.

d) Classical mechanics predicts specific heat of monoatomic solids is constant for all temperature. Explain.

e) Write clausius clapeyron equation and explain the terms there in.

Q2) Attempt any two of the following: **[10]**

a) Derive the general form of maxwell's equations. How change in entropy (ΔS) can be obtained from Maxwell's relation?

b) What is meant by partial molar quantities? Derive Gibb's-Duhem equation.

c) What are the experimental observations made in black body radiation experiment? Show that concept of quantization of light explain them correctly.

d) Discuss Gibb's free energy change during mixing of two ideal gases.

Q3) Solve any one of the following: **[5]**

a) Calculate the velocity of an ejected electron by a photon of wavelength 300 nm from a metal surface with work function 2.56 eV.

b) A sample of methane gas (4.5 g) occupies 17.16 dm^3 at 360 K.

i) Calculate work done when it expands isothermally against external pressure of 200 Ton until the volume is increased to 20.37 dm^3.

ii) Calculate the work done if same expansion occurs reversibly.

SECTION - II

Q4) Write the following: **[10]**

a) Give Eyring equation and meaning of each terms involved in it.

b) What are diffusion controlled reactions?

c) Explain steady state approximation.

d) Define fast reaction. Give two examples of it.

e) Define partition function.

Q5) Solve any two of the following: **[10]**

a) Explain pre-equilibrium reaction. Derive the expression for enzyme catalysis reaction.

b) Show that:

Reaction rate = k $(CH_3\ CHO)^{3/2}$ for thermal decomposition of acetaldehyde $CH_3CHO \rightleftharpoons CH_4 + CO$ using following mechanism

$$CH_3CHO \rightarrow CH_3^{\cdot} + {}^{\cdot}CHO \text{ (chain initiation)}$$

$$\left.\begin{aligned} CH_3^{\cdot} + CH_3CHO &\rightarrow CH_4 + CH_3CO^{\cdot} \\ CH_3CO^{\cdot} &\rightarrow CO + CH_3^{\cdot} \end{aligned}\right\} \text{(chain propogation)}$$

$$CH_3^{\cdot} + CH_3^{\cdot} \rightarrow C_2H_6 \text{ (chain termination)}$$

c) Obtain an expression for translational partition function in case of rigid diatomic molecule.

d) Explain primary salt effect. Derive an expression for dependence of reaction rate on ionic strength.

Q6) Solve any one: **[5]**

a) The moment of inertia of a rigid diatomic molecule is 4.7×10^{-47} kg.m^2. Calculate rotational partition function (Given 6 = 1) at 300 K.

b) In a first order reaction, reactant is reduced to one half in 50 sec. In how much time will it be reduced to one tenth.

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Total No. of Questions : 6]

SEAT No :

P 1881

[Total No. of Pages : 3

[5323]-102
M.Sc. - I
INORGANIC CHEMISTRY
CHI-130 : Molecular Symmetry and Chemistry of P-Block Elements
(2014 Pattern) (Semester - I) (4 Credit System)

Time : 3 Hours] *[Max. Marks : 50*

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) ***Use of logarithmic table/calculator is allowed.***

SECTION - I

Q1) Answer the following: **[10]**

a) Define centre of inversion. Illustrate using example.

b) List out symmetry elements of SO_2Cl_2 and find its point group.

c) What are commutative symmetry operations? Illustrate using suitable example.

d) Give all associative operations of S_3.

e) Draw the planes of symmetry of C_6H_6 molecule.

Q2) Attempt any two of the following: **[10]**

a) Explain all the symmetry elements of CH_4 and classify it into appropriate point group.

b) Give symmetry elements of NH_3 molecule and divide them into classes using similarity transformation.

c) Derive the character table for trans - 1, 2 - dichloroethylene.

d) Define improper axis of rotation. Prove that $S_n^{2h} = E$ using suitable example.

P.T.O.

Q3) Attempt any one of the following: **[5]**

a) Find out normalized SALC using projection operator B_1 operates on ϕ_2 orbital No_2^- ion:

C_{2V}	E	C_2^z	σ_V^{XZ}	σ_V^{YZ}
B	1	−1	1	−1

b) Find out reducible representation in $[Fe(CO)_s]$ considering sigma bond as basis of representation and find out the orbitals offered for sigma banding by iron. [Given character table]

SECTION-II

Q4) Answer the following: **[10]**

a) Write short notes on metal complexes of fullerene.

b) What are silicones? Give their two reactions.

c) Give classification of hydrides with examples.

d) Alkali metals in ammonia acts as reducing agents. Explain.

e) Discuss graphite intercalation compounds.

Q5) Attempt any two of the following: **[10]**

a) Write a note on zeolites and molecular sieves. Give advantages of zeolites.

b) What is borazole? How it is obtained? Why it is called as inorganic benzene?

c) Give an account of oxoanions of sulphur.

d) Give an account of nitrogen activation.

Q6) Draw the structures of following: **[5]**

a) $[B_6H_6]^{2-}$

b) $Si_2O_7^{6-}$

c) N_2O_4

d) S_2N_2

e) $B_3N_3H_3Cl_3$

f) P_4O_{10}

Given : Character table for D_3h point graph:

D_3h	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_V$		
A_1'	1	1	1	1	1	1		$x^2 + y^2, z^2$
A_2'	1	1	–1	1	1	–1	Rz	
E'	2	–1	0	2	–1	0	(X,Y)	$(x^2 - y^2, xy)$
A_1''	1	1	1	–1	–1	–1		
A_2''	1	1	–1	–1	–1	1	z	
E''	2	–1	0	–2	1	0	(Rx,Ry)	(xz,yz)

Total No. of Questions : 6]

SEAT No. :

P1882

[Total No. of Pages : 5

[5323]-103
M.Sc. - I
ORGANIC CHEMISTRY
CHO - 150 : Basic Organic Chemistry
(2014 Pattern) (Semester - I) (4 - Credits)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

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

SECTION - I

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

a) Discuss in brief stereoselective reactions.

b) Why indene and fluorene are acidic?

c) What is the concept of antiaromaticity?

d) Cyclohexane does not exist in planner form. Give reason.

e) What is the conecpt of NGP?

Q2) Attempt any five of the following: **[10]**

a) Discuss the structure and stability of carbene.

b) Chlorobenzene resist hydrolysis where as, benzyl choloride undergoes hydrolysis. Explain.

c) Comment on the stability of the following.

P.T.O.

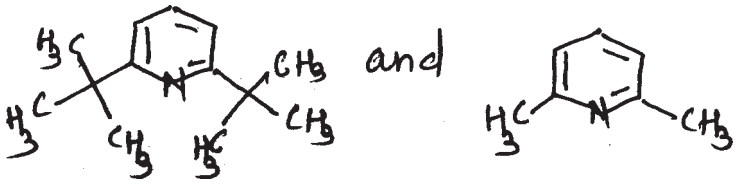
d) Discuss the acidity of the following

e) Comment on the optical activity of biphenyls.

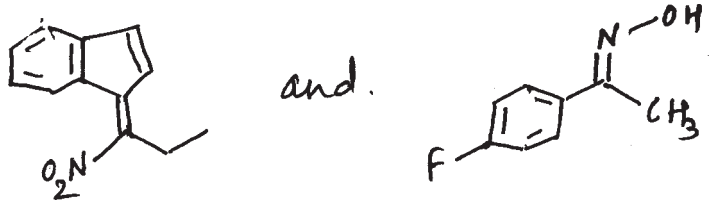
f) 3-hydroxy-2-butanone on reduction with sodium borohydride gives meso compound. Explain.

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

a) Comment on the basicity of the following.



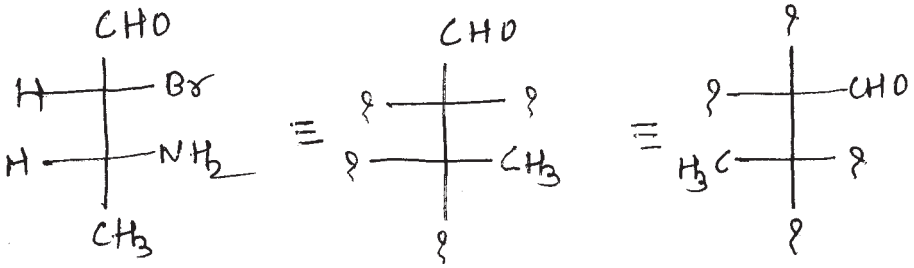
b) Assign E/Z configuration of the following.



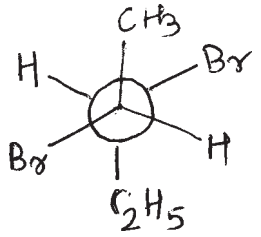
c) Describe the stereochemistry of the product formed by the reaction of maleic acid with osmium tetraoxide.

d) Assign R/S labels to the chiral carbons.

e) Write the equivalent structures.



f) Make the conversion from Newmann projection into Fischer projection and assign the configuration at each Chiral Centres.



SECTION - II

Q4) Answer the following: **[5]**

a) Describe regioselectivity in ambident nucleophile.

b) Write any one reaction involving SET mechanism.

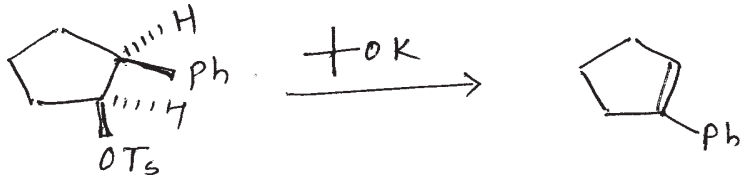
c) Explain hydrolysis of 2-bromopropionic acid.

d) What is SN^2 reaction?

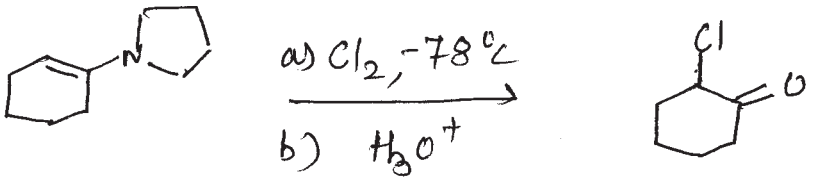
e) Benzyne intermediate. Explain.

Q5) Suggest the mechanism (any five) : **[10]**

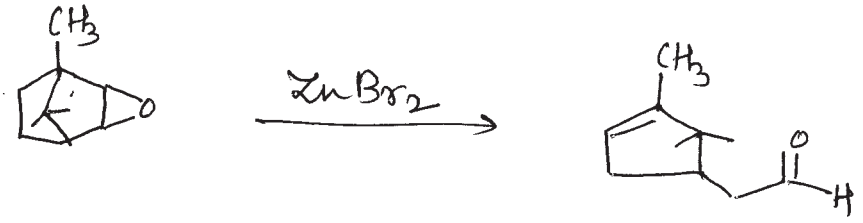
a)



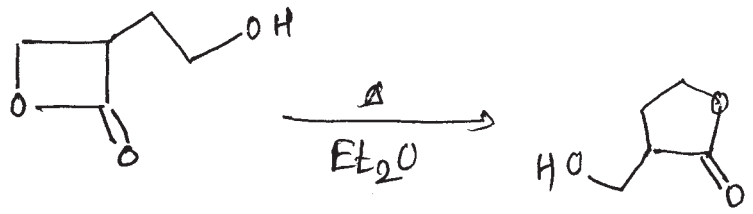
b)

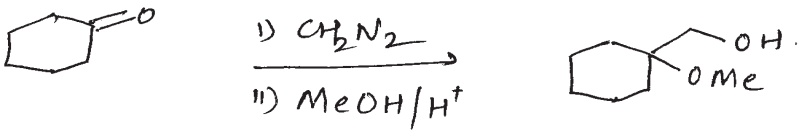


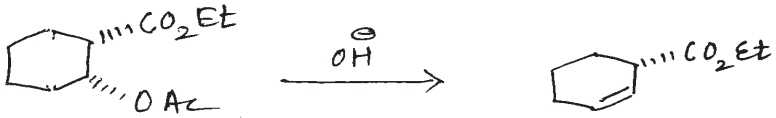
c)

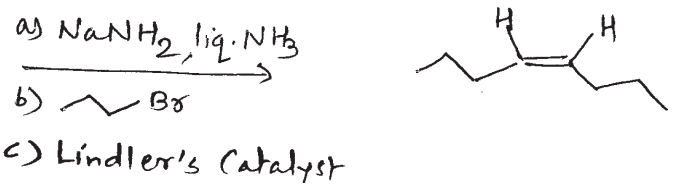


d)

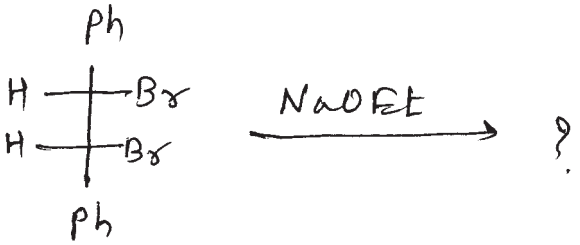


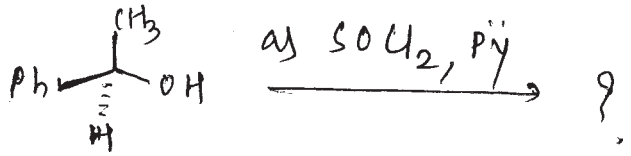
e) 

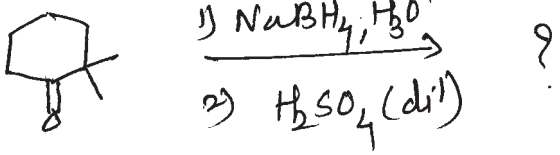
f) 

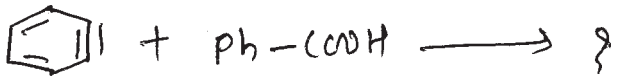
g) $H-C\equiv C-H$ 

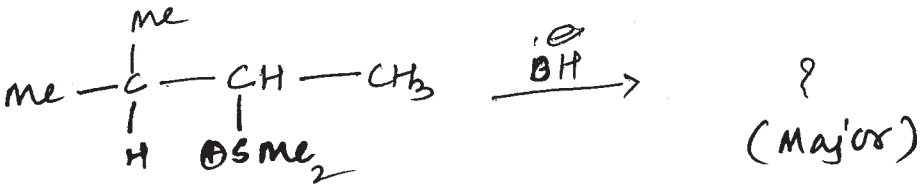
Q6) Predict the products (any five) : **[10]**

a) 

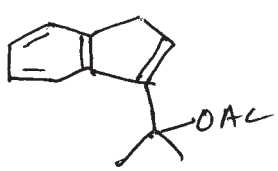
b) 

c) 

d) 

e) 

f) 

g) 

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Total No. of Questions :6]

SEAT No. :

P1883

[Total No. of Pages : 2

[5323]-104
M.Sc.-I
ANALYTICAL CHEMISTRY
CHA-190 : Safety in Chemical Laboratory and Good Laboratory Practices
(2013 Pattern) (Semester-I) (Credit System) (4-Credits)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagram must be drawn wherever necessary.***
4) ***Use of logarithmic table/non-programmable calculator is allowed.***

SECTION-I

Q1) Answer the following : **[10]**

a) What is explosive hazard?

b) Describe eye wash unit.

c) Define -

i) Reactive chemicals

ii) Flammable chemicals

d) What are neurotoxins? Give any two examples.

e) What is microscale work?

Q2) Attempt any two of the following : **[10]**

a) Give the guidelines for chemical storage.

b) Explain in brief use of personnel protective equipment.

c) Describe the assessing route of exposure for toxic chemicals with respect to inhalation.

d) Explain the flammability characteristics.

Q3) Attempt any one of the following : **[5]**

a) Explain the importance of chemical safety and security.

b) What are the chemical of concern? Explain the responsibility of CSSO's.

P.T.O.

SECTION-II

Q4) Answer the following : **[10]**

a) State any four rules of good house keeping.

b) What are the different types o∀ spillage?

c) Enlist the special safety measures for compressed gas.

d) What is waste?

e) Define :

i) GLP

ii) Chemical hygiene

Q5) Attempt any two of the following : **[10]**

a) Explain the general procedure for working with biohazard.

b) Explain the fundamental point of GLP.

c) Write a short note on mercury spillage of its safety measures.

d) What are the general guidelines for working with compressed gases.

Q6) Attempt any one of the following : **[5]**

a) Give a brief account of SOP and its approval procedure.

b) Explain-Do's and dont's in chemical laboratory.

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Total No. of Questions : 6]

SEAT No. :

P1926

[Total No. of Pages : 3

[5323]-2001
M.Sc. - I
PHYSICAL CHEMISTRY
CHP - 210 : Fundamentals of Physical Chemistry - II
(2013 Pattern) (Semester - II) (5 - Credits)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answers 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.***
4) ***Use of Logarithmic table / calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt the following: **[10]**

a) Explain signal to noise ratio.

b) Distinguish between prolate and oblate symmetric top with examples.

c) Define:

i) Zero point energy

ii) Hot bands

d) Why linear triatomic molecules shows only three vibrational modes instead of three.

e) Distinguish between Rayleigh scattering and Raman Scattering.

Q2) Attempt any two of the following: **[10]**

a) What is centrifugal distortion? Explain the effect of centrifugal distortion on the rotational energy levels of a diatomic molecule.

b) Discuss the break down of Born-Oppenhiemer approximation.

c) Explain the rule of mutual exclusion and its converse. Describe the various modes of vibration of CO_2 molecule.

d) State franck condon principle and write a brief note on dissociation energy and dissociation products.

Q3) Attempt any one of the following: **[5]**

a) What is the value of 'B' for $H^{37}Cl$ if the rotational constant of $H^{35}Cl$ is 10.5909 cm^{-1}?

b) The spectrum of HCl shows a fundamental absorption at 2886 cm^{-1}, and first overtone at 5668 cm^{-1}. Evaluate equilibrium vibrational frequency and force constant.

SECTION - II

Q4) Attempt the following: **[10]**

a) Sketch the plane (100) in simple cubic cell.

b) What is self and tracer diffusion?

c) Write any secular determinant for ethylene molecule.

d) Define the term 'Curie' and Becquerel (Bq).

e) Give preparation of ^{14}C and ^{137}I radioisotopes.

Q5) Attempt any two of the following: **[10]**

a) Discuss the principle of isotope dilution analysis. How it is used to determine the volume of blood in patient?

b) Discuss main assumptions of Huckel theory.

c) Describe how the x-rays are used to determine the Crystal Structure.

d) Explain different applications of Neutron activation analysis.

Q6) Solve any one of the following: **[5]**

a) Miller indices of the plane of a Crystal are 436. Calculate the intercept on Crystallographic axes.

b) An isotope loses $9/10^{th}$ of its activity in 23 hours. What is its half life and mean life.

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Total No. of Questions : 6]

SEAT No : ____

P 1927

[Total No. of Pages :4

[5323]-2002
M.Sc. - I
INORGANIC CHEMISTRY
CHI - 230 : Co-Ordination and Bioinorganic Chemistry
(2013 Pattern) (Semester-II) (Old) (5-Credit)

Time : 3 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate answer book.***
3) ***Figures to the right side indicate full marks.***
4) ***Given: Atomic number: V = 23, Ce = 58, Co = 27, Mn = 25.***

SECTION-I

Q1) Answer the following: **[10]**

a) Give the ground state term symbol for the following ions:

i) V^{3+}

ii) Ce^{3+}

b) Classify the following transitions as vibronically allowed, orbitally allowed and forbidden in octahedral complex. Justify your answer. $A_{1g} \rightarrow T_{1u}$, $A_{2g} \rightarrow A_{1g}$.

c) Which one of the following complex is more intense in colour? Why? $CiS\left[Cu\left(NH_3\right)_4 Cl_2\right]$ and $Trans\left[Cu\left(NH_3\right)_4 Cl_2\right]$.

d) What is meant by quenching of orbital magnetic moment? Explain why $\left[Co\left(H_2O\right)_6\right]Cl_2$ complex exibit orbital contribution in their magnetic moment. Justify your answer.

e) State Curie-Weiss law.

Q2) Answer any two of the following: **[10]**

a) Prepare the micro state table for np^2 configuration and hence derive the allowed R.S. term for the same.

b) ^5D R.S. term is allowed for d^4 configuration or M_n^{3+} ion. Find out how it looses its degeneracy when $\left[Mn\left(H_2O\right)_6\right]^{3+}$ complex ion is formed.

P.T.O.

c) Assign the spin multiplicities to the state arrising for $e't_2'$ configuration infinitely strong tetrahedral field is relaxed to strong field using Bethe's method of desending symmetry, correlation table and direct product.

d) Write note on Nephelauxetic effect and Nephelanxetic series.

Q3) Answer any one of the following: **[5]**

a) An octahedral complex of Co(II) show three absorption bonds at 8450, 17900 and 19900 cm^{-1} respectively within $\in$ = 2.75, 8.2 and 5.8 lit mol^{-1} cm^{-1}. Calculate the spectrochemical parameter 10 D_q and Nephelauxetic parameter B and β with the help of following data B° = 970 cm^{-1} for Co(II) ion.

b) Calculate μ_{eff} for $\left[Ni(H_2O)_6\right]SO_4$ complex. Given: λ = –320 cm^{-1}, D_q = 850 cm^{-1}

SECTION-II

Q4) Attempt the following: **[10]**

a) Explain the role of metal ions in Biological system.

b) Explain the term nucleoside and nucleotides.

c) What is Bleomycin? Explain its role in biology.

d) Explain the functioning of molybdenum-Binding co-factors.

e) Explain the term biomineralization with suitable example.

Q5) Answer any two of the following: **[10]**

a) Explain the mechanism of cisplatin as anticancer drug.

b) Explain the concept of Irwing-Williams series.

c) Explain the structure and function of Calmodulin.

d) Write note on Model Complexes.

Q6) Attempt any one of the following: **[5]**

a) Match the following-

i)	Haemoglobin	1)	Co
ii)	Cardiolyte	2)	Fe
iii)	Chlorophill	3)	Tc
iv)	Hydrolase	4)	Mg
v)	Vitamin B_{12}	5)	Zn

b) Draw the structures of following:

i) Enterobactin.

ii) Flavin.

iii) 3Fe - 4S.

iv) Cytosine.

v) Guanine.

DIRECT PRODUCTS

1. Groups of the form $G \times i$ or $G \times \sigma_h$:
   The g, u or $'$, $''$ additions to the IR symbols in these groups satisfy
   $g \times g = u \times u = g$, $g \times u = u$, $' x' = '' x'' = ''$, $' x'' = ''$.

2. Products of the form $A \times A$, $B \times B$, $A \times B$:
   For all groups :
   Letter symbols : $A \times A = A$, $B \times B = A$, $A \times B = B$.
   Subscripts : $1 \times 1 = 1$, $2 \times 2 = 1$, $1 \times 2 = 2$
   except for the B representations of D_2 and D_{2h} where
   $B \times B = B$ and $1 \times 2 = 3$, $2 \times 3 = 1$, $3 \times 1 = 2$.

3. Products of the form : $A \times E$, $B \times E$:
   (a) For all groups : $A \times E_k = E_k$ irrespective of the suffix on A.
   (b) For all groups except D_{6d}, D_{4d}, S_8 :
   $B \times E_1 = E_2$, $B \times E_2 = E_1$
   irrespective of the suffix on B. (If the group has only one E representative put $E_1 = E_2 = E$.)
   (c) For D_{6d} :
   $B \times E_1 = E_5$, $B \times E_2 = E_4$, $B \times E_3 = E_3$, $B \times E_4 = E_2$, $B \times E_5 = E_1$
   irrespective of the suffix on B.
   (d) For D_{4d}, S_8 :
   $B \times E_1 = E_3$, $B \times E_2 = E_2$, $B \times E_3 = E_1$
   irrespective of the suffix on B.

4. Products of the form $E \times E$:
   (For groups which have A, B or E symbols without suffixes put $A_1 = A_2 = A$, etc. in the equations below)
   (a) For O_h, O, T_d, D_{6h}, D_6, C_{6v}, C_{6h}, C_6, S_6, D_{3d}, D_{3h}, D_3, C_{3v}, C_{3h}, C_3 :
   $E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + E_2$; $E_1 \times E_2 = B_1 + B_2 + E_1$.
   (b) For D_{4h}, D_4, C_{4v}, C_{4h}, C_4, S_4, D_{2d} :
   $E \times E = A_1 + A_2 + B_1 + B_2$.
   (c) For D_{6d} :
   $E_1 \times E_1 = E_5 \times E_5 = A_1 + A_2 + E_2$,
   $E_2 \times E_2 = E_4 \times E_4 = A_1 + A_2 + E_4$,
   $E_3 \times E_3 = A_1 + A_2 + B_1 + B_2$,
   $E_1 \times E_2 = E_4 \times E_5 = E_1 + E_3$, $E_1 \times E_3 = E_3 \times E_5 = E_2 + E_4$,
   $E_1 \times E_4 = E_2 \times E_5 = E_3 + E_5$, $E_2 \times E_3 = E_3 \times E_4 = E_1 + E_5$,
   $E_1 \times E_5 = B_1 + B_2 + E_4$, $E_2 \times E_4 = B_1 + B_2 + E_2$.

(d) D_{3d}, D_{3h}, D_3, C_{3v}, C_{3h}, C_3 :

$E_1 \times E_1 = A_1 + A_2 + E_2$, $E_2 \times E_2 = A_1 + A_2 + E_1$,

$E_1 \times E_2 = E_1 + E_2$.

(e) For D_{4h}, S_6.

$E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + E_2$,

$E_2 \times E_2 = A_1 + A_2 + B_1 + B_2$

$E_1 \times E_2 = E_1 \times E_2 = E_1 + E_2$, $E_1 \times E_2 = B_1 + B_2 + E_2$.

5. Products involving the T (or F) representations of O O and T_d :

$A_1 \times T_1 = T_1$, $A_1 \times T_2 = T_2$, $A_2 \times T_1 = T_2$, $A_2 \times T_2 = T_1$,

$E \times T_1 = E \times T_2 = T_1 + T_2$.

$T_1 \times T_1 = T_2 \times T_2 = A_1 + E + T_1 + T_2$,

$T_1 \times T_2 = A_2 + E + T_1 + T_2$

6. The complete results 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	$A_2+E+T_1+T_2$	$A_1+E+T_1+T_2$

CORRELATION TABLE FOR GROUP O_h

O_h	O	T_d	D_{4h}	D_{2d}	C_{4v}	C_{2v}	D_{3d}	D_3	C_{3h}
A_{1g}	A_1	A_1	A_{1g}	A_1	A_1	A_1	A_{1g}	A_1	A_g
A_{2g}	A_2	A_2	B_{1g}	B_1	B_1	A_2	A_{2g}	A_2	B_g
E_g	E	E	$A_{1g} + B_{1g}$	$A_1 + B_1$	$A_1 + B_1$	$A_1 + A_2$	E_g	E	$A_g + B_g$
T_{1g}	T_1	T_1	$A_{2g} + E_g$	$A_2 + E$	$A_2 + E$	$A_2 + B_1 + B_2$	$A_{2g} + E_g$	$A_2 + E$	$A_g + 2B_g$
T_{2g}	T_2	T_2	$B_{2g} + E_g$	$B_2 + E$	$B_2 + E$	$A_1 + B_1 + B_2$	$A_{1g} + E_g$	$A_1 + E$	$2A_g + B_g$
A_{1u}	A_1	A_2	A_{1u}	B_1	A_2	A_2	A_{1u}	A_1	A_u
A_{2u}	A_2	A_1	B_{1u}	A_1	B_2	A_1	A_{2u}	A_2	B_u
E_u	E	E	$A_{1u} + B_{1u}$	$A_1 + B_1$	$A_2 + B_2$	$A_1 + A_2$	E_u	E	$A_u + B_u$
T_{1u}	T_1	T_2	$A_{2u} + E_u$	$B_2 + E$	$A_1 + E$	$A_1 + B_1 + B_2$	$A_{2u} + E_u$	$A_2 + E$	$A_u + 2B_u$
T_{2u}	T_2	T_1	$B_{2u} + E_u$	$A_2 + E$	$B_1 + E$	$A_2 + B_1 + B_2$	$A_{1u} + E_u$	$A_1 + E$	$2A_u + B_u$

Character Table for (O) rotational group

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

Total No. of Questions :6]

SEAT No. :

P1928

[Total No. of Pages : 4

[5323] - 2003

M.Sc. - I

ORGANIC CHEMISTRY

CHO - 250 : Synthetic Organic Chemistry and Spectroscopy

(2013 Pattern) (5 Credit) (Semester - II)

Time : 3 Hours] *[Max. Marks :50*

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) Explain any five of the following. **[10]**

a) Baeyer - villiger rearrangement in preparation of acetutes.

b) Significance of witting - Horner - E mmons reaction.

c) The reduction of chiral carbonyl compounds with $NaBH_4$ proceeds without racemization.

d) Two methods for preparation of Nitrene.

e) Mechanism of swern oxidation.

f) Synthetic applications of organocopper and organomagnesium compounds.

Q2) Attempt any five of the following. **[10]**

a) Curtius rearrangemnet.

b) Use of SeO_2 in organic synthesis.

c) Epoxidation reactions.

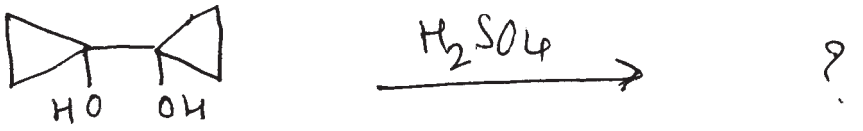
d) Grignard reagent.

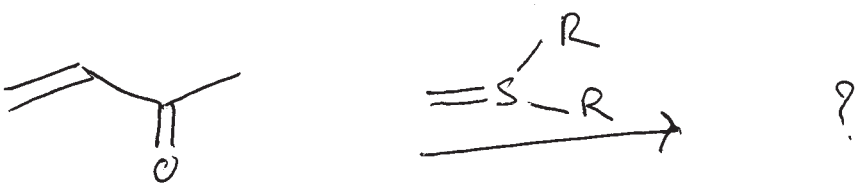
e) Nitrogen ylides.

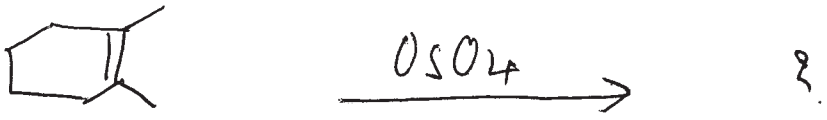
f) Claisen rearrangement.

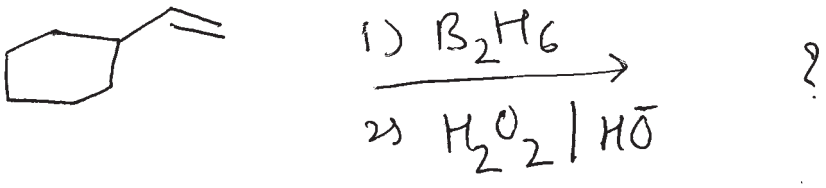
P.T.O.

Q3) Predict the product is and suggest the mechanism any two of the following:**[5]**

a) 

b) 

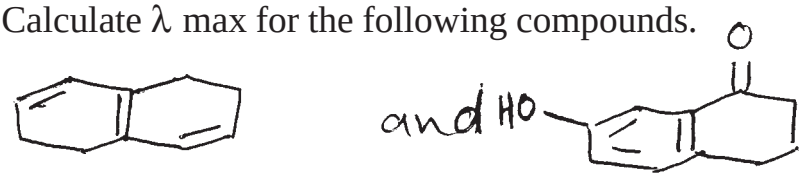
c) 

d) 

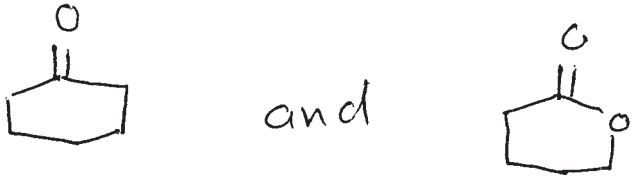
SECTION - II

Q4) Attempt the following: **[9]**

a) Calculate λ max for the following compounds.

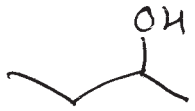


b) Distinguish the following compounds by IR spectroscopy.



c) Write a note on chemical shift.

d) Explain the genesis of the following ions in the given compound.



m/z = 59, 45

e) Explain $CDCl_3$ is used as solvent in CMR spectroscopy.

Q5) Deduce the structure of any five of the Following and Justify your answer. **[10]**

a) MF : $C_4M_5O_2N$
UV : Featureless above 210 nm
IR : 2250, 1750 cm–1
PMR : δ : 3.5 (s, 10 mm)
3.8 (S, 15 mm)

b) MF : $C_7H_{14}O$
UV : Featurless above 220 nm
IR : 1720 cm–1
PMR : δ: 0.9 (t; 30mm)
1.6 (hex, 20 mm)
2.4 (t, 20 mm)

c) MF: $C_{10}H_{15}N$
IR : 1510, 1610 cm–1
PMR :δ: 2.48 (S, 6 mm)
2. 89 (S, 6 mm)
6.38 (bs, 2 mm)
7.27 (t, 1 mm)

d) MF : $C_8H_8O_2$
UV : 250 - 265nm
IR : 2700 - 3000 (b), 1700, 1600, 1500, 920cm^{-1}
PMR : δ: 3.5 (S, 12 mm)
7.2 (S, 30 mm)
12.3 (S, 6 mm)

e) MF : $C_9 H_{12} S$

UV : 265 nm

IR : 1585, 1470 cm^{-1}

PMR : δ: 1.2(d, J = $6H_2$, 36 mm)

3. 25 (Sep. J = $6H_2$, 6 mm)

7.25 (m, 30 mm)

f) MF : $C_5H_{10}O$

UV : 285 nm

IR : 1720 cm^{-1}

PMR : δ: 1.05 (t, J = 6Hz, 30 mm)

2.40 (q, J = 6Hz, 20 mm)

Q6) Attempt <u>any two</u> of the following: **[5]**

a) How will you distinguish primary, secondary and tertiory alchols by PMR Spectroscopy?

b) Deduce the structure of the following compound

MF : $C_6H_{10}O$

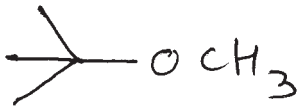
CMR : δ : 204(S)

36 (t, strong)

28 (t, strong)

24 (t)

c) Give the genesis of the following compound



m/z = 73, 57.

Total No. of Questions :3]

SEAT No. :

P1929

[Total No. of Pages :14

[5323] - 2004

M.Sc.

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry - II

(2013 Pattern) (Semester - II) (New 5 Credits)

Part - A - Modern Separation Methods and Hyphenated Techniques (2.0 credits / 25 marks)

Part - B - Basic Biochemistry (4.0 Credits / 50 marks)

Part - C - Concept of Analytical Chemistry (2.0 credits / 25 marks)

Part - D - Industrial Methods of Analysis (2.0 credits / 25 marks)

Part - E - Organometallic and Inorganic Reaction Mechanism (2.0 credits / 25 Marks)

Part - F - Mathematics for Chemists (2.0 credits / 25 marks)

Part - G - Pericyclic, Photochemistry and Free radical reactions (2.0 credits / 25 marks)

Time : 3 Hours] *[Max. Marks : 25*

Instructions to the candidates:

1) ***All questions of respective section/part are compulsory.***
2) ***Figures to right hand side indicate full marks.***
3) ***Neat labelled diagrams must be drawn wherever necessary.***
4) ***Use of log tables or /non-programmable calculator is allowed.***
5) ***Students should attempt any two parts from Part A,C,D,E,F and G or full paper of Basic Biochemistry (Part B).***
6) ***Write the answers of <u>two parts</u> on separate answer books.***

P.T.O.

PART - A

Modern Separation Methods and Hyphenated Techniques

Q1) Answer the following. **[10]**

a) Explain what is a metastable ion in mass spectrometry.

b) Explain the principle of size exclusion chromatography.

c) Differentiate between gradient elution and isocratic elution.

d) Give any two applications of mass spectrometry.

e) Give the expression for resolution of a chromatographic column and explain the terms involved in it.

Q2) Attempt any two of the following. **[10]**

a) Write a short note on Inductively coupled plasma Mass spectrometry.

b) Explain the various carrier gases and columns used in Gas chromatography.

c) Explain the stationary phases and mobile phases used in Normal phase and Reverse Phase Chromatography.

d) Explain the principle and working of GCMS.

Q3) Answer any one of the following. **[5]**

a) Following data was abtained for a liquid chromatographic column:

Length of packing = 24.7 cm

Flow Rate = 0.313 mL/min

Vm = 1.37 mL

Vs = 0.164 mL

Compound	t_R(min)	W(min)
Nonretained	3.1	–
A	13.3	1.07
B	14.1	1.16

Calculate for components A and B

i) Resolution

ii) Selectivity factor

iii) Plate height for the column

b) Explain the principle, construction and working of Thermal conductivity Detector used in Gas chromatography.

Total No. of Questions :6]

P1929

[5323] - 2004

M.Sc. - I

CHEMISTRY

CHA - 290 (B) : Basic Biochemistry

(2013 Pattern) (Semester - II) (5 Credit)

PART - B

Basic Biochemistry

Time : 3 Hours] ***[Max. Marks :50***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answer to both the sections should be solved in separate answer sheets.***
3) ***Figures to the right side indicate full marks.***

SECTION - I

Q1) Attempt any three of the following: **[9]**

a) Explain the importance of biochemistry in pharmaceutical science.

b) Enlist the different sub cellular components of eukaryotes and explain any one.

c) Classify proteins with suitable example.

d) Explain biological role of different types of fatty acids.

Q2) Answer any two of the following. **[8]**

a) How carbohydrates are classified? Give the structure and metabolim of complex carbohydrate with example.

b) What are the difference between globular and fibrous protein explain with example.

c) Explain the mechanism of glucose transport through membrane.

Q3) Write short notes on any four of the following: **[8]**

a) Drug transport.

b) Amino acid theraphy.

c) Structure of starch and chitin.

d) Lysosomes and peroxisomes.

e) Active and passive transport.

f) Essential and non essential amino acids.

SECTION - II

Q4) Answer any three of the following. **[9]**

a) What is DNA damage? Explain any one mechanism of DNA repair.

b) Enlist the different types of enzyme inhibition, explain any one of it.

c) What is Rho dependent and Rho independent of termination of transcription?

d) Explain the flow of genetic information.

Q5) Attempt any two of the following. **[8]**

a) What are the factors affecting enzyme activity? Describe the effect of substrate concentration on enzyme activity.

b) Classify vitamins, enlist water soluble vitamins with their deficiency diseases.

c) Describe translation process in prokaryotes.

Q6) Write short notes on any four of the following: **[8]**

a) Types of vitamins B

b) Therapeutic uses of enzymes.

c) Effect of temperature on the rate of enzyme reaction.

d) DNA recombination.

e) Structure of A, B and Z form of DNA.

f) Role of penicillin acylase for the production of 6-APA.

PART - C

Concept of Analytical Chemistry

Q1) Answer the following. **[10]**

a) Define the terms.

i) Stationary Phase

ii) Mobile Phase

b) What are the steps involoved in obtaining a laboratory sample.

c) If the results of an analysis are 40.98g compared with the accepted true value of 41.32g. What is the elative error in parts per thousand?

d) Give any two applications of nano - materials.

e) Give the principle of separation by distillation.

Q2) Answer any two of the following. **[10]**

a) Explain the "Q test" of significance with an example.

b) Explain the principle of separation of ions by ion exchange chromatography technique. Give their classification with examples of each type.

c) What is propogation of errors? Explain the terms absolute variance and relative variance.

d) Explain the following terms:

i) Significant figures.

ii) Micro-analysis

iii) Trace constituents

iv) Random sample

v) Gross sample

Q3) Answer any one of the following. **[5]**

a) The tin and zinc contents of a brass sample are analyzed with the following results.

Zn : 33.27, 33.37 and 33.34% and Sn = 0.022, 0.025 and 0.026%

Calculate the standard deviation and coefficient of variation for each analysis.

b) Explain solid phase extraction with the help of neat labelled diagram.

PART - D

Industrial Methods of Analysis

Q1) Answer the following. **[10]**

a) Enlist different types of process analyzers.

b) Explain the term benefit of quality system.

c) How will you prepare 15 ppm, K+ solution from KCl.

[Given : mol. wt of KCl = 744gm]

d) Give any two types of quality standards for laboratory.

e) Define the following.

i) PPB

ii) PPM

Q2) Attempt any two of the following. **[10]**

a) Write a note on : Oxygen analyser.

b) Explain the terms mmole and gmole with suitable examples.

c) Explain the terms

i) Theortical yield

ii) Limiting reactant

d) What is acidic buffer? Explain the buffer action of acidic buffer with suitable example.

Q3) Attempt any one of the following. **[5]**

a) What is chromatography? Explain the technique of gas chromatography.

b) From 0.290 gm of sample containing Ca, was dissolved in acid and Ca was precipitate as ca-oxalate. The ppt was dissolved in dil. $H_2 SO_4$ and solution was diluted to 100ml. An aliquot of 10ml was titrated with 0.025 N KM_nO_4 & gave burette reading . 7.1 ml calculate percentage of calcium.

[Given, At. wt:- Ca = 40, 0 = 16, C = 12]

PART - E

Organometallic and Inorganic Reaction Mechanism

Q1) Answer the following. **[10]**

a) Determine the valence electron counts for the transition metals in the following complexes.

i) Ni (CO)4

ii) $[(\eta^5 - C_5H_5)_2CO]^{\oplus}$

b) Define and give one example of oxidative addition reaction.

c) Give the rate law for dissociation reaction mechanism.

d) State, Ir(CO) Cl(PPh3)2 complex obey's $18e^{\ominus}$ rule or not.

e) Predict the type of reaction.

$$H_3C - Mn(CO)_5 + CO \longrightarrow CH_3 - \overset{\overset{O}{\|}}{C} - Mn(CO)_5$$

Q2) Attempt any two of the following. **[10]**

a) Explain formation of aldenyde by Hydroformylation process.

b) Write a note on - Trans effect.

c) Explain the bonding in metal - alkene compounds.

d) Write a note on - olefin metathesis.

Q3) Attempt any one of the following. **[5]**

a) Explain the role of IR spectroscopy in spectral analysis and characterisation of organometallic compounds.

b) Draw the following structures.

i) $Co_2(CO)_8$

ii) $[(\eta^5 - C_5H_5)_2V(CO)]$

iii) $[Co(H)(N_2)(PPh_3)_3]$

iv) $Fe(CO)_5$

v) Trans - Ir (CO)Cl $(PEt_3)_2$

PART - F

Mathematics for Chemists

Q1) Answer the following. **[10]**

a) Define:

i) Square matrix

ii) Diagonal matrix

b) Enlist two rules about scalar multiplication

c) Give transpose of :-

i) $\begin{bmatrix} 6 & 6 & 2 \\ 3 & 2 & 1 \end{bmatrix}$

ii) $\begin{bmatrix} -1 & 3 & 4 \\ 7 & 0 & 5 \\ 2 & 3 & -1 \end{bmatrix}$

d) If μ. is a homogeneous function of x and y of degrees n, then $\frac{du}{\partial x}$ and $\frac{\partial y}{dy}$ are also homogeneous functions of degree n.

e) Define:

i) Node.

ii) Cusp.

Q2) Attempt any two of the following. **[10]**

a) Discuss any two differential equations in physical chemistry.

b) Differentiate the following functions w.r.t. x:

i) $\sin(2x + 7)$.

ii) $\tan^2 x$.

c) Evaluate the following integrals.

i) $\int x^8 dx$

ii) $x\frac{-7}{2}dx$

d) Find the adjoint of the matrix A is

$$A = \begin{bmatrix} 1 & 1 & 3 \\ 0 & 1 & -1 \\ 2 & 0 & 4 \end{bmatrix}$$

Q3) Attempt <u>any</u> <u>one</u> of the following. **[5]**

a) Discuss any two applications of Taylor's theorem.

b) If $A = \begin{bmatrix} 1 & 2 \\ 3 & 4 \end{bmatrix}$, $B = \begin{bmatrix} -1 & 5 \\ 5 & 7 \end{bmatrix}$ then prove that $5(A + B) = 5A + 5B$.

PART - G

Pericyclic, Photochemistry and Free radical reactions

Q1) Answer Any Three of the following. **[9]**

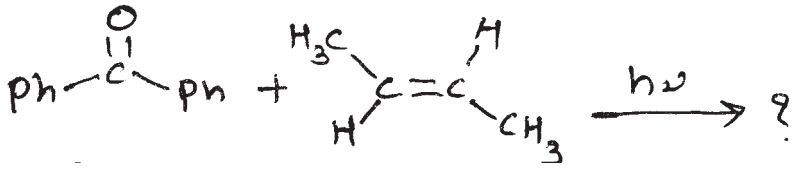
a) Write a note on photoisomerisation of Benzene.

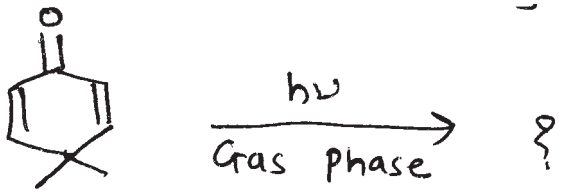
b) Draw the co-relation diagram for photochemical cyclization of 1,3 - butadiene to cyclobutene.

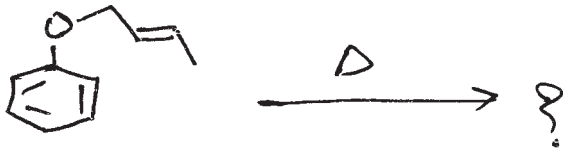
c) Explain with the help of FMO approach whether supra - supra cycloadditon reaction between allylic anion and butadiene is thermally or photochemically allowed.

d) Stability of free radicals.

Q2) a) Predict the product/s and explain the mechanism Any Two. **[4]**

i) 

ii) 

iii) 

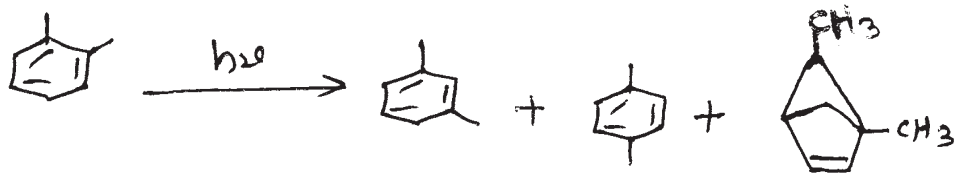
b) Answer <u>any two</u> of the following. **[4]**

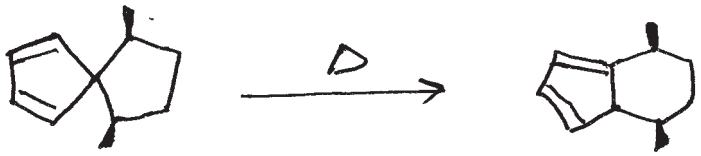
i) Discuss the synthetic application of Barton reaction.

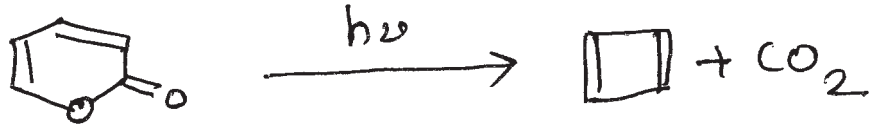
ii) What would be the configuration of the product of (2E, 4E) - Hexa - 2, 4-diene $\xrightarrow{\text{Thermal ring closure}}$.

iii) Write a note on auto-oxidation.

Q3) a) Explain the mechanism for the following reaction Any Two. **[4]**

i) 

ii) 

iii) 

b) Attempt <u>any Two</u> of the following. **[4]**

i) Explain with the help of FMO approach, whether suprafacial [1, 5] - Sigmatropic H - Shift is thermally or photochmically allowed.

ii) Write the major product of reaction between 1-methyl cyclohexene and HBr in presence of H_2O_2. Justify your answer.

iii) Write a short note on dimerization of butadiene.

Total No. of Questions : 6]

SEAT No. :

P1884

[Total No. of Pages : 3

[5323]-201

M.Sc. - I

PHYSICAL CHEMISTRY

CHP - 210 : Fundamentals of Physical Chemistry - II

(2014 Pattern) (Semester - II) (New 4 Credit)

Time : 3 Hours] *[Max. Marks : 50*

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.*
4) *Use of logarithmic table / calculator is allowed.*
5) *Neat diagrams must be drawn wherever necessary.*

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt the following : **[10]**

a) Explain the different factors affecting the intensities of spectral lines.

b) What are the criteria for a molecule to be microwave active? Give an example.

c) State the rule of mutual exclusion.

d) What are the conditions for fluorescence?

e) Explain the term pre-dissociation.

Q2) Attempt any two of the following : **[10]**

a) Sketch the polarizability ellipsoid for fundamental vibrational modes of CO_2 molecule and explain its Raman activity.

b) Explain the Fortrat diagram for $B' < B''$.

c) How does isotopic substitution help in determining the CO and CS bond lengths in linear OCS molecule?

d) Explain the principle of NMR spectroscopy and give its applications.

Q3) Solve any one of the following : **[5]**

a) If the bond length of H_2 is 0.07417 nm. What would be the position of first three rotational Raman lines in the spectrum.

b) The equilibrium vibrational frequency and unharmonicity constant for HI molecule are 2309.5 cm^{-1} and 0.0172 cm^{-1} respectively. Calculate the fundamental and first overtone transition.

SECTION - II

Q4) Attempt the following : **[10]**

a) What is design parameter? Give its significance.

b) Give the preparation of ^{22}Na and ^{35}S.

c) What is hydrated electron? Draw its structure.

d) Draw a graph showing effect of applied voltage on current pulse height for detection and measurement of radioactivity.

e) Obtain energy released during the fission of 1 Kg ^{235}U.

(1 eV = 1.6×10^{-19} J and 1 fission = 200 meV.)

Q5) Attempt any two of the following : **[10]**

a) What are the various units for measurements of radiation energy? How are they related with each other?

b) How Uranium and plutonium are recovered from spent fuel?

c) What is Fricke dosimetry? With appropriate reactions obtain the $G_{Fe^{3+}} = 15.6$.

d) Discuss the principle of isotope dilution analysis. How it is used to determine the volume of blood in patient?

Q6) Solve any one of the following : **[5]**

a) A ruby weighing 0.5 gram was irradiated in a neutron flux of 10^{12} n cm^{-2} s^{-1}. for exactly 24 hour and ^{51}Cr activity ($t_{½}$ = 27.7d) counted immediately thereafter. It was found to give 35000 c/s. Give that the σ for ^{50}Cr to be 15.9 barn, the counting efficiency 10% and the ^{50}Cr content of natural chromium to be 4.35%. Find the chromium content of the ruby.

b) An isotope losses $9/10^{th}$ of its activity in 23 hours. What is its half life and mean life.

Total No. of Questions :6]

SEAT No. :

P1885

[Total No. of Pages : 6

[5323]-202

M.Sc.-I (Inorganic Chemistry)

CHI - 230 : COORDINATION AND BIOINORGANIC CHEMISTRY

(2014 Pattern) (Semester-II)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

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

SECTION-I

Q1) Answer the following : **[10]**

a) Why is [Ti $(H_2O)_6]^{37}$ purple in colour?

b) Give the statement of curie Law and Curie-Weiss Law.

c) Show that all octahedral complexes of Ni^{27} must be outer orbital complexes.

d) Determine the ground state term for the following :

i) Gd^{3+}

ii) Co^{3+}

e) What is Zeeman effect?

Q2) Attempt any **two** of the following : **[10]**

a) Calculate number of microstates present in 3_F term.

b) How would you account for the magnetic moments listed against each of the following complexes :

i) $Na_4\left[Co\left(No_2\right)_6\right]\mu = 1.88 B.M.$

ii) $Cs\left[Ti\left(So_4\right)_2\right]\mu = 1.84 B.M.$

P.T.O.

c) Classify the following transitions in the octahedral complex as orbitally allowed, vibrionically allowed and forbidden transitions. Justify your answer:

i) $E_9 \rightarrow E_9$

ii) $A_{24} \rightarrow T_{29}$

iii) $A_{29} \rightarrow T_{29}$

d) Calculate the degeneracy for :

i) ^4F

ii) $t_{29}^4\ e_{29}^1$

Q3) Attempt any **one** of the following : **[5]**

a) Write a short note on Tanabe-sugano diagrams.

b) i) Ni^{27} (oh) complex shows 15% increase in its observed magnetic moment value. Calculate spin orbit coupling constant λ for Ni^{2T} ion using following data Dq = 850 cm^{-1}.

ii) What is spin-pairing energy?

SECTION-II

Q4) Answer the following : **[10]**

a) Give biological functions of the following elements : Co, Ca, K, Mo.

b) Why is iron suitable for redox processes in biological systems?

c) Give names of enzymes involved in mercury detoxification.

d) Give the Irwing-Williams series for divalent first row transition metal ions.

e) List two types of ion-channels.

Q5) Attempt any **two** of the following : **[10]**

a) Discuss the concept of tuning of redox potentials with respect to bioinorgamic chemistry.

b) Write a short note on transferrin.

c) Give a detailed account of zinc finger proteins.

d) Discuss the structure and functions of copper type II proteins.

Q6) Draw structures of (any 5): **[5]**

a) Aurinofin

b) Oxyhaemoglobin

c) Vitamin B_{12}

d) Pterin

e) Uracil

f) 2Fe-2S cluster

DIRECT PRODUCTS

1 Groups of the form $G \times i$ or $G \times u$, n

The g, u or $'$, $''$ additions to the IR symbols in these groups satisfy

$g \times g = u \times u = g$, $g \times u = u$, $'x' = ''x'' = '$, $'x'' =$

2 Products of the form $A \times A$, $B \times B$, $A \times B$:

For all groups :

Letter symbols : $A \times A = A$, $B \times B = A$, $A \times B = B$.

Subscripts : $1 \times 1 = 1$, $2 \times 2 = 1$, $1 \times 2 = 2$

except for the B representations of D_2 and D_{2h} where

$B \times B = B$ and $1 \times 2 = 3$, $2 \times 3 = 1$, $3 \times 1 = 2$.

3 Products of the form : $A \times E$, $B \times E$:

(a) For all groups : $A \times E_k = E_k$ irrespective of the suffix on A.

(b) For all groups except D_{4h}, D_{4d}, S_4 :

$B \times E_1 = E_2$, $B \times E_2 = E_1$

irrespective of the suffix on B (If the group has only one B representative put $E_1 = E_2 = E$.)

(c) For D_{4h} :

$B \times E_1 = E_3$, $B \times E_2 = E_4$, $B \times E_3 = E_1$, $B \times E_4 = E_2$, $B \times E_5 = E_5$

irrespective of the suffix on B.

(d) For D_{4d}, S_4 :

$B \times E_1 = E_3$, $B \times E_2 = E_4$, $B \times E_3 = E_1$

irrespective of the suffix on B.

4. Products of the form $E \times E$:

(For groups which have A, B or E symbols without suffixes put $A_1 = A_2 = A$, etc. in the equations below)

(a) For O_h, O, T_d, D_{6h}, D_{6d}, C_{6v}, C_{6h}, C_{6v}, S_6, D_{3d}, D_{3h}, D_3, C_{3v}, C_{3h}, C_3 :

$E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + E_2$; $E_1 \times E_2 = B_1 + B_2 + E_1$.

(b) For D_{3h}, D_3, C_{3v}, C_{3h}, C_3, S_6, D_{3d} :

$E \times E = A_1 + A_2 + B_1 + B_2$.

(c) For D_{4d} :

$E_1 \times E_1 = E_3 \times E_3 = A_1 + A_2 + E_2$,

$E_2 \times E_2 = E_4 \times E_4 = A_1 + A_2 + E_2$,

$E_3 \times E_3 = A_1 + A_2 + B_1 + B_2$,

$E_1 \times E_2 = E_4 \times E_3 = E_1 + E_3$, $E_1 \times E_3 = E_3 \times E_5 = E_2 + E_4$,

$E_1 \times E_4 = E_2 \times E_3 = E_2 + E_3$, $E_2 \times E_3 = E_3 \times E_4 = E_1 + E_3$,

$E_1 \times E_3 = B_1 + B_2 + E_4$, $E_2 \times E_4 = B_1 + B_2 + E_2$.

... C_{3}, C_{3A}, C_5 :

$E_1 \times E_1 = A_1 + A_2 + E_2$, $E_2 \times E_2 = A_1 + A_2 + E_1$,

$E_1 \times E_2 = E_1 + E_2$.

(e) For D_{4e}, S_4.

$E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + E_2$.

$E_2 \times E_2 = A_1 + A_2 + B_1 + B_2$

$E_1 \times E_2 = E_2 \times E_2 = E_1 + E_2$, $E_1 \times E_2 = B_1 + B_2 + E_2$.

5. Products involving the T (or F) representations of O_4, O and T_d :

$A_1 \times T_1 = T_1$, $A_1 \times T_2 = T_2$, $A_2 \times T_1 = T_2$, $A_2 \times T_2 = T_1$.

$E \times T_1 = E \times T_2 = T_1 + T_2$.

$T_1 \times T_1 = T_2 \times T_2 = A_1 + E + T_1 + T_2$.

$T_1 \times T_2 = A_2 + E + T_1 + T_2$.

6. The complete results 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	$A_2+E+T_1+T_2$	$A_1+E+T_1+T_2$

CORRELATION TABLE FOR GROUP O_h

O_h	O	T_d	D_{4h}	D_{2d}	C_{4v}	C_{2v}	D_{3d}	D_3	C_{3i}
A_{1g}	A_1	A_1	A_{1g}	A_1	A_1	A_1	A_{1g}	A_1	A_g
A_{2g}	A_2	A_2	B_{1g}	B_1	B_1	A_2	A_{2g}	A_2	B_g
E_g	E	E	$A_{1g}+B_{1g}$	A_1+B_1	A_1+B_1	A_1+A_2	E_g	E	A_g+B_g
T_{1g}	T_1	T_1	$A_{2g}+E_g$	A_2+E	A_2+E	$A_1+B_1+B_2$	$A_{2g}+E_g$	A_2+E	A_g+2B_g
T_{2g}	T_2	T_2	$B_{2g}+E_g$	B_2+E	B_2+E	$A_1+B_1+B_2$	$A_{1g}+E_g$	A_1+E	$2A_g+B_g$
A_{1u}	A_1	A_2	A_{1u}	B_1	A_2	A_2	A_{1u}	A_1	A_u
A_{2u}	A_2	A_2	B_{1u}	A_1	B_2	A_1	A_{2u}	A_2	B_u
E_u	E	E	$A_{1u}+B_{1u}$	A_1+B_1	A_2+B_2	A_1+A_2	E_u	E	A_u+B_u
T_{1u}	T_1	T_2	$A_{2u}+E_u$	B_2+E	A_1+E	$A_1+B_1+B_2$	$A_{2u}+E_u$	A_2+E	A_u+2B_u
T_{2u}	T_2	T_1	$B_{2u}+E_u$	A_2+E	B_1+E	$A_2+B_1+B_2$	$A_{1u}+E_u$	A_1+E	$2A_u+B_u$

Character Table for (O) rotational group

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

Total No. of Questions :6]

SEAT No. : ____

P1886

[Total No. of Pages : 4

[5323] - 203

M.Sc. - I

ORGANIC CHEMISTRY

CHO - 250 : Synthetic Organic Chemistry and Spectroscopy

(2014 Pattern) (4 Credit) (Semester - II)

Time : 3 Hours] ***[Max. Marks :50***

Instructions to the candidates:

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

SECTION - I

Q1) Explain any Five of the following. **[10]**

a) Oxime of ethyl -methyl ketone gives two products on treatment with H_2SO_4.

b) Uses of DIBAL in organic synthesis.

c) Organolithium reagent react with CO_2 to produce Ketones, whereas grignard reagent gives carboxylic acids.

d) Swern oxidation is preferred for oxidation of 2º alcohol over $KMnO_4$.

e) Spiro Ketones are prepared by using rearrangement reactions.

f) Significance of the Wittig reaction.

Q2) Attempt any five of the following. **[10]**

a) Wilkinson's catalyst.

b) Applications of MCPBA in organic synthesis.

c) Synthetic applications of nitrogen ylides.

d) Cope and Oxy - Cope rearrangement.

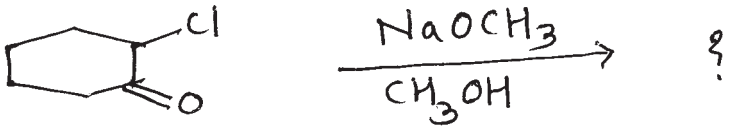
e) Organocopper reagent in organic synthesis.

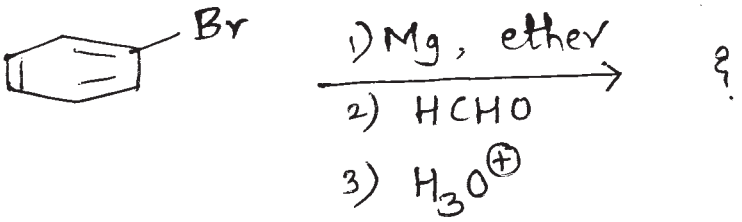
f) Ozonolysis reactions.

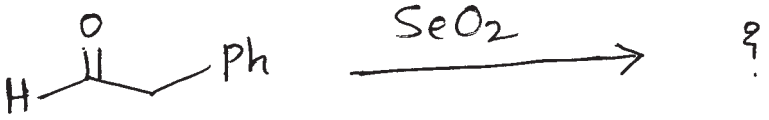
P.T.O.

Q3) Predict the product/s and suggest the mechanism for <u>any two</u> of the following: **[5]**

a) 

b) 

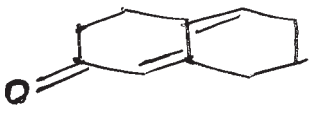
c) 

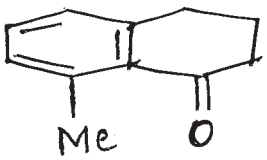
d) 

SECTION - II

Q4) Attempt the following: **[10]**

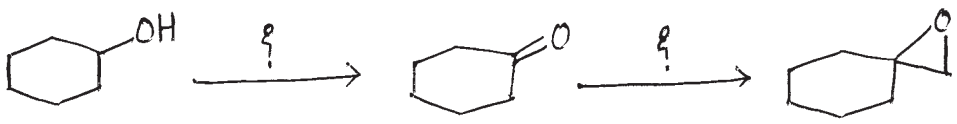
a) Calculate λ_{max} for the following compounds.

i) 

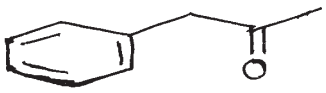
ii) 

b) Write a note on CMR spectroscopy.

c) How will you monitor the following reaction sequence by IR and suggest the reagent



d) Explain the genesis of the following ions in the given compound.



m/z = 91 & 43

e) Why ethyl acetoacetate shows IR bands at 3300, 1750, 1720, 1660 and 1620 cm^{-1}?

Q5) Deduce the structure of <u>any five</u> of the Following using spectral data and Justify your answer. **[10]**

a) $C_5H_6O_2$

UV : Featureless above 210 nm

IR : 1820 & 1770 cm^{-1}

PMR : 1.95 δ (quin, J = 6Hz, 12 mm)

2.70 δ (t, J = 6Hz, 24 mm)

b) C_8H_7N

UV : 235 nm

IR : 2220, 1620 & 1510 cm^{-1}

PMR : 2.4 δ (S, 15mm)

7.2 δ (d, J = 8Hz, 10 mm)

7.5 δ (d, J = 8Hz, 10 mm)

c) $C_4H_7BrO_2$

UV : Transparent above 210 nm

IR : 3300 – 2700 & 1720 cm^{-1}

PMR : 1.08 δ (t, J = 7Hz, 15 mm)

2. 07 δ (m, 10 mm)

4.23 δ (t, J = 7Hz, 5mm)

10.97 δ (S, exchangable with D_2O, 5 mm)

d) C_6H_5NO

IR : 2720 & 1690 cm^{-1}

PMR : 8.7 δ (d, J = 5.5 Hz, 10 mm)

7.3 δ (d, J = 5.5 Hz, 10 mm)

10.0 δ (S, 5 mm)

e) C_7H_7Br

UV : 260 - 275 nm

IR : 1600, 1480, 880 & 780 cm^{-1}

PMR : 2.35 δ (S, 21 mm)

7.02 δ (m, 14 mm)

7.30 δ (m, 14 mm)

f) $C_{10}H_{12}$

UV : < 210 nm

IR : 3300 & 2120 cm^{-1}

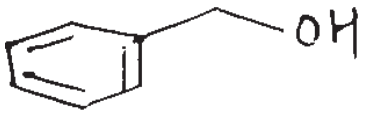
PMR : 2.0 δ (s, 8 mm)

2.4 δ (t, 8 mm)

2.6 δ (S, 32 mm)

Q6) Attempt <u>any two</u> of the following: **[5]**

a) Give the genesis of the following compound.



m/z = 107, 79 & 77

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

M.F. C_3H_7NO

CMR : 168 (s), 35 (t) & 22 (q).

c) Write a short note on 'Coupling constant'.

✈ ✈ ✈

Total No. of Questions :3]

SEAT No. :

P1887

[Total No. of Pages :12

[5323] - 204

M.Sc. - I

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry

(2014 Pattern) (Semester - II) (New 4 Credits)

Part - A - Modern Separation Methods and Hyphenated Techniques (2.0 credits / 25 marks)

Part - B - Basic Biochemistry (4.0 Credits / 50 marks)

Part - C - Concept of Analytical Chemistry (2.0 credits / 25 marks)

Part - D - Industrial Methods of Analysis (2.0 credits / 25 marks)

Part - E - Organometallic and Inorganic Reaction Mechanism (2.0 credits / 25 Marks)

Part - F - Mathematics for Chemists (2.0 credits / 25 marks)

Part - G - Pericyclic, Photochemistry and Free radical reactions (2.0 credits / 25 marks)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***All questions of the respective section/part are compulsory.***
2) ***Figures to right hand side indicate full maks.***
3) ***Neat diagramsmust be drawn wherever necessary.***
4) ***Use of logarithmic table/non-programmable calculator is allowed.***
5) ***Students should attempt any two parts from Part A,C,D,E,F and G or full paper of Basic Biochemistry (Part B).***
6) ***Write the answers of two parts in separate answer books.***

P.T.O.

PART - A

Modern Separation Methods and Hyphenated Techniques

Q1) Attempt the following. **[10]**

a) Define

i) Molecular ion peak

ii) Metastable ion

b) Give the applications of GLC.

c) How cis and trans isomers are identified using mass spectrometry?

d) State and explain size exclusion chromatography.

e) Distinguish between isocratic elution and gradient elution in HPLC.

Q2) Answer any two of the following. **[10]**

a) Draw a schematic diagram of mass spectrometer and explain the working of its essential components.

b) Describe the construction and working of FID.

c) Explain the mechanism involved in ion-pair chromatography.

d) Explain the Time of flight mass analyzer.

Q3) Answer any one of the following. **[5]**

a) Enlist the different types of ionisation methods in MS. Explain any one in detail.

b) A xylen chromatogram was obtained and recorded. The recorder speed was 3.68cm/min. The gas flowrate was 50.0 ml/min. The retention time for xylenc was 54.0cm and for the air it was 6.2 cm.

Calculate:

i) Uncorrected retention time in min.

ii) Uncorrected retention volume in ml.

iii) The adjusted retention time in min

iv) The adjusted retention volume in ml.

PART - B

Basic Biochemistry

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answer to the two sections to be written in separeate answer books.***
3) ***Draw diagrams wherever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

Q1) Answer any four of the following. **[12]**

a) Classify proteins based on their biological roles.

b) How aminoacid sequence in a protein is determined by Edman dagradation?

c) Explain in brief fibrous proteins.

d) What is meant by active transport? How do Na^+K^+ pump operate in membranes?

e) Compare and Contrast structural and functional properties of starch and Glycogen.

Q2) Disuss any two of the following. **[8]**

a) Reactons of TCA cycle.

b) Quaternary structure of protein.

c) Essential and Non essential amino acids with structures.

Q3) Explain the following terms. (any five) **[5]**

a) β- Oxidation.

b) Conjugated lipids.

c) Nonstandard aminoacids.

d) Nucleocytoplasmic Communication.

e) Drug transport.

f) Optical isomerism (in carbohydrates)

g) Glycolysis.

SECTION - II

Q4) Answer any four of the following. **[12]**

a) Give experimental evidences for semiconservative replication of DNA.

b) Explain the basic features of Genetic Code.

c) Discuss major components of balanced diet.

d) What are fat soluble vitamins? Add a note on visual cycle.

e) What is non competitive inhibition of enzyme? Discuss with suitable example.

Q5) Attempt any two of the following. **[8]**

a) Give an account on protein synthesis. (Translation Process) in prokaryotes.

b) Explain factors affecting rate of enzyme activity.

c) Write a note on different types of RNA With their structures & functions.

Q6) Explain the following terms (any five) **[5]**

a) Active site of enzyme.

b) Okazaki fragments.

c) Cofactors.

d) Scurvy.

e) Transcription bubble.

f) Template DNA.

g) Exons.

PART - C

Concept of Analytical Chemistry

Q1) Answer the following. **[10]**

a) Define term sampling and sample handling.

b) Give the procedure for sampling of metals and alloys.

c) What is F test?

d) What is determinate error?

e) What are the methods of improving column performance?

Q2) Attempt any two of the following. **[10]**

a) Explain addition and substration with suitable example.

b) What is least - squares method of calibration? Give its assumptions.

c) Describe the principles of separation by extraction.

d) Explain the term propagation of error with suitable example.

Q3) Attempt any one of the following. **[5]**

a) What is confidence limit? Explain tests of significance.

b) Calculate the uncertainty in the number of millimoles of chloride contained in 250 ml of a sample. When three equal aliquots of 25ml are titrated with silver nitrate gave the following results 36.78, 36.82 and 36.75 ml. The molarity of $AgNO_3$ solution is $0.1167 \pm 0.0002M$.

PART - D

Industrial Methods of Analysis

Q1) Answer the following. **[10]**

a) Explain the term stability constant. List the factors affecting stability of the complex.

b) Calculate the molar concentration of ethanol in an aqueous solution that contains 2.30 grams of C_2H_5OH in 3.50 liter of solution.

(Molecular weight : C_2H_5OH = 46.07 g/mole)

c) What is buffer capacity of a buffer solution? Give examples of acidic and basic buffer solutions.

d) Why H_2S is employed in presence of dilute HCl in qualitative analysis of II-group metal ions?

e) Explain theoretical yield and pratical yield.

Q2) Attempt any two of the following. **[10]**

a) What is solubility product? Explain any two applications of solubility product in qualitaive analysis.

b) To a solution of 0.1 M ammonium hydroxide, a solution of 0.1M ammonium chloride is added. Calculate hydroxyl ion concentration before and after addition of ammonium chloride. ($K_b = 1.8 \times 10^{-5}$)

c) Explain the types of quality standards for chemical laboratories.

d) Explain cost and benefits of quality system.

Q3) Attempt any one of the following. **[5]**

a) Explain automatic chemical analyzer and automatic elemental analyzer.

b) A precipitate of lead sulphate is washed with 200 ml of distilled water. Calculate how many milligrams of the precipitate will be lost in washing operation.

(Molecular weight = 303.2, solubility Product = 2.2×10^{-6}).

♦ ♦ ♦

PART - E

Organometallic and Inorganic Reaction Mechanism

Q1) Answer the following. **[10]**

a) Determine the number of metal-metal bonds in the following complex which obey the 18 electron rule and draw the structure.

$(CO)\ (\eta^5 - C_5H_5)\ Fe(\mu\text{–}CO)_2Fe(\eta^5\ \text{–}C_5H_5)\ (CO)$

b) Predict the type of reaction.

$(\eta^5 - C_5H_5)_2\ TaH_3 \longrightarrow (\eta^5\text{–}C_5H_5)_2TaH$

c) What is Zeiglar-Natta polymerisation?

d) What is meant by inert and labile complex? Give suitable example.

e) DescribeTolman angle and its effect on dissociation of ligands.

Q2) Answer any two of the following. **[10]**

a) Explain hydroformylation reaction in detail.

b) Explain the bonding in Π - ethylene complexes.

c) Write a note on trans effect.

d) Explain the difference in IR spectra of $Mo(PF_3)_3(CO)_3$ versus $Mo(pme_3)_3(CO)_3$.

Q3) Answer any one of the following. **[5]**

a) Write a short note on kinetic chelate effect.

b) Explain the formation of acetaldehyde by Wacker process.

♦ ♦ ♦

PART - F

Mathematics for Chemists

Q1) Answer the following. **[10]**

a) If $A=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$ $B=\begin{bmatrix}2 & 1\\ 4 & 2\end{bmatrix}$ $C=\begin{bmatrix}5 & 1\\ 7 & 4\end{bmatrix}$ then verify that A(B + C) = AB + AC.

b) Define:-

i) Point of inflexion

ii) Cusps.

c) Define and illustrate:

i) Unit matrix

ii) Vector matrix

d) Give derivatives of the following:-

i) Sec x

ii) a^x

iii) cos x

iv) x^n

v) tan x.

e) Give differential coefficients of the following w.r.t. x.

i) 10^x

ii) $3x^4$

Q2) Attempt <u>any</u> <u>two</u> of the following. **[10]**

a) Differentiate the following functions w.r.t. x.

i) $Y=\dfrac{x^2+2x+2}{x-4}$

ii) $Y=\dfrac{Sinx}{Cosx}$

b) What is the maxima and minima of a function of single independent variable? Give the rules.

c) With a suitable example explain the Taylor and McLaurin theorem.

d) Evaluate the following:-

i) $\int \frac{\tan x}{\sec x + \tan x} dx$

ii) $\int \left(x^3 + x + 5\right) dx.$

Q3) Answer <u>any</u> <u>one</u> of the following. **[5]**

a) What are exact and inexact differentials? Give their applications in thermodynamics.

b) Solve the linear equations by Cramer's rule.

i) $2x - 2y = 1,\ x + 2y = 2$

ii) $3x + 4y = 27,\ 5x - 3y = 16$

♦ ♦ ♦

PART - G

Pericyclic, Photochemistry and Free radical reactions

Q1) Attempt any three of the following. **[9]**

a) Construct a correlation diagram for the conrotatary opening of the cyclohexadiene to hexatriene. Predict whether these transformation are allowed thermally or photochemically.

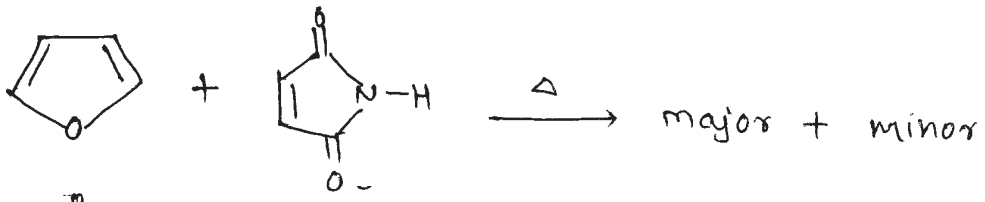
b) Give mechanism of Norrish Type II reaction with the help of gas phase irradiation of 2 - pentanone.

c) Explain free radical arylation of aromatic rings.

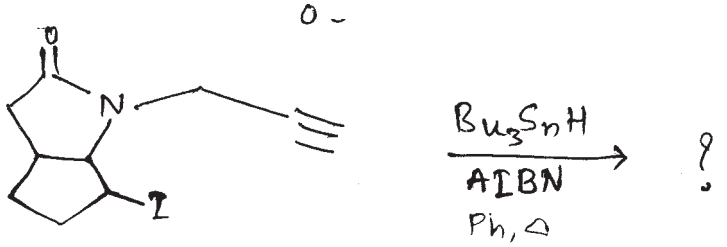
d) Discuss the mechanism of claisen rearrangment.

Q2) a) Predict the product/s and explain (any two) **[4]**

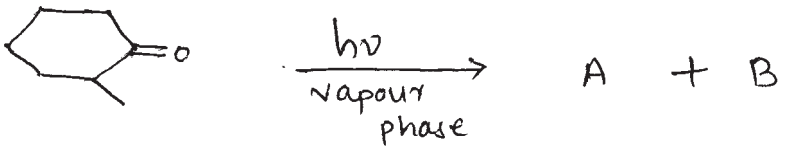
i)



ii)



iii)



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

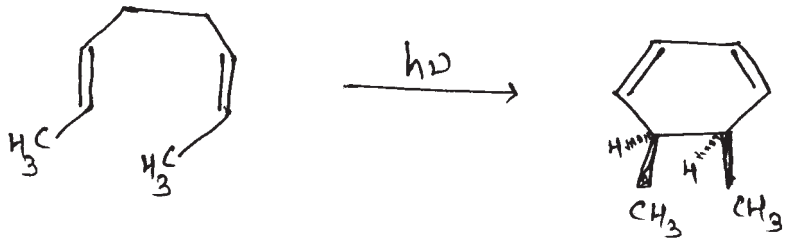
i) Reaction of 6-bromo-1-hexene on heating with Bu_3SnH and AIBN gives mixture of 1 - hexene, methylcyclopentane and cyclohexane.

ii) Why [1.5] sigmatropic shift of hydrogen is thermally allowed process.

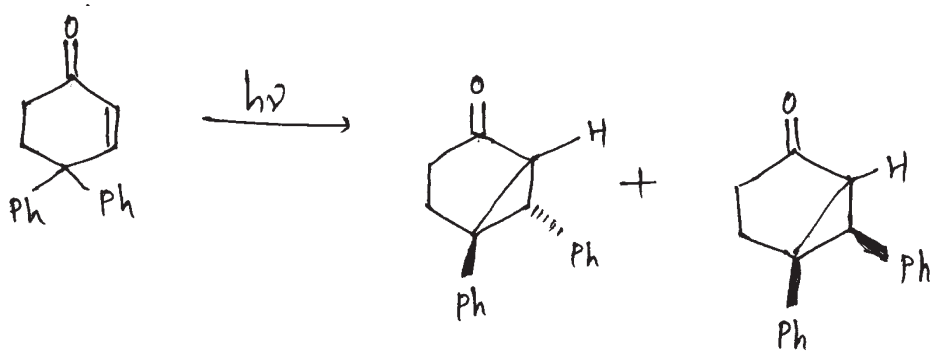
iii) Irradiation of O-xylene yields a mixture at m-xylene and p-xylene.

Q3) a) Explain the mechanism for the following reaction (any two) **[4]**

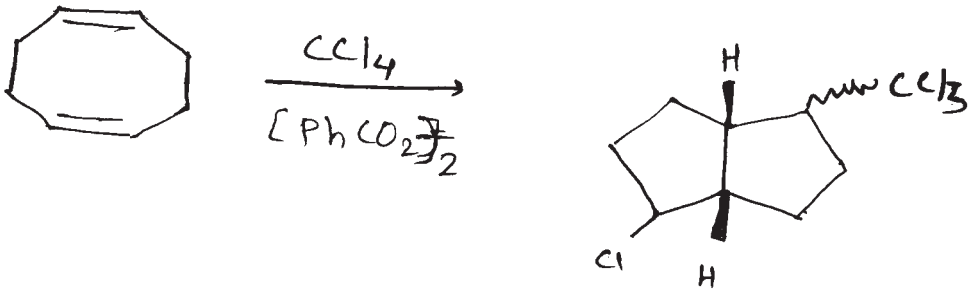
i)



ii)



iii)



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

i) Telomerisation

ii) Paterno-Buchii reaction

iii) 1, 4, Photoaddition of benzene.

♦ ♦ ♦

Total No. of Questions :6]

SEAT No. :

P1888

[Total No. of Pages : 4

[5323]-301

M.Sc.

PHYSICAL CHEMISTRY

CHP - 310 : Quantum Chemistry and Solid State Chemistry

(2013 Pattern) (Semester - III) (New)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answers 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.***
4) ***Use of logarithmic table/calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt the following: **[10]**

a) Show that $f(x) = 32\ e^{3x}$ is an eigenfunction of $\frac{d^2}{dx2}$. What is the corresponding eigenvalue?

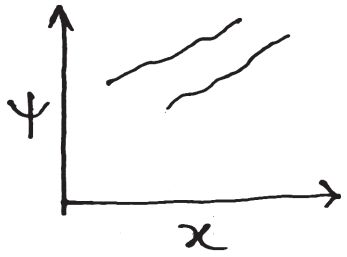
b) Write the condition for operator to be hermitian. Define the terms in it.

c) State the need of approximate methods in quantum chemistry.

d) Explain the following figures:-

i)

ii)



e) State the following operators linear or non linear, justify.

i) $\int dx$ and

ii) exp

Q2) Attempt any two of the following: **[10]**

a) Derive the expression for the first order correction to the wave function for non-degenerate perturbation method.

b) Discuss the application of variation method to helium atom.

c) Construct the energy opearator for

i) H_2^- ion and

ii) H_2 molecule. Explain the terms involved in these.

d) Apply HMO theory to butadiene and hence calculate the magnitude of the delocalisation energy.

Q3) Attempt any one of the following: **[5]**

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

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

ii) $\hat{A}f(x)$

iii) $f(x)\hat{A}$

iv) $f(x)\hat{A}\hat{B}\ g(x)$

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

b) Show that

$$\frac{\partial^2}{\partial\theta^2}\left(3\cos^2\theta-1\right)+\frac{\partial}{\partial\theta}\cot\theta\left(3\cos^2\theta-1\right)=6\hbar^2\left(3\cos^2\theta-1\right).$$

SECTION - II

Q4) Attempt the following: **[10]**

a) Define Burgers circuit.

b) Give the classification of defects.

c) State the Bravais law in relation to the crystal growth.

d) What is nucleation? Write its equation in case of decomposition of a single solid.

e) How does the McLeod and Pirani gauges measure the pressure of the evolved gas?

Q5) Attempt any two of the following: **[10]**

a) Discuss the various rate laws for gas-solid reactions.

b) Explain the mechanism of crystal growth from vapour phase.

c) Explain the mechanism of the following solid-solid reactions

i) $Agcl(s)+NaI(s) \rightarrow AgI(s) + Nacl(s)$.

ii) $Cu(s)+Agcl(s) \rightarrow Cucl(s) + Ag(s)$.

d) Derive the expression for Frenkel defects in a crystal at a given temperature.

Q6) Attempt any one of the following: **[5]**

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

b) If 1 ev energy is required to move an atom from the crystal's interior to the surface, What is the proportion of vacancies present in the crystal at 1000K? At 500K?

Total No. of Questions : 6]

SEAT No. :

P1889

[Total No. of Pages : 3

[5323] - 302

M.Sc.

PHYSICAL CHEMISTRY

CHP-311: Nuclear, Radiation and Photo-Chemistry

(2013 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 50*

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.***
4) ***Use of logarithmic table/calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***

Physico - Chemical Constants

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4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{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	=	2.997×10^{10} cm s^{-1}
			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION-I

Q1) Attempt the following: **[10]**

a) What are the properties of scintillator?

b) What is RBE and REM?

c) What is the role of H_2SO_4 in ceric sulphate dosimeter? Write the expression for $G(Ce^{3+})$.

d) Explain the role of moderator and coolant in reactor.

e) What is the role of Tl in NaI (Tl) scintillator?

Q2) Attempt any two of the following: **[10]**

a) Discuss the working of Li-drifted detector with schematic diagram.

b) Explain projectile acceleration & target preparation in PIXE.

c) Explain the general aspects of reactor design with suitable schematic diagram.

d) Write the sequence of filling of nuclear orbitals. What is necessity of proposing spin-orbital coupling?

Q3) Solve any one of the following: **[5]**

a) Calculate the energies of the two peaks in the RBS spectrum corraspond to ^{28}Si and ^{65}Cu assuming an incident $^{4}He^{+}$ ions of 2 meV energy and a scattering angle of 170^{o}.

b) Calculate the thickness of Zn (Z=30 & A = 64) plate required to reduced the level radiation from 1.4 Gy/min to 1.4 mGy/hr. Given: $\mu_{e^-} = 0.211 b/e^{\ominus}$ Density of Zn = 7.1 g/m^3.

SECTION-II

Q4) Answer the following: **[10]**

a) State Grotthuss-Draper's law.

b) Define quantum efficiency.

c) Explain briefly the Uranyl Oxalate Actinometer.

d) What are primary and secondary photochemical processes?

e) Calculate the frequency of ultraviolet light having a wavelength of 1500 Å.

Q5) Attempt any two of the following: **[10]**

a) Discuss the types of electronic transitions in organic molecules. Explain Kasha's test for the identification of different transition in organic molecules.

b) Discuss lifetimes of excited electronic states of atoms and molecules. Give relation between the natural radiative lifetime and the oscillator strength.

c) Explain the characteristics of fluorescence.

d) Explain with the help of derivation the photophysical kinetics of unimolecular processes.

Q6) Attempt any one of the following: **[5]**

a) Explain the working of Ruby and Nd: YAG Laser.

b) A certain system absorbs 2.8×10^{16} quanta of light per second. At the end of the 12 minutes, it is observed that 0.12 mole of the irradiated substance was reacted. What is the quantum yield of the process?

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Total No. of Questions : 6]

SEAT No :

P 1890

[Total No. of Pages :3

[5323]-303

M.Sc. : PHYSICAL CHEMISTRY

CHP-312 :Physico-Chemical Methods of Analysis

(2013 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
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			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{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}
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION-I

Q1) Answer precisely the following : **[10]**

a) What are X-rays ? Which is the useful region of X-ray for chemical analysis?

b) Define the terms -

i) Binding energy

ii) Work function of spectrometer

iii) K.E. of ejected electron

iv) Fermi energy level.

c) What is the basic difference between DTA and DSC.

d) Write Duane - Hunt equation and explain the terms involved in it.

e) Draw a neat labeled diagram of an ESCA spectrometer.

Q2) Answer <u>any two</u> of the following : **[10]**

a) Describe heat flux DSC instrument.

b) Discuss typical X-ray absorption spectra.

c) Write a note on spectral splitting.

d) Draw the energy level diagram for the sample and spectrometer used in ESCA technique and explain the same.

Q3) Solve <u>any one</u> of the following : **[5]**

a) The mass absorption coefficient of metal foil measured with CuK_α is 50 Cm^2/g. Calculate the thickness of metal foil that was found to transmit 45.8% of incident power beam of CuK_α radiations. The density of metal is 8.90 g/Cm^2.

b) TGA of plaster of paris showed mass loss of about 6.5% of original sample mass for complete dehydration of POP at about 100ºC. Determine the number of water molecules present in POP

[Given : At. Wt. of Ca = 40, S=32, O = 16, H = 1]

SECTION - II

Q4) Answer precisely the following : **[10]**

a) State the principle of hydrodynamic voltammetry.

b) What is plasma ? State its types.

c) Give the mechanism of Chemiluminescence.

d) What is heavy - atom effect observed in photoluminescence?

e) What is controlled potential coulometry?

Q5) Answer any two of the following : **[10]**

a) Discuss 'S' route and 'T' route mechanisms observed in electrochemiluminescence.

b) With a neat labelled diagram, describe the construction and working of a Plasma torch.

c) Explain the application of coulometry to perform neutralization titrations.

d) Write a note on cyclic voltammetry.

Q6) Solve <u>any one</u> of the following : **[5]**

a) A current of 1.7A is passed through 300.0 ml of 0.16 M solution of Z_{nSO_4} for 230S with current efficiency of 90%. Find out the molarity of Z_n^{2+} after the deposition of Zn.

Assume the volume of solution remains constant during electrolysis.

[At.Wts : Zn = 65.4, S = 32, O = 16]

b) Potassium ferrocyanide (n=1) has a diffusion coefficient of 6.5×10^{-6} cm^2s^{-1} during its oxidation in 0.1M KCl. It was used to measure the area of a stationary disk electrode. At a scan rate of 100 mV/s the amedic peak current for the oxidation of 1.0mM solution of potassium ferrocyanide was 32 μA. Estimate the electrode area.

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Total No. of Questions :6]

SEAT No. :

P1891

[Total No. of Pages : 3

[5323]-304
M.Sc.
PHYSICAL CHEMISTRY
CHP - 313: Polymer Chemistry
(2013 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answers 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.*
4) *Use of logarithmic table/calculator is allowed.*
5) *Neat diagrams must be drawn wherever necessary.*

Physico - Chemical Constants

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			=	1.602×10^{-19} J
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			=	8.314 J K^{-1} mol^{-1}
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

Q1) Answer precisely the following. **[10]**

a) Define theta temperature.

b) Explain 'Deborah' number.

c) Define glass transition temperature.

d) Explain creep phenomenon.

e) Define flory temperature.

Q2) Attempt any two of the following: **[10]**

a) Discuss the WLF equation and give its application.

b) Explain stress-strain curves at higher elongation in elastomers.

c) Discuss the Voigt mode of viscoelastic behaviour.

d) Give limitations of Hilderbrand theory.

Q3) Attempt any one of the following **[5]**

a) Write a note on membrane osmometry.

b) Explain the process of dissolution of a polymer.

SECTION - II

Q4) Attempt the following: **[10]**

a) Define viscosity and state the S1 unit of it.

b) What is meant by thermosetting polymer?

c) Define the term random degradation.

d) Define the term copolymerization.

e) Distinguish between homochain polymers and heterochain polymers.

Q5) Answer any two of the following: **[10]**

a) Describe in detail the molecular forces and chemical bonding in polymers.

b) Describe sedimentation transport method to determine the molecular weight of polymer.

c) Explain the conduction mechanism in conducting polymers.

d) Derive copolymer equation.

Q6) Answer any one of the following **[5]**

a) 210g of vinyl acetate and 50g of methyl acrylate copolymerize. Find the polymer composition.

[monomer reactivity ratios: 0.23 and 1.68 respectively.

At. wts: c = 12, H = 1, cl = 35.5, 0 = 16]

b) Describe the process of vulcanization with suitable example.

Total No. of Questions :6]

SEAT No. :

P1892

[Total No. of Pages : 3

[5323]-305
M.Sc.
PHYSICAL CHEMISTRY
CHP - 314 : Modern Trends in Physical Chemistry
(2013 Pattern) (Optional) (Semester - III)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answers 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.*
4) *Use of logarithmic tables and calculator is allowed.*
5) *Neat diagrams must be drawn wherever necessary.*

Physico - Chemical Constants

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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

Q1) Answer precisely the following. **[10]**

a) Explain the term the degree of freedom with examples.

b) Draw a neat labeled temperature - composition diagram for an ideal mixture with component A more volatile than B.

c) Write charge balance for a solution of KCl.

d) Write mass balance on phosphate in 0.1 M NaH_2PO_4.

e) Write the proton condition for NaHS.

Q2) Answer any two of the following: **[10]**

a) Describe experimental procedure for one component system.

b) What is meant by eutectic. Explain the temperature-composition phase diagram for two immiscible solids.

c) Interprete the vapour pressure phase diagram for two component system.

d) Draw a logarithmic concentration diagram for 0.01M H_2CO_3.

$$\left[\text{Given} : K_{a_1} = 4.47\times10^{-7}, K_{a_2} = 5.62\times10^{-11}\right]$$

Q3) Solve any one of the following: **[5]**

a) The pH of 0.01 M solution of a salt succinic acid is 9.2. Find the fractions of $C_6H_6O_4$, $C_6H_5O_4^-$ and $C_6H_4O_4^{2-}$.

$$\left[\text{Given} : K_{a_1} = 6.45\times10^{-5}, K_{a_2} = 3.31\times10^{-6}\right]$$

b) Calculate pH and concentration of all the species in 0.1M CH_3COONa [Given : $K_a = 1.8\times10^{-5}$]

SECTION - II

Q4) Answer the following: **[10]**

a) Define the term smart materials.

b) Write the abbey equation. Explain the terms involved in it.

c) What is edge effect?

d) Which are the principle images produced in SEM.

e) Define the term resolution and resolving power.

Q5) Answer any two of the following: **[10]**

a) How are rubber like ceramics prepared.

b) Explain in brief the schottky emission electron gun.

c) Discuss the properties of nanoparticles.

d) Write a note on smart polymers.

Q6) Answer any one of the following: **[5]**

a) Describe briefly electron beam lithography.

b) Give an account of scanning tunneling microscope.

♦ ♦ ♦

Total No. of Questions :4]

SEAT No. :

P1893

[Total No. of Pages :3

[5323] - 306

M.Sc. - II (Inorganic Chemistry)

CHI - 326 : ORGANOMETALLIC CHEMISTRY AND HOMOGENEOUS CATALYSIS

(2013 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat diagrams must be drawn wherever necessary.***

Q1) Answer the following: **[20]**

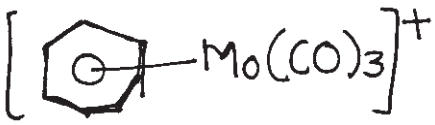
a) Give the general features of homogeneous catalysis.

b) What are the prerequisite conditions for asymmetric catalysis?

c) List the various biphasic systems.

d) Which of the following complexes obey $18\bar{e}$ rule?

i) $Fe_2(Co)_g$

ii) 

e) What is hapticity? Explain with example.

f) Define one angle and bite angle.

g) What are similarities between Suzuki and Heck couplling reaction.

h) List the different methods for the preparation of metal-carbonyl compounds.

i) Why do transition metals acts as catalyst? Give two examples.

j) Comment on the therapeutic properties of.

i) Mercurochrome.

ii) Cisplatin.

P.T.O.

Q2) Attempt any TWO of the following: **[10]**

a) Give the systematic classification of σ-bonded transition metal hydrocarbonyls.

b) Discuss Tollman catalytic cycle.

c) Explain the $\gamma(\text{co})$ band in the IR spectrum of $\left[Fe(\text{co})_4\right]^{-2}$ is at about 1>90 cm^{-1}; whereas for $Ni(\text{co})_4$ it is about 2060 cm^{-1}.

d) Explain with the help of suitable example of the role of organometallic compound as a protecting agent.

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

a) Give synthesis, bonding and properties of cyclobutadienes compounds.

b) What do you mean by Heck reaction? Explain the steps involved in cyclopropanation reaction.

c) Give the typical reactions of $(\eta^6\text{- arene})$ - metal derivatives.

d) Give an account of the chemistry, structure and bonding of the π-alhyl complexes of transition metals.

Q4) A) Write note on any one. **[5]**

a) Importance of chiral ligand in Asymmetric catalyst.

b) Fluxional behaviour of organometallics.

B) Complete the following reactions **[5]**

a) $Mn(CO)_6 + \text{cycloheptatriene} \longrightarrow ?$

b) $(CO)_5Cr=C(OMe)R + HN=Cphg \longrightarrow ?$

c) $(PPh_3)_2COCl_2Os=CCl_2 + 2\,LiAr \longrightarrow ?$

d) $Mo(\eta^6\text{-}C_6H_6)_3 + 6\,PF_3 \xrightarrow[600\ atm.]{100^\circ C} ?$

e) $(\eta^5\text{-}C_5Me_5)_2UR_2 + 2\,CO \xrightarrow[25^\circ C]{PhMe} ?$

Total No. of Questions : 4]

SEAT No. : ____

P1894

[Total No. of Pages : 3

[5323] - 307

M.Sc. - II

INORGANIC CHEMISTRY

CHI-330: Inorganic Reaction Mechanism, Photochemistry and Magnetic Properties of Coordination Compounds

(2013 Pattern) (Semester - III) (4 Credit)

Time : 3 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

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

Q1) Attempt the following: **[20]**

a) Four coordinated tetrahedral or square planer complexes reacts faster than six coordinated octahedral complexes. Explain.

b) Thermodynamically stable complexes could be kinetically inert or labile. Illustrate with suitable example.

c) How does following modifications affects the rate of substitution reactions in square planer complexes.

i) Adding bulky subtituent to the cis ligand.

ii) Inoresing positive charge on metal complex.

d) Suggest the mechanism for following reaction.

$[Co\ (NH_3)_5\ SCN]^{2+} \rightarrow [Co(NH_3)_5\ NCS]^{2+}$

e) List out the characterestics of outer sphere electron transfer reactions.

P.T.O.

f) Which of the following octahedral substitution reaction is faster? Why?

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

$[NiCl(NH_3)_5]^+ + NH_3 \rightarrow [Ni(NH_3)_6]^{2+} + Cl^-$

g) List out the reactions coordinated ligands.

h) Describe the phenomenon of phosphorescence.

i) Find out the R.S. term symbol for Cr^{2+} & Cu^{2+}

j) What do you mean by magnetically dilute and concentrated systems.

Q2) Answer the following: (Any Two) **[10]**

a) Differentiate between intimate and stoicheometric mechanism.

b) How isotope labelling technique is used in studying the kinetics and mechanism of the reactions.

c) What is base hydrolysis? Explain with suitable example.

d) What do you mean by quenching of orbital angular momentum. Provide explaination by VBT and CFT for the same.

Q3) Attempt the following: (Any Two) **[10]**

a) Discuss the mechanism of cis-trans isomerism in octahedral complexes with suitable example.

b) Explain the nudeophilic behaviour of coordinated ligand.

c) Discuss the mechanism of inner sphere electron transfor reaction with suitable example.

d) Predict the magnetic exchange which occurs via the 90^o exchange pathway in the system d^1 - d^1, d^2 - d^2, d^3 - d^3, d^8 - d^8, and d^9 - d^9.

Q4) Write a note on (Any Two): **[10]**

a) Methyl migration and CO insertion reactions.

b) Applications of photochemic reactions of coordination compounds.

c) Complementary and Non complementary reactions.

d) Magnetic properties of mixed valence compounds.

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Total No. of Questions : 4]

SEAT No : ____

P 1895

[Total No. of Pages :2

[5323]-308

M.Sc. - II

INORGANIC CHEMISTRY

CH1-331 : Physical Methods in Inorganic Chemistry

(2013 Pattern) (Semester - III) (Credit System)

Time : 3 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Draw neat diagrams wherever necessary***
3) ***Figures to the right indicate full marks.***
4) ***Use of log tables and calculators is allowed.***

Q1) Answer the following : **[20]**

a) Define quadrupole splitting.

b) Why XPS required Ultrahigh Vacuum (UHV) condition.

c) Predict the number of lines expected in ESR of $\dot{C}D_3$ radical.

d) Which changes can be detected by DSC.

e) What is cyclic voltammetry.

f) Write the equation for calculating chemical shift in mössbauer spectroscopy.

g) Draw the following planes in cubic cess [100] [110]

h) What is mean by non-isothermal thermogravimetry?

i) Calculate the number of atom present in BCC lattice.

j) Draw the Mössbauer spectrum for Fe_2O_3.

P.T.O.

Q2) Attempt any two of the following : **[10]**

a) Calculate the interplanar spacing of a set of planes, if the angle for the first order diffraction is 45^0. When X-rays of wavelength 1.54 A^0 are used.

b) Explain the cyclic voltammogram of benzene hexachloride.

c) Draw the ESR - spectrum for iso-propyl-alcohol.

d) Sodium chloride (Mol.wt.=58.5) and density (2.16 gmL^{-1}) exists in FCC lattices with unit cell edge 5.64 A^0. The unit cell containt Four molecules. Calculate Arogadros is number.

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

a) Explain the application of thermogravi-metry in evaluation of suitable standard for the gravimetric estimation.

b) Explain the instrumental factors affecting on D>A curve.

c) Explain the principle; instrumentations of XPS.

d) Draw the structure of $Fe_3(CO)_{12}$ with the help of Mossbauer spectroscopy.

Q4) Attempt any two of the following : **[10]**

a) Spin-lattice relaxation in ESR spectroscopy.

b) Role of supporting electrolyte in CV.

c) Draw the DTA - curve for $Mn(PH_2O_2)H_2O$.

d) Discuss the application of XPS.

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Total No. of Questions :4]

SEAT No. :

P1896

[Total No. of Pages :2

[5323] - 309

M.Sc. - II

INORGANIC CHEMISTRY

CHI - 332 : Bioinorganic and Inorganic Medicinal Chemistry

(2013 Pattern) (Credit System) (Semester - III)

Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

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

Q1) Answer the following: **[20]**

a) What is the rate determining step in hydrolysis of CO_2 catalyzed by carboanhydrase?

b) Which element is present at the active centre of carboxy peptidase and give an account of its role in biological system?

c) Why type-1 cu proteins are blue in color.

d) Name the naturally occuring organometallic enzyme. Which element is present at the active site?

e) Define P-Cluster. Give its role.

f) What are Rieske profeins? Mention oxidation states of Fe centres.

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

h) Draw the structure of Cu-PSTM and Cu-ASTM.

i) Name any four biological processes in which Fe-s proteins are involved.

j) Which element is present in SOD? Mention their roles in biological processes.

P.T.O.

Q2) Answer any two of the following. **[10]**

a) Explain the following actions of alkyl cobalamin.

i) One electron redox reaction.

ii) Co-c band cleavage.

b) Write an account of zn- cataining enzymes.

c) Discuss the mechanistic aspects of the reactions of hydrolysis of CO_2 catalyzed by carboanhydrase.

d) Explain in detail the model complexes of blue- copper proteins.

Q3) Answer any two of the follwoing: **[10]**

a) Give an account of therapeutic and diagnostic applications of radiopharmaceuticals.

b) Mention the deficiency of vit - B_{12} and give an account of model compounds of vit - B_{12}.

c) Explain the model of pathway for reduction and accumulation of varadium.

d) Give the schematic diagram for the following types of reaction.

i) Biological oxidation of phenyl alanine in presence of Dopamine - β - mono oxygenase.

ii) O_2 production at a four Mn cluster.

Q4) Answer any two of the following: **[10]**

a) Write note on

i) Galactose oxidase

ii) Ribonucleotide reductase.

b) Give the mechanism of how cu-PSTM is trapped inside the cell.

c) Write a note on

i) Antitumor agents

ii) MRI

d) Write a note on hypoxia imaging agants.

♦ ♦ ♦

Total No. of Questions :6]

SEAT No. :

P1897

[Total No. of Pages :4

[5323] - 310

M.Sc. - II

ORGANIC CHEMISTRY

CHO - 350 : Organic Reaction Mechanism

(2013 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

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

SECTION - I

Q1) Answer the following: **[10]**

a) Give synthetic applications of EAA.

b) Pyrrole on reaction with $CHCl_3$ in aq. NaOH gives 2-Formyl pyrrole and 3-Chloropyridine. Explain.

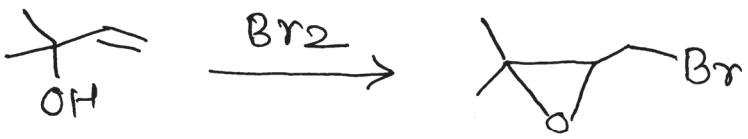
c) Explain in brief the stork-enamine synthesis.

d) Give synthetic utility of nitrenes.

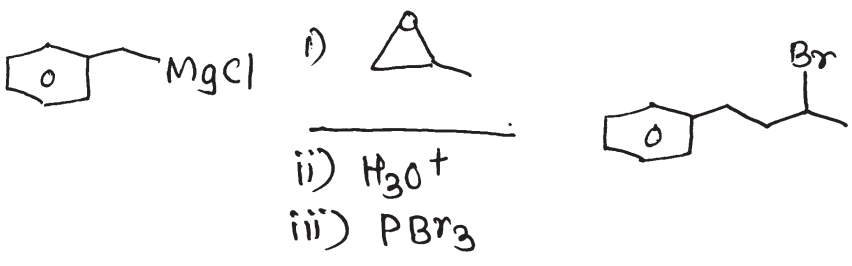
e) Explain anchimeric assistance involving π -bonds.

Q2) A) Suggest suitable mechanism in any three **[6]**

a)

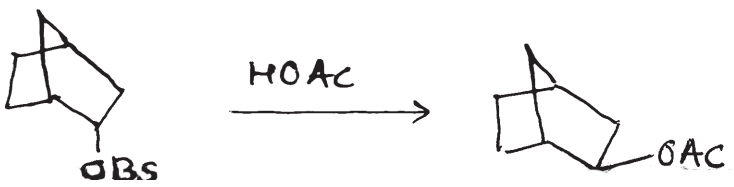


b)



P.T.O.

c)



d) $PhCHO+CH_3COCH_3 \xrightarrow{NaOH} Ph\text{-}CH{=}CH\text{-}\overset{\overset{O}{\|}}{C}\text{-}CH{=}CH\text{-}Ph$.

B) Write short notes on any two. **[4]**

a) Role of pyridoxal phosphate in nature.

b) Perkin condensation.

c) Benzoin condensation.

Q3) Answer any one of the following: **[5]**

a) Michael reaction fails with o-phenylcinnamic ester. Explain.

b) Explain the use of thymine phosphate as an acyl anion equivalent.

SECTION - II

Q4) Answer the following: **[10]**

a) The peroxyester $PhCH{=}CHCH_2COOOCMe_3$ decomposes about 5000 times as rapid as t-butyl peroxyacetate. Explain.

b) Give synthetic applications of malonate ester.

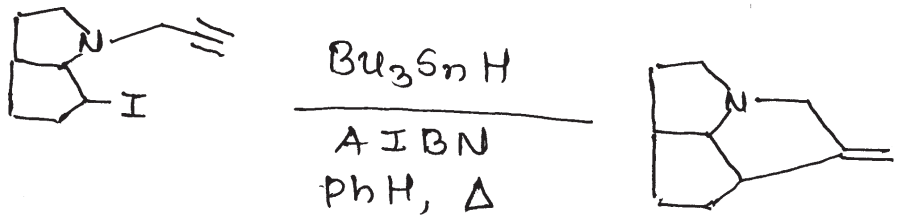
c) Explain generation of free radicals using heat with suitable example.

d) List any two reactions involving enamine approach.

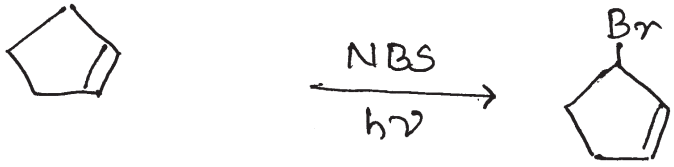
e) Give role of AIBN in organic radical chemistry.

Q5) A) Suggest the mechanism in any three. **[6]**

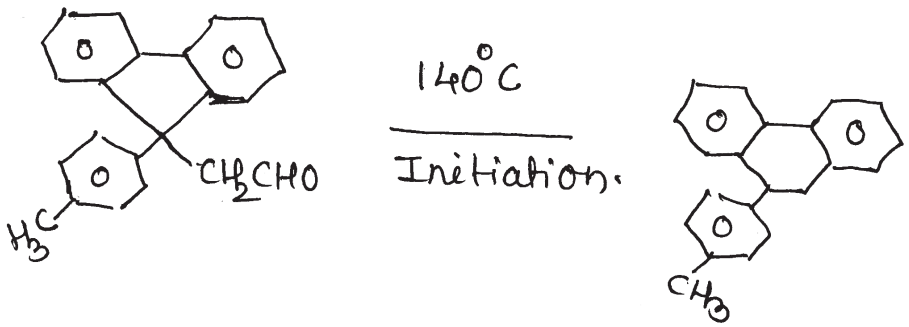
a)



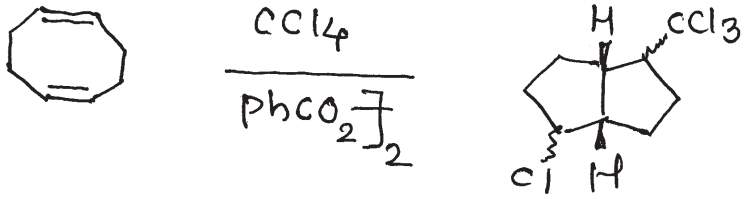
b)



c)



d)



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

a) Write short note on acyloin condensation.

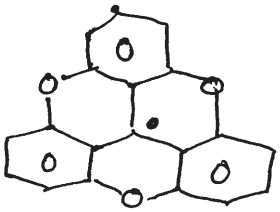
b) Write a note on Sandmeyer Reaction.

c) Write a note on arylation of aromatic ring.

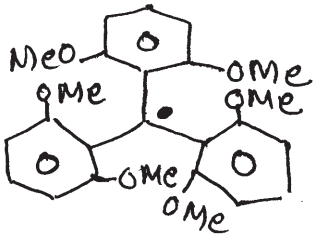
Q6) Answer any one of the following: **[5]**

a) Irradiation of 2,2,5,5 - tetraphenylcyclohexanone gives two products. Explain.

b) Compound A exists primarily in the dimeric form. Compound B exists as a free radical even in the solid state. Explain.



A



B

Total No. of Questions :5]

SEAT No. :

P1898

[Total No. of Pages : 7

[5323]-311
M.Sc. - II
ORGANIC CHEMISTRY
CHO-351: Spectroscopic Methods in Structure Determinations
(2013 Pattern) (Semester-III) (4-Credits)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

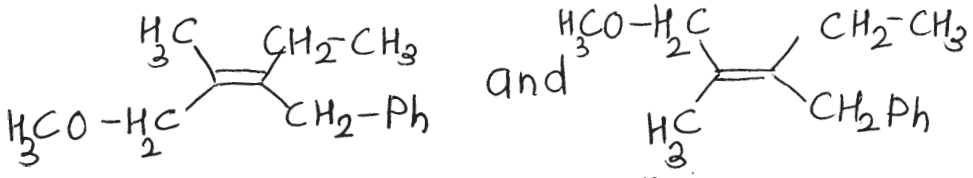
1) ***All questions are compulsory.***
2) ***Answer to the two sections to be written on two separate answer books.***
3) ***Figures to the right indicate full marks.***

SECTION-I

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

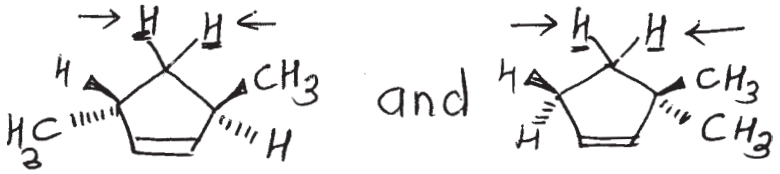
a) Why $CDCl_3$ gives triplet (1:1:1) in ^{13}C–NMR?

b) How will you differentiate the following pair of isomers by advanced ^1H–NMR spectrosocpy?



c) The compound C_6H_6 shows two peaks in ^{13}C–NMR However, DEPT-135 gives only one-ve peak at 90 ppm. suggest the structure.

d) How will you differentiate following underlined protons using ^1H–NMR spectroscopy?



e) Assign the structure to isomers A and B [MF:C_4H_8O]

Isomer A : +ve iodoform test and characteristic ^{13}C–NMR chemical shift, δ= 207ppm.

Isomer B: –ve iodoform test and characteristic ^{13}C–NMR chemical shift, δ=101ppm

(No peak above 160 ppm).

P.T.O.

Q2) A) Answer any three of the following : **[12]**

a) Assign the structure to the following using the given spectroscopic data:

i) $m^+=152$

ii) IR cm^{-1}=3190, 2954, 1674cm^{-1}

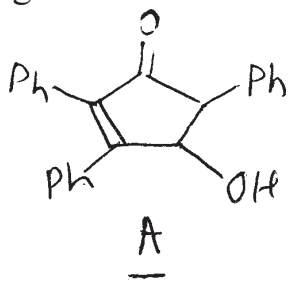
iii) ^{1}H–NMR (δppm): 4.2 (S, 12mm); 6.8 (dt, J=8,2 Hz, 4mm); 6.91 (dd J=8,2 Hz 4mm); 7.45 (dt,J=8, 2Hz, 4mm); 7.92 (dd,J= 8,2 Hz, 4mm); 10.9 (S, exch. 4mm).

iv) Normal ^{13}C–NMR(δ,PPM): 52, 112, 118, 119, 128, 137, 160, 174

DEPT-135 : 118,160 and 174 absent remaining are +ve peaks

DEPT-90 : except disappearence of peak at 52 everything is same as DEPT-135.

b) The compound A has two stereoisomers X and Y. Using following spectral data of aliphatic region, assign the correct structure. Justify your assignment and stereochemistry



A

^{1}H–NMR Data-1:

3.69_{ppm} (d, J=2Hz 1H, exch. D_2O)

4.05ppm (d, J=7 Hz 1H)

4.20 ppm (dd, J = 7, 2 Hz 1H)

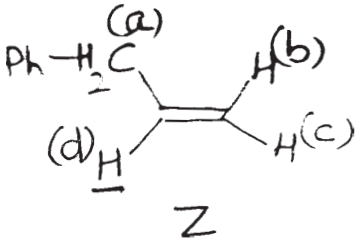
^{1}H–NMR Data-2:

3.65_{ppm} (d, J=2Hz, 1H, exch. D_2O)

4.10ppm (d, J=16 Hz, 1H)

4.27 ppm (dd, J = 16, 2 Hz 1H)

c) In the following compound Z, the proton d shows δ at 5.2 ppm on 600 MHz NMR instrument. Predict the multiplicity pattern and find out the chemical shift for each line of multiplet in Hz. Justify your assignment with the help of tree diagram.



Z

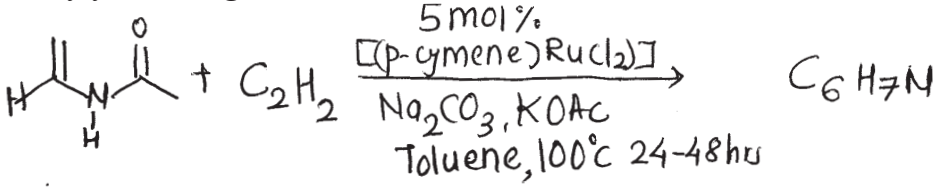
Jad = 1Hz

Jbd = 16Hz

Jcd = 8 Hz

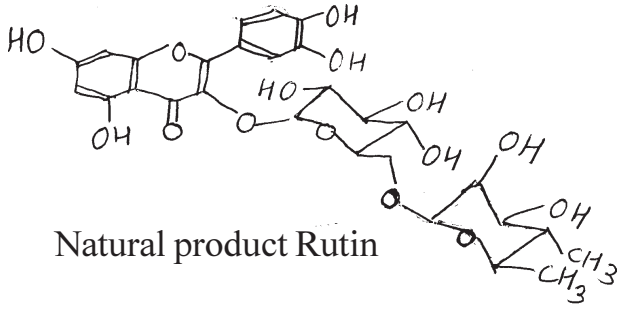
Jbc = 2.5Hz

d) Deduce the structure of the product formed in the following reaction. Justify your assignment.



^{1}H–NMR, (δ_{in} ppm): 7.12 (ddd, J = 7.6, 5.5, 1.5 Hz, 5mm) 7.15 (dd, J=7.6, 1.5 Hz, 5mm); 7.60 (dt, 7.6, 1.0 Hz 5mm 8.48 (dd, J=5.5, 1.0 Hz 5mm)

B) Assign the signals to the various protons of natural product rutin. The ^{1}H–NMR was recorded using D_2O. **[5]**



Natural product Rutin

a) 7.58 (dd, J = 8, 2 Hz, 1H)
b) 7.47 (d, J = 2 Hz, 1H)
c) 6.85 (d, J = 8 Hz 1H)
d) 6.73 (d, J = 2 Hz, 1H)
e) 6.65 (d, J = 2 Hz, 1H)
f) 5.82 (d, J = 12Hz, 1H)
g) 5.58 (d, J = 5 Hz, 1H)
h) 4.15 (ddd, J = 13,6, 6.5Hz, 1H)
i) 3.99 (dd, J = 5, 12Hz, 1H)
j) 3.85 (t; J = 5 Hz, 1H)
k) 3.82 (dd, J = 5Hz, 13 Hz, 1H)
l) 3.81 (dd, J = 18,6 Hz, 1H)
m) 3.80 (dd, J = 18,6.5 Hz, 1H)
n) 3.78 (dd, J = 5, 3Hz, 1H)
o) 3.75 (dd, J = 5, 3Hz, 1H)
p) 3.62 (dd, J = 11, 7Hz, 1H)
q) 1.42 (ddq, J = 11, 7,5 Hz, 1H)
r) 1.21 (d, J = 7 Hz, 3H)
s) 1.15 (d, J = 7 Hz, 3H)

SECTION-II

Q3) Write short notes on any three of the following : **[9]**

a) Chemical ionisation.

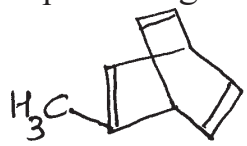
b) INEPT in ^{13}C-NMR signal enhancement.

c) Chiral shift reagents.

d) Time of flight.

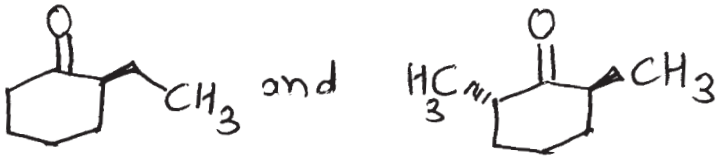
Q4) Answer any four of the following : **[8]**

a) Explain the genesis of ions in the following compound.

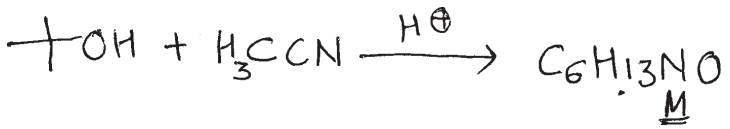


m/z = 91, 26

b) How will you differentiate the following pair of isomers by mass spectrometry?



c) How will you follow the following reaction sequence by mass spectrometry?

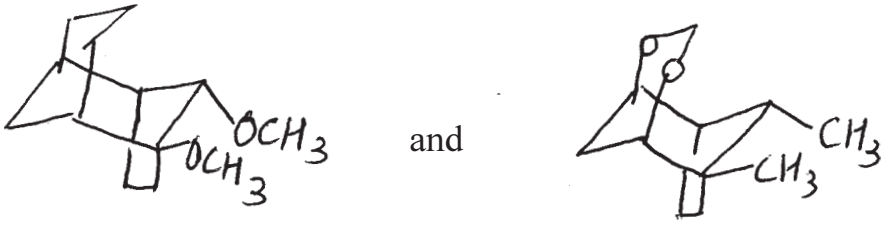


mass M/z = 115(7%); 100 (10%), 64 (5%), 60 (21%), 59 (17%), 58(100), 56(7)

Deduce the structure of M using the M/z tragments.

d) How isotopic peaks in MS will help to determine the number and type of halogens in unknown compound?

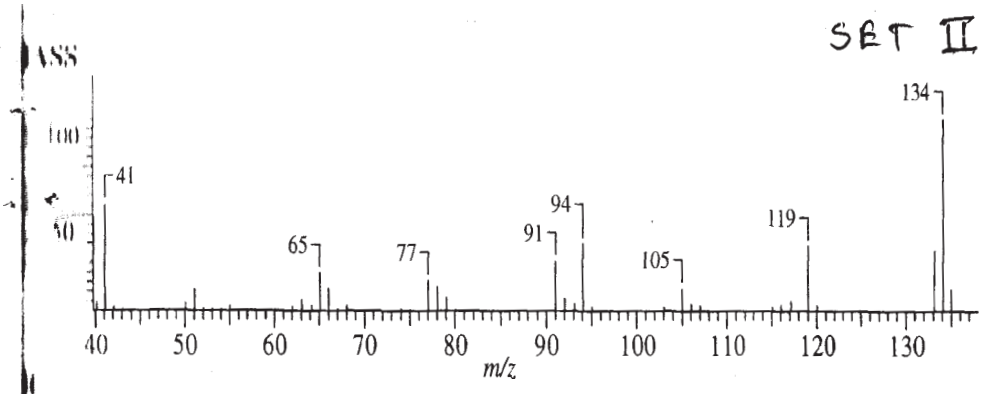
e) Which spectroscopic method will you use to differentiate the following pair of isomers?

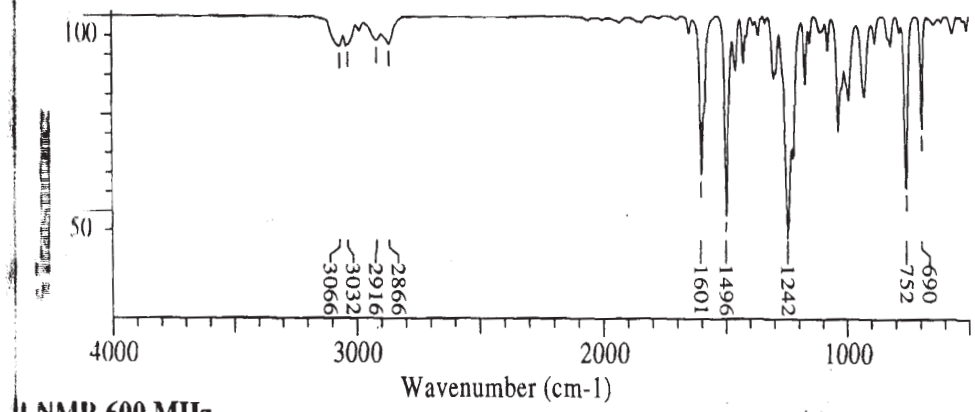


Q5) The spectra of an unknown compound are shown on adjacent page. Analyse the spectral data and by using this data arrive at a correct structure of the unknown compound. Justify your assignments. **[8]**

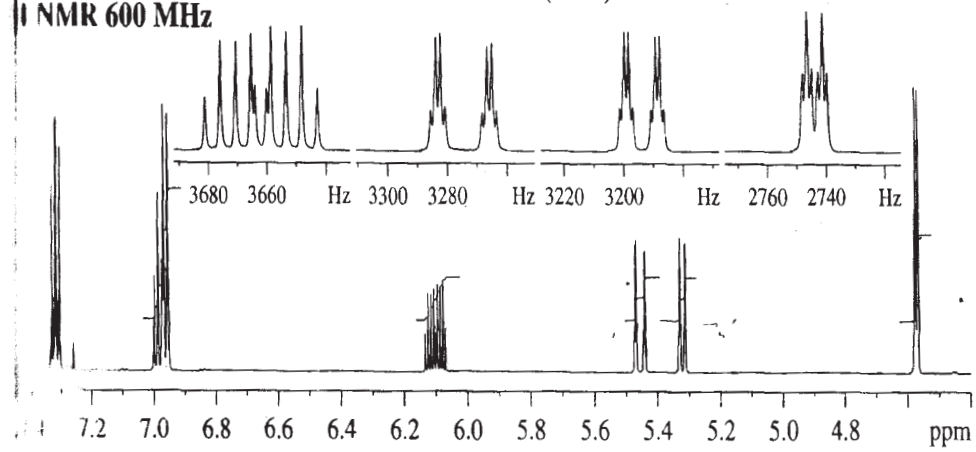
SET II

(8)

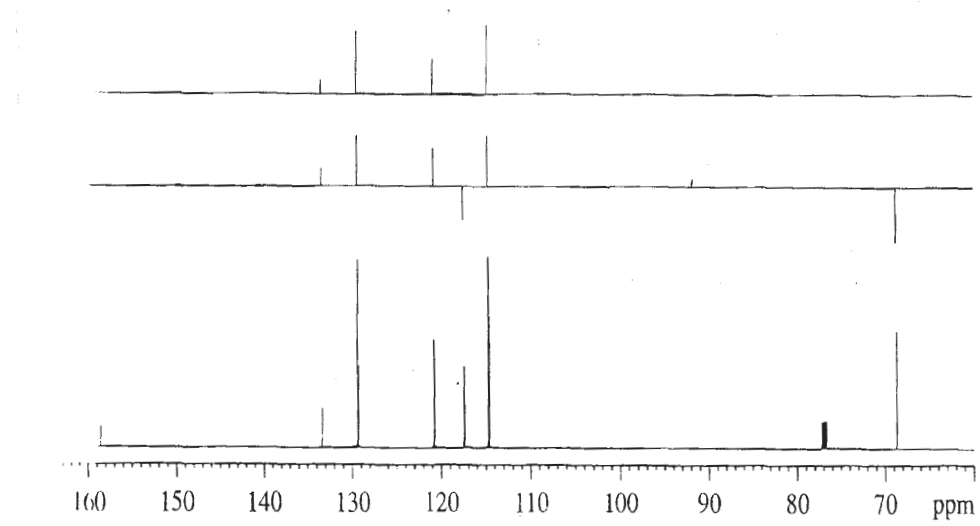


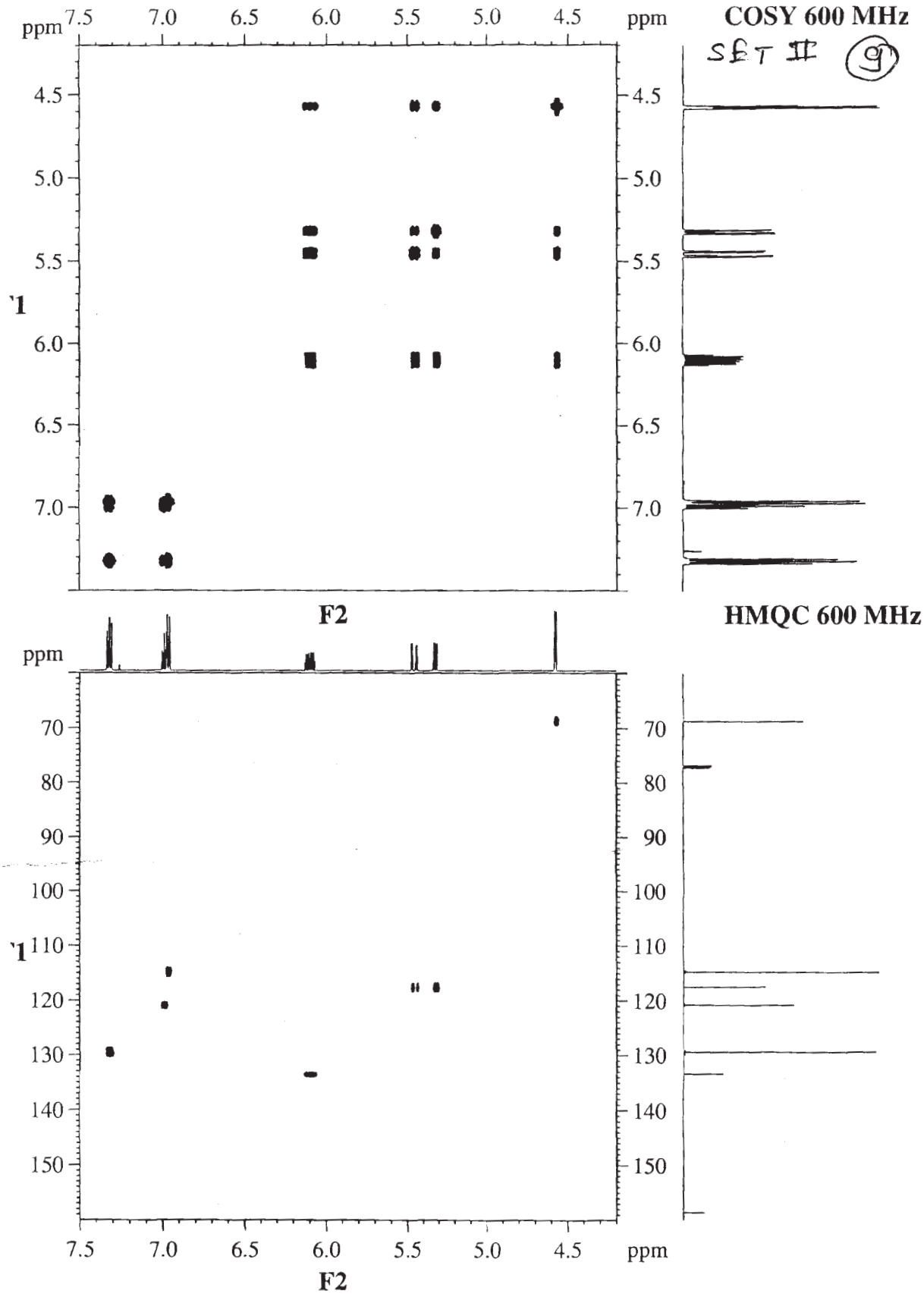


NMR 600 MHz



/DEPT NMR 150.9 MHz




COSY 600 MHz
SET II (9)
ppm
7.5
7.0
6.5
6.0
5.5
5.0
4.5
F1
F2
HMQC 600 MHz
70
80
90
100
110
120
130
140
150

ⓘⓘⓘⓘ

Total No. of Questions : 6]

SEAT No : ____

P 1899

[Total No. of Pages :4

[5323]-312

M.Sc. - II

ORGANIC CHEMISTRY

CHO-352 : ORGANIC STEREOCHEMISTRY

(2014 Pattern) (Semester - III) (New) (4 Credits)

Time : 3 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

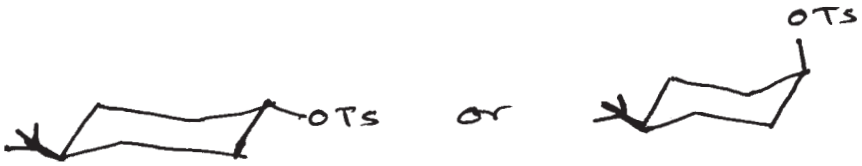
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer book.***

SECTION - I

Q1) Answer the following : **[10]**

a) Cyclopropanone and cyclobutanone prefers to undergo addition reaction than substitution reaction. Explain

b) Which of the following isomer gets solvolysed Faster and why.



c) Give two methods of preparation of compounds with bridged ring systems.

d) What is the difference between uv spectra at paracyclophanes when n = m= 2 and when n = m = 6 and why ?

e) Why β - benzene hexachloride reacts more slowly by several powers of 10 than any of its isomers?

Q2) Attempt any two of the following : **[10]**

a) Draw all possible conformations of cis and Trans1-Phenyl-2-Aminocyclohexanol and comment on their stability giving reasons.

P.T.O.

b) Explain giving reason the orientation of hydroxyl group during reduction of cyclohexanone by

i) Catalytic hydrogenation

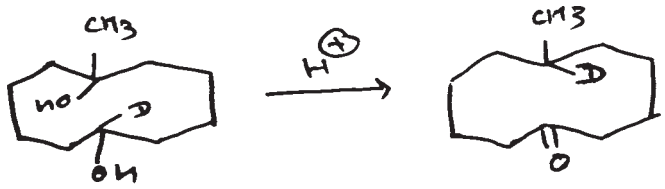
ii) MPV reduction

iii) Reduction with metal hydride.

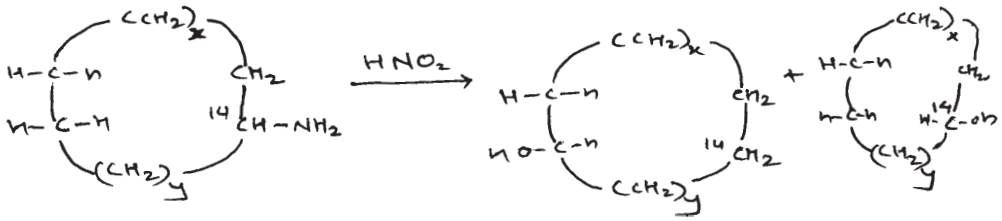
c) Write the stable conformation at trans-anti-trans and trans - syn - trans perhydroanthracene. Calculate their energies and comment on their optical activity.

d) Explain the product formation giving mechanism in following reactions. Justify your answer.

i)



ii)



Q3) Answer the following (Any one) **[5]**

a) Write short note on

i) 3 - alkyl ketone effect

ii) Enolization in cyclohexanone

b) i) Why H_A in Compound A can undergo tautomerism and H_B in compound B can not.

ii) Explain the concept of bond opposition strain with suitable example.

SECTION - II

Q4) Answer Any Three of the following : **[09]**

a) Describe the method of resolution via molecular complexes.

b) Cis, 1,2 dichloro, Cis 1,2 dibromo Ethylene have dipole moments of 1.89, and 1.35 D respectively whereas the trans isomers are zero. Explain

c) Describe the method of resolution via biochemical transformation with suitable examples.

d) Explain, how Cis and trans isomers of trisubtituted ethylenes of the $CH_3aC = CH_b$ differentiate by using N.M.R spectroscopy study.

Q5) Answer Any Four of the following **[08]**

a) Explain the stereochemistry of addition reaction of Olefins.

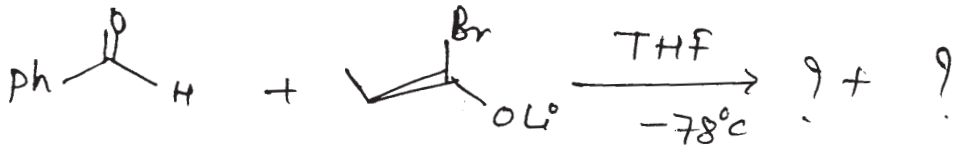
b) Describe enantiomeric excess with suitable examples.

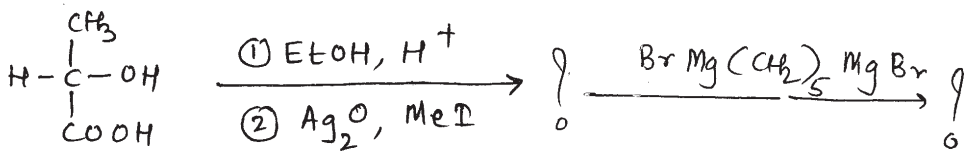
c) Explain use of chiral solvating agents.

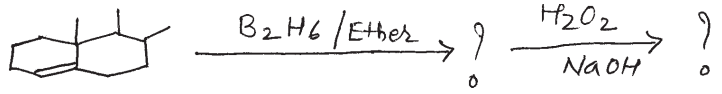
d) Describe the methods of determination of relative configuration of diastereomers.

e) Malic acid on treatment with PCl_5 gives (+) chlorosuccinic acid while on treatment with $SOCl_2$ gives (-) chlorosuccinic acid. Explain.

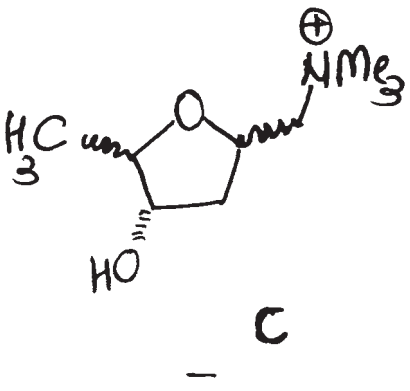
Q6) a) Predict the product/s in Any Two of the following and explain stereochemical principles involved. Justify. **[04]**

i) 

ii) 

iii) 

b) Draw the correct stereostructure of a compound C with the help of ^{1}H-NMR data given below and justify your assignment. **[04]**



C

^{1}H-NMR (δ, ppm)

1.16 (d, J = 6.5Hz, 3H): 1.86 (ddd), J = 12.5, 9.5, 5.5 1H); 2.02 (ddd, J = 12.5, 2.0, 6Hz 1H); 3.36 (S, 9H) 3.54 (dd, J = 13, 9 1H); 3.74 (dd, J = 13,10 Hz, 1H); 3.92 (dq J = 2.5, 6.5, 1H); 4.03 (m, 1H); 4.30 (1 H d J = 3.5exch. D_2O); 4.68 (m, 1H)

✠✠✠✠✠

Total No. of Questions :6]

SEAT No. :

P1900

[Total No. of Pages : 4

[5323] - 313

M.Sc. - II

ORGANIC CHEMISTRY

CHO - 353 : Photochemistry, Pericyclic Reactions and Heterocyclic Chemistry

(2014 Pattern) (4 Credit) (Semester - III)

Time : 3 Hours] *[Max. Marks :50*

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.***

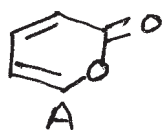
SECTION - I

Q1) Explain the following (all sub questions are compulsory). **[10]**

a) Norrish type II reaction.

b) Irradiation of benzophenone in the presence of $(ph)_2$ CHOH gives benzpinacol as the only product.

c) Compound 'A' gives cyclobuta -1, 3-diene and carbondioxide on irradiation. Show the reaction and explain.

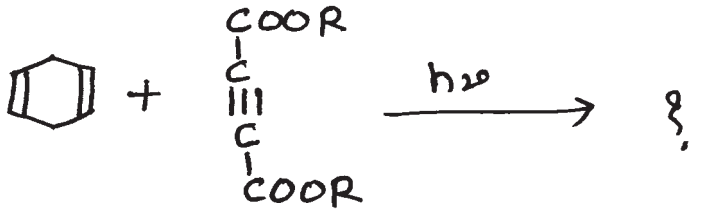


d) Draw the π molecular orbitals of $H_2C = CH\text{-}\overset{\ominus}{C}H$. Indentify the Homo and LUMO and find out their symmetry elements.

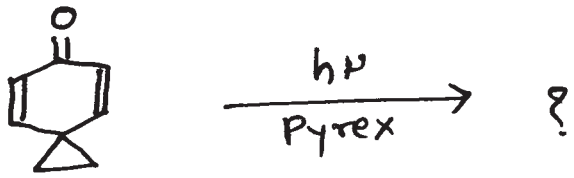
e) Ene reaction.

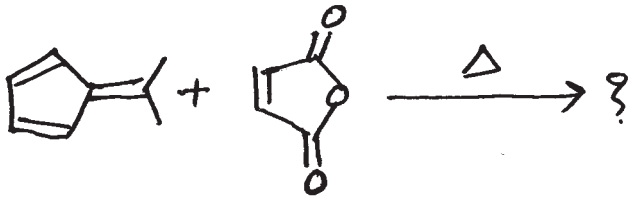
P.T.O.

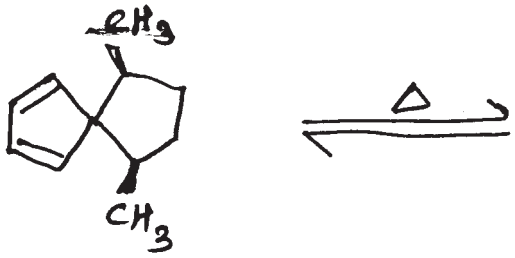
Q2) Predict the products and suggest the mechanism. **[10]**

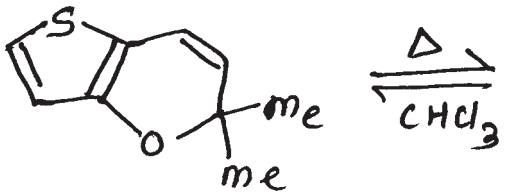
a) 

b) 

c) 

d) 

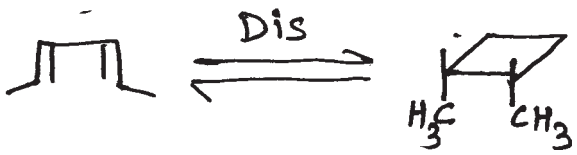
e) 

f) 

Q3) Answer Any Two. **[5]**

a) Photochemical reactions in cedrene synthesis.

b) Construct the correlation diagram for the following transformation.



c) Explain with the help of FMO approach whether suprafacial [1, 5] sigmatropic Hydrogen shift is thermally or photochemically allowed.

SECTION - II

Q4) Answer all the questions in brief. **[10]**

a) N - Methyl imidazole has lower boiling point than imidazole.

b) Diazines are more resistant to electrophilic attack than pyridine.

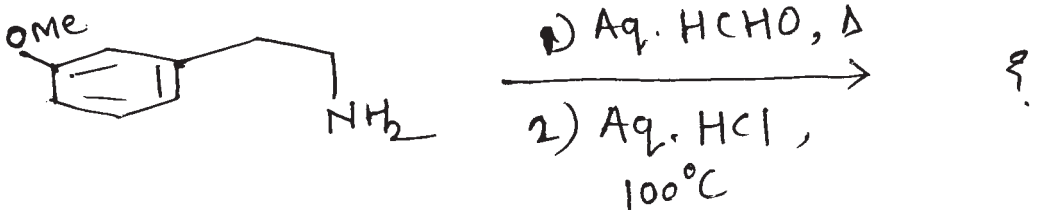
c) Reactivity of pyrrole is much higher than pyridine & Pyrimidine in electrophilic substitution reactions.

d) Pyridine N-Oxide readily undergoes electrophilic substitution at 4 - position.

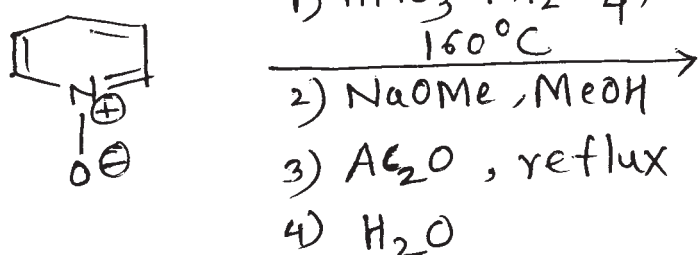
e) Furan is less aromatic than pyrrole and thiophene.

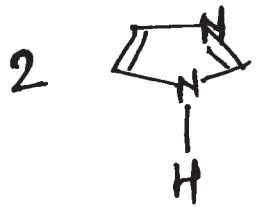
Q5) Predict the products suggesting suitable mechanism for any two of the following. **[10]**

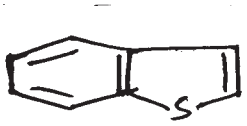
a)



b)



c)  1) NaH, 0°C, THF → 2) Cl–C(=O)–Cl ?

d)  1) BuLi, ether, reflux → 2) C_6H_5–N(CH$_3$)–CHO, Ether, reflux ?

Q6) Write short note on <u>any two</u> of the following. **[5]**

a) Hantzsch synthesis

b) Reissert synthesis

c) Hinsberg synthesis

♦ ♦ ♦

Total No. of Questions :6]

SEAT No. :

P1901

[Total No. of Pages :3

[5323] - 314

M.Sc. II (Analytical Chemistry)

CHA - 390 : ELECTROANALYTICAL AND RADIOANALYTICAL METHODS OF ANALYSIS

(2013 Pattern) (Semester - III) (Credit System)

Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of the logarithmic table, non programmable calculator is allowed.***

SECTION - I

Q1) Answer the following: **[10]**

a) Explain following terms

i) Half wave potential.

ii) Capacitive current.

b) State and explain faraday first law of electrolysis.

c) Give advantages and limitations of amperostatic coulometry.

d) State Koutecky equation and give meaning of each term involved in it.

e) What are the applications of coulometric titrations?

Q2) Attempt any two of the following: **[10]**

a) What are different pulse methods in voltammetry? Explain why pulse methods are better than direct methods.

b) Define limiting current. Discuss the factors affecting the limiting current in polarography.

c) State principle of amperometry. Describe the nature of ampero metric titration curve of lead nitrate with potassium dichromate.

P.T.O.

d) Calculate the diffusion current flowing through the cell containing solution of cd having concentration 5.5 millimoles per litre. if the drop time was measured at the rate of 3.51 second per drop.

The mercury flow rate was 1.68 mg per second.

(Given: $D=7.58\times10^{-6}$ cm^2/s).

Q3) Attempt any <u>one</u> of the following: **[5]**

a) What is coulometry? Describe a method of separation of nickel and cobalt by controlled potential coulometer.

b) A constant current of 10.3 A is passed through a copper chloride solution for 14.80 min. Calculate the weight of Cu metal deposited on cathode and oxygen evolved at anode,

Given: At. wt. Cu = 63.54, O = 15.9.

SECTION - II

Q4) Answer the following: **[10]**

a) Give the different applications of DSC techniques.

b) State and explain the principle of isotope dilution analysis.

c) State and explain the principle of thermogravimetry.

d) Explain the terms

i) isotopic abundance

ii) flux

e) Discuss the principle of radiometric titrations.

Q5) Attempt any <u>two</u> of the following: **[10]**

a) State and explain the principle of neutron activation analysis. Discuss the steps involved in neutron activation analysis.

b) State the principle of DTA. Discuss with neat labelled diagram the working of differential thermal analysis.

c) Explain the characteristic of thermometric titrations. How it differs from conventional titrations?

d) 5 mg of Mno_2 powder was irradiated in a neutron flux of $10^7 n.cm^{-2}.s^{-1}$ for a period of 15 min. calculate the activity induced in the sample due to manganese at the end of irradiation.

Given: $t_{1/2}$ 56Mn = 2.58 hours, 6(55Mn) = 13.3 barns.

% abundance of Mn = 100%

At. wt. Mn = 54.93, O = 16.0.

Q6) Attempt any <u>one</u> of the following: **[5]**

a) Distinguish between direct isotope dilution analysis and inverse isotope dilution analysis.

b) A TG curve was obtained for 5.80 mg of sample containing $Cuso_4.5H_2o$, when the monohydrate formation was complete at 200°c. The loss in mass was 0.89 mg. Find the percentage of the $Cuso_4.5H_2o$ in the sample.

Given: At. wt. Cu = 63.54, S = 32.0, O = 16.0, H = 1.0.

Total No. of Questions : 6]

SEAT No : ____

P 1902

[Total No. of Pages :2

[5323]-315
M.Sc. - II
ANALYTICAL CHEMISTRY
CHA - 391 : Pharmaceutical Analysis
(2013 Pattern) (Semester-III) (Credit System)

Time : 3 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic table, non-programmable calculator is allowed.***

SECTION-I

Q1) Answer the following: **[10]**

a) What are the types of waters used in pharmaceuticals?

b) What is biological assay?

c) Name the stages of new drug development.

d) What are substandard drugs?

e) Define undue toxicity.

Q2) Attempt any two of the following: **[10]**

a) What is sterilization? Explain in detail steam sterilization and sterilization by ionizing radiation.

b) Give biological assay of insulin in solution.

c) Explain in detail "Stability study of tablets".

d) Give procedure for preparation of Karl Fisher's reagent. Explain it's standardization.

Q3) Attempt any one of the following: **[5]**

a) How is ash and sulphated ash estimate from pharmaceutical preparations?

b) Write a note on 'cup plate method'.

P.T.O.

SECTION-II

Q4) Answer the following: **[10]**

a) What are parentals?

b) Give advantages of suspensions.

c) Define shelf life of drug.

d) What is packaging error?

e) Define cross contamination.

Q5) Attempt any two of the following: **[10]**

a) What are Nonaqeous type of solutions in Pharamaceuticals. Explain in details.

b) Write a note on 'Manufacturing Hazards.

c) Give an analytical method for determination of sodium benzoate.

d) 0.5 gm of isoniazid ($C_6H_7N_3O$)sample was dissolved in 40 ml water and diluted to 100 ml. 10 ml of diluted solution was transferred to stoppered bottle to which 10 ml 0.1 N bromine solution, 5 ml conc. HCL and 10 ml (10%) KI solution was added. The liberated iodine was titrated with 0.1 N $Na_2S_2O_3$ solution using starch indicator. The titration reading was 7.0ml. The blank titration reading was 10.0 ml. Calculate the percentage of isoniazid present in the given sample. (Given C = 12, H = 1, N = 14, O = 16).

Q6) Attempt any one of the following: **[5]**

a) What are waters in pharmaceuticals? How aromatic water is prepared?

b) 0.5 gm adrenaline ($CgHl_3O_3N$) sample was dissolved in 50 ml glacial acetic acid. It was titrated with 0.1 N perchloric acid using 2 drops of crystal violet indicator. The burette reading was 14.5ml. Determine the percentage of adrenaline in given sample. [Given C = 12, H = 1, O = 16, N = 14].

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Total No. of Questions : 6]

SEAT No : ____

P1903

[Total No. of Pages :3

[5323]-316

M.Sc.-II

ANALYTICAL CHEMISTRY

CHA-392 : Advanced Analytical Techniques

(2013 Pattern) (Credit System) (Semester-III)

Time : 3 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate books.***
2) ***All questions are compulsory.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic table / non programmable calculator is allowed.***

SECTION - I

Q1) Attempt the following : **[10]**

a) Give the classification of liquid-liquid extraction.

b) Enlist the factors affecting on solid phase micro extraction.

c) Give the applications of SPME.

d) Give the stages of solid phase extraction.

e) What is SFE?

Q2) Attempt any two of the following : **[10]**

a) Describe factors affecting on solid phase extraction.

b) What are the problems arises with liquid-liquid extraction process? How these are removed?

c) Draw schematic diagram of pressurized microwave assisted extraction device. Explain its working.

d) Give the applications of SFE.

P.T.O.

Q3) Answer any one of the following : **[5]**

a) Outline the analysis procedure of fungicides in water sample by SPME coupled with HPLC.

b) Describe automation and online SPE with diagram.

SECTION - II

Q4) Attempt the following : **[10]**

a) Describe the phenomenon of stimulated emission.

b) Explain the interference observed in AFS.

c) Distinguish between FES and AAS.

d) Define the term

i) Releasing agent

ii) Protective agent.

e) Draw the block diagram of mass spectrometry.

Q5) Attempt any two of the following: **[10]**

a) Enlist the different type of mass analyzer. Explain the construction and working of time of flight mass analyzer.

b) What is micronutrients and macronutrients? Explain the procedure to estimation of molybdenum.

c) Write short note on

i) LASERS and

ii) Hollow cathod lamp.

d) What is ICP? Explain the construction and working of ICP-MS with diagram.

Q6) Solve any one of following : **[5]**

a) A serum sample is analyzed for potassium by FES using standard addition method. Two 0.5 ml aliquots are added to 5.0 ml portions of water. To one portion 10.0 µl of 0.05 M KCl solution is added. The net emission signals in arbitrary units are 32.1 and 58.6. What is the concentration of Potassium in the serum.

b) The AAS method was used to determine the concentration of strontium in sample.

Determine the amount of strontium from the following data

Flask	A	B	C	D	E
Solution	20	20	20	20	20
Std. 'Sr' (5×10^{-3} mg/ml)	0	1	2	3	4
Water (ml)	5	4	3	2	1
Absorbance	0.311	0.470	0.630	0.788	0.949

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Total No. of Questions : 9]

SEAT No. :

P1904

[Total No. of Pages : 3

[5323]-317
M.Sc. - II
ANALYTICAL CHEMISTRY
CHA - 380 : Analytical Method Developments and Validation, Geochemical and Alloy Analysis and Laboratory Automation and Sensor Based Techniques
(2013 Pattern) (Semester - III)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Attempt any two sections.***
2) ***Answer to the two sections should be written in separate answer books.***
3) ***All questions from respective sections are compulsory.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Use of logarithmic table, non-programmable calculator is allowed.***

SECTION - I

Q1) Answer the following : **[10]**

a) Mention the essential elements of method validation report.

b) Define :

i) Accuracy.

ii) Method transfer.

c) Give the role of communication in method transfer process.

d) Enlist the topics selected for initial harmonization.

e) What is dissolution test?

Q2) Attempt any two of the following : **[10]**

a) Give an account of limit of detection and limit of quantitation.

b) With the help of schematic diagram, explain USP type I apparatus for dissolution study.

c) Give essential principle of method transfer process and explain method modification and revalidation.

P.T.O.

d) Determine the relationship between response and concentration by linear regression analysis from the below data.

Concentration ^{o}K Standard (mg/l)	0.00	0.10	0.20	0.30	0.40
Response value	0.00	5.20	9.90	15.30	19.10

Q3) Attempt any one of the folowing : **[5]**

a) What is an error? Explain its type.

b) Analysis of blood sample for its lead content, gives 0.412, 0.424, 0.436, 0.445 and 0.460 ppm of lead. Calculate mean, mean deviation, standard deviation, relative stand deviation and relative mean deviation.

SECTION - II

Q4) Answer the following : **[10]**

a) Give the principle for determination of tin in gun metal.

b) Outline the method for determination of organic matter in soil.

c) How silica is determined from Ilmenite ore?

d) Give the percentage composition of constituent present in solder and nichrome alloy.

e) Give the method and reagent used for the determination of copper in brass.

Q5) Attempt any two of the following : **[10]**

a) Outline the analytical procedure used for estimation of total nitrogen in soil.

b) Give an analytical method to estimate aluminium in Bauxite ore.

c) Discuss the method for determination of chromium in Nichrome alloy.

d) 0.5302 g steel sample was dissolved in 15 ml concentrated HCl and neutralized by ammonia. The nickel was precipitated as Ni - $(DMG)_2$ with DMG reagent. The weight of Ni-$(DMG)_2$ precipitate was 0.3879 gm. Calculate the % of the nickel in steel sample.

[Given : At. wt. Ni = 58.69, O = 15.99, N = 14, C = 12, H = 1]

Q6) Attempt any one of the following : **[5]**

a) Discuss the method of extraction and estimation of titanium in Ilmenite ore.

b) A 2.185 g brass sample was dissolved in 30 ml concentrated HCl and excess of KI was added to liberate iodine. The liberated iodine was titrated against 0.0879 N $Na_2S_2O_3$. The burette reading was 12.4 ml. Determine percentage of copper in the sample.

[Given At. wt. Cu = 63.54, I = 127, Na = 23, S = 32, O = 15.99, Zn = 65.38].

SECTION - III

Q7) Answer the following : **[10]**

a) Define Optical sensor.

b) What is continuous flow analysis?

c) What is control loop? Give its type.

d) State any four criteria for sensor.

e) What is serial and parallel integration?

Q8) Attempt any two of the following : **[10]**

a) What is Biosensor? Explain its role in analysis.

b) Explain with diagram the construction and working of discrete sample analyser.

c) Give a brief account of Biotransduction.

d) Define microfabrication. Explain silicone and glass micromatching.

Q9) Attempt any one of the following : **[5]**

a) Explain in brief surface acoustic wave sensor.

b) Explain discrete sample analyser.

Total No. of Questions : 6]

SEAT No. :

P1905

[Total No. of Pages : 3

[5323]-401
M.Sc. - II
PHYSICAL CHEMISTRY
CHP - 410 : Molecular Structure and Spectroscopy
(2013 Pattern) (Semester - IV) (New)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt the following: **[10]**

a) Distinguish between δ and τ Chemical Shift Scales.

b) Explain the terms with respect to nmr spectroscopy.

i) Deshielding and

ii) Coupling constant.

c) What is kramers degeneracy?

d) Write the applications of nqr.

e) Why esr spectra are always recorded in the derivative form? Explain.

Q2) Attempt any two of the following: **[10]**

a) Explain the instrumentation involved in high resolution nmr spectroscopy.

b) What is g-value? Explain the factors affecting it.

c) What is the need of reference for recording high resolution nmr? Explain the advantages of TMS.

d) Explain the concept of electric field gradient and quadrupole coupling constant.

Q3) Solve any one of the following: **[5]**

a) Differentiate among the following compounds from ^{19}F spectra at high field.

$CH_3-CH_2F,\ CH_2F-CH_2F,\ CH_3-CF_3$

b) Calculate the precessional frequency of a proton in a field of 1.8T. The *g* factor for proton is 5.585.

SECTION - II

Q4) Attempt the following: **[10]**

a) What is the principle of X-ray diffraction?

b) Explain how the Wierl equation is used to deduce molecular geometry.

c) Write Van-Vlecks formula and explain the terms therein.

d) Enlist the applications of neutron diffraction technique.

e) State the phase, problems in XRD.

Q5) Attempt any two of the following: **[10]**

a) Give a brief account of main XRD methods used in the elucidation of the crystal structure of NaCl and KCl. What are limitations of Bragg's method?

b) Distinguish between ferrimagnetism and antiferromagnetism with suitable examples.

c) Describe the instrumentation of neutron diffraction technique with a suitable diagram.

d) Explain the cause of electron diffraction. How is it experimentally studied?

Q6) Solve any one of the following: **[5]**

a) The mass and density of copper atom are 63.5 and 8.94 gcm^{-3} respectively. It has FCC structure. Calculate the atomic radius of copper atom.

b) Calculate molar susceptibility of phenanthroline ($C_{12} H_8 N_2$) and pyridine ($C_5 H_5 N$) from following data.

* pascal constant (χ_A) in cgs unit

C = -6.0×10^{-6}, H = -2.93×10^{-6}, ring N = -4.61×10^{-6}

* Constitutive corrections (λ)

C in one ring = -0.24×10^{-6}

C shared by two rings = -3.07×10^{-6}

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Total No. of Questions : 6]

SEAT No. :

P1906

[Total No. of Pages : 3

[5323]-402
M.Sc. - II
PHYSICAL CHEMISTRY
CHI - 411 : Surface Chemistry and Electrochemistry
(2013 Pattern) (Semester-IV) (New)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answer to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
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}
		$= 1.38 \times 10^{-23}$ JK^{-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	$\beta_e = -9.274 \times 10^{24}$ J T^{-1}
12)	Nuclear magneton	$\beta_n = 5.051 \times 10^{-27}$ J T^{-1}
13)	Mass of an electron	$m_e = 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION-I

Q1) Answer precisely the following : **[10]**

a) What is wetting phenomenon? Give its two applications?

b) Define the terms :

i) interfacial tension and

ii) gibbs monolayer

c) What is isosteric heat of adsorption? Write its equation.

d) Give the assumptions of polarization theory for multilayer adsorption.

e) What is hysteresis of adsorption? Draw different types of hysteresis loops.

Q2) Answer any two of the following : **[10]**

a) Describe the tracer method for verification of Gibbs adsorption equation.

b) Starting with chemical potential, derive the equation for isosteric heat of adsorption.

c) How is Harkins-Jura equation used to determine the surface area of a solid?

d) Discuss the Zsigmondy's theory used to explain the hysteresis of adsorption.

Q3) Solve any one of the following : **[5]**

a) Calculate the enthalpy of adsorption, ΔH_{ads} at1atm, given that 155cm^3 of the gas (measured at STP) is adsorbed by 1g of charcoal at 88 k and 15 cm^3 at 273 k.

b) The adsorption of N_2 on charcoal at liquid nitrogen temperature fits the BET equation. The volume of nitrogen necessary to form a monolayer on powdered sample is found to be 11.05 cm^3 at STP. Calculate the area per gram of powder if the sample weighs 17.52g and one molecule of N_2 occupies 16.2$Å^2$.

SECTION-II

Q4) Answer the following : **[10]**

a) Write Butler-Volmer equation, explain the terms involved in it.

b) Enlist the steps in Eley and Evans thought experiment for determining work of ion solvent interaction.

c) Write Debye-Huckel limiting law and explain the terms involved in it.

d) Enlist the methods of preventing corrosion.

e) Define :

i) faradic efficiency

ii) voltage efficiency

iii) maximum efficiency

iv) overall efficiency

Q5) Answer any two of the following : **[10]**

a) Derive Tafels equation from Butler-Volmer equation.

b) Discuss the Stern theory of electrical double layer.

c) Describe with neat diagram H_2–O_2 fuel cell.

d) Show that in Debye-Huckel theory the maximum volue of charge on spherical shell is at $r = x^{-1}$.

Q6) Solve any one of the following : **[5]**

a) Consider the oxidation reaction $Fe \rightarrow Fe^{+2} + 2e^{-}$. It overpotential of 0.1V is applied to the anode assuming $\beta = ½$ and t = 25°C, By what factor does this increases i over i_o.

b) If the mobility of the silver ion in aqueous solution at 298 k is 6.5×10^{-4} cm^2 $s^{-1}v^{-1}$. Calculate

i) diffusion coefficient of silver ion

ii) its equivalent conductivity

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Total No. of Questions :6]

SEAT No. :

P1907

[Total No. of Pages : 3

[5323]-403
M.Sc. - II
PHYSICAL CHEMISTRY
CHP - 412 : Materials Chemistry and Catalysis
(2013 Pattern) (Semester - IV)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) *Answers 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.*
4) *Use of logarithmic table/calculator is allowed.*
5) *Neat diagrams must be drawn wherever necessary.*

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt the following: **[10]**

a) What are quantum dots?

b) Draw the schematic cross sectional diagram of the Rf-sputtering system.

c) Define rectifiers & draw the diagram of full wave rectifier.

d) Discuss optical properties of solid devices.

e) What is Langmuir-Blodgett film?

Q2) Attempt any two of the following: **[10]**

a) What is capacitor? Explain the three types of capacitor on the basis of dielectric material.

b) Explain the term MOCVD.

c) Explain the normal state properties of 1-2-3 & 2-1-4 materials.

d) What are the applications of hitech material?

Q3) Attempt any one of the following **[5]**

a) Explain the term photolithography using suitable diagram.

b) Write note on optical photon modes in hitech materials.

SECTION - II

Q4) Attempt the following: **[10]**

a) Define 'catalyst deactivation'.

b) Define 'inhibition' and 'support'.

c) Define 'Functionality' with example.

d) State the principles of calcination method in catalyst activation.

e) Write the principles of green chemistry.

Q5) Attempt any two of the following: **[10]**

a) Discuss impregnation method of preparation of catalyst.

b) Discuss the AES method to determine solid particle size.

c) Derive the expression for kinetics of unimolecular surface reaction.

d) Differentiate between physisorption and chemisorption.

Q6) Solve any one of the following **[5]**

a) The data below are for the chemisorption of hydrogen on copper powder at 25°C. Confirm that they fit the Langmuir isotherm at low coverages. Then find the value of K for the adsorption of equilibrium and the adsorption volume corresponding to complete coverage.

P/Pa	25	129	253	540	1000	1593
V/cm^3	0.042	0.163	0.221	0.321	0.411	0.471

b) The adsorption of a gas is described by the Langmuir isotherm with $K = 0.75\ kPa^{-1}$ at 25°C. Calculate the pressure at which the fractional surface coverage is 0.95.

Total No. of Questions :6]

SEAT No. :

P1908

[Total No. of Pages : 3

[5323]-404

M.Sc.-II PHYSICAL CHEMISTRY

CHP-413 : Biophysical Chemistry

(2013 Pattern) (Semester-IV)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answers 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.***
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}
		$= 1.38 \times 10^{-23}$ JK^{-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)	leV	$= 23.06$ 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}
		$= 2.997 \times 10^{8}$ ms^{-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	$\beta_e = -9.274 \times 10^{24}$ J T^{-1}
12)	Nuclear magneton	$\beta_n = 5.051 \times 10^{-27}$ J T^{-1}
13)	Mass of an electron	$m_e = 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION-I

Q1) Attempt the following : **[10]**

a) Define genome and gene.

b) Give two functions of proteins.

c) Differentiate between RNA and DNA.

d) Write the Henderson's equation and explain the terms therein.

e) State Bragg's law.

Q2) Attempt any two of the following : **[10]**

a) Distinguish between active and passive transport.

b) Write a note on nerve impulse.

c) Explain the role of nucleic acids in cell biology.

d) Explain a method to determine molecular weight of a protein.

Q3) Attempt any one of the following : **[5]**

a) Explain the role of ATP in biological systems.

b) Write a note on DNA sequencing.

SECTION-II

Q4) Answer precisely the following : **[10]**

a) What are extracellular and instracellular enzymes?

b) Explain the effect of concentration of enzyme and of substrate on enzyme activity.

c) Define Circular Dichroism (CD).

d) Explain 'all or none law' applicable to all nerves.

e) Explain the role of Na^+/k^+ pump.

Q5) Answer any two of the following : **[10]**

a) Discuss the mechanism of ion transport through the cell membrane.

b) Describe the viscosity method of determination of molecular weight of biopolymers.

c) What is enzyme inhibition? Explain the mechanism of reversible inhibition.

d) What is optical rotatory dispersion? Give the theory of ORD.

Q6) Solve any one of the following : **[5]**

a) A polymer sample contains equal weights of molecules with molecular weight 25000 and 35000. Calculate $\bar{M}_n$ and $\bar{M}_w$.

b) 1.0 g of a polyester in $100cm^3$ methyl ethyl ketone required $11.5cm^3$ of 0.01M alcoholic KOH for neutralization. Calculate the molecular weight of the polymer.

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Total No. of Questions :6]

SEAT No. :

P1909

[Total No. of Pages : 3

[5323]-405

M.Sc.-II (Physical Chemistry)

CHP-414 : SPECIAL TOPICS IN NUCLEAR AND RADIATION CHEMISTRY

(2013 Pattern) (Semester-IV) (New)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answers 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.***
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		$= 23.06$ 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) Attempt the following : **[10]**

a) Enlist various man made sources of radiation.

b) Explain the term elastic scattering and inelastic scattering.

c) Define the terms radiopharmaceutical and Nuclear pharmacy.

d) Complete the following reactions by writing equation

i) $^{197}_{79}Au(n,\gamma).....$

ii) $^{3}H(\alpha,n).....$

Q2) Attempt any two of the following : **[10]**

a) Draw and explain linear accelerator.

b) Write a note on Radiation protection.

c) Explain various natural and man made sources of radiations.

d) Explain general aspects of use of radiopharmaceuticals.

Q3) Attempt any one of the following : **[5]**

a) Evaluate Q-value for the

^{7}Li (p, n)^{7} Be reaction

Given : ^{7}Li = 7.01822 amu

^{1}H = 1.00814 amu

$^{1}_{0}$H = 1.008665 amu

^{7}Be = 7.019465 amu

b) What do you understand by the terms in-vivo and in-vitro techniques. Explain in-vivo diagnostic procedure.

SECTION-II

Q4) Attempt the following : **[10]**

a) Explain the term incineration.

b) Write products formed in radiolysis of methanol.

c) Explain the term G-value.

d) Give IAEA classification of radioactive waste.

e) What is the condition required for choosing a radioactive nuclide as indicator for radiometric titrations.

Q5) Attempt any two of the following : **[10]**

a) Draw and describe the radiometric titrations based on absorption of β-particles.

b) Write a note on pulse radiolysis.

c) Describe in detail the various methods for disposal of low and intermediate level waste.

d) Write a note on premordial nucleosynthesis.

Q6) Attempt any one of the following : **[5]**

a) 20cc Na*I solution was titrated with 0.05M $AgNo_3$. Addition of 1ml of $AgNo_3$ showed a loss in activity from 6,000 counts per minute to 5000 counts per two minutes. Find the amount of iodide in the solution. Back ground counts are 60 for 2 min.

[Given : At. wts: Na = 23, I = 127, Ag = 108, N = 14 and O = 16]

b) Give a brief account on Non-homogenous kinetics.

Total No. of Questions : 4]

SEAT No. :

P1910

[Total No. of Pages : 2

[5323]-406
M.Sc. - II
INORGANIC CHEMISTRY
CHI - 430 : Inorganic Polymers & Heterogeneous Catalysis
(2013 Pattern) (Semester - IV)

Time : 3 Hours] *[Max. Marks : 50*

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) ***Use of logarithmic table and calcualtor is allowed.***

Q1) Answer the following: **[20]**

a) How oxoanions plays an important role during the synthesis of zeolite?

b) What are the desired properties of heterogeneous catalyst?

c) Describe Incipient wetness method for preparation of supported metal catalyst.

d) What is chemical reactor? Which reactor is used for ammonia synthesis?

e) Draw the sheelite structure & give it's physical properties.

f) Why TiO_2 is considered as good photocatalyst?

g) Draw the structures of keggins heteropolyanion.

h) Differentiate between Chemisorption & Physisorption.

i) What is Pervoskite? Explain it's structure.

j) What are phosphazenes? Draw the structure of tetrameric phosphazene.

Q2) Answer any **two** of the following: **[10]**

a) Discuss in detail the characteristics of zeolite framework structure.

b) Give an account of use of Bismuth molybdate in the oxidation & ammoxidation of olefins.

c) Discuss various methods of catalyst deactivation.

d) Discuss the role of support in support metal catalyst.

P.T.O.

Q3) Attempt the following. (**any two**) **[10]**

a) Discuss construction, working, merits & demerits of fixed bed reactor.

b) What do you mean by shape selective catalysis? How zeolites are used as shape selective catalyst. Illustrate with suitable example.

c) Give an account of the surface characterisation methods used for supported metal catalyst.

d) Discuss in detail heteropolyacids of M_o & W.

Q4) Write notes on (**any two**): **[10]**

a) Applications of heterogeneous catalysis in Industry.
b) S-N polymers.
c) SOD & LTA type zeolites.
d) Semiconducting oxides as photocatalyst.

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Total No. of Questions :4]

SEAT No. :

P1911

[Total No. of Pages : 2

[5323]-407

M.Sc.-II (Inorganic Chemistry)

CHI - 431 : MATERIAL SCIENCE - I : INORGANIC SOLID STATE MATERIALS

(2013 Pattern) (Semester - IV)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

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

Q1) Answer the following : **[20]**

a) What is diffusion? List the different types of diffusion in solids.

b) Give four important applications of composite materials.

c) What is permanent magnet?

d) Explain the classification of super conductors.

e) Define :

i) Ageing and

ii) Gelation

f) Draw the structure of wood.

g) Give the full forms of C_2S and C_3AF.

h) Explain classification of biomaterials.

i) Explain the composition of portland cement.

j) A piece of wood containing moisture weighed 95.3 gram and after over drying showed constant weight of 80.5 gram. Calculate the percentage of moisture in it.

Q2) Attempt any **two** of the following : **[10]**

a) What is defect? Explain different types of defects?

b) What is magnetism? Explain different types of it.

c) Explain Meissner effect. Explain different types of super conductors.

d) Derive the expression : $X = \frac{c}{T - v_c}$.

P.T.O.

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

a) What is hysteresis loop? Explain with retentivity and corecitivity.

b) Draw the FCC, BCC and HCP structure in solids. Calculate number of atoms per unit cell in each of the above.

c) What are important applications of biomaterials?

d) What is concrete? Explain different concrete mixtures used.

Q4) Write short notes on (any two) : **[10]**

a) Fullerence

b) Macrodefect free cement

c) Kirkendall effect

d) Pyroelectric materials

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Total No. of Questions : 4]

SEAT No : ____

P 1912

[Total No. of Pages :2

[5323]-408
M.Sc. - II
INORGANIC CHEMISTRY
CHI - 432 : Material Science - II (Nanomaterials)
(2013 Pattern) (Semester-IV) (4 Credits)

Time : 3 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Use of calculators allowed.***

Q1) Answer the following: **[20]**

a) Define pyroelectricity. Give two examples of nanomaterials shows pyroelectricity.

b) What is a quantum dot? Give its aspects.

c) What is meant by stokes and antistokes lines in Raman spectroscopy?

d) What is the most common magnetic nanoparticle oxide compound family? What are the variants, and why is it used more commonly than other compounds?

e) How gold nanoparticles are prepared? Give the chemical reaction involved in it.

f) Give the methods for synthesis of oxide nanoparticles.

g) Give the application of nanomaterials in drug delivery.

h) What are the methods that can be used to stabilise colloidal nano-suspensions?

i) What is photonic nanocyrstals? Give two examples.

j) Define surface plasmon band.

P.T.O.

Q2) Answer the following (any two): **[10]**

a) Explain sonochemical fabrication of nanomaterials.

b) Explain various methods for carbon nanotube synthesis and give its application in various fields.

c) Explain the mechanism of zero valent metal nanoparticle for formation of encapsulation with suitable example.

d) How PbSe nanowire prepared? Give the chemical reaction involved in it.

Q3) Answer the following (any two): **[10]**

a) How Raman spectroscopy is useful in characterization of nanoparticles.

b) Discuss the different applications of nanomaterials in medicinal field.

c) Explain the principle and working of SEM?

d) What is nanoporous materials? Explain different types of nanoporous materials.

Q4) Answer the following (any two): **[10]**

a) What are nanosensors? Explain gas sensor with suitable example.

b) Explain the magnetic properties of nanoparticles.

c) Explain optical properties of nanoparticles.

d) Explain the role of surfactant in preparation of nanomaterials. Give the two examples of surfactant.

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Total No. of Questions :9]

SEAT No. :

P1913

[Total No. of Pages : 3

[5323]-409
M.Sc.-II
INORGANIC CHEMISTRY
CHI-445 : Inorganic Chemistry : Applications in Industry, Environment and Medicine.
(2013 Pattern) (Semester-IV)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Attempt any two sections of the following :***
2) ***Both sections should be written in the same answer book.***
3) ***All questions are compulsory.***
4) ***Figures to the eight indicate full marks.***
5) ***Neat diagram must be drawn wherever necessary.***
6) ***Use of logarithmic table or calculators is allowed.***

SECTION-I
(Applications in Industry)

Q1) Attempt the following : **[10]**

a) What is meant by azo dyes? Give suitable example.

b) Why animal pigment like melanin in light shows dark colour?

c) Write the composition of lithophone white pigment.

d) Draw the structure of sunset yellow and white its applications.

e) What is tining?

Q2) Answer the following (any two) : **[10]**

a) Discuss the different process available for electroplating of Zinc.

b) What is PVP electrode? Explain the methods for electrodeposition of PVP on metal.

c) Explain the manufacturing process of medially metallizable azo dyes of cobalt.

d) Explain the following physical properties of inorganic pigments.

i) Colour

ii) Oil absorption

iii) Resistant to light

iv) Dispersion

P.T.O.

Q3) Write a note on any one : **[5]**

a) Brightening agents

b) Mordant dyeing

c) Electroplating of chromium on Iron metal.

SECTION-II

(Environment)

Q4) Answer the following : **[10]**

a) What is the effect of suspended solids and sediments on aquatic life?

b) Explain oil and grease removal from waste water.

c) What is power ball? How is the hydrogen liberated from power ball.

d) List the provisions of clean water act.

e) What do you understand by geothermal energy?

Q5) Answer the following (any two) : **[10]**

a) Explain how coliform bacterial count is useful to test pathogens from drinking water.

b) Define PE. What is the range of PE in natural water. If a sample from lake gave a PE = 12.5 does the lake favour oxidation?

c) Explain the sources, incidents and biochemicals effect of Hg?

d) Draw a schematic diagram of a Phosphoric Acid Cell (PAFC). What reactions occurring at cathode and anode. Show over are reaction.

Q6) Write a note on any one : **[5]**

a) Energy sources for the 21st century.

b) Industrial and municipal waste water treatment.

c) Atomic absorption hydride method for As.

SECTION-III

(Applications of Metal ions in Medicine)

Q7) Answer the following : **[10]**

a) What is the full form of NSAIDS and RIDS give example of each type of drug?

b) What are the disorders causal due to overdose of Lithium?

c) Name any three gold compounds used in crysotherapy. Which oxidation states of gold are important in medicines.

d) Explain the binding modes of Bismuth complexes with biomolecules.

e) Give the properties of radionuclides.

Q8) Answer the following : **[10]**

a) Discuss the non associative interactions of metal complexes with DNA.

b) Explain mechanism of inhibition of H. Pylori bacterium by Bismuth.

c) Explain the binding interactions of this phenanthroline metal complexes with DNA.

d) Explain the mechanism of action of gold complexes with the help of sulfhydryl shuttle model.

Q9) Write a note on any one : **[5]**

a) Chelation therapy

b) Toxicity of vanadium

c) Second and third generation of cisplatin analogues

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Total No. of Questions : 6]

SEAT No. :

P1914

[Total No. of Pages : 3

[5323]-410
M.Sc. - II
ORGANIC CHEMISTRY
CHO - 450 : CHEMISTRY OF NATURAL PRODUCTS
(2013 Pattern) (Semester - IV)

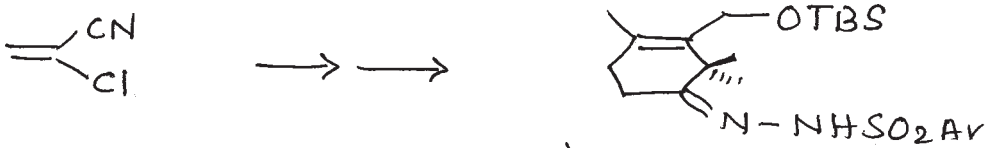
Time : 3 Hours] *[Max. Marks : 50*

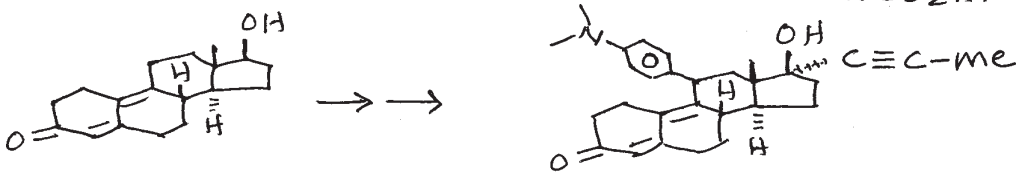
Instructions to the candidates:

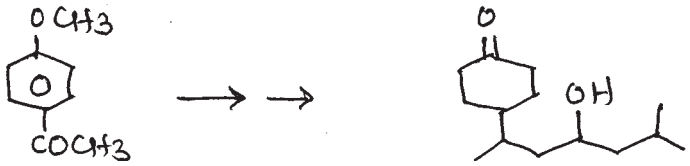
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

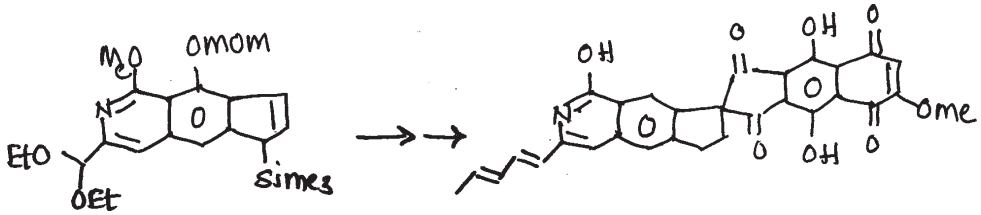
SECTION - I

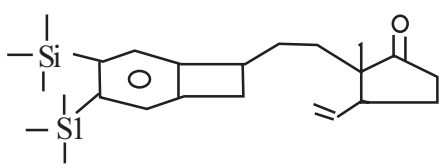
Q1) Outline the steps involved in the following synthetic sequences. **[10]**

a) 

b) 

c) 

d) 

e) 

⟶ → ± Estrone

P.T.O.

Q2) Answer any two of the following: **[10]**

a) Describe the evidence for the stereochemistry at Cq in Hardwickiic Acid.

b) Give evidence for the presence of following:

i) Quinoline ring

ii) Pyridove ring and presence of Ar–CH_2–N–CO grouping.

c) Give evidence for the following in podophyllotoxin.

i) Presnece of lactone ring

ii) Prsence and nature of OH group

Q3) Attempt any one of the following: **[5]**

a) Give evidence to show the presence of pyrroloquinoline ring in hydroxy comptothecin.

b) Give brief account of silyl ether protection of hydroxyl group in Taxol.

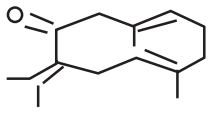
OR

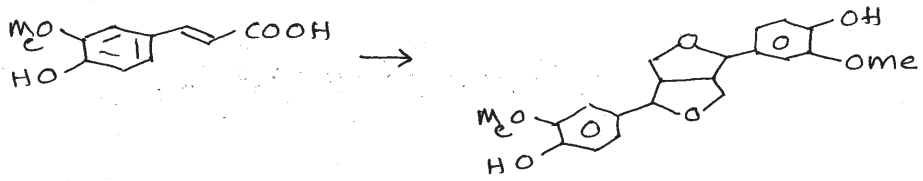
a) Role of Boron mediated Diels-Aider reaction in Taxol synthesis.

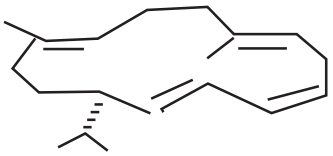
b) Draw the stereostructures of any two isomers of podophyllotoxin.

SECTION - II

Q4) Suggest biogenetic schemes for the following. **[10]**

a) 2Z,6E FPP ⟶ 

b) 

c) GGPP ⟶ 

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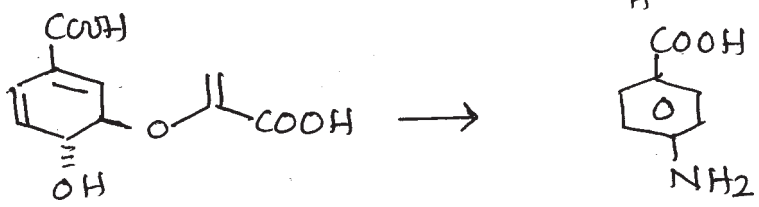
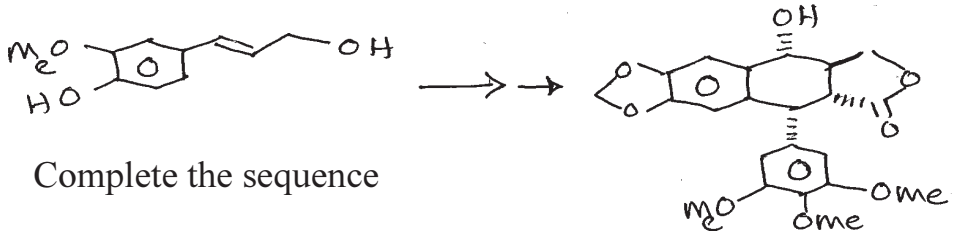
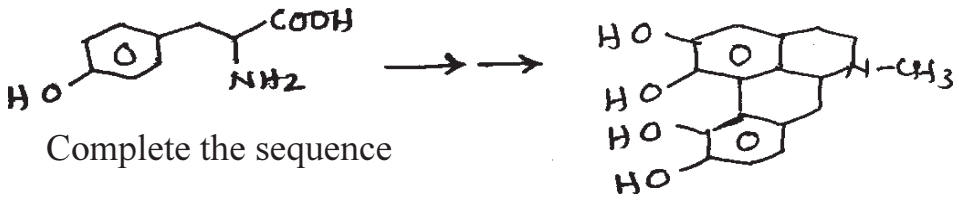
e) 

Q5) Answer any two of the following: **[10]**

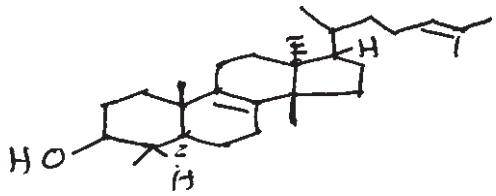
a) 

Complete the sequence

b) 

Complete the sequence

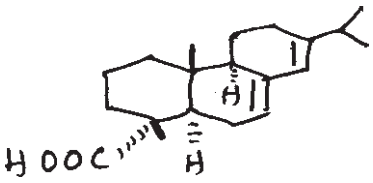
c) Outline the steps involved inthe following conversion.

Squalene ⟶ → 

Q6) Attempt any one of the following: **[5]**

a) Discuss the transamination reaction and role of pyridoxal phosphate in biosynthesis of alkaloids.

b) Suggest the biogenetic steps for the following.

GGPP ⟶ → 

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Total No. of Questions :6]

SEAT No. :

P1915

[Total No. of Pages : 4

[5323]-411

M.Sc.-II (Organic Chemistry)

CHO - 451 : ADVANCED SYNTHETIC ORGANIC CHEMISTRY

(2013 Pattern) (Semester-IV)

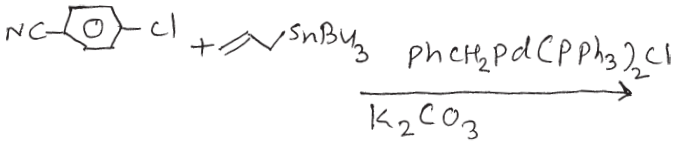
Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

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

SECTION-I

Q1) Predict the products of the following : **[10]**

a) 

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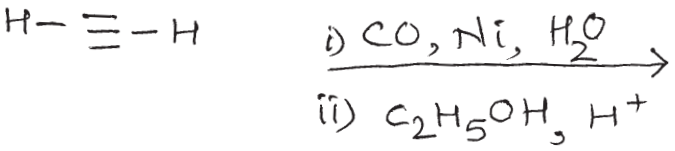
b) 

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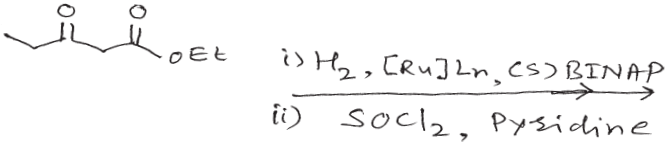
c) 

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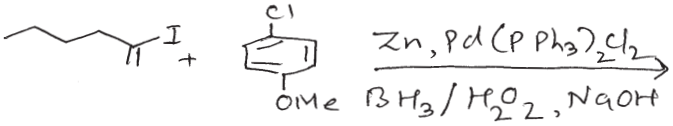
d) 

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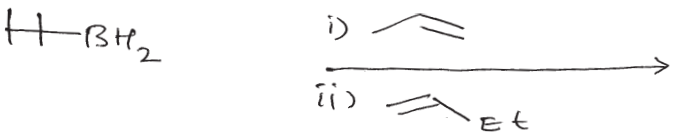
e) 

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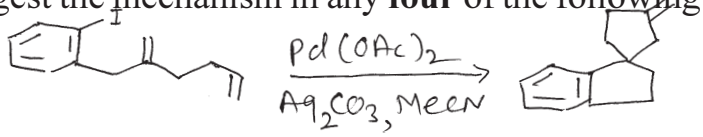
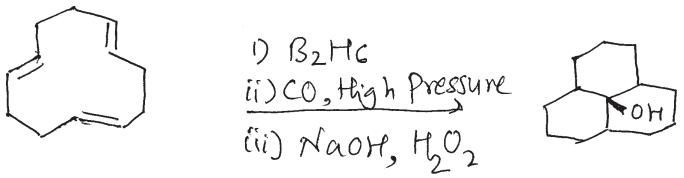
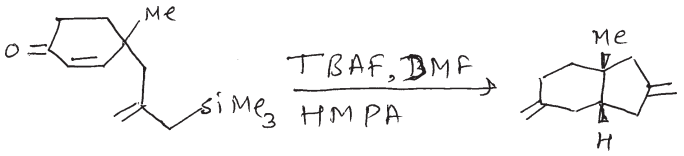
iii) NaCN, $(CF_3CO)_2O$

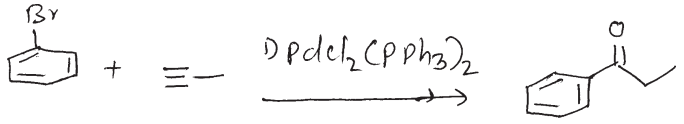
iv) NaOH, H_2O_2

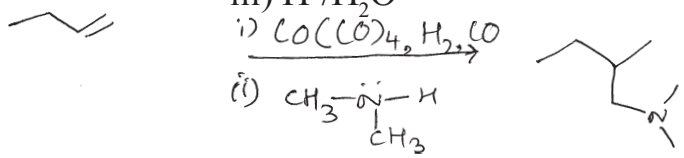
Q2) Suggest the mechanism in any **four** of the following : **[10]**

a) 

b) 

c) 

d) 

e) 

Q3) Answer any **two** of the following : **[5]**

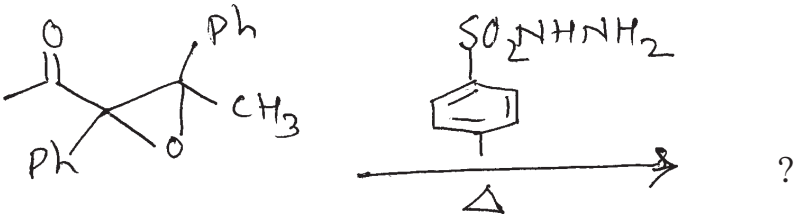
a) Explain sonogashira coupling.

b) Organosilane in organic synthesis.

c) Discuss mechanism of Suzuki coupling.

SECTION-II

Q4) Predict the products of the following : **[10]**

a) 

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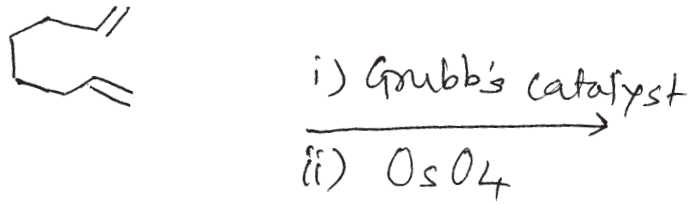
b) 

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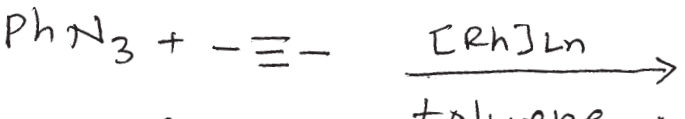
c) 

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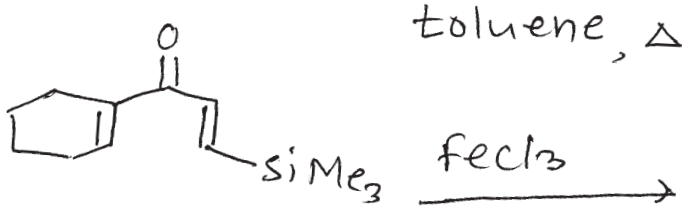
d) 

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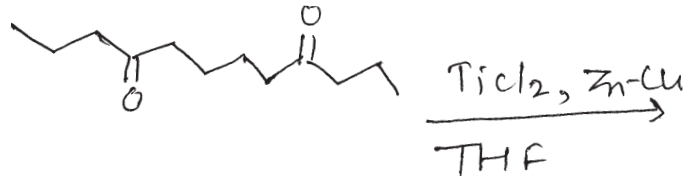
e) 

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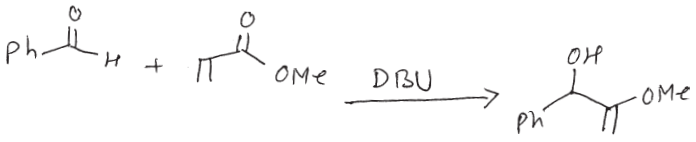
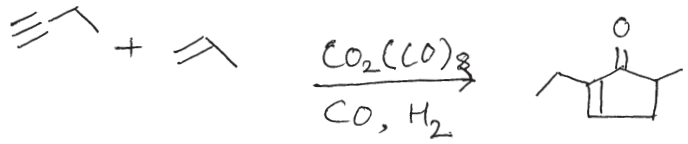
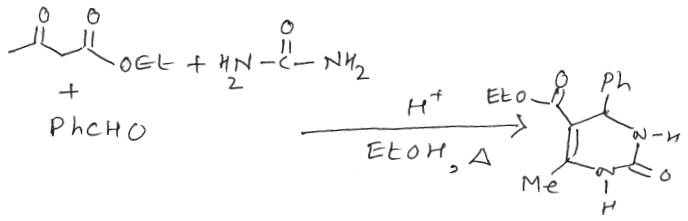
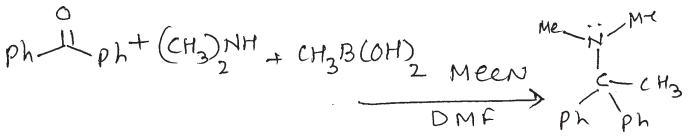
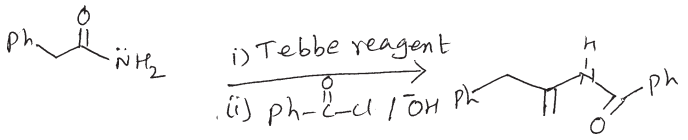
Q5) Suggest the mechanism in any four of the following : **[10]**

a) 

b) 

c) 

d) 

e) 

Q6) Answer any **two** of the following : **[5]**

a) Discuss Julia Olefination

b) Explain Witting Horner reaction

c) Discuss Ugi reaction

Total No. of Questions :6]

SEAT No. : ____

P1916

[Total No. of Pages : 3

[5323] - 412

M.Sc. - II

ORGANIC CHEMISTRY

CHO - 452 : Carbohydrates, Chiron Approach, Chiral Drugs and Medicinal Chemistry

(2013 Pattern) (Semester - IV)

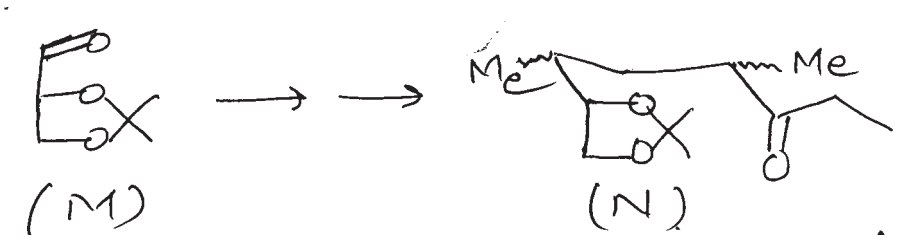
Time : 3 Hours] ***[Max. Marks :50***

Instructions to the candidates:

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

SECTION - I

Q1) a) Complete the following sequence from (M) to (N). **[10]**



Describe the role of ethyl magnessium bromide in this sequence.

b) Write a short note on “anomeric effect”.

c) Define the term ‘Eutomer’ and explain with suitable examples.

d) Write the retrosynthesis of (–) – multistriatin using hexose.

e) Write adverse effects of s- metoprolol.

P.T.O.

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

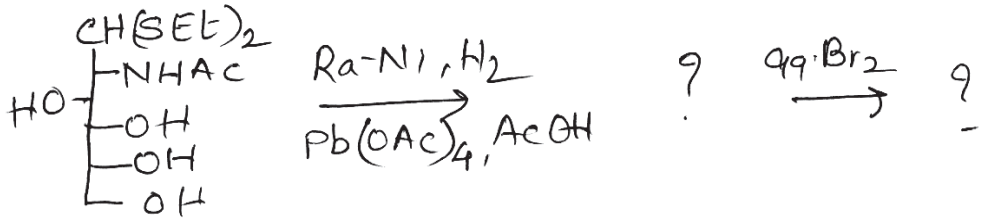
i) Write the pharmacological activities of Ephidrine.

ii) How will you cenvert D - mannitol into (R) - Epichlorohydrin.

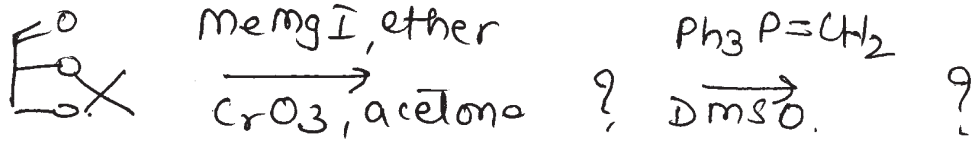
iii) Describe the role of oxidation studies using HIO_4 in carbohydrate chemistry.

b) Identify the intermediates formed in any two of the following sequence of reactions and rewrite the sequence again. **[4]**

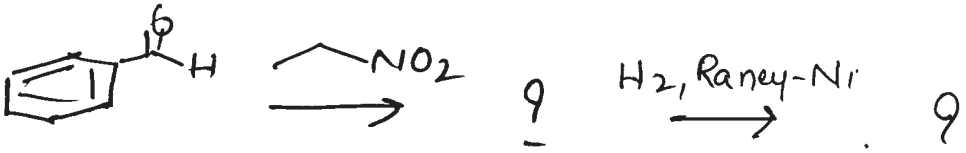
i)



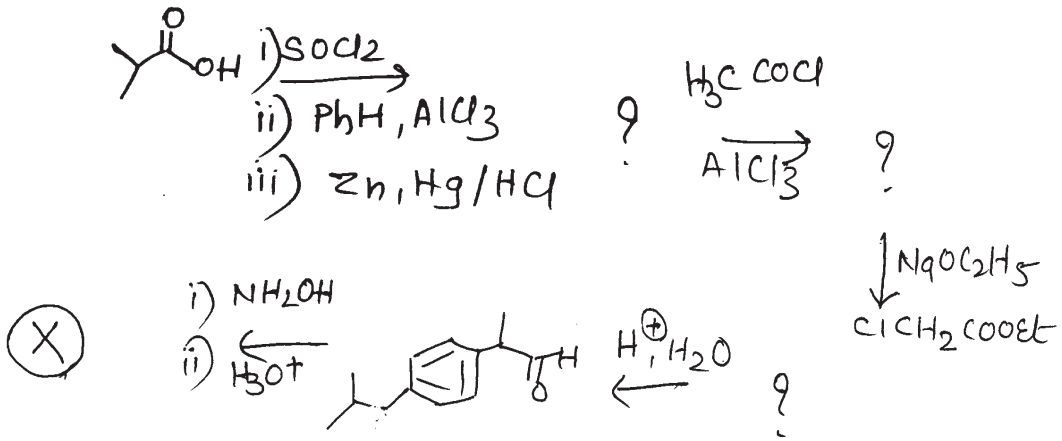
ii)



iii)



Q3) Complete the following sequence using appropriate reagents.



Comment on optical activity of compound (X) formed in the sequence of reactions.

How will you convert it into optically active (S) - Ibuprofen? **[5]**

SECTION - II

Q4) Answer the following. **[10]**

a) Explain the term broad spectrum antibiotics with suitable example.

b) What is ADME in drug design?

c) What are anti metabolites?

d) Give SAR of Chloramphenicol.

e) Give an account of history of antibiotics.

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

i) Name any two antifungal agents and explain their mode of action.

ii) Write note on protein synthesis inhibitor antibiotics.

iii) Discuss in brief antiviral agents and selective toxicity.

b) Explain the following (any two). **[4]**

i) Chloroquine as antimalarial agent.

ii) Macrolides as antibiotics.

iii) SAR of tetracyclins.

Q6) What are β- Lactum antibiotics? How they act as cell wall inhibitors? Give examples of semisynthetic penicillins. **[5]**

Total No. of Questions :6]

SEAT No. :

P1917

[Total No. of Pages : 4

[5323]-413
M.Sc.-II
INORGANIC CHEMISTRY
CHO-453 : Designing Organic Synthesis and Asymmetric Synthesis
(2013 Pattern) (Semester-IV)

Time : 3 Hours] *[Max. Marks : 50*

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 : **[10]**

a) What is the use of Fmoc protecting group in organic synthesis?

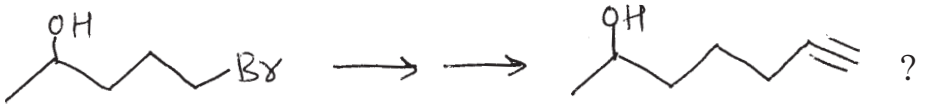
b) Give the synthetic equivalents to the following synthons.

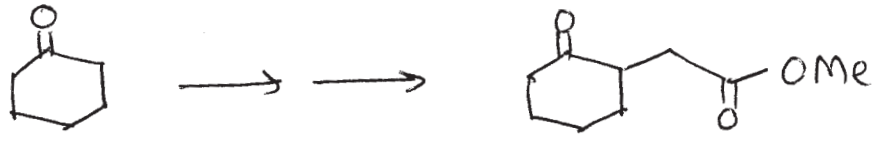
c) Explain the alkylation of aldehyde or ketone using enamine.

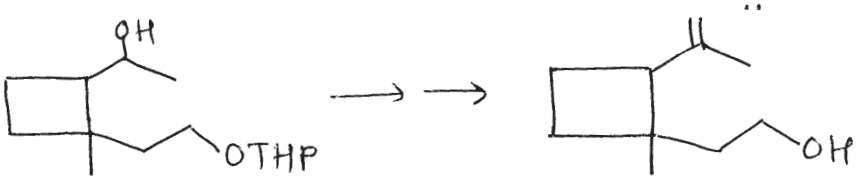
d) Use of cynide ion in umpolung of reactivity.

e) What are disadvantages of linear synthesis, explain with suitable example.

Q2) a) How will you effect the following conversions? (any two) **[5]**

i)  ?

ii)  ?

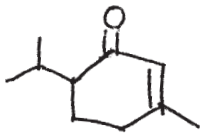
iii)  ?

P.T.O.

b) Predict the products in any two of the following : **[5]**

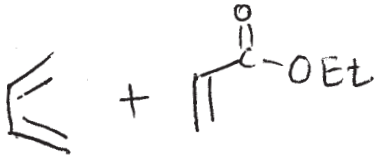
i) $Ph - C \equiv C - H$ $\xrightarrow[2.\ CH_3I]{1.\ Na,\ NH_3}$?

3. Lindlar's Catalyst

ii)  $\xrightarrow[\text{Cat. CuCl}]{1.\ \text{  }}$?

CH_3-S-CH_3

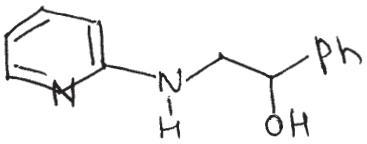
2. H_2, Pd/C

iii)  $\xrightarrow[2.\ LiAlH_4]{1.\ \triangle}$?

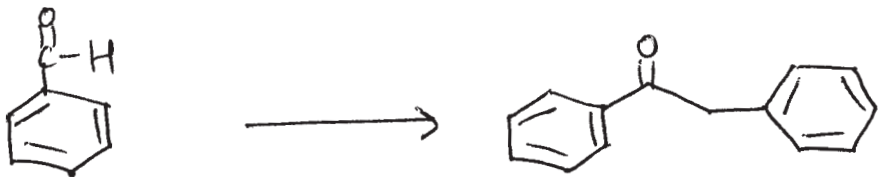
3. PCC

Q3) a) Using retrosynthetic analysis, suggest suitable method to synthesis any one of the following : **[3]**

i) 

ii) 

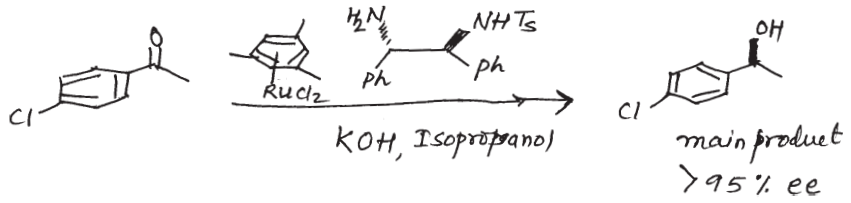
b) Arrange the given reagents in proper order to accomplish the following conversion. Write the structures of the intermediates. **[2]**

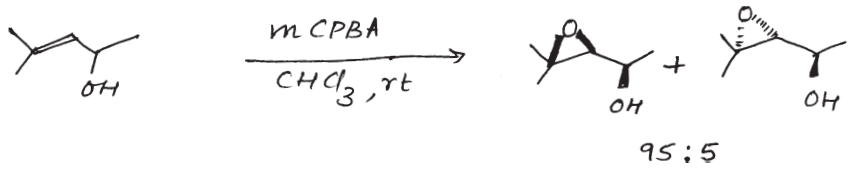


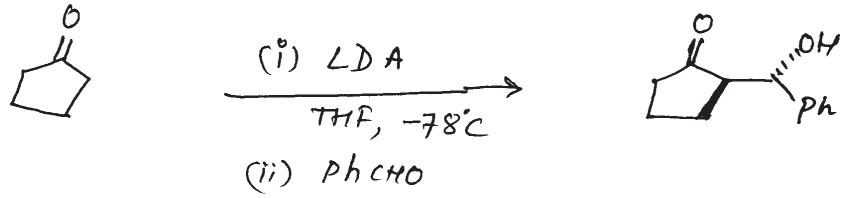
H_3O^+, Hg^{2+}, CuHgLi, THF,–10°C; HS–CH_2–CH_2–SH, H^+; $C_6H_5CH_2Br$

SECTION-II

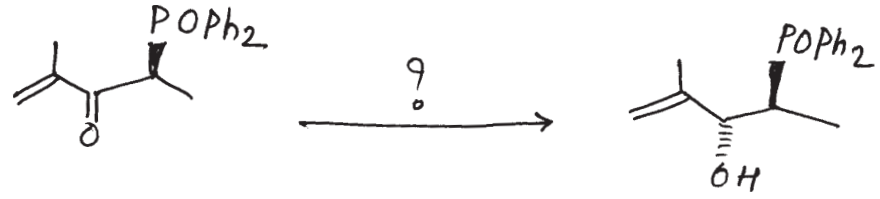
Q4) a) Explain the following transformations with respect to stereochemical outcome of the reaction (any two) **[6]**

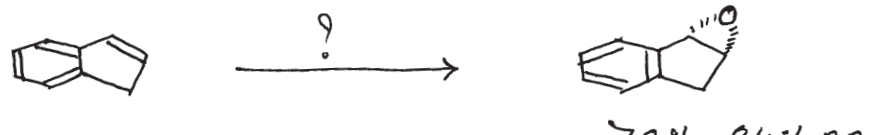
i) 

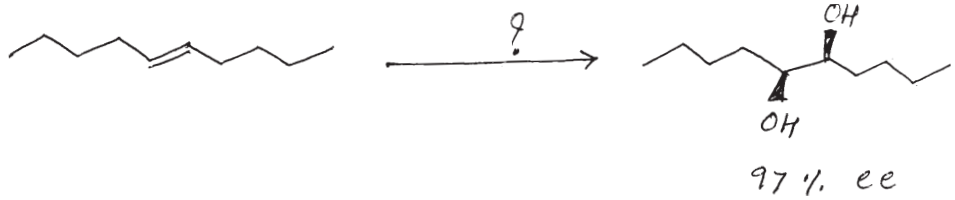
ii) 

iii) 

b) Name the suitable reagent for the following transformations and comment on the formation of the product (any two) : **[4]**

i) 

ii) 

iii) 

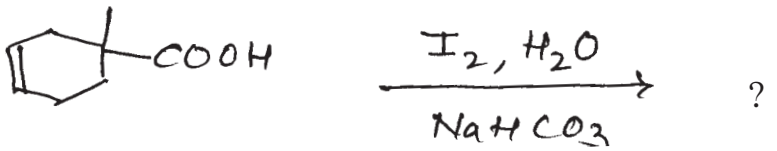
Q5) a) Write a short note on (any two) : **[6]**

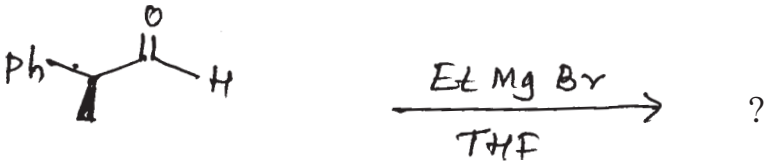
i) Felkin-Anh Model

ii) Sharpless Asymmetric Epoxidation

iii) Chiral Pool.

b) Predict the product/s and comment on the following transformations (any two) : **[4]**

i) 

ii) 

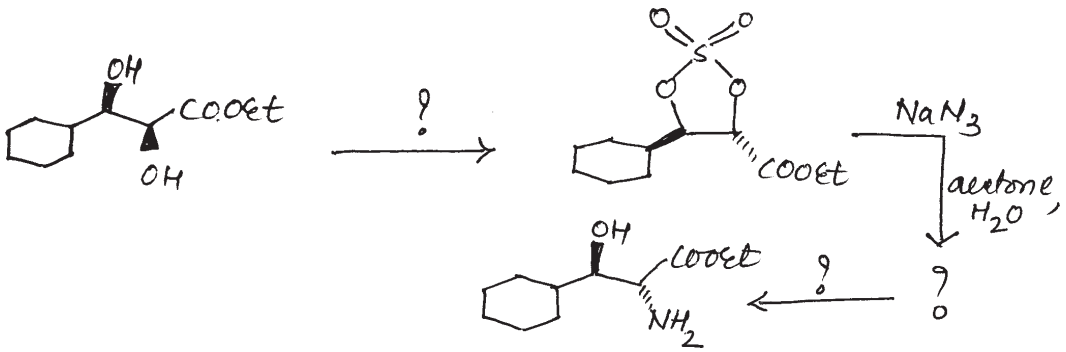
iii) 

Q6) a) Define the following terms (any one) : **[2]**

i) Burgi-Dunitz Trajectory

ii) Noyori-Catalyst

b) Complete the following multistep synthesis using appropriate reagents or intermediates. **[3]**



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Total No. of Questions : 6]

SEAT No. :

P1918

[Total No. of Pages : 2

[5323]-414
M.Sc. - II
ANALYTICAL CHEMISTRY
CHA - 481 : Analytical Toxicology and Food Analysis
(2013 Pattern) (Semester - IV)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic tables/non programmable calculator is allowed.***

SECTION - I

Q1) Answer the following: **[10]**

a) What is coma? Which system is used to classify coma?

b) Give the principle of isolation and identification of cocaine and heroin.

c) Define the terms:

i) Narcotic drugs ii) Hemp (cannabis)

d) Explain "Stimulants".

e) State the principle of estimation of benzodiazepine.

Q2) Attempt any two of the following: **[10]**

a) How barbiturates are estimated? Explain procedure-C in detail.

b) State principle of determination of caffeine. Discuss procedure in detail.

c) Explain type B procedure for isolation and determination of amphetamine from urine.

d) Write a short note on offences and penalties for narcotic and psychotropic substances.

Q3) Attempt any one of the following: **[5]**

a) By using gas chromatographic method a sample of barbiturate was analysed following data is obtained.

i) Concentration of known barbiturate = 3.1 mg/ml.

ii) Peak area of drug in sample = 6.7 min.

iii) Peak area of internal standard = 5.1 min.

iv) Peak area of known drug in reference = 3.6 min.

v) Peak area of internal standard in reference barbiturate solution = 8.7 min.

Calculate concentration of barbiturate in the sample.

P.T.O.

b) Define the terms:

i) Addict

ii) Opium

iii) Coca leaf

iv) Poppy straw

v) Medicinal Cannabis

SECTION - II

Q4) Answer the following: **[10]**

a) Give the principle of estimation of carbohydrate by Anthrone method.

b) What is peroxide value?

c) How saponification value of an oil is determined?

d) Give the composition of milk.

e) Define preservative. Give any two examples.

Q5) Answer any two of the following: **[10]**

a) Discuss the analytical method for estimation of pectic substances by gravimetric method.

b) Explain method for estimation of benzoic acid from food sample.

c) Explain the analytical method used for estimation of saccharin.

d) Give the principle and outline the method for estimation of protein by Lowry's method.

Q6) Attempt any one of the following: **[5]**

a) Calculate the peroxide value of 2.30 gm ghee sample requiring 16.7 ml of 0.01 M $Na_2S_2O_3$ solution, if blank reading of $Na_2S_2O_3$ solution was 24.9 ml.

b) If nitrogen retained, nitrogen absorbed and nitrogen intake from protein by rat was 1.74 mg, 1.18 mg and 8.24 mg respectively. Calculate net protein utilization, digestibility and biological value.

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Total No. of Questions : 6]

SEAT No :

P 1919

[Total No. of Pages :2

[5323]-415
M.Sc. - II
ANALYTICAL CHEMISTRY
CHA - 490 : Analytical Spectroscopy
(2013 Pattern) (Semester-IV)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic table/non-programmable calculator is allowed.***

SECTION-I

Q1) Answer the following questions: **[10]**

a) State and explain the principle of UPS.

b) Enlist the detectors used for X-ray method of analysis.

c) Explain the ESCA satellite peak.

d) State and explain the principle of scanning electron microscopy.

e) Give the applications of X-ray method of analysis.

Q2) Attempt any two of the following: **[10]**

a) What is scanning probe microscopy? Explain its working with neat labeled diagram.

b) Explain the Bragg's X-ray spectrometric method. How different order reflections are obtained using Bragg's equation.

c) What is analyzer? Enlist various analyzers used in ESCA. Explain electrostatic field analyzer in detail.

d) What is X-ray fluorescence? Draw labeled diagram and discuss major components of X-ray fluorescence method.

P.T.O.

Q3) Solve any one of the following: **[5]**

a) The 1 'S' electron of Na ion has binding energy 1068 eV. Estimate the work function of electron spectrometer if incient radiation is the K_α line of Mg and kinetic energy of measured electron is 167.0 eV. (Given : Plank constant h = 6.626×10^{-34} Js, λ = 1.89Å velocity of light C = 3×10^{8} m/s).

b) Calculate the mass absorptive coefficient of an alloy which consists of 29% Ni and 37% Cu of the wavelength corresponding to K_α radiation of copper. The mass absorptive coefficient at that wavelength is 45.0 cm^2/g for Ni and 53.0 $cm^2./g$ for Cu.

SECTION-II

Q4) Answer the following questions: **[10]**

a) Explain the term delayed Fluorescence.

b) What is heavy-atom effect?

c) Explain the term quantum efficiency.

d) Enlist various solvent used in NMR.

e) What is nuclear overhauser effect?

Q5) Attempt any two of the following: **[10]**

a) Give the application of photoluminescent analysis with suitable example.

b) What is 2-D NMR? Explain in brief HETCOR and cosy.

c) Explain phenomenon of an electrochemiluminescence with suitable example.

d) Calculate the chemical shift of a particular nucleus in a 60 MHz instrument if the reference nucleus absorbs at a magnetic flux density that is 0.074 G greater than that at which the sample nucleus absorbs.

Q6) Attempt any one of the following: **[5]**

a) How solid sample was handled in NMR technique.

b) The 'H NMR of a compound with empirical formula $C_4H_8O_2$ shows quartet at δ 4.1, triplet at δ 1.2 and singlet at δ. 1.97. The integration of each peak shows 2:3:3 ratio respectively. Identify the compound.

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Total No. of Questions : 6]

SEAT No : ____

P 1920

[Total No. of Pages :3

[5323]-416
M.Sc. - II
ANALYTICAL CHEMISTRY
CHA - 491 : Analytical Methods for Analysis of Fertilizers, Detergents, Water and Polymer, Paint and Pigment
(2013 Pattern) (Semester-IV)

Time : 3 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Draw neat diagrams wherever necessary.***
4) ***Use of lagarithmic table, non-programmable calculator is allowed.***

SECTION-I

Q1) Answer the following: **[10]**

a) What is meant by syndet? Give suitable examples.

b) List standard test methods for estimation of acidity and alkalinity.

c) What is total Nitrogen? Give principle of estimation of Nitrogen by Kjeldahl method.

d) Explain the terms:-

i) Iodine value.

ii) Saponification value.

e) Enlist four organic pollutants found in waste water.

P.T.O.

Q2) Answer <u>any two</u> of the following: **[10]**

a) What is available and non-available phosphorus? Discuss the alkali metric ammonium molybdophosphate method.

b) Discuss general scheme of analysis of soaps and give tests for:-

i) Total fatty acids.

ii) Anhydrous soap.

iii) Active ingredient.

c) Write a note on industrial waste water treatment.

d) Orthophosphate was determined by weighing as ammonium phosphomolybdate $(NH_4)_2\ PO_4.12MoO_3$. Calculate the percentage of phosphorus and phosphorus pentoxide if, 1.673 g precipitate was obtained from 0.328 g of sample. Given At. Wt N = 14, H = 1, P = 30.97, Mo = 95.94, O = 15.99.

Q3) Answer <u>any one</u> of the following: **[5]**

a) Discuss analytical method for the determination of cyanide from waste water.

b) Nitrogen containing fertilizer weighing 0.54 g was treated in a Kjeldahl flask and NH_3 produced was absorbed in 0.1 N H_2SO_4. The excess of acid required 17 ml 0.1 N NaOH solution for neutralization. Find the percentage of Nitrogen in the fertilizer. (Given: atomic weight of N = 14).

SECTION-II

Q4) Answer the following: **[10]**

a) Explain the role of thinner in paints.

b) How are organic pigments analysed?

c) Define degree of polymerisation.

d) Explain the terms:

i) Impact testing.

ii) Tear resistance.

With respect to polymers.

e) Distinguish between thermosetting polymers and thermoplastic polymers.

Q5) Attempt <u>any two</u> of the following: **[10]**

a) Explain the characterisation of polymers by X-ray diffraction technique.

b) Write a short note on 'end group analysis' method for molecular weight determination of polymers.

c) When a certain polymer sample contains 200 molecules with molecular weight 10^4, 250 molecules with molecular weight 10^5 and 300 molecules with molecular weight 10^3 and 50 molecules with molecular weight 10^7. Find $\bar{M}_n$ and $\bar{M}_w$ for the given polymer sample.

d) Explain isolation and determination of pigments.

Q6) Answer <u>any one</u> of the following: **[5]**

a) 0.846 g CTPB sample was dissolved in a mixture of ethanol and xylene solution and was titrated with 0.295 N alcoholic potassium hydroxide solution. The burette reading was 5.1 ml. Calculate $\bar{M}_n$ and $\bar{M}_w$ of the polymer. (Given: functionality = 2).

b) Explain the optical properties of polymers.

Total No. of Questions :9]

SEAT No. :

P1921

[Total No. of Pages : 3

[5323]-417
M.Sc.-II
ANALYTICAL CHEMISTRY
CHA-492 : Methods of Analysis and Applications Pollution Monitaring and Control. Analysis of Body Fluid, Carbon Nanostructures and Application of Nanotechnology
(2013 Pattern) (Semester-IV)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic tables/non-programmable calculator is allowed.***

SECTION-I
(Pollution Monitoring and Control)

Q1) Attempt the following : **[10]**

a) What are the sources of SO_x and NO_x?

b) Give the principle of Brownian diffusion.

c) Discuss the sources of Inorganic particulate matter.

d) Give any two methods for the control of particulate matter.

e) Explain the term electrocoagulation.

Q2) Attempt any two of the following : **[10]**

a) Discuss the phenomenon of the photochemical smong.

b) Describe in detail a method used for detection of lead (Pb) in waste water.

c) Discuss any two method for the control of particulate emissions.

d) Write a short note on wet scrubbing.

Q3) Attempt any one of the following : **[5]**

a) Outline the analytical method for estimation of Amonia (NH_3)

b) Enlist adverse effects of particulate matter. Describe any two in details.

P.T.O.

SECTION-II

(Analysis of Body Fluid)

Q4) Answer the following : **[10]**

a) What is the composition of faeces? How it is collected?

b) Give the structures of the following :

i) Retinol

ii) Vitamin D_3

c) Give any two functions of liver in details.

d) Give principal of estimation of inorganic phosphate by colorimehy.

e) Give any two functions and deficiency diseases of vitamin C.

Q5) Attempt any two of the following : **[10]**

a) Discuss the chemistry of vitamin B_1 with respect to structure, sources and bio functions.

b) Explain principle, instrumentation and any two applications of radioimmuno assary.

c) Explain the principle of fluorometry and estimation of xanthunic acid using above technique.

d) Discuss kidney function tests in details.

Q6) Attempt any one of the following : **[5]**

a) Give a short note on estrogen and progesteron.

b) Describe 2, 6 dichlorophenot indophenot method for the estimation of vitamin C.

SECTION-III

(Carbon Nanostructure and Applications of Nanotechnology)

Q7) Answer the following : **[10]**

a) Give the applications of quantum dots.

b) How pantide shape of nano material causes a potential health hazards? Explain.

c) Explain the term internal delivery.

d) List factors involved in rapid developement of sensors in modern medicines.

e) Give the different types of biosensors.

Q8) Answer any two of the following : **[10]**

a) Write a short note on plant and microbes as nanofactories.

b) How CNTs are fabricated.

c) Describe the applications of CNTs in fund cells and catalysts.

d) Explain the functioning of implantable devices for drug delivery.

Q9) Attempt any one of the following : **[5]**

a) Write a short note on sensing modalities.

b) Discuss the importance of material characterization in nano biotechnology.

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