Total No. of Questions :6]

SEAT No. :

P2196

[Total No. of Pages :3

[4823]-1001

M.Sc.

PHYSICAL CHEMISTRY

CHP - 110: Fundamentals of Physical Chemistry - I

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

Time : 2 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) Work and heat are not state funciton, but energy is a state function. Explain.

b) Give Kelvin and clauslus statements of the second law of thermodynamics.

c) Define the terms heat capacity and specific heat capacity and give their units.

d) Write the Gibb's - Helmholtz equation and give the significance of the terms involved in it.

e) Give the relation between wavelength and intensity of radiation emitted by a hot body.

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

a) Obtain the Gibb's -Duhem equation. Explain how it defines the non independance of the intensive variables.

b) What is Osmosis and Osmotic pressure? Derive the Van't Hoff equation.

c) Explain the phase diagram of water system as a function of pressure and temperature. What is triple point?

d) Using Schrodinger wave equation obtain thewave function for partical in a one dimensionalbox.

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

a) Calculate the Linear momentum of photons of wavelength 750nm. What speed does an electron need to travel to have the same linear momentum.

b) 8gm of nitrogen is expanded from 1 lit to 10 lit at 300^{o}C and 100 kPa.pressure. Calculate $\Delta G, \Delta H$ and ΔS.

SECTION -II

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

a) Define the term einstein.

b) Distinguish between molecularity and order of reaction.

c) Give the different steps involved in chain reactions.

d) Plot Lineweaver Burk and Eadie plots for enzyme uncompetitive inhibition.

e) Define partition function. Give its equation.

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

a) What are diffusion controlled limits? Derive the equation for the diffusion controlled reactions.

b) Explain the flash photolysis technique for studying fast reactions.

c) Derive the rate equation for competitive inhibition of enzymes.

d) Derive the expression $Q = Q_t\ Q_r\ Q_v\ Q_e$ where Q is the total partition function and Q_t, Q_r, Q_v and Qe are translational , rotational, vibrational and electronic partition functions respectively.

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

a) In a reaction, the decrease in reactant concentration is 20% in 20 min and 40% in 40 min. Calculate order of reaction and rate constant.

b) A certain system of N partical possesses among other two energy levels from which $g_1 = 4$ and $E_1 = 1.661 \times 10^{-20}$ cal/ molecule and $g_2 = 5$ and $E_2 = 2.325 \times 10^{-20}$ cal/molecule. What will be the ratio of the total number of particals in the two states at 1000K.

EEE

Total No. of Questions : 6]

SEAT No. :

P2197

[Total No. of Pages : 3

[4823]-1002
M.Sc. - I
INORGANIC CHEMISTRY
CHI- 130 : Molecular Symmetry and Chemistry of p-block Elements
(2013 Pattern) (New - 4 Credit System) (Semester - I)

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 log tables/character tables and calculator is allowed.***

SECTION - I

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

a) What is the point group symmetry of square and rectangle?

b) When n is odd, $S_n^{2n} \equiv E$, prove this.

c) How will you distinguish between C is and trans isomers of 1,2-dichloroethylene using plane of symmetry?

d) Find out the product of $C_3 \times \sigma_{v_1}$ in NF_3 molecule and also find whether the two operations are commutative or not.

e) Mention the symmetry elements, order and classes of D_4h point group.

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

a) Explain all the symmetry elements in Benzene molecule and assign the correct point group to it.

b) Define an abelian group. Explain whether C_{3v} belongs to abelian or non-abelian group using various symmetry operations.

P.T.O.

c) Derive the character table for C_2h point group using great orthogenality theorem.

d) Give the matrices for σ^{xy} and C_2^z and find out the product of them. Give the matrix representation for improper axis of rotation.

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

a) For $[Ni(CN)_5]^{3-}$ considering sigma bond as basis of representation find the reducible representation and find out the orbitals that are offered for sigma bonding.

b) Find out the normalized SALC using projection operator of B_{1g} irreducible representation which operates on σ_1 orbital of the $[AuC1_4]^{2-}$ ion.

D_4h	E	$2C_4$	C_2	$2C_2'$	$2C_2''$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$
B1g	1	-1	1	1	-1	1	-1	1	1	-1

SECTION - II

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

a) Explain the alkali metal solution in ammonia used as a good reducing agent.

b) What are boranes? Mention the precautions for handling boranes.

c) What are different classes of hydrides? Give the example of each.

d) What are allotropes of carbon? Draw the structure of graphite.

e) What are pseudohalogens? Name different pseudohalogens and corresponding halogens.

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

a) Write a note on zeolites.

b) What are carboranes? Give the different types of carboranes with structures.

c) What are organometallic compounds? Explain organometallic compounds of Beryllium with synthesis, properties and uses.

d) What are oxoanions? Explain oxyacids of Halogens.

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

a) Explain the structure and bonding in:

i) Water ii) PN compounds.

b) Draw the structures of following:

i) IF_7

ii) $B_4 H_{10}$

iii) Dibenzo 18 - crown - 6

iv) $Al_2 (ph)_2 Et_4$

v) $A_5 H_3$

Charactor table for C_{4v} point group.

C_{4v}	E	$2C_4$	C_2	$2\sigma_v$	$2\sigma_d$		
A_1	1	1	1	1	1	Z	x^2+y^2,z^2
A_2	1	1	1	-1	-1	Rz	x^2-y^2
B_1	1	-1	1	1	-1		
B_2	1	-1	1	-1	1		xy
E	2	0	-2	0	0	$(x,y)(R_x,R_y)$	(xz,yz)

Total No. of Questions : 6]

SEAT No. :

P2198

[Total No. of Pages :4

[4823]-1003
M.Sc.(Part-I)
ORGANIC CHEMISTRY
CHO-150:Basic Organic Chemistry
(2013 Pattern)) (Semester-I) (04 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 books.***

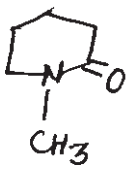
SECTION-I

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

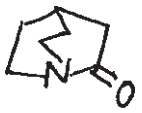
a) Justify the pKa of the following compounds.

	Benzoic Acid	Salicylic Acid	Picric acid
$\xrightarrow{pKa}$	4.1	2.98	1.02

b) Compound (B) is stronger base than compound(A).



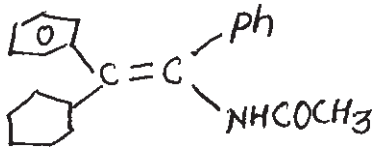
(A)

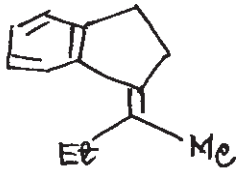


(B)

c) Discuss structures of carbocation and corbanion with suitable examples.

d) Assign E/Z configurational labels to the following compounds.

i) 

ii) 

P.T.O.

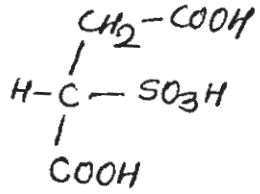
Q2) a) Write short notes on (any two) **[4]**

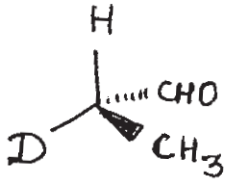
i) Stereospecific reactions

ii) Stability of free radicals.

iii) Hyperconjugation.

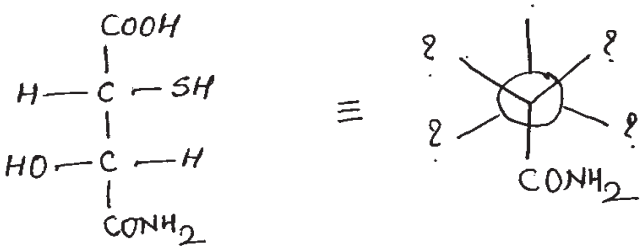
b) Assign R/S configurational labels to the following: **[4]**

i) 

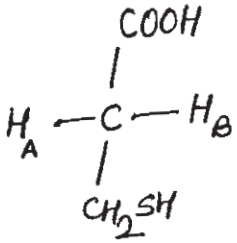
ii) 

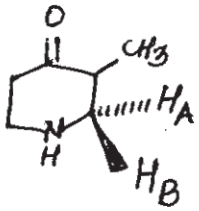
Q3) Attempt any four of the following. **[8]**

a) Convert Fischer projection to Newman projection as shown.

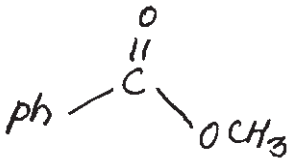


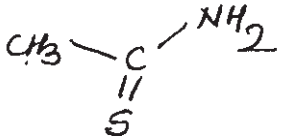
b) Assign pro-R and pro-S labels to H_A & H_B

i) 

ii) 

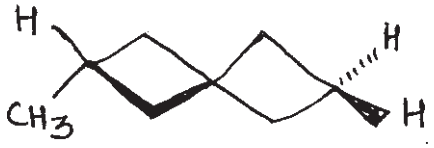
c) Assign Re/ Si face labels to the following.

i) 

ii) 

d) Trans-1,2-dichlorocyclohexane exists predominantly in aa conformation. Justify.

e) Comment on optical activity of the following compound.



SECTION-II

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

a) Give an account of Benzyne mechanism with suitable example.

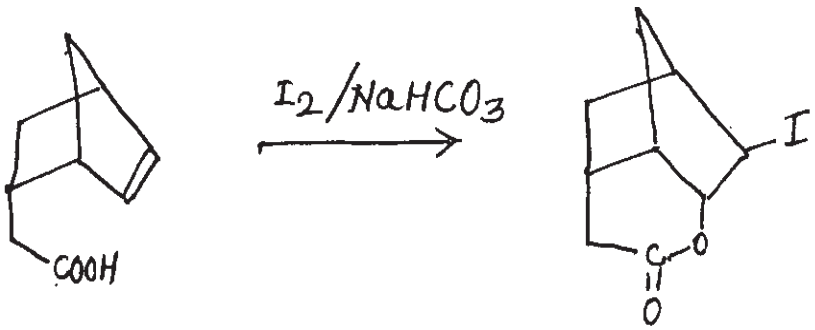
b) Anisole undergoes nitration at 0ºC while nitration of Benzene requires high temperature. Justify.

c) Vinyl chloride resists hydrolysis while allyl chloride is easily hydrolysed by S_N1 mechanism.

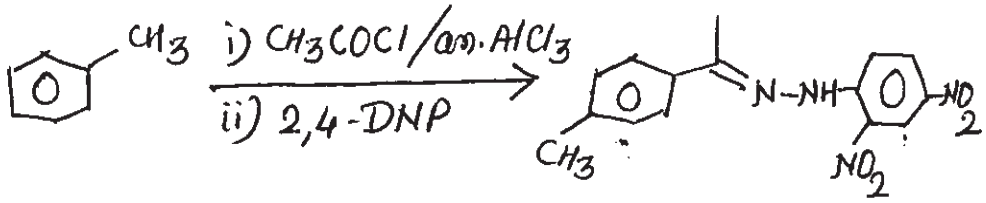
d) Explain syn and anti elimination.

Q5) Suggest the mechanism(any four) **[8]**

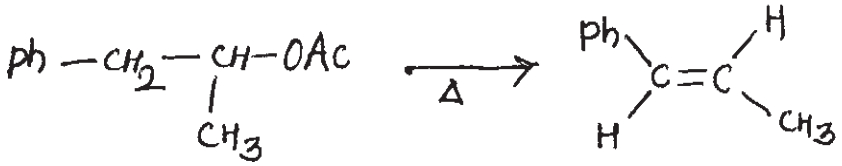
a)

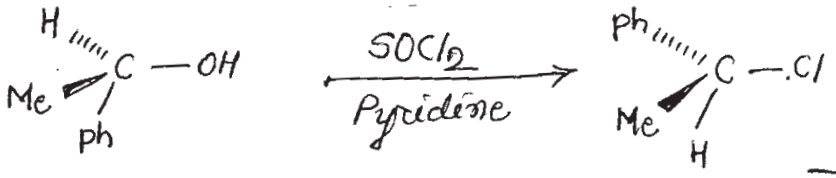


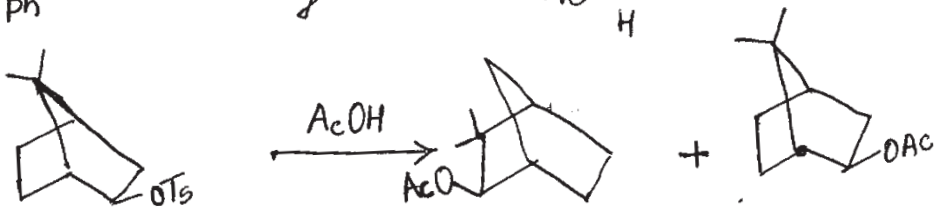
b)



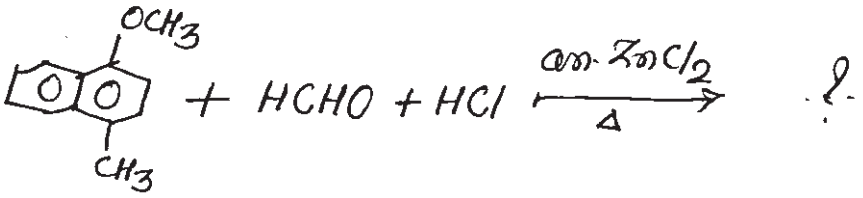
c)

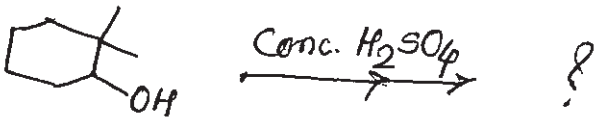


d) 

e) 

Q6) a) Predict the products **[4]**

i) 

ii) 

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

i) Effect of leaving group on S_N1 reaction.

ii) Write note on Ambident Nucleophile.

iii) Explain Saytzeff elimination.

♦ ♦ ♦

Total No. of Questions : 6]

SEAT No. :

P2199

[Total No. of Pages :2

[4823]-1004

M.Sc.-I

ANALYTICAL CHEMISTRY

CHA-190:Safety in Chemical Laboratory and Good Laboratory Practices

(2013 Pattern) (Semester-I) (Credit System) (New) (4-Credits)

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.***
4) ***Use of logarithmic table non-programmable calculator is allowed.***

SECTION-I

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

a) Give the different safety measures related to the human health.

b) Enlist the types of hazards and give its examples.

c) Define the terms.

i) Accute toxiconts.

ii) Corrosives.

d) Explain the respiratory protection and enlist its types.

e) What are the asphyxiants? Give its examples.

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

a) Explain the different types of fire extinguishers.

b) What are the safety Goggles! Explain the various safety Goggles & face shield.

c) What are the chemicals of concern? Give steps to securing it.

d) Define inventory management. Explain its types & importants.

P.T.O.

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

a) Write a short note on personel protective equipments.

b) Define the flammable, toxic, harmful, explosive & hazardous chemicals.

SECTION-II

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

a) What is OSHA Laboratory standards?

b) Give the Do's and Dont's in the laboratory.

c) Distinguish between Iso & NABL.

d) Define fire & Give its different types.

e) Explain acid spillage in short.

Q5) Attempt <u>any two</u> of the following: **[10]**

a) Define GLP and give its applications.

b) What types of accidents max occur in the laboratory?
mention the precautions to be taken against it.

c) What are the general procedure for working with hazardous chemicals?

d) Define and explain the term waste classification.

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

a) Write a short note on 'sop'.

b) Discuss the general procedure for working with biohazard material.

♦ ♦ ♦

Total No. of Questions : 6]

SEAT No. :

P2155

[Total No. of Pages :3

[4823]-101
M.Sc.
PHYSICAL CHEMISTRY
CHP-110:Physical Chemistry-I
(2013 Pattern) (Semester-I) (Old5 – 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 tables/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 is a wave-particle duality?

b) What are bosons and fermions?

c) What is the physical significance of Helmholtz free energy?

d) Under what conditions $K_p = K_c$?

e) Write the time dependent Schrödinger equation and explain the terms involved in it.

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

a) Discuss the dual nature of matter. Derive the expression for de Broglie wavelength.

b) Deduce the relation $\frac{E_{n+1} - E_n}{E_n} = \frac{2n+1}{n^2}$ for a particle in a box and hence account for the energy continum as $n \to \infty$.

c) What is partial molar volume? Explain the graphical method to determine it.

d) Define partition function.Derive the expression for rotational partition function.

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

a) The velocity of electrons ejected from a metal surface when irradiated with 215 nm light is 6×10^5 ms^{-1}. Calculate the work function of the metal in eV.

b) A mixture contains 5g Helium, 20g oxygen and 11g carbondioxide. Calculate ΔS_{mix} and ΔG_{mix} at 27°C.

[Atomic masses He=2, O=16, C=12]

SECTION-II

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

a) Write a short note on Lineweaver-Burk plot for enzyme catalyzed reaction.

b) Give the Eyring equation and explain the terms therein.

c) State the principle of microscopic reversibility.

d) What is activation energy? What is the effect of temperature on activation energy.

e) Give the principle of stopped -flow technique.

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

a) Derive an equation for the velocity constant of a bimolecular reaction on the basis of absolute reaction rate.

b) Distinguish between order and molecularity of a reaction. Write the general expression for order and half life of a reaction.

c) Discuss briefly collision theory for the rate of a bimolecular reaction.

d) What is enzyme catalysis? Derive Michaelis-Meten equation for enzyme catalyzed reactions.

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

a) 75% of reaction of the first order was completed in 32 min when was it half complete?

b) The decomposition of urea in 0.1m HCl occurs according to the reaction $NH_2CONH_2 + 2H_2O \rightarrow 2NH_4^+ + CO_3^{2-}$. The first order rate constant for this reaction at 71.2ºC is 2.77×10^{-5}, with the frequency factor $1.38\times10^{13}S^{-1}$. Calculate the entropy of activation at 71.2ºC.

◀▶◀▶◀▶

Total No. of Questions : 6]

SEAT No. :

P2156

[Total No. of Pages : 3

[4823]-102

M.Sc. - I

INORGANIC CHEMISTRY

CHI - 130 : Molecular Symmetry and Chemistry of P- block Elements

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

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 and labelled diagrams must be drawn whenever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION-I

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

a) By schematic representations, give the product of $C_3 \times \sigma V_1$ for NH_3 molecule.

b) What are the symmetry criteria for a molecule to possess permanent dipole moment.

c) Write the symmetry elements, order and classes of D_3 point group.

d) Define a dihedral plane of symmetry with suitable example.

e) Write down the point group and symmetry elements for cis and trans $[Co(en)_2Cl_2]C1$.

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

a) Using matrix multiplication method, find the product of

i) $C_2^{(z)} \times \sigma_v^{xy}$ ii) $i \times i$

b) Prove that associative conjugation is present in any non Abelian group.

c) Using great orthogonality theorem, derive the character table for C_2h point group.

P.T.O.

d) For $[NiCl_4]^{2-}$ ion, find out reducible representation for which sigma bonds form the basis and find out which of the orbitals from the Ni atom will be offered for sigma bonding.

(Given = character table)

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

a) Find out resultant SALC using projection operator Eu irreducible representation which operates on σ_1 of $[Ni:CN_4]^{2-}$ ion belonging to D_4h point group.

D_4h	E	$2c_4$	c_2	$2C_2'$	$2C_2''$	i	$2S_4$	σh	$2\sigma v$	$2\sigma d$
Eu	2	0	-2	0	0	-2	0	2	0	0

b) Sketch and describe all the symmetry elements is $KReO_4$ molecule and classify it into appropriate point group.

SECTION-II

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

a) Alkali metal solutions are good conductors of electricity. Explain.

b) Organometallic compounds of alkali metals are to be handled carefully. Justify.

c) What is an allotrop? Give different allotrops of Carbon.

d) Fluorine can form FCl type, but cannot form FCl_3 type interhalogen compound. Why?

e) What are electron deficient hydrides?

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

a) Write note on Zeolites.

b) Give an account of activation of Nitrogen.

c) Write note on interhalogen compounds.

d) Give an account of phosphazenes.

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

a) Explain the structure and bonding in

i) IF_7 ii) P_4O_{10}

b) Draw the following structures:

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

ii) 2, 2, 2 cryptand

iii) $B_3N_3H_3Cl_3$

iv) ClF_3

v) S_2N_2

Given

Character Table for Td point group.

Td	E	$8C_3$	$3C_2$	$6S_4$	6Sd		
A_1	1	1	1	1	1		$(x^2+y^2+z^2)$
A_2	1	1	1	-1	-1		
E	2	-1	2	0	0		$(2z^2-x^2-y^2, x^2-y^2)$
T_1	3	0	-1	1	-1	(R_x,R_y,R_z)	
T_2	3	0	-1	-1	1	(x,y,z)	

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Total No. of Questions : 6]

SEAT No. :

P2157

[Total No. of Pages : 4

[4823]-103
M.Sc. - I
ORGANIC CHEMISTRY
CHO - 150 : Basic Organic Chemistry
(2013 Pattern) (Semester - I) (Old - 5 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 books.***

SECTION - I

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

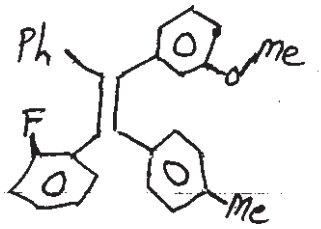
a) O-t-butyl benzoic acid is ten times more acidic than its para isomer.

b) Explain benzenoid and non-benzenoid systems with suitable examples.

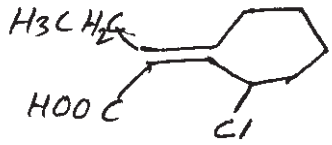
c) What are Lewis acids and Lewis bases. Give one example each.

d) Assign E/Z designation to the following:

i)



ii)



Q2) a) Write short notes on (any two): **[4]**

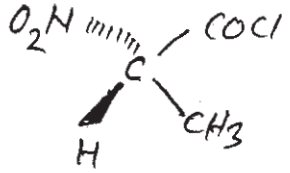
i) Prochiral relationship.

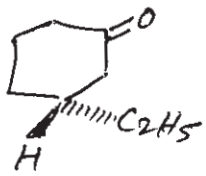
ii) Structure and stability of carbenes.

iii) Tautomerism.

P.T.O.

b) Assign R/S designation to the following compound. **[4]**

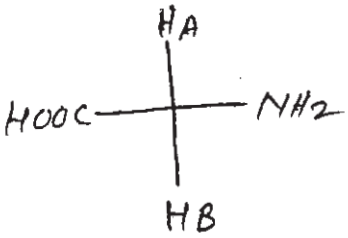
i) 

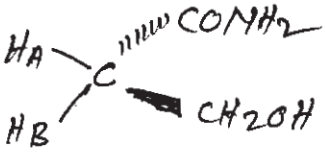
ii) 

Q3) Attempt <u>any four</u> of the following: **[8]**

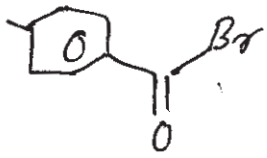
a) Draw conformations of 1, 4 - dimethylcyclohexane. Comment on their energies and stabilities.

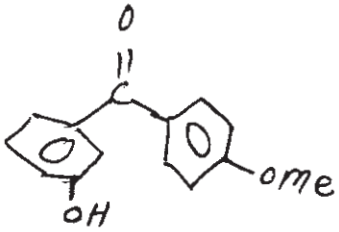
b) Assign Pro-R and Pro-S labels to H_A and H_B.

i) 

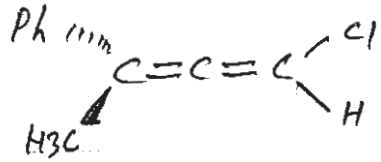
ii) 

c) Assign Re/Si face labels to the following:

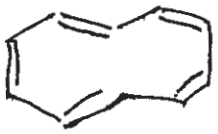
i) 

ii) 

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



e) Comment on aromacity of the following:



and

SECTION - II

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

a) Explain the effect of nature of the leaving group on rate of SN2 mechanism with suitable examples.

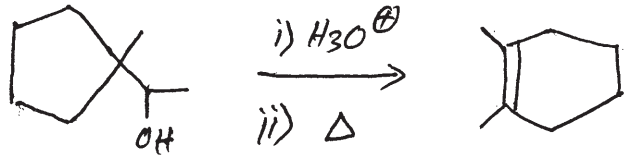
b) Naphthalene on sulphonation at 10N temperature gives 1-naphthylsulphonic acid, while at higher temperature it gives 2-naphthylsulphonic acid.

c) Meso -2, 3-dibromobutane on treatment with KI gives only trams - 2 - butene, while (±) isomer gives only cis -2- butene.

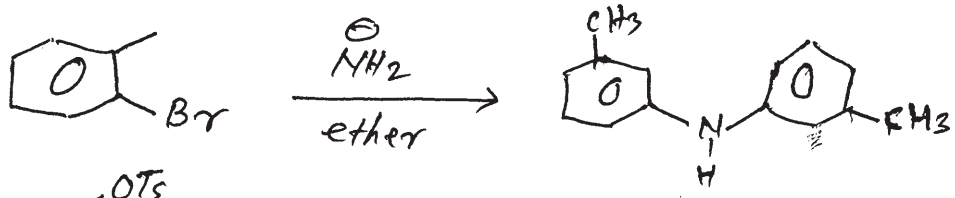
d) Use of H_2O_2 and peracids in formation of epoxides.

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

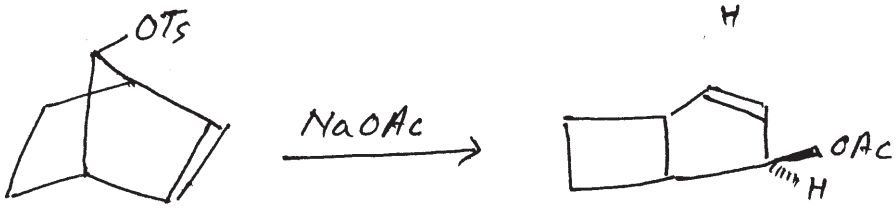
a)



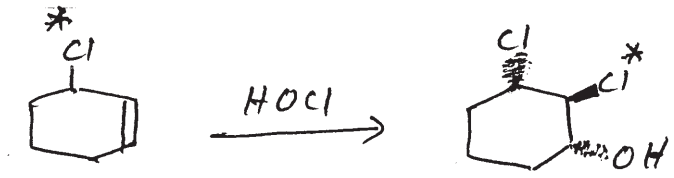
b)



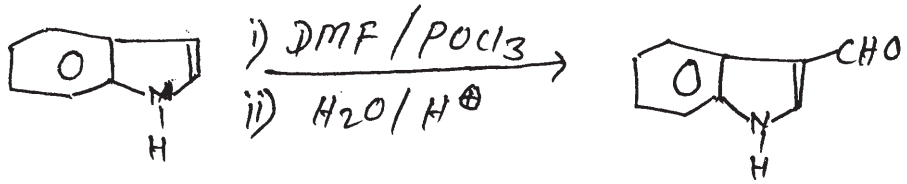
c)



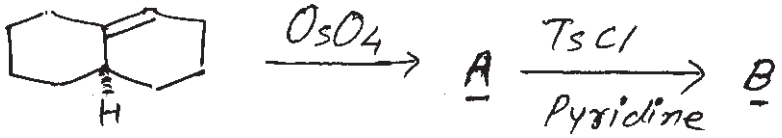
d)

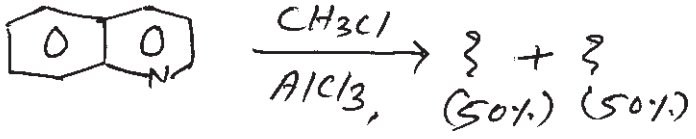


e)



Q6) a) Predict the products: **[4]**

i) 

ii) 

b) Attempt <u>any two</u>: **[4]**

i) A note on S_Ni reaction.

ii) Give an account of pyrolytic syn eliminations.

iii) An S_RN1 mechanism.

Total No. of Questions : 6]

SEAT No. :

P2158

[Total No. of Pages : 2

[4823]-104
M.Sc. (I)
CHEMISTRY

CHA-190 : Safety in Chemical Laboratory and Good laboratory practices
(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 seperate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagrams must be drawn wherever necessary.***

SECTION-I

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

a) What are the symbols used for the chemicals?

b) Enlist the various safety glasses.

c) How labels on chemicals helps in hondling the toxic chemicals?

d) Why safety materials are required in chemistry laboratory?

e) What are the effects of hazards on health?

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

a) What is the importance of safety and health in the laboratory?

b) What precautions should be taken in the storage of chemicals?

c) Define harmful , toxic and hazardous chemicals and explain it with examples.

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

a) Give the first Aid methods for contact of chemicals with skin & eyes .

b) Write a note on globally harmonised system for safety data sheets.

P.T.O.

SECTION-II

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

a) Give the characteristic of GLP.

b) Define the term disposals in the laboratory.

c) What is eye protection standard?

d) Give the principle of OSHA.

e) Define principle of SOP'S.

Q5) Answer Any Two of the following: **[10]**

a) Explain the procedure given in sop for instrument validation and reagent certification.

b) What are the precautions taken to reduce accidentes in laboratory?

c) How will you compramise between accident cost and prevention cost?

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

a) What types of sop's should be used in the laboratory?

b) Give yours opinion about the structure of safety chemical laboratory with diagram.

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Total No. of Questions :6]

SEAT No. :

P2200

[Total No. of Pages :4

[4823]-2001

M.Sc.

PHYSICAL CHEMISTRY

CHP - 210: Fundamentals of Physical Chemistry - II

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

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) Classify the following molecules on the basis of their moment of inertia,

i) BF_3,

ii) Vinyl chloride,

iii) CH_3F and

iv) HCl.

b) State the conditions for Raman activity.

c) State the factors determining the intensity of spectral lines.

d) State Born-Oppenheimer approximation. Under what conditions it breaks down.

e) Explain what is pre-dissociation spectra.

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

a) Explain the applications of ESR spectroscopy.

b) Explain UPES with the help of a spectrum for CO molecule.

c) Obtain an expressions for stokes and anti-stokes frequencies for pure rotational Raman spectra for linear molecule.

d) Sketch and explain the different stretching vibrational frequencies for H_2O and CO_2 molecules.

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

a) The bond length of H_2 molecule is 0.07417nm, predict the spacing of lines in the pure rotational Raman spectrum.

b) Calculate the force constant for $^{1}H\ ^{35}Cl$. Given, $\bar{w}_e = 2990\ cm^{-1}$.

SECTION -II

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

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

b) Define the term-

i) Tracks and

ii) Spurs.

c) Write a short note on excess reactivity.

d) Explain the principle underlying radiometric titrations.

e) Define elementry seperation factor.

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

a) Write a note on compton scattering.

b) Explain isotope dilution analysis and reverse isotope dilution analysis.

c) Obtain critical size of a cubical nuclear reactor.

d) How does molecular distillation used for 6Li seperation?

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

a) Calculate the thickness of Zn (Z = 30, A = 64) plate required to reduce the level of radiation from 1.2 Gy / min to 1.2 m Gy / hr.

(Given $e\mu$ = 0.211 b/electron, Density of Zn = 7.1 g cm^{-3})

b) The half life period of a radio isotope is 24.5m. How much of it would be left after 30 minutes if its initial amount is 1.09.

EEE

Total No. of Questions : 6]

SEAT No. :

P2201

[Total No. of Pages : 5

[4823]-2002
M.Sc. - I
INORGANIC CHEMISTRY
CHI - 230 : Coordination and Bioinorganic Chemistry
(2013 Pattern) (New 4-Credits) (Semester - II)

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 and labelled diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

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

a) Prepare a microstate table for $1s^1$ configuration and find out the R-S term symbol.

b) Write the formula for effective magnetic moment and give the significance of terms involved in it.

c) Which one of the following complex is more intense in colour why?

i) Cis $[Cu(NH_3)_4Cl_2]$ ii) Trans $[Cu(NH_3)_4Cl_2]$

d) Calculate the total degeneracy for the following terms/states/ configurations.

i) $t2g^3.\ eg^2$ ii) ^6G

e) What is spin selection rule for electronic transition? State whether the following transition is spin allowed or spin forbidden.

$^3A_2g \rightarrow {}^3T_2g$

P.T.O.

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

a) Determine the full spectroscopic term symbols for the following ions.

i) $Ni^{2+}(Z = 28)$ ii) Mn^{2+} $(Z = 25)$ iii) Sm^{3+} $(Z = 62)$

iv) Gd^{3+} $(Z = 64)$ v) Lu^{3+} $(Z = 71)$

b) Determine the spin multiplicities of states arising from eg^2 configuration when infinitely strong octahedral field is relaxed to strong field using Bethe's method of descending symmetry, correlation table and direct product table.

c) Explain the factors affecting the band broadening in electronic spectra.

d) Arrange the following transitions in octahedral complexes according to increasing order of intensity

i) $A_{1g} \rightarrow T_{2u}$ ii) $A_{2g} \rightarrow A_{1g}$

iii) $E_g \rightarrow E_g$

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

a) How would you account for the magnetic moment listed against each of the following complexes.

i) $[Ni\ (NH_3)_6]SO_4$ $\mu_{obs} = 2.84$ B.M.

ii) $[Fe(CN)_6]^{3-}$ $\mu_{obs} = 2.40$ B.M.

b) An octahedral complex of Co(II) shows three absorption bands at 8350, 17850 and 20,000cm-1 respectively within $\in$ = 2.8, 8.3 and 5.7 lit mol^{-1} cm^{-1}. Calculate the spectrochemical parameter Dq and the nephelauxetic parameter B and β^o with the help of following relations:

i) $10Dq = \frac{1}{3}[2\nu_2 - \nu_3] + 5B$

ii) $10Dq = \nu_2 - \nu_1$

iii) $B^o = 971\ cm^{-1}$ for Co(II) ion.

SECTION - II

Q4) a) Answer in short: **[4]**

i) Explain the role of Iron in biological system.

ii) Only cis- platin is used as an anticancer drug and not trans-platin. Justify.

b) Draw structures of : (Any three) **[6]**

i) Porphyrine

ii) Flavin

iii) Siderophore

iv) $[(Py)_2\ Pt(en)]^{+2}$

Q5) Write short notes on (Any two) **[10]**

a) Dioxygen transport

b) Fe-S cluster compounds.

c) Photosynthesis

d) Proteins as ligands

Q6) Attempt the following: (Any one) **[5]**

a) Match the following:

i)	Iron	a)	Toxic
ii)	Sodium	b)	Nitrogen fixation
iii)	Mercury	c)	Myoglobin
iv)	Vanadium	d)	Dehydrogenase
v)	Tungsten	e)	Osmotic balance

b) Give an account of zinc fingers.

DIRECT PRODUCTS

1. Groups of the form $G \times I$ or $G \times \sigma_1$:

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

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

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_4 and D_{2i} 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_{4i}, 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_{4i} :

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

   irrespective of the suffix on B.

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

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

   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_{3h}, C_6, S_6, D_{3d}, D_{3h}, D_3, C_{3v}, C_{3h}, C_3 :

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

   (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_{4d} :

   $E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + B_2$,

   $E_2 \times E_2 = E_1 \times E_1 = A_1 + A_2 + B_1$,

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

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

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

   $E_1 \times E_5 = E_1 + E_2 + E_5$, $E_2 \times E_5 = E_1 + E_2 + E_5$.

(*d*) D_{2d}, D_{3h}, D_3, C_{3v}, C_{1h}, C_s

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

$E_1 \times E_2 = E_1 + E_2$.

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

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

$E_2 \times E_3 = A_1 + A_2 + B_1 + B_2$

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

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

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)

Correlation Table for the Group O_h

Oh	O	T_d	D_{4h}	D_{3d}	C_{6v}	C_{2v}	D_{3h}	D_3	C_{3h}
A_{1g}	A_1	A_1	A_{1g}	A_1	A_1	A_1	A_{1g}	A_1	Ag
A_{2g}	A_2	A_2	B_{1g}	B_1	B_1	A_2	A_{2g}	A_2	Bg
Eg	E	E	$A_{1g}+B_{1g}$	A_2+B_1	A_2+B_1	A_1+A_2	Eg	E	A_g+B_g
T_{1g}	T_1	T_2	$A_{2g}+E_g$	A_2+E	A_2+E	$A_{1g}+B_{2g}$	$A_{2g}+E_g$	A_2+E	A_g+2B_g
T_{2g}	T_2	T	$B_{2g}+E_g$	B_2+E	B_2+E	$A_2+B_2+B_2$	$A_{2g}+E_g$	A_2+E	$2A_g+B_g$
A_{1u}	A_1	A_2	A_{2u}	B_2	A_2	A_2	A_{2u}	A_2	A_u
A_{2u}	A_2	A_1	B_{2u}	A_2	B_2	A_2	A_{2u}	A_2	B_u
E_u	E	E	$A_{2u}+B_{2u}$	A_2+B_2	A_2+B_2	A_2+A_2	E_u	E	A_u+B_u
T_{1u}	T_1	T_2	$A_{2u}+E_u$	B_2+E	A_2+E	$A_2+B_2+B_2$	$A_{2u}+E_u$	A_2+E	A_u+2B_u
T_{2u}	T_2	T_1	$B_{2u}+E_u$	A_2+E	B_2+E	$A_2+B_2+B_2$	$A_{2u}+E_u$	A_2+E	$2A_u+B_u$

Total No. of Questions : 6]

SEAT No. :

P2202

[Total No. of Pages : 5

[4823]-2003
M.Sc. - I
ORGANIC CHEMISTRY
CHO - 250 : Synthetic Organic Chemistry and Spectroscopy
(2014 Pattern) (New - 4 Credits) (Semester - II)

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

Instructions to the candidates:

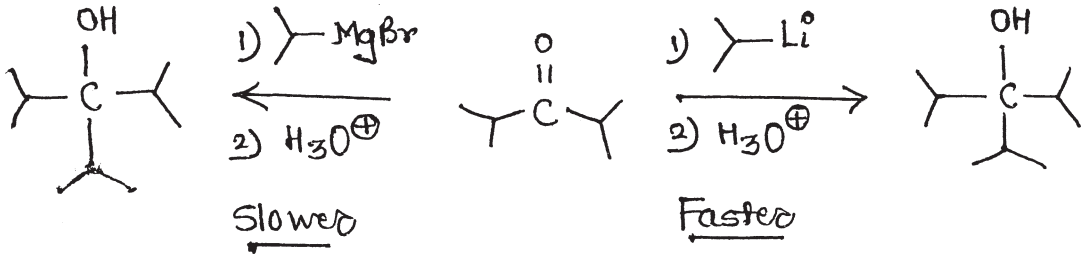
1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Figures to the right indicate full marks.***

SECTION - I

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

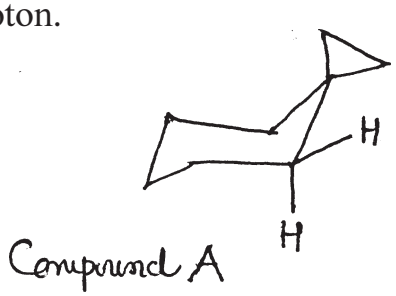
a) Reaction of Ketone with phosphorous ylide gives alkene whereas with sulphur ylide, it gives epoxide.

b) Explain the following observations.



c) At high temperature, phenyl acetate on reaction with $AlCl_3$ gives O-acyl phenol as a major product. Explain.

d) In compound A, an equitorial proton resonates at high field as compared to axial proton.



Compound A

P.T.O.

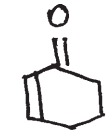
Q2) Attempt <u>any four</u> of the following: **[8]**

a) The reduction of conjugated ketones is best achieved by $NaBH_4$ in $CeCl_3$.

b) How spiro ketones are prepared by using rearrangement reactions?

c) Give the significance of Wittig-Horner-Emmons reaction.

d) Epoxidation of compound B is achieved by using $H_2O_2/\overset{\ominus}{O}H$ and not by m-CPBA.

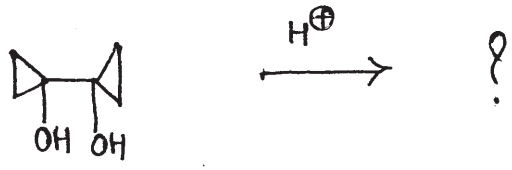


Compound B

e) Write a short note on Dakin reaction.

Q3) a) Predict the product (<u>any two</u>) **[4]**

i)



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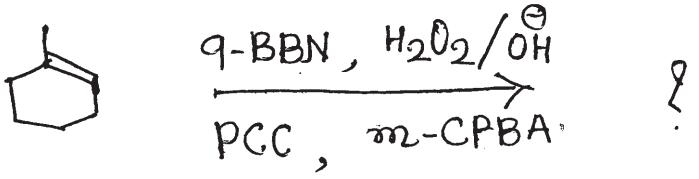

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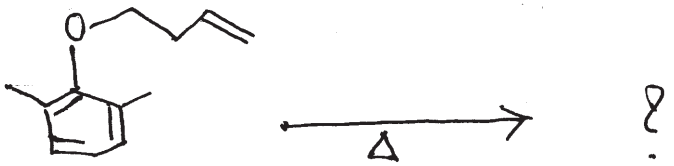
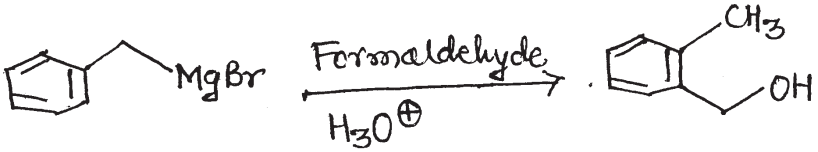
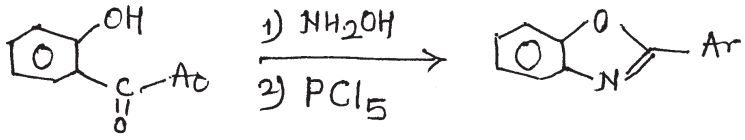


b) Suggest the Mechanism (any two): **[4]**

i)



ii)



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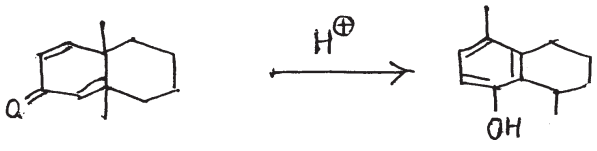


SECTION - II

Q4) Deduce the structure from spectral data and justify your answer. (any three): **[9]**

a) M.F : - $C_{11}H_{12}O_4$

IR : 1745, 1720, 1610, 1510 cm^{-1}

PMR: 3.35 δ (S, 2H)

3.90 δ (S, 3H)

5.19 δ (S, 2H)

7.20 δ (S, 5H)

b) M.F. - $C_{15}H_{24}O$

IR : 3650, 1605, 1505, cm^{-1}

PMR : 1.35 δ (S, 18H)

2.20 δ (S, 3H)

5.00 δ (bs, exchangable 1H)

7.00 δ(S, 2H)

c) M.F. - $C_{11}H_{15}NO_2$, it shows +ve bicarbonate test.

IR: 1730 cm^{-1}

PMR : 2.32 δ(S, 6H)

3.05 δ(t, J = 6Hz, 2H)

4.20 δ (t, J = 6Hz, 2H)

6.97 δ (d, J = 7 Hz, 2H)

7.82 δ (d, J = 7 Hz, 2H)

9.97 δ (S, 1H)

d) M.F. - $C_8H_{15}NO$

IR : 1715 cm^{-1}

PMR : 1.08 δ (d, J = 7Hz, 6H)

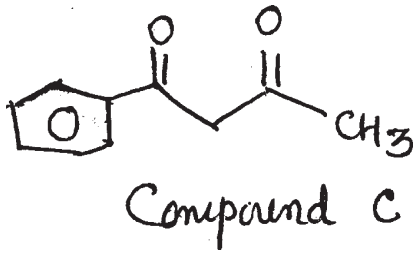
2.45 δ (t, J = 5Hz, 4H)

2.80 δ (t, J = 5Hz, 4H)

2.93 δ (septate, J = 7 Hz, 1H)

Q5) Attempt <u>any four</u> of the following: **[8]**

a) The compound C Also shows peak at 16.2 δ. Explain.



Compound C

b) Distinguish following pair by IR spectroscopy.

c) Explain why 1-acetyl cyclohexene absorbs at 233 nm ($\in$ = 13000) while 2-methyl - 1 acetyl-cyclo-hexene absorbs at 249 nm ($\in$ 6890).

d) Mesitylene on treatment with HF/SbF_5 gives an intermediate having the following PMR peaks.

2.8δ (6H), 2.90 δ(2H), 4.6 δ(2H), 7.70 δ(2H)

(All are singlets)

Explain.

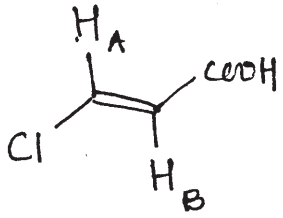
e) Explain MacLafferty rearrangement with suitable example.

Q6) Attempt <u>any four</u> of the following: **[8]**

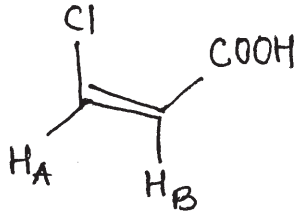
a) Integration is used in PMR and not in CMR. Explain.

b) 2-hydroxy-3-nitroacetophenone shows two carbonyl stretching frequencies at 1692 & 1658 cm^{-1}. Explain.

c) Explain coupling constants in the following:

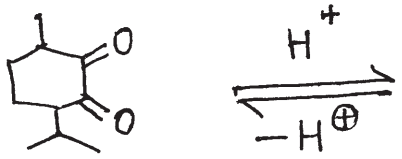


$J_{AB} = 15$ Hz



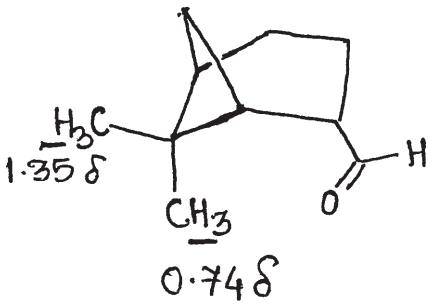
$J_{AB} = 9$ Hz

d) Calculate the λ_{max} of compound D.



Compound D

e) Explain the given chemical shift values.



Total No. of Questions : 3]

SEAT No. :

P2203

[Total No. of Pages : 14

[4823]-2004
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry (2013 Pattern) (New 4 Credits)
New Course Based on Credit & Semester System

PART - A : Modern Separation Methods and Hyphenated Techniques (2.0 Credit / 25 marks)

PART - B : Basic Biochemistry (4.0 Credit / 50 marks)

PART - C : Concept of Analytical Chemistry (2.0 Credit / 25 marks)

PART - D : Industrial Methods of Analysis (2.0 Credit / 25 marks)

PART - E : Organometallic and Inorganic Reaction Mechanism (2.0 Credit / 25 marks)

PART - F : Mathematics for Chemists (2.0 Credit / 25 marks)

PART - G : Pericyclic, Photochemistry and Free Radical Reactions (2.0 Credit / 25 marks)

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

Instructions to the candidates:

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

PART-A

Modern Separation Methods and Hyphenated Techniques

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

a) Define the retention time. Give the characteristics of retention time.

P.T.O.

b) Give the characteristics of detectors used in HPLC. Explain ultraviolet detector.

c) Explain the Ring rule for interpretation of Mass spectra.

d) Give the application of HPLC.

e) Give the characteristics of wall coated open tubular column in gas chromatography (WCOT).

Q2) Attempt Any Two of the following: **[10]**

a) Explain the column packing in Adsorption chromatography.

b) Draw the schematic diagram of Tandem Mass spectrometry explain it in detail.

c) Give the advantages and applications of mass spectrometry.

d) Draw the schematic diagram of thermal conductivity detector. Explain its essential components.

Q3) Answer Any One of the following: **[5]**

a) Following peak area were obtained after analysis of mixture of alcohol by gas chromatography.

Sr. No.	Alcohol	peak area (cm^2)	Detector Responce
1	n-butyl alcohol	2.74	0.603
2	iso-butyl alcohol	1.61	0.530
3	sec-butyl alcohol	3.19	0.667
4	ter-butyl alcohol	1.60	0.681

Calculate the percentage composition of each component.

b) Explain in details "super critical fluid chromatography".

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Total No. of Questions : 3]

P2203

[4823]-2004
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
PART-C
Concept of Analytical Chemistry

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

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

a) Calculate the absolute standard deviation of the following calculation

$$Y = \text{antilog}\,[1.200\ (\pm 0.003)] = 15.489 \pm ?$$

b) Clarify the following errors in its main and sub class

i) Weighing a hot crucible

ii) Incorrect burette reading

c) Define surface plasmon resonance.

d) What factors determine the weight of gross sample?

e) Give the difference between GSC & GLC.

Q2) Attempt Any Two of the following: **[10]**

a) Give the principle of separation of ion by ion exchange process. What are ion exchange resin.

b) Write a note on salt induced precipitation of proteins.

c) Explain "blue shift in Uv-visible spectra is observed for nano-materials as compared to bulk materials".

d) What are hypenated gas chromatographic methods. Briefly describe three hyphenated methods.

Q3) Attempt Any One of the following: **[5]**

a) A column packing material for chromatography consists of a mixture of two types of particles. Assume that the average particle in the batch being sample is approximately spherical with radius of about 0.5mm. Roughly 20% of the particles appear to be pink and are known to have about 30% by weight of a polymeric stationary phase attached (analyte). The pink particles have a density of 0.48 g/cm^3. The remaining particles have a density of about 0.24 g/cm^3 and contain little or no polymeric stationary phase. What mass of the material should the gross sample contain if the sampling uncertainty is to be kept below 0.5% relative?

b) Write a note on salt induced precipitation of proteins.

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Total No. of Questions : 3]

P2203

[4823]-2004
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA-290 : General Chemistry
PART-D
Industrial Methods of Analysis

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

a) What do you mean by continuous online process.

b) Explain the cost of quality system.

c) Explain theoretical & practical yield of the sample.

d) Define the term solubility and solubility product.

e) Give the principle of automatic elemental analyser.

Q2) Attempt Any Two of the following: **[10]**

a) Write a note on quality audits.

b) Explain the concept of formation constant and stepwise formation constant.

c) Describe centrifugal analyser indetail.

d) Explain the responsibilities of laboratory staff for quality.

Q3) Attempt Any One of the following: **[5]**

a) Write a note on methods based on bulk properties.

b) The solubility of silver chloride is 0.0015 gm/lit and silver chromate is 2.5×10^{-2} gm/lit. Calculate the solubility product of silver chloride and silver chromate.

(Given: Relative molecular mass of silver chloride = 143.3 and silver chromate = 331.7).

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Total No. of Questions : 6]

P2203

[4823]-2004
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
PART-B
Basic Biochemistry
SECTION-I

Q1) Answer Any Four of the following: **[12]**

a) What is meant by facilitated diffusion? Explain with suitable examples.

b) Describe the structure and functions of three biochemically important disachharides.

c) Explain the following in brief:

i) Ninhydrin reaction.

ii) α-helical structure of protein.

d) What are standard amino acids? Classify them based on their structure and chemical nature.

e) Explain in brief, tertiary structure of protein.

Q2) Attempt Any Two of the following: **[8]**

a) What is glycogenesis? Give their reactions.

b) Describe the reactions of β-oxidation in mitochondrial matrix.

c) Discuss the structure and importance of endoplasmic reticulum and lysosomes.

Q3) Answer in brief Any Five of the following: **[5]**

a) Titration curve of amino acid.

b) Biological significance of essential fatty acids.

c) Role of peroxisomes.

d) Components of prokaryotic cell.

e) Differences between Glycogen and starch.

f) Fluid Mosaic Model of cell membrane.

g) Features of peptide bond.

SECTION-II

Q4) Answer Any Four of the following: **[12]**

a) What are the similarities and differences between DNA synthesis (Replication) and RNA synthesis (Transcription).

b) What are high energy phosphates? Give some example and reactions.

c) Write an essay on the role of carbohydrates, lipids and proteins in human nutrition.

d) Describe in detail biochemical functions of pyridoxal phosphate. Add a note on deficiency of vitamin B_6.

e) i) What is the significance of km.

ii) What are double reciprocal plots.

iii) Give the importance of double reciprocal plot.

Q5) Attempt Any Two of the following: **[8]**

a) What is homologous and non-homologous recombination? Explain any one in detail.

b) Describe the stages of protein biosynthesis.

c) What are the different types of enzyme inhibition? Explain competitive inhibition with example.

Q6) Explain the following terms (Any 5): **[5]**

a) Complementary base pairs.

b) Template DNA.

c) Beri Beri.

d) DNA topoisomerase.

e) Enzyme immobilization.

f) Genetic code.

g) Active site of enzymes.

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Total No. of Questions : 3]

P2203

[4823]-2004
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
PART-E
Organometallic and Inorganic Reaction Mechanism

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

a) Identify the transition metal in the following $18e^-$ species.

[all metals belong to 1st transition series].

i) $(\eta^5 - C_5H_5)\ M(C_2H_4)_2$

ii) $(\eta^5 - C_5H_5)\ M(CO)_2\ Cl$

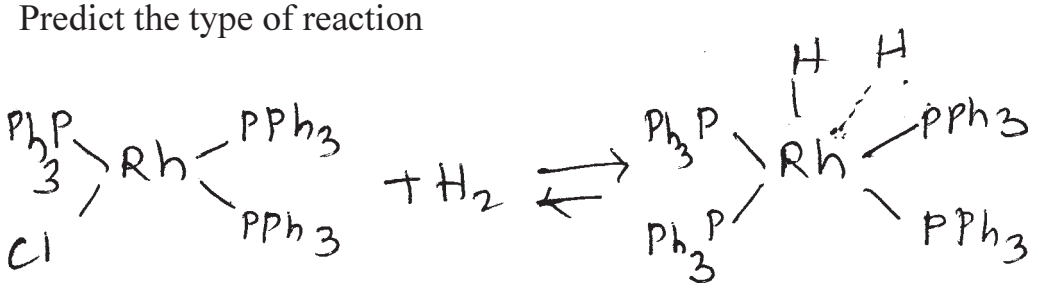
iii) $Cl\ M(CO)_5$

b) Determine the M – M bond order consistent with the $18e^-$ rule for the following

i) $[\eta^5 - C_5H_5\ Fe(CO)_2]_2$

ii) $Fe_3(CO)_{12}$

c) Predict the type of reaction



d) What do you understand by inert and labile complexes.

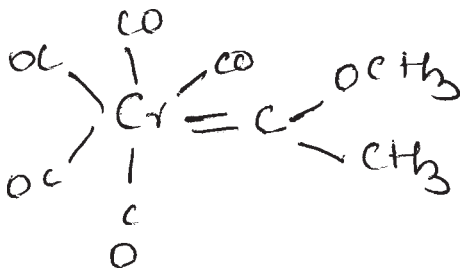
e) $[Cr(CN)_6]^{4-}$ has half life less than one minute while $[Cr(CN_6]^{3-}$ has more than one day. Explain.

Q2) Attempt Any Two: **[10]**

a) What are carbenes? Distinguish between Fischer and Schrok carbenes.

b) Discuss the conjugate base mechanism for substitution in Oh complexes with suitable examples.

c) Explain the ^{1}H and ^{13}C nmr of



How many lines do you expect in each nmr?

d) Explain M – L bonding in metal-alkenes.

Q3) Write note on: **[5]**

a) Organometallic compounds of Fullerene.

b) Trans effect.

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Total No. of Questions : 3]

P2203

[4823]-2004
M.Sc.-I (Semester-II)
ANALYTIC AL CHEMISTRY
CHA - 290 : General Chemistry
PART-F
Mathematics for Chemists

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

a) Define:

i) Converging series.

ii) Exact differential Equation.

b) i) If $A = \begin{bmatrix} 8 & 8 & 3 \\ 2 & 5 & 6 \end{bmatrix}$ $3A = ?$

ii) Add the following matrices: $\begin{bmatrix} 1 & 2 \\ 9 & 7 \end{bmatrix} \begin{bmatrix} 6 & 3 \\ 1 & 1 \end{bmatrix}$.

c) Give the reciprocal rule for differentiation.

d) i) If $y = uv$, $\frac{dy}{dx} = ?$

ii) What is the Simpson's rule for curves?

e) What is a partial differential equation? Give a suitable example.

Q2) Attempt Any Two of the following: **[10]**

a) Differentiate with respect to x:-

i) $y = \frac{4x^3 - 7x}{5x^2 + 2}$

ii) $y = (x^3 + 7x - 1)(5x + 2)$

b) Write a short note on Mclaurin theorem.

c) Discuss with suitable example, the two-point equation of a straight line.

d) Find the inverse of $A = \begin{pmatrix} 1 & -1 & 2 \\ -3 & 1 & 2 \\ 3 & -2 & -1 \end{pmatrix}$.

Q3) Attempt <u>Any One</u> of the following: **[5]**

a) Evaluate:

i) $\int_{v=1}^{v=100} RT\frac{dv}{v} = ?$

ii) $\int \frac{(x^3 + 3x^2 + 2)}{x} dx = ?$

iii) Give the transpose of $A = \begin{pmatrix} 7 & 7 & 3 \\ 2 & 1 & 2 \end{pmatrix}$.

b) Using Falk's scheme evaluate the following:

i) $A = \begin{pmatrix} 3 & 6 & 2 \\ 4 & 2 & 3 \end{pmatrix}$ $x = \begin{pmatrix} 6 \\ 2 \\ 1 \end{pmatrix}$ $Ax = ?$

ii) $B = \begin{pmatrix} 8 & 9 & 4 \\ 2 & 6 & 8 \end{pmatrix}$ $y = \begin{pmatrix} 3 \\ 2 \\ 3 \end{pmatrix}$ $By = ?$

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Total No. of Questions : 3]

P2203

[4823]-2004
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
PART-G
Pericyclic, Photochemistry and Free Radicals

Q1) Attempt Any Two of the following: **[8]**

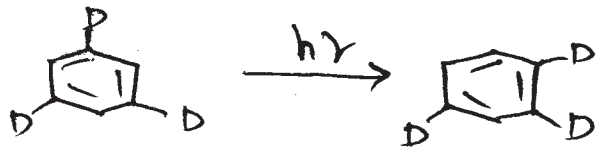
a) Explain with the help of FMO approach whether antrafacial [1, 5] sigmatropic H shift is thermally or photochemically allowed.

b) Explain Norrish type-I reaction with any two suitable examples.

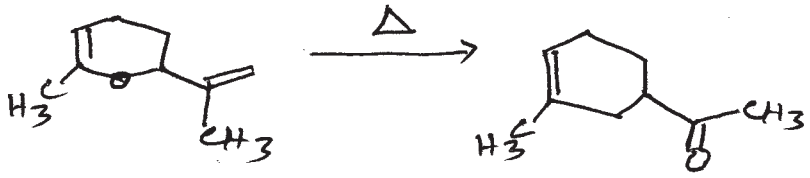
c) Discuss Sandmeyer reaction in detail.

Q2) Explain the mechanism for Any Three of the following: **[9]**

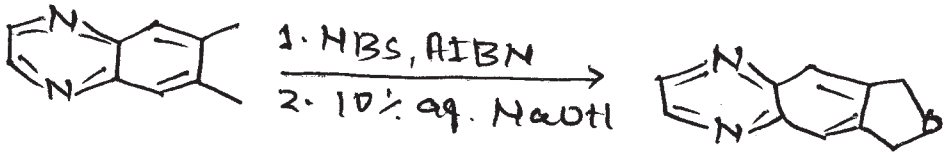
a)



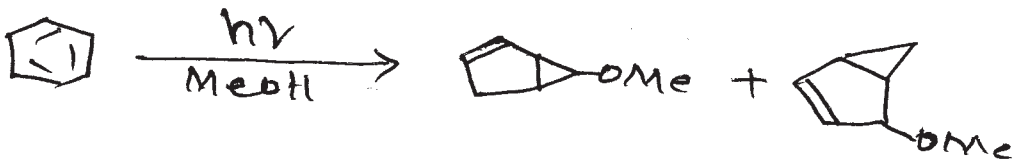
b)



c)

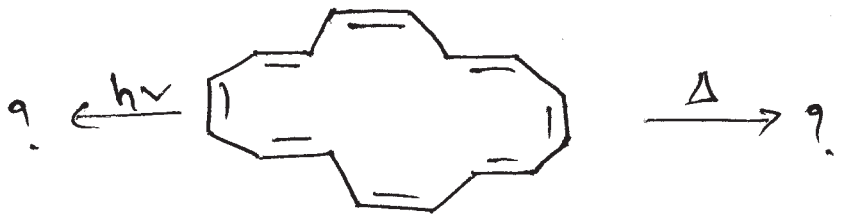


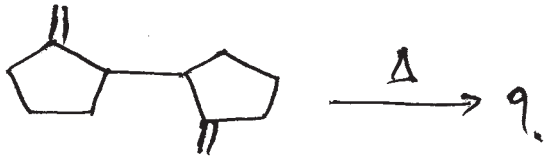
d)

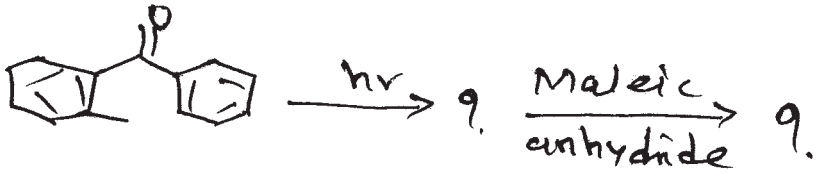


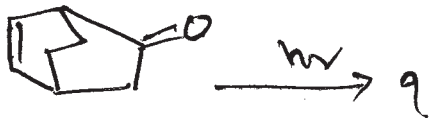
Q3) Predict the products for <u>Any Four</u> of the following indicating the mechanism involved. **[8]**

a) 

b) 

c) 

d) 

e) 

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Total No. of Questions : 6]

SEAT No. :

P2159

[Total No. of Pages :3

[4823]-201
M.Sc.
PHYSICAL CHEMISTRY
CHP- 210 : Fundamentals of Physical Chemistry - II
(2013 Pattern) (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	=	$6.022 \times 10^{23} mol^{-1}$
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} $ergK^{-1}$ 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	=	2.997×10^{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} JT^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) Write the energy expression for non-rigid diatomic molecule along with the expressions for constants involved in it.

b) Why are the stokes lines more intense than the antistoke lines?

c) What is the criterion for the molecule to be IR active?

d) Explain why is the broadening due to Heisenberg's uncertainty very important in case of ESR and less important in case of electron spectroscopy?

e) What is the zero point energy?

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

a) What is stock effect? What are its applications?

b) Sketch and explain polarizability ellipsoids for vibrational modes of CO_2 molecule. Which of them are Raman active?

c) Differentiate between harmonic and anharmonic oscillator with respect to
   i) energy expression
   ii) energy diagram
   iii) selection rule
   iv) spectral line
   v) Nature of the spectrum

d) Write a note on Fortrat diagram.

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

a) The exciting radiation frequency for the HCL molecule is 404.7 nm Hg line. Calculate first two stokes and antistokes lines in rotational Raman spectra of the molecule (r = 0.1275 nm).

b) The anharmonicity constant for a diatomic molecule is 6.0×10^{-3} evaluate the vibrational level that will cause dissociation and approximate dissociation energy in $Jmol^{-1}$(equilibrium vibrational frequency = 1640 cm^{-1}).

SECTION - II

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

a) How does 32_P synthesized using reactor neutrons?

b) Explain the use of radioisotopes in pest control.

c) State Bragg equation and explain the terms involved?

d) What are the miller indices for a plane that cuts the crystallographc axis at 2a, 2b and 1c?

e) Draw bonding and antibonding wavefunctions for H_2 molecule using valence bond theory.

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

a) Give the principle of neutron activation analysis. What are its advantages and disadvantages?

b) How can the surface area of a sample be determined using radioisotopes? Explain with suitable examples.

c) Explain Huckel theory of butadiene molecule.

d) Derive the expression for wavefunction of H_2 molecule using valence bond theory.

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

a) A herbal medicinal sample weighing 165 mg was neutron irradiated in a reactor with flux of 1.2×10^{12} n cm^{-2} S^{-1} for 20 m when $55mn(n,r)^{56}mn$ occures. The isotopic abandance of 55mn is 100% and σ = 2.19b. The half life period of 56 mn is 2.58h. The γ-ray activity was found to be 2500 cps when counted using a detector with efficiency 25% after cooling of 2 h. Determine the percentage of mn in the irradiated sample?

b) The unit cell of an element of atomic mass 96 and density $10.3 gcm^{-3}$ is a cube with edge length 314pm. Predict the Bravals lattice of the cube.

Total No. of Questions : 6]

SEAT No. :

P2160

[Total No. of Pages : 5

[4823]-202
M.Sc. - I
INORGANIC CHEMISTY
CHI - 230 : Co-ordination and Bioinorganic Chemistry
(2013 Pattern) (Old 5 credits) (Semester - II)

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 the separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***

SECTION - I

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

a) Give the full spectroscopic symbol for the following ions.

i) Mn^{3+} (Z = 25) ii) Yb^{3+} (Z = 70)

b) Explain in brief 'Hole formalism'.

c) State curie and Curie Weiss law.

d) Determine appropriate term symbol using following data.

i) L = 3, S = $3/2$

ii) L = 4, S = $1/2$

e) Write following R-S terms in increasing order and justify.

^1G, ^1S, ^3P, ^3F, ^1D.

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

a) Calculate the total degeneracy for the following terms/ configurations / states.

i) 3. ^1T_1g ii) ^1G iii) $(t2g)^2.(eg)^2$

iv) 2. $(p^1.d^2)$ v) ^3F

P.T.O.

b) Write a note on orgel diagram.

c) Derive the allowed R-S terms and hence prepare a table of microstates for $ns^1\ np^2$ configuration.

d) Give the spitting of ^2I R-S term in weak cubic field using character table for pure rotational point group and reduction formula.

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

a) Calculate the effective magnetic moment of $[C_r(OX)_3]^{3-}$ using following data.

i) $\lambda = +\ 92\ cm^{-1}$

ii) $10Dq = 17{,}000\ cm^{-1}$

b) Determine the spin multiplicities of states from $(t2g)^2$ configuration when infinitely strong octahedral field is relaxed to strong field using Bethe's method of descending symmetry correlation table and direct product table.

SECTION - II

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

a) Explain the role of magnesium in biological system.

b) Draw the structure of RNA and explain in brief.

c) Explain briefly any two metal binding biomolecules.

d) Explain the concept of Irving - Williams series.

e) Give different types of electron transfer processes.

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

a) Explain any five amino acids as chelating agents.

b) Explain Fe-S cluster compounds.

c) Write a note on Vit. B_{12}.

d) What are nucleic acids? Give its synthesis in vitro.

Q6) Draw Structures (Any five) **[5]**

a) Corrin

b) Adenine

c) Fe_2S_4

d) Oxy-hemerythrin

e) Deoxyhemoglobin

f) Uracil

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)

Correlation Table for the Group O_h

Oh	O	T2	D_{4h}	D2d	C_4^v	C_2^v	D2d	D3	C2h
A1g	A1	A1	A1g	A1	A1	A2	A1g	A1	Ag
A2g	A2	A2	B1g	B1	B1	A2	A2g	A2	Bg
Eg	E	E	A1g+B1g	A1+B1	A1+B1	A1+A2	Eg	E	Ag+Bg
T1g	T1	T1	A2g+Eg	A2+E	A2+E	A2+B2+B2	A2g+Eg	A2+E	Ag+2Bg
T2g	T2	T	B2g+Eg	B2+E	B2+E	A1+B1+B2	A2g+Eg	A2+E	2Ag+Bg
A1u	A1	A2	A2u	B1	A2	A2	A2u	A1	Au
A2g	A2	A1	B2u	A2	B2	A2	A2u	A2	Bu
Eu	E	E	A2u+B1u	A2+B2	A2+B2	A2+A2	Eu	E	Au+Bu
T1u	T1	T2	A2u+Eu	B2+E	A2+E	A2+B2+B2	A2u+Eu	A2+E	Au+2Bu
T2u	T2	T1	B2u+Eu	A2+E	B2+E	A2+B2+B2	A2u+Eu	A2+E	2Au+Bu

1. Groups of the form $G \times 1$ or $G \times \sigma_1$:

   The g, u or $'_1$ ' additions to the IR symbols in these groups satisfy

   $g \times g = u \times u = g$, $g \times u = u$, $'x' = 'x_2' = '_1x'' = '$.

2. Products of the form $A \times A_1$, $B \times B_1$, $A \times B$:

   For all groups :

   Letter symbols : $A \times A = A_1$, $B \times B = A_1$, $A \times B = B$.

   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_{2h}, D_{4h}, S_6 :

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

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

   (c) For D_{2h} :

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

   irrespective of the suffix on B.

   (d) For D_{4h}, S_6 :

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

   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_{3h}, C_{6v}, C_{3v}, C_{2v}, S_6, D_{3d}, D_{2d}, D_3, C_{3v}, C_{2v}, C_3 :

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

   (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_{2h} :

   $E_1 \times E_1 = E_2 \times E_2 = A_1 + A_2 + B_3$

   $E_2 \times E_2 = E_3 \times E_3 = A_1 + A_2 + E_4$

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

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

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

   $E_1 \times E_4 = B_1 + B_2 + E_5$, $E_2 \times E_4 = B_1 + B_2 + E_5$.

(d) D_{5d}, D_{5h}, D_5, C_{5v}, C_{5h}, 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_{4d}, S_4.

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

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

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

5. Products involving the T (or F) representations of O_h, 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	$A_2+E+T_1+T_2$	$A_1+E+T_1+T_2$

Total No. of Questions : 6]

SEAT No. :

P2161

[Total No. of Pages :4

[4823]-203
M.Sc. - I
ORGANIC CHEMISTRY
CHO- 250 : Synthetic Organic Chemistry and Spectroscopy
(2013 Pattern) (Semester - II) (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 indicate full marks.***

SECTION - I

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

a) What are sulfur - ylides? Give two methods of preparation and one use of sulfur-ylides?

b) Write a note on organocopper reagents.

c) Explain Birch reduction.

d) Describe the use of Bayer-villiger rearrangement in organic synthesis.

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

a) Cyclohexene on treatment with OsO_4 gives cis-diol while per-acid followed by hydrolysis gives trans diol.

b) β-hyroxyesters cannot be prepared using Grignard reagent but can be prepared by organozinc compounds.

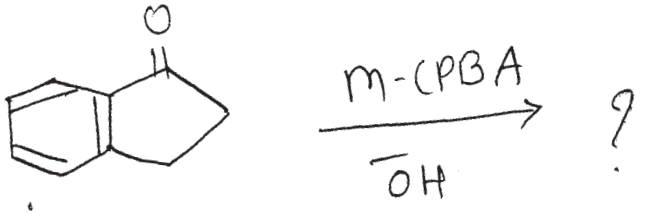
c) A note on Curtius rearrangement.

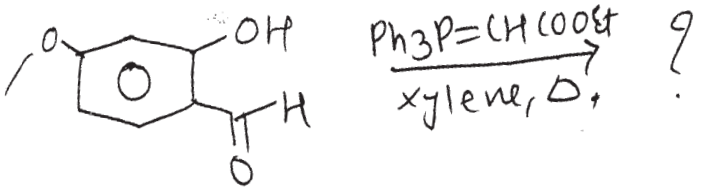
d) Use of PCC in organic synthesis.

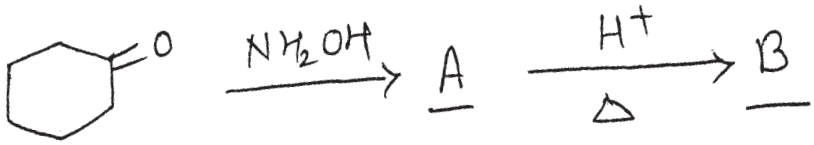
e) Use of R_3SiH in organic synthesis.

P.T.O.

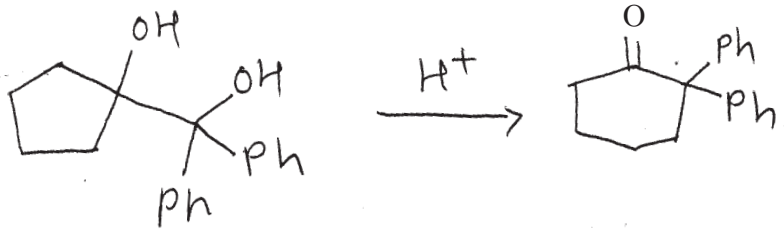
Q3) a) Predict the product (Any Two) **[4]**

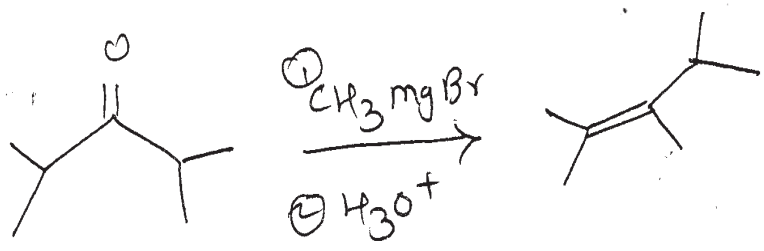
i) 

ii) 

iii) 

b) Suggest the mechanism (Any Two) **[4]**

i) 

ii) 

iii) 

SECTION - II

Q4) Deduce the structure from spectral data with justification. (Any three): **[9]**

a) $C_8H_8O_2$

U.V. : 250, 260, 265nm ($\in$ = 220, 250, 200)

I.R. : 3300-2700 (Broad), 1700, 1600, 920cm^{-1}

P.M.R.: 3.5δ (2H, s)

7.2δ (5H, s)

12.3δ (1H, s)

b) $C_5H_{10}O_3$

U.V. : Not significant,

I.R. : 1730 cm^{-1}

P.M.R.: 2.1δ (30mm, s)

3.35δ (60mm, s)

4.60δ (10mm, s)

c) $C_4H_7BrO_3$

U.V. : Transparent above 210nm

I.R. : 3000-2700, 1720cm^{-1}

P.M.R.: 1.08δ (t, J = 7Hz, 30mm)

2.07δ (m, 20mm)

4.23δ (t, J = 7Hz, 10 mm)

10.97δ (s, exchangeable with D_2O, 10mm)

d) C_5H_6O

U.V. : Not significant,

I.R. : 1600, 1500 cm^{-1}

P.M.R.: 2.3δ (3H, s)

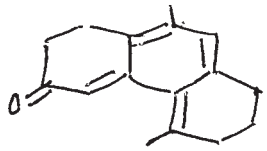
5.85δ (1H, J = 2Hz, d)

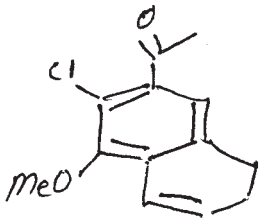
6.20δ (1H, J = 1.5 and 2Hz, dd)

7.20δ (1H, J = 1.5Hz, d)

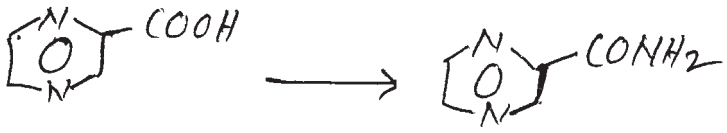
Q5) Attempt any four of the following **[8]**

a) Calculate λmax of the following.

i) 

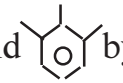
ii) 

b) How will you follow the reaction using IR spectroscopy?



c) $CH_3\text{-}CO\text{-}CH_2\text{-}\underset{\underset{O}{\|}}{C}\text{-}O\text{-}CH_2\text{-}CH_3$ shows IR bands for OH and $\rangle C = C \langle$ groups. Explain.

d) Propanone shows different λmax value in water and cyclohexane. Justify.

e) Distinguish  and  by PMR spectroscopy.

Q6) Attempt <u>any four</u> of the following: **[8]**

a) Define terms molecular ion and base peak used in mass spectrometry.

b) Why peaks of ^{13}C are weak?

c) What are the advantages of using TMS in $^{1}HNMR$.

d) Write a note on factors affecting IR frequencies.

e) Discuss various transitions in U.V. spectroscopy.

Total No. of Questions : 3]

SEAT No. :

P3458

[Total No. of Pages : 12

[4823] - 204

M.Sc. - I (Semester - II)

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry - II

(2013 Pattern) (2.5 Credits)

(New Course Based on Credit & Semester System)

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

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 diagram must be drawn wherever necessary.***
4) ***Use of log table/non programmable calculator is allowed.***
5) ***Students should attempt any two parts from A, C, D, E, F and G or full paper of biochemistry (Part - B) of 5- credit or 50 marks.***
6) ***Write the answer of <u>two parts</u> on separate answer books.***

PART A : Modern Separation Methods and Hyphenated Techniques (2.5 credit/25 marks)

PART B : Basic Biochemistry (5.0 credits/50 marks)

PART C : Concept of Analytical Chemistry (2.5 credit/25 marks)

PART D : Industrial Methods of Analysis (2.5 credit/25 marks)

PART E : Organometallic and Inorganic Reaction Mechanism (2.5 credit/ 25 marks)

PART F : Mathematics for chemists (2.5 credit/25 marks)

PART G : Pericyclic, Photochemistry and free Radical Reactions (2.5 credit/ 25 marks)

P.T.O

PART - A

Modern Seperation Methods and Hyphenated Techniques

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

a) What is retention time?

b) Give the applications of Gas chromatography.

c) Sketch and labelle the basic components of HPLC.

d) What are metastable ion in mass spectrometry?

e) Give the characteristic of support coated open tabular column.

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

a) Enlist different sources of ionisation in mass spectrometry and explain electron impact ionisation method indetail.

b) Explain size exclusion chromatography.

c) Enlist the mass analyzer. Explain any one of them.

d) Give the block diagram of GC. Explain its various components.

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

a) A mixture of ethanol-heptane-benzene & ethyl acetate was analysed using T.C.D. Determine the weight percentage of each component if areas were 5.0 cm^2, 9.0 cm^2. 4.0 cm^2 and 7.0 cm^2 respectively.

(Given

Compound	Weight factor
Ethanol	0.64
Heptane	0.70
Benzene	0.78
Ethylacetate	0.79)

b) Write a short note on derivatisation in HPLC.

PART - C

Concept of Analytical Chemistry

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

a) What are the errors? Explain the classification of determinate and indeterminate error.

b) Calculate the proper number of significant figures in each of the following:

i) 0.00613.

ii) 30.0021.

c) What factors are determine the weight of gross sample?

d) Derive the relation between distribution ratio (D) and distribution coefficient (K_D).

e) Mention any two properties of nanomaterials.

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

a) Write a note on Salt induced precipitation of proteins.

b) Explain in details the determinate error with suitable example.

c) Describe the various steps involved in sampling operations.

d) Explain "Blue Shift in UV-visible spectra is observed for nano-materials as compared to bulk materials".

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

a) Draw a neat labelled diagram of fractionating column and explain its principle and working.

b) The following results were obtained in the replicate determination of lead content of blood sample : 0.752, 0.756, 0.752, 0.751, and 0.760 ppm of lead. Calculate the mean and standard deviation for the set of data.

PART - D

Industrial Methods of Analysis

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

a) What is common ion effect? Give one example.

b) Explain continuous flow method.

c) Define the term solubility and solubility product.

d) Explain the term 'benefit of quality system'.

e) Enlist the different types of process analyzers.

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

a) Explain the term total quality management in detail.

b) Describe stability and instability constant with suitable example.

c) Write a note on methods based on bulk properties.

d) Explain different quality systems in chemical laboratory.

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

a) Explain the concept of formation and step-wise formation constant.

b) Calculate the solubilities of silver chromate in 0.001M and 0.01M silver nitrate solution, 0.001m and 0.01m pottacium chromate solutions.

[Given : Silver chromate has $K_{sp} = 1.7 \times 10^{-12}$ mole^3.L^{-3} and it's solubility in water = 5.5×10^{-5} mol. L^{-1}.

Total No. of Questions : 6]

P3458

[4823] - 204
M.Sc. (Semester - II)
CHEMISTRY
CH - 290 B : Basic Biochemistry
(2013 Pattern) (5 Credits)

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

Instructions to the candidates:

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

SECTION - I

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

a) What are conjugated proteins? How are they classified further?

b) What are ribosomes? Explain prokaryotic and eukaryotic ribosomes.

c) Comment on role of membrane constituents in drug transport.

d) i) What are saturated and unsaturated fatty acids?

ii) Explain biological role of lipids.

Q2) Attempt any two of the following: **[8]**

a) Give details of different types of forces involved in stabilizing tertiary and quaternary structure of protein.

b) Discuss TCA cycle.

c) What is meant by facilitated diffusion? Explain with suitable example.

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

a) Essential aminoacids.

b) Denaturation and renaturation of protein.

c) Structure and importance of Glycogen.

d) Ninhydrin reaction.

e) Aromatic amino acids.

f) Amino acid therapy.

SECTION - II

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

a) What is enzyme commission number? Give the six classes of enzyme according to enzyme commission.

b) Explain the characteristics of Genetic code.

c) Discuss the events that take place during the movement of replication fork.

d) Discuss the advantages and disadvantages of enzyme immobilization.

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

a) Give an overview on diseases related to nutritional deficiencies.

b) What is enzyme inhibition? Discuss in detail reversible inhibition.

c) Describe the process of transcription in prokaryotes.

Q6) Answer the following in brief (any four): **[8]**

a) What are coenzymes? Give any one reaction involving NAD/NADH as coenzyme.

b) Give the functions of vitamin D.

c) Post translational modification of protein.

d) DNA polymerases.

e) Structures of nitrogenous bases present in RNA.

f) What is the effect of temperature on enzyme activity?

Total No. of Questions : 3]

P3458

[4823] - 204
M.Sc. - I (Semester - II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
(2013 Pattern) (2.5 Credits)
(Part E) - Organometallic & Inorganic Reaction Mechanism

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

Instructions to the candidates:

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

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

a) Explain the fullevene complexes with suitable examples.

b) State complex trans-pt $(NH_3)_2 Cl_2$ obeys $16^{e\ominus}$ valence shell configuration.

c) What is oxidative addition reactions in coordination compounds? Give suitable example.

d) Define and explain ligand dissociation reaction.

e) Write a short note on linear free energy relationship in co-ordination compounds.

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

a) Explain the role of IR and NMR techniques in characterisation of organometallic compounds.

b) Write a short note on olefin metathesis reaction.

c) Give an account of polymerisation using Zeiglar - Natta catalyst.

d) Predict the products of the following reactions with mechanism.

i) $\left[P+Cl_4\right]^{2-} + \bar{N}o_2 \longrightarrow a \xrightarrow{NH_3} b$.

ii) $\left[Pt\,Cl\left(NH_3\right)_3\right]^{3+} + \bar{N}o_2 \longrightarrow e \xrightarrow{\bar{N}o_2} f$.

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

a) Explain the trans effect with suitable examples.

b) Explain the hydroformylation reaction in organometallic compounds with suitable mechanism.

Total No. of Questions : 3]

P3458

[4823] - 204
M.Sc. - I (Semester - II)
CHA - 290 : General Chemistry - II
(2013 Pattern) (Part - F) (2.5 Credits)

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

Instructions to the candidates:

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

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

a) Define:

i) Probability.

ii) Vector matrix.

b) Give the quotient rule for differentiation.

c) Enlist any two rules about matrix multiplication.

d) Add the following matrices:

$$\begin{bmatrix} 6 & 1 \\ 1 & 3 \end{bmatrix} \quad \begin{bmatrix} 5 & 2 \\ 7 & 1 \end{bmatrix}$$

e) Give the statement of any two probability theorems.

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

a) Give equations and graphical representation for the following with suitable illustrations.

i) Straight lines.

ii) Slope and intercept.

b) Solve the following:

i) $y = \frac{x^3}{6}, \frac{dy}{dx} = ?$

ii) $y = x^{\frac{3}{2}} - 7x^4 + 10e^{-3x} - 5, \frac{dy}{dx} = ?$

c) The following readings were taken on a polari-meter ; 20.25, 20.27, 20.31, 20.22, 20.37, 20.26, 20.21, 20.28. What is the average reading and average error, the mean square error and the most probable error.

d) One hundred colloidal particles a.e. suspended in 2CC of a solution. What is the chance of drawing out 60 particles when 1CC is removed? Out of 1000 trials, how many times can one expect to draw out 45 particles?

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

a) Integrate the following:

i) $\int \frac{x+1}{x-1} dx = ?$

ii) $\int x^3 \sqrt{2x^4 + 5}\, dx = ?$

b) Carry out the following matrix-vector multiplication using Falk's scheme.

i) $A = \begin{pmatrix} 5 & 6 & 2 \\ 3 & 4 & 1 \end{pmatrix} \quad B = \begin{pmatrix} 4 \\ 2 \\ 6 \end{pmatrix}.$

ii) $X = \begin{pmatrix} 9 & 8 & 2 \\ 4 & 5 & 4 \end{pmatrix} \quad Y = \begin{pmatrix} 5 \\ 6 \\ 3 \end{pmatrix}.$

Total No. of Questions : 3]

P3458

[4823] - 204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
(2013 Pattern) (2.5 Credits)
(Part - G) : Pericyclic, Photochemistry and Free Radicals

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

Instructions to the candidates:

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

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

a) Explain Di-Π methane rearrangement with suitable examples.

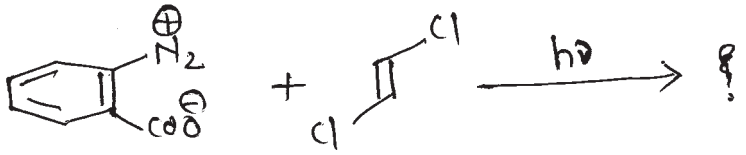
b) Explain various methods of generation of free radicals.

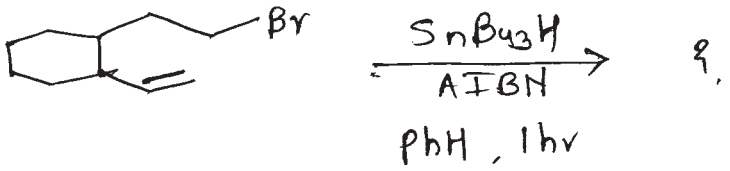
c) Discuss stepwise mechanism of antimarkonikoff's rule with suitable examples.

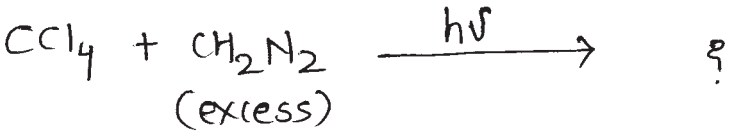
d) Explain all various photochemical reactions undergoes by carbonyl compounds.

Q2) Predict the product for any four of the following: **[8]**

a) 

b) 

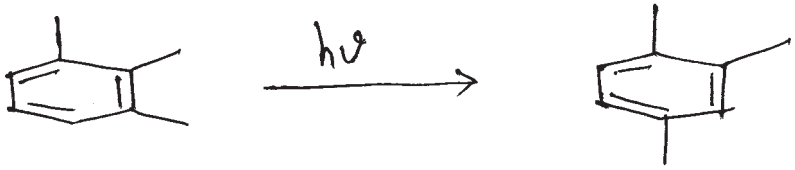
c) 

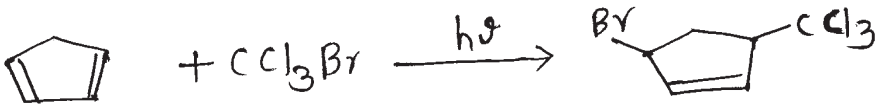
d) 

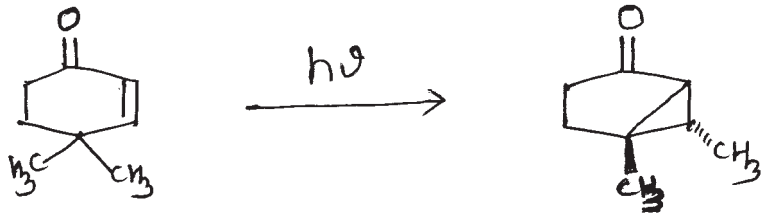
e) 

Q3) a) Draw the correlation diagram for disrotatory conversion of 1, 3-Cyclohexadiene to 1, 3, 5-hexatriene using the conservation of orbital symmetry approach. **[4]**

b) Explain the mechanism for any two of the following: **[4]**

i) 

ii) 

iii) 

Total No. of Questions : 6]

SEAT No. :

P2162

[Total No. of Pages :3

[4823]-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	=	$6.022 \times 10^{23} mol^{-1}$
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} $ergK^{-1}$ 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	=	2.997×10^{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} JT^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) Which of the following are eigen functions of $\frac{d^2}{dx^2}$? Give eigenvalue.

i) sin x and ii) $3e^x$

b) If $\hat{A}$ is linear, show that

$\hat{A}\ (bf + cg) = b\hat{A}f + c\hat{A}g$

where b and c are arbitrary constants and f and g are arbitrary functions.

c) Construct the Hamiltonian operator for H_2^- ion.

d) Define ladder operator and give its properties.

e) State and explain Huckel's 4m +2 rule.

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

a) Derive the expression for the first order correction to the energy of the non-degenerate unperturbed level.

b) Compare perturbation method with the variation method on the basis of principle, precision and convergence.

c) Why is $K_2C_8H_8$ stable but not cyclo-octa-tetraene?

d) Define and explain REPE and its significance in stable and unstable molecules.

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

a) Explain the following:

i) Expansion theorem and

ii) Variation theorem

b) Show that

$$\left[\hat{L}_z, \hat{L}_x\right] = i\hbar\hat{L}_y$$

for a set of angular momentum operators $\hat{L}_x$, $\hat{L}_y$ and $\hat{L}_z$.

SECTION - II

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

a) Define screw and edge dislocations.

b) State the conditions to grow crystal from melts.

c) How does pirani guage measures the pressure of an evolved gas during solid phase decomposition.

d) Define the terms : climb and Jog or kink.

e) Define PEM effect.

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

a) The fast growing faces are eliminated whereas slow growing faces persist in a crystal-prove this statement on the basis of geometrical consideration.

b) Explain the parabolic rate law used to explain the mechanism of gas-solid reactions.

c) Derive the expression

$E_o = \frac{E_c + E_v}{2}$ for an intrinsic semiconductor.

d) State and explain the various methods of electric breakdown in insulators.

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

a) The average energy required to create one Schottky defect in the sample of sodium chloride at 25^oC is 1.971 eV. If the observed interionic ($Na^+ – Cl^–$) distance is 2.82 Å calculate the density of Schottky defects in the NaCl sample.

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

Total No. of Questions : 6]

SEAT No. :

P2163

[Total No. of Pages : 3

[4823]-302

M.Sc.

PHYSICAL CHEMISTRY

CHP - 311 : Nuclear, Radiation and Photochemistry

(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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			=	1.38×10^{-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} $ergK^{-1}$ 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	=	2.997×10^{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} JT^{-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 is the role of H_2SO_4 in Fricke dosimeter? Write the expression for $G_{Fe^{3+}}$.

b) What are prompt and delayed neutrons?

c) Discuss the principle of PIXE technique.

d) What are the applications of semi-empirical mass equation?

e) Give the classification of nuclear reactions.

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

a) Give a comparative account of Nuclear shell model, liquid drop model and collective model.

b) Discuss the theory of semi-conductor detectors and explain the working of surface barrier detector.

c) Explain in brief the terms: Fission energy, fission cross section and thermal neutrons.

d) Write a note on breeder reactor.

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

a) Calculate the energy of following fission reaction.

$^{235}U + n \rightarrow {}^{236}U^{*} \rightarrow {}^{139}Xe + {}^{95}Sn + 2n$

Given mass of $^{235}U = 235.0439$ amu

$n = 1.0087$ amu

$^{236}U = 236.0526$ amu

$^{139}Xe = 138.9187$ amu

$^{95}Sn = 94.919$ amu

b) If the number of uranium atoms fissioning per seconds are 3.12×10^{17}, find the power generated in MW,

Given : energy released per nuclear fission is 200 MeV.

SECTION - II

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

a) Define a chemical reaction. Distinguish between dark reactions and photochemical reactions.

b) State Grotthus - Draper law. Define the term, 'effective light of photochemical change'.

c) Define the terms:

i) Oscillator strength and

ii) the natural radiative life time of the atom or molecule.

d) Give two important characteristics of fluorescence.

e) Define quantum yield. Give the relation between quantum yield and photoluminescent intensity.

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

a) Discuss the theory of fluorescence.

b) What are the types of electronic transitions in organic molecules? Explain Kasha's test for the identification of such transitions.

c) Define actinometry. Enlist the various types of chemical actinometers. Explain uranyl oxalate actinometer.

d) What is meant by quenching and state its importance.

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

a) Derive the Stern-Volmer equation for the kinetics of collisional quenching.

b) On irradiation of propionaldehyde at 30ºC with light (λ=3020 Å), the quantum yield for CO is 0.54. The intensity of the incident light is 15,000 erg/sec. What is the light intensity in Einsteins per second. Find the rate of the formation of CO.

Total No. of Questions :6]

SEAT No. :

P2164

[Total No. of Pages : 3

[4823]-303
M.Sc.
PHYSICAL CHEMISTRY
CHP-312: Physicochemical Methods of Analysis (New)
(Semester-III) (2013 Pattern)

Time : 2 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 indicate full marks.***
4) ***Use of logarithmic table and calculator is allowed.***
5) ***Neat diagrams must be drawn wherever necessary.***

Physico-Chemical Constants

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9.	1 cal		=	4.184×10^{7} erg
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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 the term short-wavelength cutoff. Write Duane-Hunt equation and explain the terms involved in it.

b) What is meant by EXAFS? Give two applications of x-ray absorption.

c) What is the basis for qualitative and quantitative analysis in ESCA technique?

d) Define the terms work function and kinetic energy of electron used in ESCA.

e) Draw a typical DTA curve and show glass transition temperature, crystallisation, melting and oxidation.

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

a) Explain the various factors which affect thermogravimetric analysis.

b) Discuss the applications of DSC technique.

c) Explain spectral splitting and chemical shift observed in ESCA technique.

d) Explain electron microprobe used in electron probe X-ray microanalysis technique with a neat labelled diagram.

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

a) Calculate the mass absorption coefficient for the solution prepared by mixing 11.00g of KI with 89.00g of water.

Given: The mass absorption coefficients for K, I, H and O are 16.7, 39.2, 0.00 and 1.50 cm^2/g respectively.

b) Calculate the wavelength of X-ray photon in picometer that was used to create inner-shell vacancy in Fluorine. Given: B.E. for F = 696 eV, work function of the spectrometer = 4.71 eV and K.E. of the electron =799 V.

SECTION-II

Q4) Attempt precisely the following. **[10]**

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

b) Why is the lowest excited state for most organic molecules a triplet rather than a singlet state?

c) Draw a neat labelled diagram of a typical plasma and show different temperature zones in it.

d) Define singlet state, doublet state and triplet state.

e) Give two differences between normal pulse and differential pulse voltammetry.

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

a) Explain the analysis of gaseous pollutants by chemiluminescence.

b) Draw a neat labelled diagram of a typical ICP spectrometer. Give its working.

c) Enlist the applications of controlled potential coulometry.

d) Discuss the technique of hydrodynamic voltammetry.

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

a) Potassium ferrocyanide (n = 1) has a diffusion coefficient of 6.5×10^{-6} cm^2/s 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 anodic peak current for the oxidation of 1.0 mM solution of potassium ferrocyanide was 32 µA. Estimate the electrode area.

b) Constant current coulometry was used to assay a solution containing Fe^{2+}. To ensure 100% current efficiency, the assay was performed in 0.1M cerium (III) sulphate -sulphuric acid solution. At the end point of titration of 25 ml sample, a controlled current of 6.45 mA had flowed for 3min 40s. Calculate the concentration of Fe^{2+} in the sample.

Total No. of Questions :6]

SEAT No. :

P2165

[Total No. of Pages :3

[4823]-304

M.Sc.

PHYSICAL CHEMISTRY

CHP - 313: Polymer Chemistry

(2013 Pattern) (Semester - III) (Optional Course)

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, 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) Enlist two differences between monomers and polymers.

b) Distinguish between organic and inorganic polymers with examples.

c) State two assumptions of the Flory theory.

d) Define shear thinning and shear thickening.

e) State the stress-strain equation for an elastomer.

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

a) Distinguish between morphology and rheology. Explain glass transition temperature.

b) Explain the Krigbaum theory to deduce $\Delta S, \Delta H$ and ΔG of polymer solutions.

c) Discuss the co-polymer equation.

d) Explain measurement of viscosity by any one method.

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

a) Calculate $\overline{X_n}, \bar{X}_w$ and weight fraction of $\bar{X}_n$-mers where 95% step polymerization is complete.

b) Calculate the viscosity of a polymer at 0.4g/dl concentration .

[Huggin constant = 0.33, k = 1.2×10^{-4}, α=0.72, M = 120000]

SECTION -II

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

a) Define copolymers and homopolymers.

b) Define heteropolymers.

c) Explain briefly glass transition temperature.

d) Distinguish between molding and casting.

e) Define conducting polymers with example.

Q5) Attempt <u>any two</u> of the following: **[10]**

a) Write a note on vulcanization.

b) Explain the membrane osmometry technique to determine molecular weight of polymer.

c) Write a note on re-inforcement.

d) Distinguish between dry spinning and wet spinning.

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

a) Calculate the instantaneous composition of a polymer with monomer reactivity ratio 0.2 and 1.6 respectively for 3 moles vinyl bromide co-polymerizing with 1 mole vinyl acetate.

b) The relative viscosities of polymer having $\bar{M}n = 28000$ in a solvent at 25°C were-

%	0.01	0.02	0.05	0.10	0.25
η_r	1.05	1.11	1.25	1.59	2.70

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Total No. of Questions :6]

SEAT No. :

P2166

[Total No. of Pages :3

[4823]-305

M.Sc.

PHYSICAL CHEMISTRY

CHP - 314: Modern Trends in Physical Chemistry

(2013 Pattern) (Optional) (New) (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 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) Answer the following: **[10]**

a) Define the term phase. Give examples of single phase and two phases.

b) Write the mass balance on sodium and sulphide ions in 0.2 M Na_2S.

c) Write the charge balance for 0.1 M $H_3A_sO_3$.

d) Write the proton condition for $NaHCO_3$.

e) Define the term upper critical solution temperature. Give its example.

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

a) Calculate pH and concentration of all species in 0.1 M H_3PO_4. [Given: $Ka_1 = 5.89 \times 10^{-3}$, $ka_2 = 6.10 \times 10^{-8}$ and $ka_3 = 4.78 \times 10^{-13}$.]

b) Discuss a high boiling azeotrope with a neat labelled diagram.

c) Explain the temperature - composition diagram for hexane and nitrobenzene at one atmosphere.

d) State and explain the lever rule.

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

a) Draw a logarithmic concentration diagram for 0.1 N acetic acid. [Given: $ka = 1.8 \times 10^{-5}$]

b) The pH of 0.2 M solution of oxalic acid is 7.2. Find the concentrations of $H_2C_2O_4$, $HC_2O_4^-$ and $C_2O_4^{2-}$. [Given:ka_1 5.30×10^{-2}, $ka_2 = 5.37 \times 10^{-5}$]

SECTION -II

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

a) Give the principle of electron microscopy.

b) Calculate the wavelength of an electron emitted in a cathode ray tube operating at 10,000v.

c) State the principle of electron beam lithography.

d) Write the various types of interactions between specimen & electron beam in SEM.

e) How does a biosensor work?

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

a) How are rubber like ceramics prepared?

b) Write a note on carbon nanotubes.

c) Describe the secondary electron detector used in SEM.

d) Discuss the metal nanoparticles & their properties.

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

a) Write the applications of nanoparticles in the medical & biological fields.

b) Discuss the treatment of biological specimen used in SEM.

EEE

Total No. of Questions : 4]

SEAT No. :

P2167

[Total No. of Pages : 2

[4823]-306
M.Sc. - II
INORGANIC CHEMISTRY
CHI-326 : Organometallic Chemistry and Homogeneous Catalysis
(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.***

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

a) Give the general features of homogeneous catalysis.

b) Draw the principle coordination modes of CO lig and.

c) Generally Organometallic complexes of late transition metals are used as homogeneous catalysts. Explain.

d) What is oxidative addition reaction?

e) Definec one angle and bite angle.

f) Write a balanced chemical equation for the synthesis of nickel carbonyls from an appropriate cyanide.

g) Discuss chemoselectivity with suitable example.

h) What is Fenton reagent? Mention its advantages.

i) Explain synergic bonding in organometallic compounds.

j) Which of the following Complexes obey $18e^-$ rule.

i) $Ni(Cp)_2$ ii) $Cr(Co)_6$

P.T.O.

Q2) Attempt Any Two of the following: **[10]**

a) Give the systematic classification of 6- bonded transition metal hydrocarbonyls.

b) Explain the Dewar- chatt-Duncanson model for bonding in metal olefin complexes.

c) Discuss Tollman catalytic cycle.

d) Give an account of different types of biphasic systems for oxidation reactions.

Q3) Answer the following:(any two) **[10]**

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

b) Give an account of synthesis, bonding and properties of phosphine complexes.

c) Discuss the catalytic cycle for Heck reaction.

d) Discuss the role of metallocenes in homogeneous catalysis.

Q4) Write notes on (any two) **[10]**

a) Fluxional behaviour of organometallic compounds.

b) Organometallic compounds as electrophiles and nucleophiles.

c) Asymmetric catalysis.

d) Zeigler - Natta polymerisation.

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Total No. of Questions :4]

SEAT No. :

P2168

[Total No. of Pages :3

[4823]-307

M.Sc. II

INORGANIC CHEMISTRY

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

(2013 Pattern) (4-Credit) (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.***
3) ***use of calculator is allowed.***

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

a) Complete the following reaction sequence

$[pt\ cl_y]^{2-} \xrightarrow{NH_3} ? \xrightarrow{C_2H_4} ?$

$[pt\ cl_y]^{2-} \xrightarrow{C_2H_4} ? \xrightarrow{NH_3} ?$

b) Arrange the following complexes according to their increasing order of lability. Justify your answer.

$[Mg\ (H_2O)_n]^{2+}, [Al\ (H_2O)_n]^{3+}, [Na\ (H_2O)_n]^{+}$

c) Give the main types of inorganic reactions.

d) List out the characteristics of Inner sphere electron transfer reactions.

e) Suggest the mechanism for following reaction.

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

f) What do you mean by anation reaction? Give example.

P.T.O.

g) Describe the mechanism for alkylation of coordinated sulphur or nitrogen atom.

h) Find out R.S term symbol for Mn^{3+} and Ni^{2+}.

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

j) Define the terms:

i) Paramagnetism

ii) Curie temperature

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

a) What is acid hydrolysis? Discuss its mechanism and controlling factors.

b) Differentiate between intimate and stoichiometric mechanism.

c) Discuss the various factors that affects on lability of metal complexes.

d) The extent of exchange interaction in the Cu_2O_2 ring system is greater than that in Cr_2O_2 ring system. Explain.

Q3) Attempt <u>any two</u> of the following: **[10]**

a) Discuss the mechanism for the racemisation reaction of trischelate octahedral complexes.

b) Complete the following inner sphere electron transfer reaction which reaction will be max fastor justify your answer.

$[Cr\ (H_2O)_6]^{2+} + [CO\ (NH_3)_5\ H_2O]^{3+} \longrightarrow\ ?\ +\ ?$

$[Cr\ (H_2O)_6]^{2+} + [CO\ (NH_3)_5\ OH]^{2+} \longrightarrow\ ?\ +\ ?$

c) Discuss the electrophilic behaviour of coordinated ligand with suitable example.

d) Explain the experimental magnetic moment of the following ions:

i) Mn^{3+} $\mu expt = \sim 4.9$ BM

ii) CO^{2+} $\mu expt = 4.1 - 5.2$ BM

Q4) Write short notes on (Any two): **[10]**

a) Excited state outer sphere reactions.

b) Methyl migration and CO insertion reactions.

c) Magnetic exchange interactions.

d) Applications of photochemical reactions of coordination compounds.

EEE

Total No. of Questions : 4]

SEAT No. :

P2169

[Total No. of Pages : 2

[4823]-308
M.Sc. - II
INORGANIC CHEMISTRY
CHI - 331 : Physical Methods in Inorganic Chemistry
(2013 Pattern) (Semester - III)

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

Instructions to the candidates:

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

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

a) Define : i) density in unit cell

ii) Bravais lattice

b) What are the differences between DTA and DSC.

c) Define the terms β and A in the following equation: $\Delta E = g\beta H + \frac{1}{4}A$.

d) State Braggs Law.

e) Explain magnetic splitting and isomer shift in Mössbauer spectroscopy.

f) What is meant by isotropic and anisotropic g values.

g) Give criteria for determination of Reversible Electron transfer reaction by CV.

h) Which Mössbauer nuclei will be required to determine the structures of

i) $I_2B_2Cl_4$ ii) $Ge(SnPh_3)_4$

i) Predict the coordination number of NaCl given : radius of $C1^- = 1.81A^o$; $Na^+ = 0.99A^o$.

j) Give four important applications of ESR.

P.T.O.

Q2) Attempt any two: **[10]**

a) Draw the energy level diagram to explain the interaction of nuclear quadrupole moment with the Electric field gradient (EFG) and resultant splitting of degenerate nuclear energy levels. for

i) $I_g = \frac{1}{2};\ I_e = 3/2$

ii) $I_g = 7/2;\ I_e = 5/2$

b) Explain how crystallite size can be determined using XRD.

c) Explain the use of ESR measurements for studying magnetically dilute complexes.

d) Draw and explain the ESR of methyl radical.

Q3) Attempt any two **[10]**

a) Amounts of calcium and magnesium in a mixture are determined by converting them into their oxalates. The mixture of oxalates was heated from 30° to 900°C. Sketch the thermogram and explain the reactions taking place.

b) ESR of $CuCl_2.2H_2O$ shows 4 peaks. Predict the number of peaks expected for$Cu(salicylaldimine)_2$ complex and give reasons for the same.

c) Comment on the following data obtained in an experiment of Mössbauer spectroscopy.

	δ mms^{-1}	ΔE_Q/MHz
I_2Cl_6	3.50 ± 0.1	3060 ± 10
$I_2Br_2Cl_4$	I_A 2.82 ± 0.1	2196 ± 10
	I_B 3.48 ± 0.1	3040 ± 10

d) Discuss the effect of various factors instrumental and experimental on the thermogram of a compound.

Q4) Write notes on (any two) **[10]**

a) Applications of thermal techniques

b) XPS

c) Applications of Mössbauer spectroscopy.

d) Cyclic voltametry

Total No. of Questions :4]

SEAT No. :

P2170

[Total No. of Pages :2

[4823]-309
M.Sc. -II
INORGANIC CHEMISTRY
CHI-332: Bioinorganic and Inorganic Medicinal Chemistry
(2013 Pattern) (Semester-III)

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

Instructions to the candidates:

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

Q1) Answer in brief. **[20]**

a) Give the names and functions of any four zinc proteins.

b) Write any two reactions catalysed by the enzyme Nitrogenase.

c) What is the biological role of vanadium? Which are its stable oxidation states in the body?

d) What do you understand by non-harm iron? Give two important functions.

e) What are oxidases? Give suitable examples.

f) Draw the active site of carbonic anhydrase. Which is the metal present init.

g) What is meant by antagonism? Explain with reference to copper and Molybdenum.

h) What are the differences between blue and non blue proteins? Give suitable examples.

i) Give the role of Histidine, methionine and cystein as legands in metal coordination.

j) Give the biological functions of four Inorganic elements.

P.T.O.

Q2) Answer any two: **[10]**

a) Explain the role of manganese in production of dioxygen.

b) Discuss the role of zinc in transcreption.

c) i) Give the schematic representation of Biological oxidation of L-phenyl alanine to L-epinephrine.

ii) Explain Glucose tolerance factor.

d) Discuss the model compounds of Fe/s proteins. How do they help in understanding the structures of proteins?

Q3) Answer any two: **[10]**

a) What is meant by MRI? Name important MRI contrast reagents and explain their functions.

b) Justify the statement: "Radio-pharmaceuticals have revolutionised the field of medicine".

c) Explain the role of tyrosinase in the oxidation of 1,2-dihydroxy substituted aromatic compounds.

d) Explain the role of Molybdenum model complex in oxygen transfer from dimethylsulphoxide to tri-phenyl phosphine.

Q4) Write notes on (any two) **[10]**

a) High potential Iron sulphur proteins.

b) Radiopharmaceuticals of Gallium, Technitium and Indium.

c) Bone imaging agents.

d) Copper enzymes.

Total No. of Questions :6]

SEAT No. :

P2171

[Total No. of Pages : 3

[4823]-310
M.Sc. -II
ORGANIC CHEMISTRY
CHO-350: Organic Reaction Mechanism
(2013 Pattern -New - 4 Credits) (Semester-III)

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

Instructions to the candidates:

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

SECTION-I

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

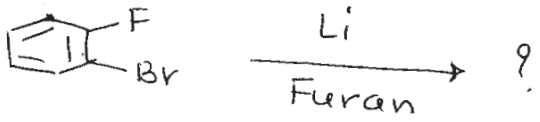
a) Formation of carbenes from tosy hydrazones.

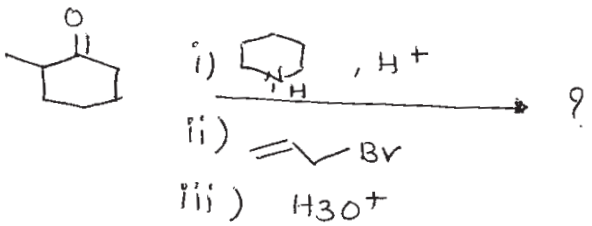
b) Acetylacetone is stronger acid than ethyl acetoacetate.

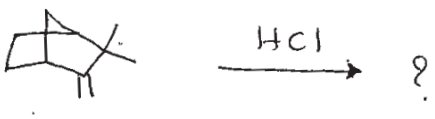
c) Neighbouring group participation by aryl group.

d) When pyrrole is reacted with chloroform in aq.NaOH 2-formyl pyrrole and 3-chloropyridine are formed.

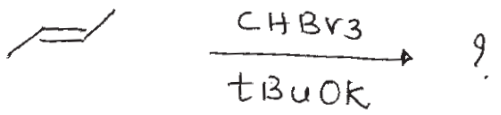
Q2) Predict the products in any four of the following. **[8]**

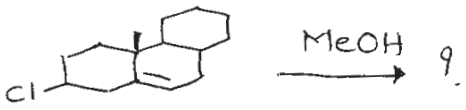
a) 

b) 

c) 

P.T.O.

d) 

e) 

Q3) Write notes on any two of the following. **[8]**

a) Biotransformation of citric acid from oxaloacetic acid.

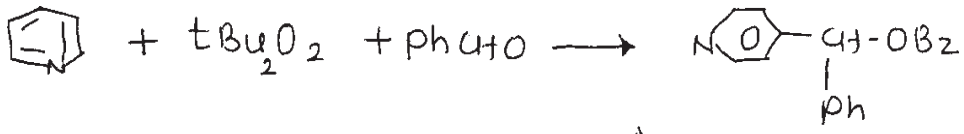
b) Photochemistry of benzene

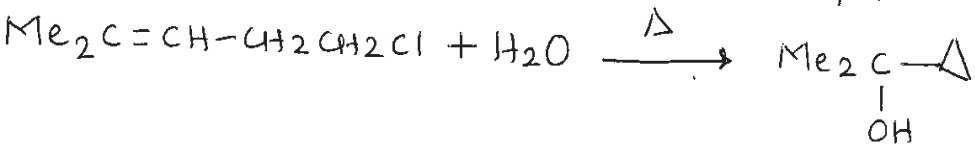
c) Transannular rearrangements

d) Stork Enamine synthesis.

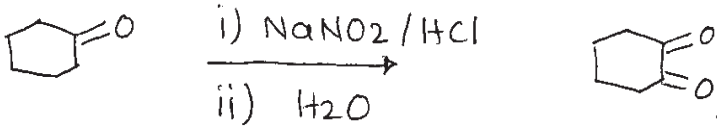
SECTION-II

Q4) Suggest mechanisms for any three of the following. **[9]**

a) 

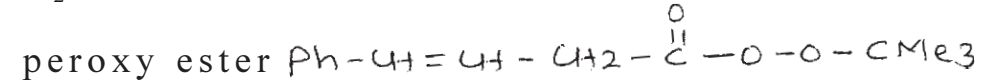
b) 

c) 

d) 

Q5) Answer any four of the following. **[8]**

a) Hydrolysis of phSCH$_2$-CH$_2$-Cl is considerably slower than that of Ets CH$_2$ CH$_2$-Cl. Explain.

b) The peroxy ester 

decomposes about-5000 times as rapidly as t-butyl peroxyacetale. Explain.

c) Acetaldehyde when reacts with large excess of formaldehyde in presence of base forms penta erythritol. Explain.

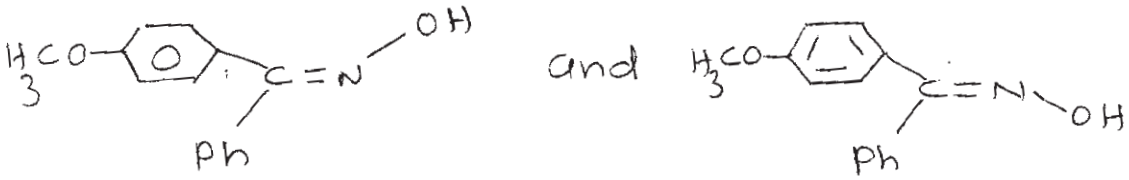
d) Tri (o-tolyl) methane is less acidic than tri(p-tolyl) methane. Explain.

e) Decarboxylation of benzoic acid is not possible merely by heating. Explain.

Q6) Answer any four of the following. **[8]**

a) Predict, which member in the following pair is the stronger acid. Justify your answer.

b) Which member of the following pair will undergo Beckmann rearrangement more readily?



c) Ethyl methyl ketone with benzaldehyde in presence of base and acid gives two different products. Explain.

d) Explain Hunsdiecker reaction with suitable example.

e) Discuss the mechanism of reduction of pyruvic acid by NADH.

Total No. of Questions :6]

SEAT No. :

P2172

[Total No. of Pages :6

[4823]-311

M.Sc. -II

ORGANIC CHEMISTRY

CHO - 351: Spectroscopic Methods in Structure Determination

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

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

Instructions to the candidates:

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

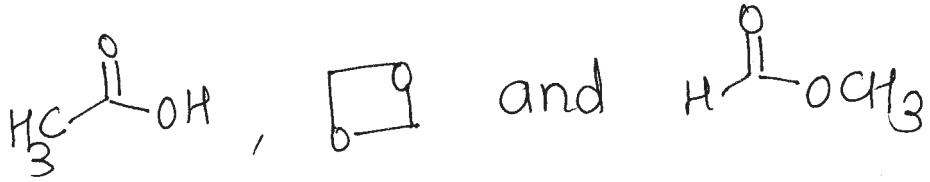
SECTION -I

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

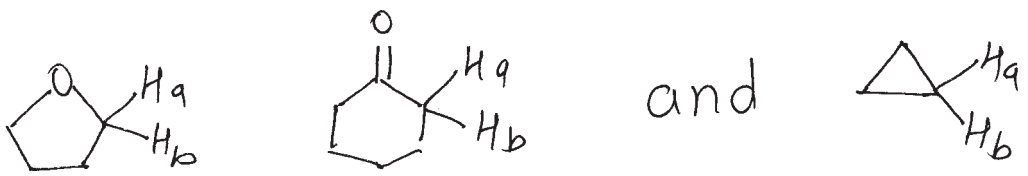
a) A compound $C_{10}H_8$ exhibits two doublets at 7.8 & 7.5δ ppm in ^{1}H-NMR. It exhibits 133.7 (s), 128(d) and 126.6(d) in ^{13}C-NMR. Deduce the probable structure.

b) The MS of a ketone exhibits M+ at 86 and prominent ions at 71, 58, 43; arrive at a probable structure.

c) Distinguish following isomers by ^{13}C-NMR.



d) Arrange the following compounds in increasing order of Jgem. Justify your order.



P.T.O.

e) Distinguish the following pairs by indicated spectroscopic methods.

i)  by ^{13}C-NMR

ii)  by PMR

Q2) Answer <u>any three</u> of the following: **[12]**

a) Deduce the structure of the following compound with the data given. Justify your assignment.

M.F. : $C_5H_{10}O$

CMR : 18, 41,67, 116, 141

DEPT-I : 18, 41, 141 all up and 116 down.

DEPT-II : 41 and 141 up.

b) A compound exhibits the following spectral data. Analyse the data and arrive at a structure consistant with data.

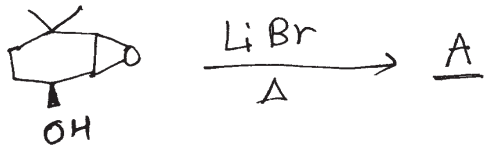
Elemental analysis: C 64.3% H - 8.8%

IR (cm^{-1}): 1720, 1620, 1150

MS (m/2): 114, 99, 86, 69, 41

^{1}H-NMR : 1.3 (t, 7Hz, 3mm); 2.0 (d, J = 7Hz 3mm); 4.2(q, J = 7Hz, 2mm)
5.8(d, 16Hz, 1mm) 6.9(dq, 7 & 16Hz, 1mm)

c) The following reaction gives a compound A,which exhibits the following spectral data.



M.F : $C_8H_{12}O$; IR (cm^{-1}) : 1685, 1618 cm^{-1}.

CMR : 189.2, 153.4, 152, 43, 40, 30, 25

PMR : 1.26 S, 6H; 1.83 t 7Hz, 2H;

2.50 dt, 7 & 2.6Hz, 2H;

6.78 t 2.6Hz 1H;

9.8 S 1H

d) Analyse the following spectral data and arrive at a structure consistant with the data.

MS(m/z) : 130(m+), 115, 100, 73, 43

CMR : 20.8 (s); 75(s); 54(t); 50(q);

33(q); 25(q.str)

PMR : 1.3 (s) 30 mm; 2.2 (s) 15 mm

2.5(s) 10 mm; 3.6 (s) 15 mm

e) $C_8H_{16}O_2$ exhibits the following PMR and CMR signals; along with the COSY and HETCOR data. Analyse the data and arrive at a structure consistant with the data

PMR : 0.78 t, 3H; 0.85 t, 3H; 1.28 sextet 2H;
1.40 quin, 2H; 1.55 sextet; 2H; 2.15 t, 2H; 4.0 t, 2H

CMR : 13, 15, 19, 20, 31, 36, 64, 173.

COSY : 0.78 $\leftrightarrow$ 1.28; 0.85 $\leftrightarrow$ 1.55; 1.28 $\leftrightarrow$ 0.78, 1.4

1.4 $\leftrightarrow$ 4.0, 1.2; 1.55 $\leftrightarrow$ 2.15, 0.85

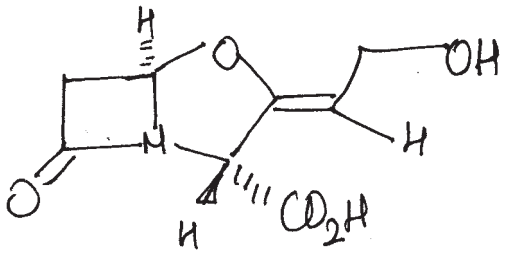
2.15 $\leftrightarrow$ 1.55; 4.0 $\leftrightarrow$ 1.4

HETCOR: 13 $\leftrightarrow$ 0.85; 15 $\leftrightarrow$ 0.78; 19 $\leftrightarrow$ 1.55;

20 $\leftrightarrow$ 1.20; 31 $\leftrightarrow$ 1.4; 36 $\leftrightarrow$ 2.15

64 $\leftrightarrow$ 4.0

Q3) Assign the chemical shifts to the various protons of compound B. Justify your assignments. **[5]**



3.05 d 18 Hz 1H;

3.60 dd 18 & 2.5 Hz 1H;

4.75 d 7.5 Hz 2H;

4.95 bs exch 1H;

5.66 S, 1H

5.78 t 7.5 Hz 1H;

6.0 d, 2.5 Hz 1H;

11.3 S, 1H

Decoupling experiments

a) Irradiation of 6.0 changes 3.6 to a doublet J = 18 Hz

b) NOE : Irradiation of 4.75 increases the intensity of 5.78 by 30%.

SECTION -II

Q4) Write short notes on any three of the following: **[9]**

a) Explain the concept of nuclear Overhausen effect using Solomon's diagram.

b) Important fragmentation patterns in mass spectrum of organic compounds.

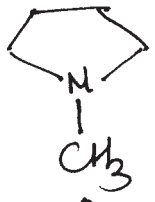
c) Factors affecting vicinal coupling constants.

d) FT- NMR- benefits and applications.

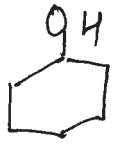
e) Use of 2D NMR in structure determination.

Q5) Answer <u>any four</u> of the following: **[8]**

a) Identify the ions having given M/z values.

i) 

84, 57

ii) 

99, 82 57

b) A carboxylic acid (MF : $C_{10}H_{12}O_2$) exhibits ions at 164 M+), 149(100%), 119, 105, 91, 79, 77. Deduce the structure.

c) Find out the consistant structure with the data given below. Justify your answer.

2- Hexanone m/e - 100(20%), 71 (40%)

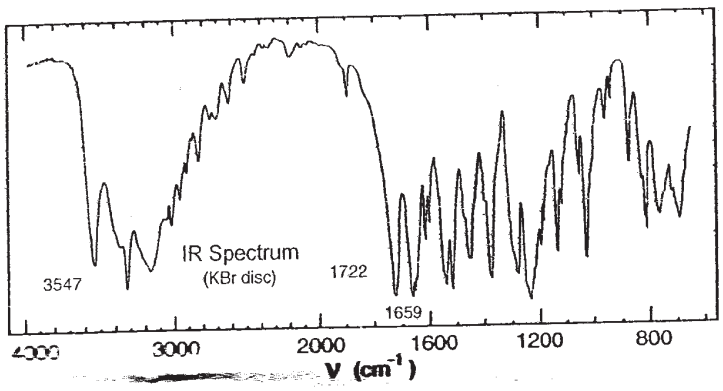
or 57 (62%), 43 (100%)

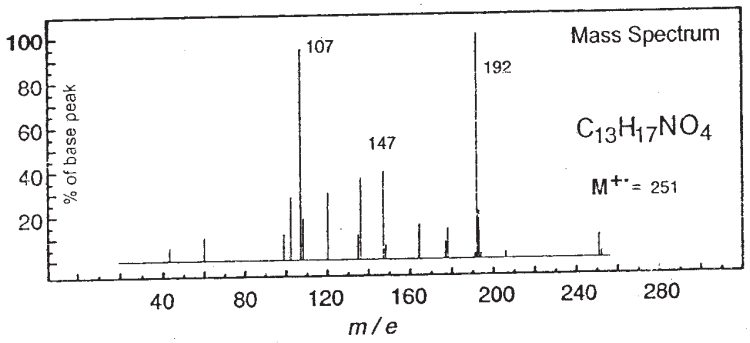
3 - Hexanone 29 (30%)

d) Explain in brief MALDI-TOF and electron spray ionisation.

e) Calculate the intensities for ions at m/e 171, 172, 173, 174 for C_3H_4OC1Br if the relative intensity of the ion at m/e 170 is 50%

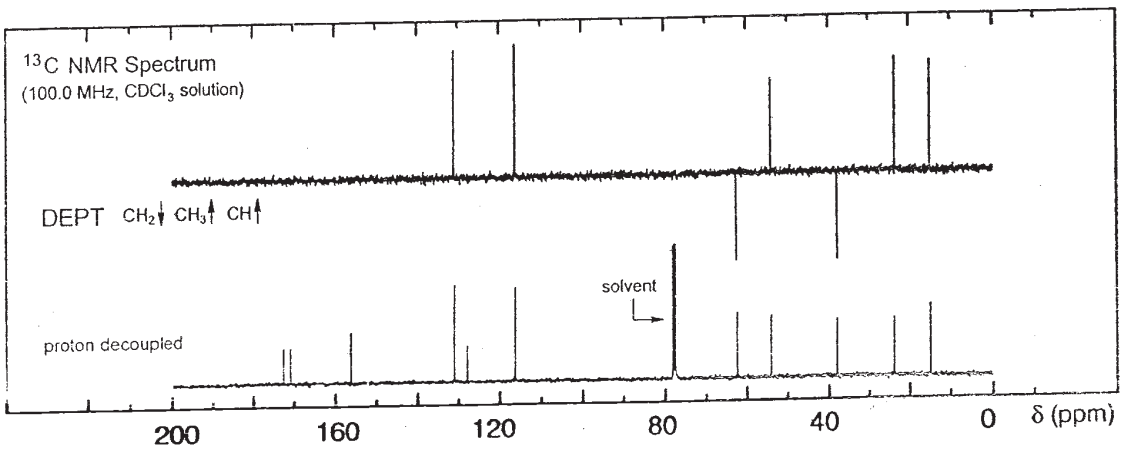
Q6) You are provided the spectra of unknown compound are shown on the adjacent page. Analyse the spectra and arrive at a suitable structure. Justify your structure. **[8]**

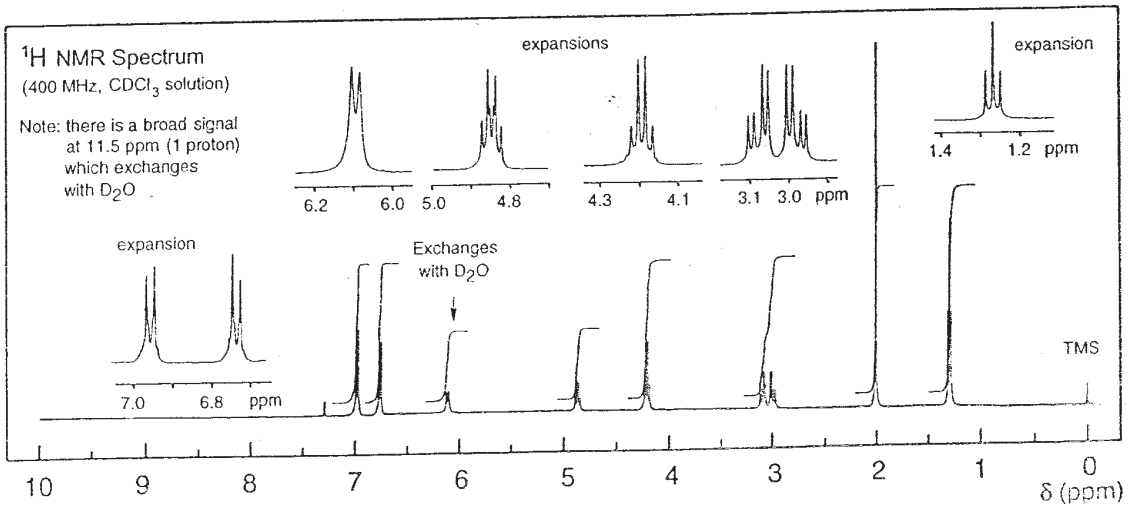




UV Spectrum

$\lambda_{max} \approx 215$ nm ($\log_{10}\varepsilon$ 3 - 4)





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Total No. of Questions : 6]

SEAT No. :

P2173

[Total No. of Pages : 4

[4823]-312
M.Sc.
ORGANIC CHEMISTRY
CHO-352 : Organic Stereochemistry
(2013 Pattern) (Semester-III)

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

Instructions to the candidates:

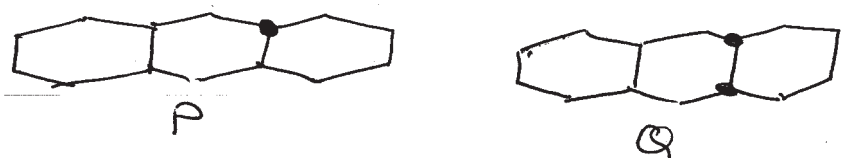
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer book.***

SECTION-I

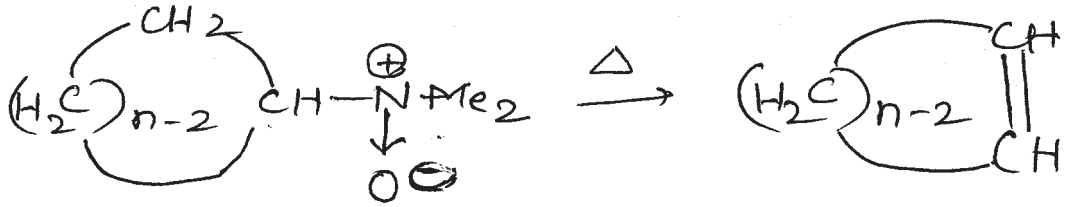
Q1) Answer Any Four of the following: **[8]**

a) Trans-hydrindane is more stable than cis isomer below 466°K, while cis isomer is predominant above 466°K.

b) Draw conformational stereoisomers of compound P and Q. Write the name of each and discuss their stability.



c) Explain the following observation

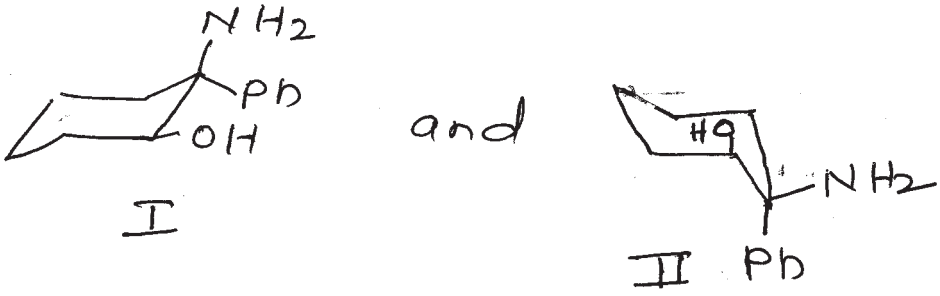


for n = 7, 8 only cis Olefin

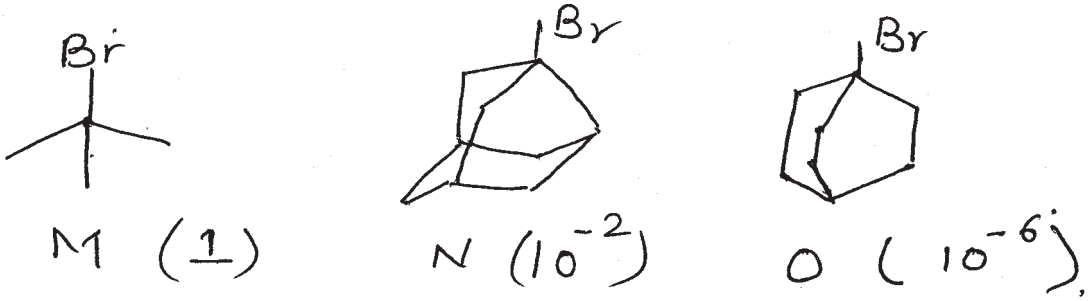
n = 9, 10 only trans Olefin

P.T.O.

d) Which among the following (I & II) is the most stable conformation justify.

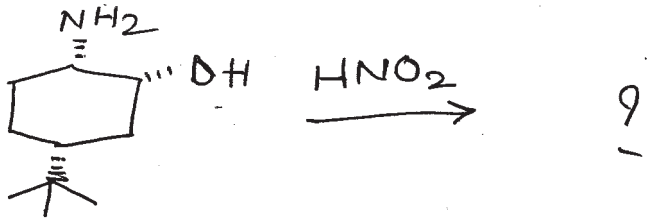


e) Relative rates of solvolysis of compounds M, N and O are as follows. Explain.

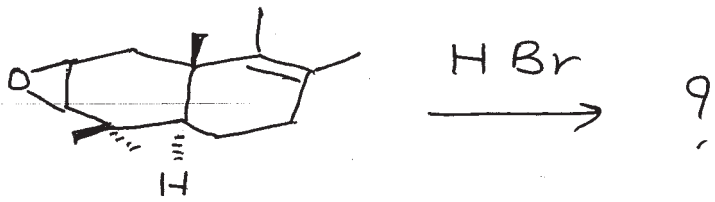


Q2) Predict the product/s in Any Four of the following and explain stereochemical principles involved. Justify. **[8]**

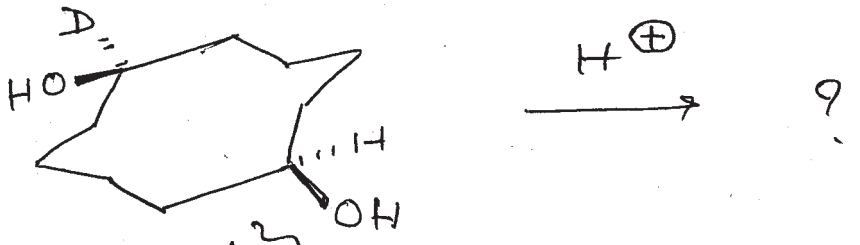
a)



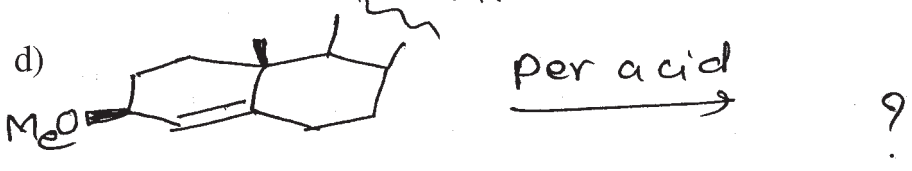
b)

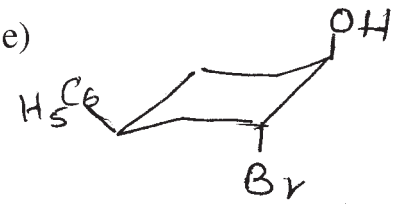


c)

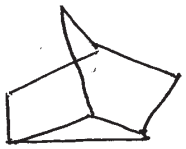


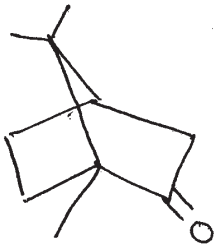
d)

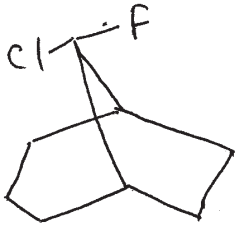


e) 

Q3) a) Write the correct IUPAC names for the following compounds. **[3]**

i) 

ii) 

iii) 

b) Write short notes on <u>Any Two</u> of the following: **[6]**

i) Van Arkel rule.

ii) 3-Alkyl ketone effect.

iii) Pyrrolysis of xanthate esters.

SECTION-II

Q4) Answer <u>Any Three</u> of the following: **[9]**

a) Describe Inoculation method for resolution of (±)-sodium ammonium tartarate.

b) Write applications of cotton effect curves.

c) Trans isomer usually has higher melting point than cis isomer in Olefins.

d) How dipole moment study helps in determination of configuration in Olefins?

Q5) Answer Any Four of the following: **[8]**

a) Explain the term "circular dichroism".

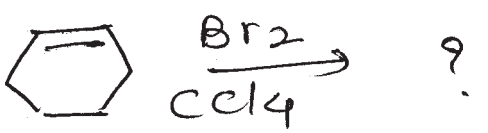
b) Describe the method of resolution by chromatography.

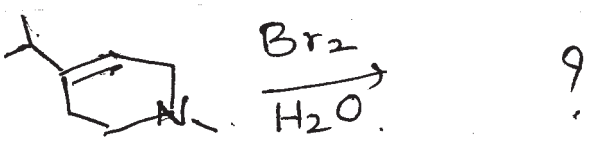
c) Explain the role of tartranilic acid as a resolving agent.

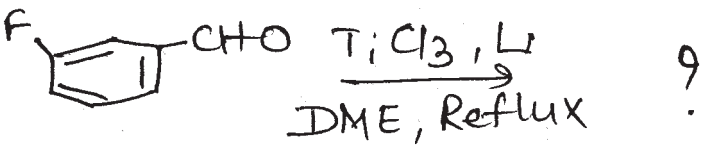
d) Oxidation of maleic acid with OsO_4 gives mesotartaric acid whereas while with fumaric acid dl pair of tartaric acid. Explain.

e) What is the product from the reduction of (2S, 3R) - 2, 3 - dichlorocyclobutanone with $LiAlH_4$ by attack from the Si side?

Q6) a) Predict the product/s in Any Two of the following and explain stereochemical principles involved. Justify. **[4]**

i) 

ii) 

iii) 

b) How would you determine the stereochemistry of this cyclopropane? The NMR spectra of three protons on the ring are given 8H 1.64(1H, dd, J = 6 & 8Hz) 2.07 (1H, dd, J = 6 & 10 Hz) & 2.89 (1H, dd, J = 10 & 8 Hz). **[4]**

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Total No. of Questions : 6]

SEAT No. :

P2174

[Total No. of Pages : 3

[4823]-313
M.Sc. - II
ORGANIC CHEMISTRY
CHO - 353 : Photochemistry, Pericyclic Reactions and Heterocyclic Chemistry
(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) Explain any three of the following: **[9]**

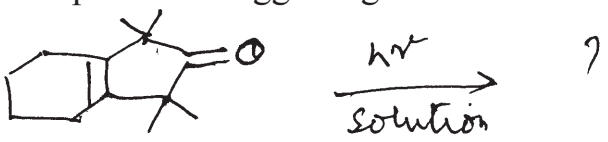
a) Gas phase irradiation of cyclopentanone gives three products.

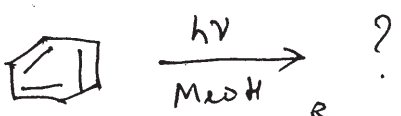
b) Molecular orbitals of heptatrienyl system and comment on their symmetry and C_2 axis of symmetry.

c) 1, 3 - diphenylpropene on photoirradiation forms 1, 2 - diphenyl cyclopropane.

d) With the help of FMO predict whether (2+2) cycloaddition reaction of two ethylenes will be photochemically allowed or not.

Q2) Predict the product/s suggesting suitable mechanism for any two: **[8]**

a) 

b) 

c) 

P.T.O.

Q3) Write Notes on <u>any two</u>: **[8]**

a) Jablonski diagram.

b) Photochemical synthesis of Isocomene.

c) Nazarov cyclisation.

SECTION - II

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

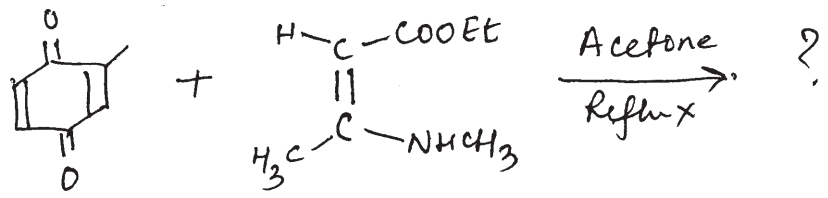
a) Pyrrole-2- carbaldehyde does not respond to Tollen's reagent.

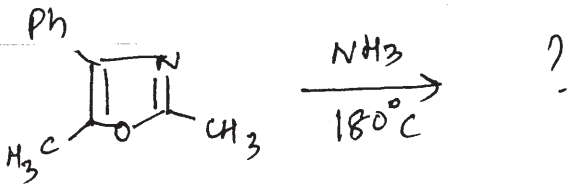
b) The electrophilic attack on Pyrazole is hindered in acidic medium.

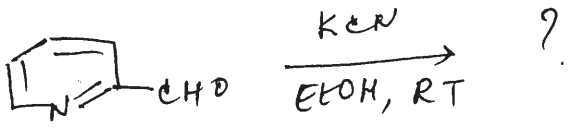
c) Acrotein itself is not used in the skraup synthesis of quinoline.

d) Pyrimidine is weak base (pKa = 1.3) as compared to pyridine (pKa = 5.2) and imdidazole (pKa = 7.2).

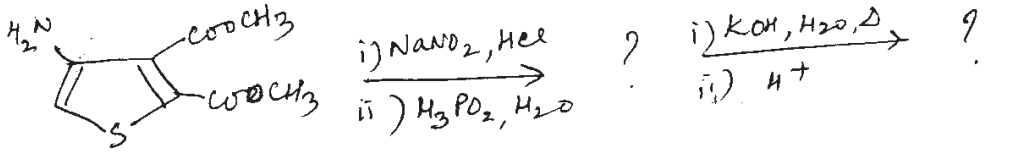
Q5) Predict the product/s suggesting suitable mechanism for <u>any two</u>: **[8]**

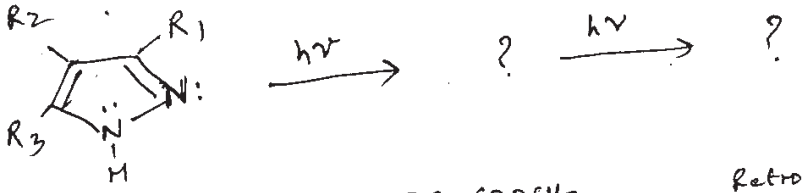
a) 

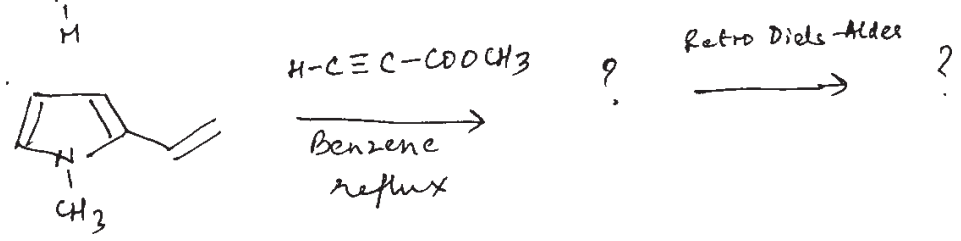
b) 

c) 

Q6) a) Complete the following sequence of reactions for any two: **[4]**

i) 

ii) 

iii) 

b) Write notes on any two: **[4]**

i) The Gabriel synthesis.

ii) The First-Benary synthesis.

iii) The Friadlander synthesis.

Total No. of Questions :6]

SEAT No. :

P2175

[Total No. of Pages :3

[4823]-314

M.Sc. -II

ANALYTICAL CHEMISTRY

CHA - 390: Electro Analytical and Radio Analytical methods of Analysis

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

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

Instructions to the candidates:

1) ***Answers to the two sections should be writtem 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) Enlist the criteria for reversibility in a electrochemical reaction.

b) State any two applications of amperometry.

c) State and explain Faraday first law of electrolysis.

d) Sketch and label oxygen sensor.

e) Differentiate between polarography and pulse polarography.

Q2) Attempt any two: **[10]**

a) Explain the construction and working of rotating ring electrode.

b) Explain the application of amperometry as a sensor.

P.T.O.

c) Sketch and explain the cyclic voltammogram of $K_3[Fe(CN)_6]$.

d) An electroactive species yielded a wave with a limiting current of 15.2 μA at a rotating disk electrode which was rotated at 10 r/s. What limiting current would be expected at 30 r/s.

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

a) Explain the construction and working of amperostatic coulometry.

b) Nicotinamide adenine dinucleotide (NAD^+) can be coulometrically assayed at a constant potential by reduction to the dimer $(NAD)_2$. If the area under the current time curves for the reduction of 15 ml aqueous solution of NAD^+ is 54.3 mA min. Calculate the concentration of NAD^+ in the sample.

SECTION -II

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

a) What is the principle of neutron activation analysis?

b) Explain the principle of inverse isotope dilution analysis.

c) State applications of radiometric titration.

d) State and explain the principle of thermogravimetry.

e) Give the different applications of DSC techniques.

Q5) Attempt any <u>two</u> of the following: **[10]**

a) Describe the comparator method used in NAA.

b) Write a critical note on thermometric titrations.

c) Draw a block diagram of DSC and explain each component in brief.

d) 1 gm of an alloy containing 0.12% Mn was irradiated in a neutron flux of 10^8 n.cm^{-2}. sec^{-1} for 3.0 hours. Find the activity of a sample at the end of irradiation in dpm. (Given: Isotopic abundance for Mn = 100%, capture cross section = 13.3 barn, t 1/2 (Mn^{56}) = 2.58 hrs.)

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

a) What are the applications of isotope dilution analysis.

b) Calculate the percentage of $MgCO_3$ and $CACO_3$ in 65 mg of limestone sample that exhibits thermogram showing weight of 56 mg at 500^{o}C and 36 mg at 900^{o}C.

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

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Total No. of Questions :6]

SEAT No. :

P2176

[Total No. of Pages : 2

[4823]-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) Define personal error. Explain with suitable example.

b) What is sterilization by ionizing radiation?

c) What is ash value?

d) What is assay design?

e) What is stability of drugs?

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

a) Explain disintegration tests for tablets and capsules.

b) Discuss in detail the cylinder and cup plate method for microbial assay.

c) Discuss in detail the determination of amylase activity in biological assay.

d) What is test for undue toxicity? Explain in detail.

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

a) Discuss the following:

i) Sterilization by heating with bacteriacides.

ii) Sterilization using gas.

b) How self life of drug is determined?

P.T.O.

SECTION-II

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

a) Give advantages of emulsions.

b) What are parentals?

c) Define cross contamination.

d) What are suspensions? Give it's types.

e) What are gel and magma?

Q5) Attempt <u>any two</u> of the following: **[10]**

a) Dissuss inadequate storage conditions and their effects on product.

b) Give determination of acid insoluble ash in vegetable drugs.

c) Define aerosols. Explain quality control test for aerosols.

d) 1.3g salicylic acid [$C_{10}H_8O$] sample was dissolved in 10ml of ethanol, to this 50ml 0.5M NaOH solution was added and solution was boiled for 15 minutes. After coding the excess of alkali was titrated with 0.5M HCl solution using phenol red indicator. The burette reading was 22.1 ml. The blank titration burette reading was 40 ml. Determine percentage of salicyclic acid in the sample.

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

a) What are solutions in pharmaceutical preparations? Explain aqueous type of solutions in detail.

b) 0.40 g adrenaline [$C_9H_{13}O_3N$] sample was dissolved in 50 ml glacial acetic acid solution. It was titrated with 0.1N acetous perchloric acid using 2 drops of crystal violet indicator. The burette reading was 14.5 ml. Determine percentage of adrenalin in the sample.
[At. wt C=12, H = 1, O=16, N=7]

Total No. of Questions : 6]

SEAT No. :

P2177

[Total No. of Pages : 3

[4823]-316
M.Sc.-II
ANALYTICAL CHEMISTRY
CHA-392 : Advanced Analytical Techniques
(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 questions: **[10]**

a) In a reversed phase HPLC in which phase the target organic compound is isolated?

b) What are advantages and limitation of SPE disk?

c) What are the five key stages of SPE?

d) What are the two functions of the SPME holder?

e) What are the components of microwave system?

Q2) Attempt Any Two of the following: **[10]**

a) Explain theory of liquid-liquid extraction.

b) Discuss types of SPE media.

c) Describe automation and online SPE with diagram.

d) Draw schematic diagram of SFE and explain its essential components.

P.T.O.

Q3) Attempt Any One at the following: **[5]**

a) Give the theortical considerations of SPME.

b) Draw a schematic diagram of microwave assisted extraction device & explain its essential components.

SECTION-II

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

a) Explain the role of electrical discharge in atomic emmisive spectrometry.

b) Explain the term counter electrode.

c) Explain the effect of temperature on FES.

d) What are limitations of the flame emission spectroscopy.

e) Explain the interferences occuring in atomic fluorescence spectrometry.

Q5) Answer Any Two of the following: **[10]**

a) Mention importance of micronutrients for the growth of plants. Describe suitable method for determination of boron from soil.

b) Describe inductively coupled argon plasma spectrometry with suitable diagram.

c) Explain different components involved in mass spectrometer.

d) Explain applications of atomic absorbance spectroscopy with suitable example.

Q6) Solve Any One of the following: **[5]**

a) Calcium was assayed by FES. Enough strontium was added to each standard solution of calcium and to the analyte to make each solution contain 2.50 µg/ml. After aspiration of each solution into the flame the emitted intensity of the calcium line was measured at 422.7 nm and of the strontium line at 460.7 nm. Determine the concentration of calcium in the sample.

Concentration of calcium (µg/ml)		2.00	4.00	6.00	8.00	10.00	sample
Relative intensities	460.7 nm	18.5	21.7	15.3	19.2	21.4	16.2
	422.7 nm	13.3	34.7	40.1	65.2	92.1	33.2

b) The mass spectrum of nitrogen produced air is characterized by the presence of peaks of isotopic forms of nitrogen ^{14}N ^{14}N and ^{14}N ^{15}N to 544 and 4 mm respectively. What is the percentage of nitrogen (^{15}N) in the sample?

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Total No. of Questions : 9]

SEAT No. :

P2178

[Total No. of Pages : 3

[4823]-317
M.Sc. - II
ANALYTICAL CHEMISTRY
CHA - 380 : I - Analytical Method Development and Validation
II - Geochemical and Alloy Analysis
III - Laboratory Automation and Sensor Based 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 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 is inter-laboratory qualification process?

b) Define, selectivity and specificity.

c) State the statistical formulae to estimate the linear regression coefficient and explain the terms involved in it.

d) Explain the terms: accuracy and precision.

e) Give the Noyes-Whitney equation with it's significance.

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

a) Discuss the important guidelines of analytical method validation as per ICH.

b) Explain, dissolution test of drug substances.

c) Define systematic error. How to reduce the systematic error?

P.T.O.

d) Determine the relation ship between response (S_{mean}) and concentration (C_s) by linear regression method from the following data:

Concentration of standard (C_s) (mglh)	0.00	0.10	0.20	0.30	0.40	0.50
Response value (S_{mean})	0.00	12.36	24.83	35.91	48.79	60.42

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

a) Explain, with a schematic diagram of USP apparatus-3 used in the dissolution study.

b) The blood sample was analysed for calcium by atomic absorption spectroscopic method. Eight analysis of same blood sample gave the following results (mg dl) :8.9, 10.3, 9.4, 11.7, 9.4, 11.9, 11.4and 10.9. Determine whether 8.9 mg\dl value is rejected or retained.

[Given: Q critical = 0.524]

SECTION-II

Geochemical and alloy analysis

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

a) What is an alloy? Give two examples.

b) How is silica determined from pyrolusite ore?

c) What is soil fertility?

d) Name the constituents present in dolomite and haematite ore?

e) What is cation exchange capacity of soil?

Q5) Attempt <u>any two</u> of the following: **[10]**

a) Discuss a method for determination of phosphorous from soil.

b) Outline the analytical procedure used for estimation of chromium from steel.

c) Describe a method to estimate calcium from dolomite ore.

d) 0.485 gm of soil was analysed for nitrogen content by Kjeldahl's method. The evolved ammonia was absorbed in 55 ml of 0.15 NHCl. the remaining acid when back titrated with 0.15 N NaOH gave the burette reading of 16.4ml. Calculate the percentage of nitrogen in the given sample of soil.

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

a) Outline analytical procedure for estimation of aluminium from bauxite ore.

b) A sample of ilmenite ore weighing 0.952 g was disintegrated using con $H2So_4$ and diluted to 250ml. 100ml aliquot from the filtrate was used to precipitate titanium as eupferron complex. The Ti-cupterron complex was ignited and weight of TiO_2 was found to be 0.289 gm. Calculate the percentage of TiO_2 in the given sample. [Given At mass gma^{-1} Ti=47.86,O=15.99]

SECTION-III

Q7) Answer the following: **[10]**

a) What is control loop? Give their types.

b) What is silicon and glass micromatching?

c) List the different types of mass sensors.

d) What is biosensor?

e) State the four criteria for sensors.

Q8) Attempt <u>any two</u> of the following: **[10]**

a) Sketch the cylindrical robot and explain its essential components.

b) Discuss in detail colorimetric sensor.

c) Draw a diagram of automated laboratory analyzer and explain it's essential components.

d) Expalin the continuous flow analyzer in detail.

Q9) Attempt <u>any one</u> of the following: **[10]**

a) Explain in detail centrifugal force analyzer.

b) Write a note on potentiometric sensors.

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Total No. of Questions : 6]

SEAT No. :

P2179

[Total No. of Pages : 4

[4823]-401

M.Sc.

PHYSICAL CHEMISTRY

CHP-410 : Molecular Structure and Spectroscopy (New)

(2013 Pattern) (Semester-IV)

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 tables/calculator is allowed.***

Physico - Chemical Constants

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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) State the Larmor equation and terms therein in nmr spectra.

b) Explain the factors affecting width of esr spectra.

c) Discuss the application of nmr in medical diagnostics.

d) Compare transverse and longitudinal relaxation times in nmr spectroscopy.

e) State advantages of ^{13}C nmr over PMR spectroscopy.

Q2) Attempt Any Two of the following: **[10]**

a) Discuss the application of the Mc Connell equation to predict the number of unpaired electrons in a species.

b) Explain the factors associated with magic angle spinning in nmr.

c) Explain NOE. What is spin pumping?

d) Discuss solid state nmr spectra.

Q3) Attempt Any One of the following: **[5]**

a) Calculate the magnetic field required to bring a proton at resonance in a 500 MHz instrument. [nuclear magnetogyric ratio = $2.675^2 \times 10^8\ T^{-1}\ s^{-1}$]

b) Sketch and explain the esr spectrum of the benzene radical.

SECTION-II

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

a) Explain the principle of X-ray diffraction.

b) What is electron diffraction?

c) Which are the different components of a neutron spectrometer?

d) Define the terms: Paramagnetism and diamagnetism.

e) Write Van-Vleck's general equation for magnetic susceptibility and explain the terms therein.

Q5) Attempt Any Two of the following: **[10]**

a) Explain the important applications of electron diffraction.

b) Distinguish between ferro and antiferromagnetism with suitable examples.

c) Describe the measurement technique of neutron diffraction with a suitable diagram.

d) Derive Langevin equation for magnetic susceptibility.

Q6) Solve Any One of the following: **[5]**

a) XRD studies of NaCl crystals gave the unit cell dimensions as 564 Pm. Find the number of atoms in the unit cell.

Given: density of NaCl = 2.165 g Cm^{-3}

Atomic Wt. of Na = 23, Cl = 35.5

b) Using Pascal constants and appropriate constitutive corrections given below, calculate the molar susceptibilities of phenantroline ($C_{12}H_8N_2$)

χ_A in cgs unit: C = -6.0×10^{-6}

H = -2.93×10^{-6}

ring N = -4.61×10^{-6}

constitutive corrections:

C (shared by two rings) = -3.07×10^{-6}

C (in one ring) = -0.24×10^{-6}

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Total No. of Questions :6]

SEAT No. :

P2180

[Total No. of Pages : 3

[4823]-402
M.Sc.
PHYSICAL CHEMISTRY
CHP:-411 Surface Chemistry and Electrochemistry
(2013 Pattern) (New) (Semester-IV)

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 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}
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			=	6.626×10^{-34} Js
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} 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	=	2.997×10^{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) Answer precisely the following: **[10]**

a) What is surface excess? Give its equation.

b) State the characteristics of a gaseous molecular film.

c) Define isosteric heat of adsorption. Give its equation.

d) Write a linear form of BET equation and explain the terms involved in it.

e) Explain the adsorption behaviour of porous materials.

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

a) Discuss the role of micelles in detergent action.

b) Describe the gravimetric method for measurment of adsorption.

c) Give comparison between B.E.T and H-J equation.

d) What is hystereris of adsorption? How has it been explained on the basis of zsigmondy's theory?

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

a) A fatty acid forms a surface film on water that obeys the two-dimensional perfect gas law. If the lowering of the surface tension is 10×10^{-3} Nm^{-1} at 25ºC, what is the surface excess concentration, Γ, and the surface area per adsorbed molecule?

b) A certain solid sample adsorbs 0.63 mg of CO when the pressure of the gas is 36.0 kPa and the temperature is 300 K.The mass of gas adsorbed when the pressure is 4.0 kPa and the temperature is 300K is 0.21 mg. The Langmuir isotherm is known to describe the adsorption. Find the fractional coverage of the surface at the two pressures.

SECTION-II

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

a) Draw a neat labelled structure of water when an ion present in it.

b) State the postulates of Debye-Huckel theory.

c) Define the terms inner potential and outer potential.

d) What is kolbe electrolysis?

e) Define corrosion current and corrosion potential.

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

a) Describe the working of Pb-acid accumulator.

b) Explain Helmholtz theory of double-layer structure at the metal-solution interface.

c) Explain the various methods for preventing corrosion.

d) Derive the Einstein equation relating diffusion coefficient and mobility of ion.

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

a) Consider the oxidation reaction $Fe \rightarrow Fe^{2+} + 2e^{-}$. If the overpotential of 0.1 V is applied to the anode, assuming $\beta = \frac{1}{2}$ and t = 25°C. Calculate i/i_0

b) Calculate the ionic strength of the following solutions.

i) 150 ml 0.01 M $CuSO_4$ + 150 ml 0.1 M NH_4OH

ii) 100 ml 0.02 M H_3PO_4 + 200 ml 0.1 M KCl.

Total No. of Questions : 6]

SEAT No. :

P2181

[Total No. of Pages : 3

[4823]-403

M.Sc.

PHYSICAL CHEMISTRY

CHP - 412 : Materials Chemistry and Catalysis

(Semester - IV) (2013 Pattern) (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

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3.	Planck Constant	h	=	6.626×10^{-27} erg s
			=	6.626×10^{-34} JS
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} $ergK^{-1}$ 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	=	2.997×10^{10} cm s^{-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) Attempt the following: **[10]**

a) What is positive photolithography?

b) Define 'rectifier'. Give its types.

c) What is anisotropy?

d) State two applications of hi-tech solids.

e) How are defects in perovskites formed?

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

a) Define specific heat capacity. Give its significance and units.

b) What are optical photon modes in solids?

c) Explain pairing and multigap structure in hitech materials.

d) Explain sol-gel method to prepare thin films.

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

a) Explain the p-n-p transistor. What is the effect of temperature on its functioning?

b) How are Langmuir - Blodgett films prepared?

SECTION - II

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

a) State the principle of calcination method in catalyst activation.

b) Define 'site' and 'support'.

c) What are zeolites? Give an example.

d) Define 'catalyst deactivation'.

e) Write the principles of green chemistry.

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

a) Describe the FTIR method to determine solid particle size.

b) Discuss the hydrothermal method of preparation of a catalyst.

c) How is the surface area of a powdered solid measured?

d) How are organic pollutants degraded using photocatalysts?

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

a) Explain the AES technique used to determine particle size.

b) How is ozone produced in the environment? Explain its attenuation by a catalyst.

Total No. of Questions : 6]

SEAT No. :

P2182

[Total No. of Pages : 3

[4823]-404

M.Sc.

PHYSICAL CHEMISTRY

CHP - 413 : Biophysical Chemistry

(New) (2013 Pattern) (Semester - IV) (Optional Course)

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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4.	Electronic Charge	e	=	4.803×10^{-10} esu
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5.	1 eV		=	23.06 k cal mol^{-1}
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			=	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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9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
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11.	Bohr magneton	β_e	=	-9.274×10^{-24} J T^{-1}
12.	Nuclear magneton	β_n	=	5.051×10^{-27} JT^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) Compare the amounts of ATP consumed per minute by a human at rest and in strenuous activity. Give justification for the values.

b) State the functions of histones.

c) Explain the importance of mitochondria in cytology.

d) State and explain Bragg's law of XRD analysis.

e) Explain the significance of the protein ferritin in metabolism.

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

a) Discuss the technique of gel electrophoresis.

b) Write a note on protein folding.

c) Discuss the high energy phosphate bond linkage in the ATP molecule.

d) The values of diffraction angles for three faces of NaCl were found to be 5.9º, 8.4º and 5.2º respectively, from XRD analysis. Determine the unit cell type of NaCl.

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

a) Discuss the strategies adopted in studying biophysical chemistry.

b) Explain the tests for proteins.

SECTION - II

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

a) What are the characteristics of Fluid Mosaic model of a cell membrane?

b) Explain the role of Na^+/K^+ pump in conduction of stimulus.

c) What are fibrous and globular proteins? Give one example of each type.

d) State the functions of enzyme.

e) What is the principle of circular dichroism?

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

a) Describe the lamellar model for the structure of cell membrane.

b) Discuss the thermodynamics of ion-transport through the cell membrane.

c) Derive the Michaelis-Menten equation for the enzyme catalyzed chemical reactions.

d) Write a note on optical rotatory spectroscopy.

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

a) A polymer sample has the following distribution of molecular weight:

Fraction	0.15	0.20	0.40	0.15	0.10
Mol.Wt.	20000	35000	55000	70000	80000

Calculate $\bar{M}_n$ and $\bar{M}_w$.

b) Fractions of a biopolymer, when dissolved in an organic solvent gave the following intrinsic viscosities at 25°C:

$M(g\ mole^{-1})$	34000	61000	1,30,000
$[\eta]$	1.02	1.60	2.75

Determine K and α in Mark-Howoink equation for this system.

Total No. of Questions : 6]

SEAT No. :

P2183

[Total No. of Pages : 3

[4823]-405

M.Sc.

PHYSICAL CHEMISTRY

CHP - 414 : Special Topics in Nuclear and Radiation Chemistry

(Semester - IV) (New) (2013 Pattern) (Optional Course)

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	=	1.38×10^{-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} $ergK^{-1}$ 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	=	2.997×10^{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} JT^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) Give an account on thermonuclear reactions.

b) Explain the terms hot atom and recoil atom.

c) Enlist the various man made sources of radiations.

d) What is a difference between somatic and genetic effects of radiation?

e) Give an examples of radionuclides used as radiopharmaceutical tracers with their uses, in specific diagnosis.

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

a) Explain the construction and working of Van-de Graaff accelerator.

b) Explain the various stages of interactions of radiations with biological cells.

c) Discuss how compound nucleus theory is verified experimentally.

d) Explain the In-Vivo diagnostic procedures of radiopharmaceutical.

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

a) If the linear mass absorption coefficient of Pb is 0.57 cm^{-1}, what thickness of lead is required to reduce the activity from 10000 cpm to 6000 cpm.

b) A classified radiation worker is permitted to receive dose upto 2 rem/yr. How many hours of each week can be spend in an area having an average dose rate of 4 mrem/hr?

SECTION - II

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

a) What are the various categories of radioactive waste defined by AERB, India.

b) Why are aromatic hydrocarbons resistant to radiolysis.

c) Define chain reaction and addition chain reaction.

d) Explain in brief the C-N-O bicycle with a neat labelled diagram.

e) State the principle of radiometric titration.

Q5) Answer <u>any two</u> of the following: **[10]**

a) Discuss the radiometric titration based on absorption of β-particles. What are its advantages?

b) Write a note on Supernovae.

c) Explain the procedure for the disposal of high level waste.

d) What are the chemical reactions during radiolysis of methanol.

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

a) 10 cm^3 of zinc ions labeled with ^{65}Zn were titrated with 0.001 M dithiozone. Addition of 1 cm^3 of the titrant followed by the extraction of complex in an organic solvent showed a decrease in activity of 9800 count per 5 minutes to 4700 counts per 5 minutes. Calculate the concentration of zinc ions in terms of molarity.

b) What is meant by non-homogeneous kinetics? Explain Sworski and Schwarz theory for the yield of molecular products and solute concentration.

Total No. of Questions : 4]

SEAT No. :

P2184

[Total No. of Pages : 2

[4823]-406
M.Sc.-II
INORGANIC CHEMISTRY
CHI-430 : Inorganic Polymers and 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 calculate is allowed.***

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

a) What do you understand by monolayer and multilayer adsorption.

b) How do promoters affects the performanceo facatalyst? Explain with suitable example.

c) Give the classification of heterogeneous catalysts.

d) Differentiate between physisorption and chemisorption.

e) Discuss the incipient wetness method of preperation of heterogeneous catalyst.

f) What are intercalation compounds? Give examples.

g) What are the raw materials required for zeolite synthesis?

h) Which are the structural binding units of zeolites?

i) What is the role of organic additives in zeolite synthesis?

j) Which properties of heteropolyacids make them useful in catalysis?

P.T.O.

Q2) Attempt Any Two of the following: **[10]**

a) What are the different types of reactors? Mention their merits and demerits.

b) Give an account of various post treatments given to the supported metal catalysts.

c) How are zeolites charecterised? Explain their characterisation by XRD.

d) Discuss the use of zeolites as hydrocracking and isomerisation catalyst.

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

a) Discuss the Bonding in S-N compounds.

b) What are molecularsieves? Discuss their classification.

c) Give the importance of temperature programmed techniques in characterisation of heterogeneous catalysts.

d) Discuss in brief the role of Bismuth in catalysis.

Q4) Answer Any Two of the following: **[10]**

a) Explain the catalytic hydrogenation of alkenes. Which is the best suited metal as a catalyst for this reaction.

b) Write note on supported transition metal complex as a catalyst.

c) Discuss the hydrothermal synthesis of zeolites and how ratio of Si/Al affects on the properties of zeolites.

d) What are inorganic polymers? Give their classification synthesis and applications.

●●●●●

Total No. of Questions : 4]

SEAT No. :

P2185

[Total No. of Pages : 2

[4823]-407
M.Sc. (Part-II)
INORGANIC CHEMISTRY
CHI-431: Material Science-I
Inorganic Solid State Materials
(2013 Pattern) (Semester-IV)

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

Instructions:

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

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

a) Derive the expression $\vec{J} = -D\left(\frac{d\bar{c}}{dx}\right)$

b) Distinguish between hard & soft ferrites.

c) What is the effect of temp. on ferromagnetic & antiferromagnetic materials?

d) What is high temp. Superconductivity? Give two examples of such materials.

e) Give the synthesis of fullerene.

f) List the different steps involved in sol-gel process.

g) What are bioactive composites?

h) Explain cardiovascular applications of biomaterials.

i) Explain macrodefect free cement.

j) A piece of wood containing moisture weighed 105-3 gm & after over drying showed constant weight of 92.3 gms. Calculate the percentage moisture in it.

P.T.O.

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

a) With the help of suitable diagrams explain normal, inverse & Random spinels.

b) What is BCS theory? Explain its applications.

c) Write an account on bioactive glasses ceramics.

d) What is diffusion? Explain mechanism of diffusion.

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

a) Describe the different types of magnetic substances and give their properties.

b) What do you understand by fibre-reinforced plastics?

c) What are biomaterials? How they are classified?

d) Draw HCP, FCC & BCC structures of solids & calculate number of atoms per unit cell in each.

Q4) Write short notes (any two). **[10]**

a) Applications of superconductors.

b) Oxide & carbide ceramics.

c) Cement making process.

Total No. of Questions : 4]

SEAT No. :

P2186

[Total No. of Pages : 2

[4823]-408
M.Sc. - II
INORGANIC CHEMISTRY
CHI - 432 : Material Science - II : Nanomaterials
(2013 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

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

a) Define Cathod luminiscence.

b) List the Factors affecting resolution in SEM.

c) What is meant by nanodots and nanowire?

d) Explain the process of Fluorescence.

e) List the applications of metal oxide nano particles.

f) Name the precursors, solvents and surfactants used for synthesis of zinc oxide nano particles.

g) What is meant by inelastic scattering in Raman spectroscopy?

h) Explain synthesis of nanoparticles of zero valent metals.

i) What are capping agents what is their role in synthesis of nanoparticles.

j) What is meant by nanoassemblies? Give example.

P.T.O.

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

a) Explain how metal nanoparticles can be synthesized via colloidal route?

b) Explain the use to TEM for studiying the marphology of nanoparticles.

c) What is the role of nanoparticles in semiconductor photocatalysis.

d) Give an account of the optical and electrical properties of nanomaterials.

Q3) Answer the following: (any two) **[10]**

a) Which properties of nanoparticles makes them suitable as sensor? Name different types of sensors.

b) Explain the working concept of CVD with examples and state the applications of this Technique.

c) Discuss the binding of Fluorophore molecule to metal nanoparticle.

d) Explain how photocurrent is generated by nano structured metal oxide films.

Q4) Write note on (any two): **[10]**

a) Photoluminesent nanomaterials.

b) SWCNT and MWCNT.

c) Chemical methods for Nanopartical synthesis.

d) Size dependent properties of nanomaterial.

Total No. of Questions : 9]

SEAT No. :

P2187

[Total No. of Pages : 3

[4823]-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 right indicate full marks.***
5) ***Neat diagrams must be drawn wherever necessary.***

SECTION - I
(Applications in Industry)

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

a) What is lithopone?

b) What is meant by oil absorption of a pigment?

c) What is the function of coordination compound in electroplating.

d) Give the names of two essential natural pigments.

e) What is meant by Alloy plating?

Q2) Attempt any two: **[10]**

a) List the general methods of preparation of pigments for use as paint material. Describe any one method.

b) Give an account of electrodeposition of Copper.

c) Describe giving chemical reactions process of manufacture of Red Iron Oxide by synthetic route.

d) Discuss the use of polymers in Electroplating.

P.T.O.

Q3) Write short note on any one: **[5]**

a) Nafion modified Electrodes.

b) Green pigments.

c) Electrodeposition of chromium.

SECTION - II
(Environment)

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

a) List the different methods of removal of Nitrogen from waste water.

b) What are pollutants? Name two water pollutants.

c) Distinguish between Primary and Secondary sludge.

d) List the important differences between aerobic and anaerobic methods for waste water treatment.

e) What do you understand by Geothermal energy?

Q5) Attempt any two: **[10]**

a) "Coliform bacterial count is useful to test pathogens in drinking water". Explain.

b) Explain the construction and working of Alkali Fuel Cell.

c) Draw a schematic diagram to show all the components of Atomic Absorption Spectrometer. How is an aqueous sample introduced into an AAS? How is the sample converted to a neutral ion?

d) Explain the different biotechnological methods for waste water treatment?

Q6) Write a note on any one: **[5]**

a) Electrodialysis.

b) Energy from biomass.

c) Trickling filters.

SECTION - III

(Medicine)

Q7) Answer the following in brief: **[10]**

a) Define "pro-drug".

b) What is meant by chelation therapy? What is it used for?

c) Draw diagrams to show interstand and intrastand crosslinking of metal complexes to DNA.

d) Name the stable Lithium isotopes of Lithium and Name the techniques by which they can be determined.

e) List the mechanisms by which Bismuth exerts its bactericidal activity against H.Pylori.

Q8) Answer the following (any two): **[10]**

a) Describe a method for the synthesis of Bi(III) compounds using solid-solution reactions.

b) Explain the role of metal complexes as chemical nucleases.

c) Discuss the mechanism of action of cis-platin based anticancer drugs.

d) Comment on the toxicity of Vanadium Complexes.

Q9) Write note on : (any one) **[5]**

a) Biochemistry of Lithium.

b) Metals in Medicine.

c) Role of Vanadium complexes in curing Diabetes Mellitus.

Total No. of Questions : 6]

SEAT No. :

P2188

[Total No. of Pages : 4

[4823]-410
M.Sc.-II
ORGANIC CHEMISTRY
CHO-450 : Chemistry of Natural Products
(2013 Pattern) (Semester-IV) (New Course)

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

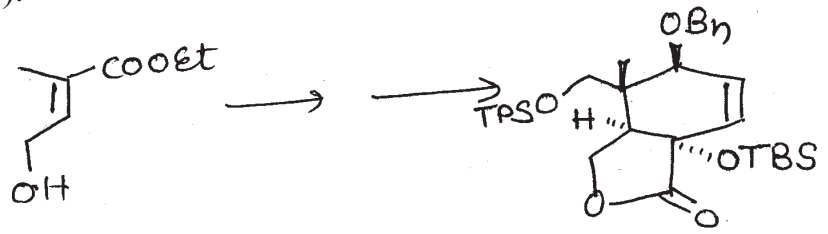
Instructions to the candidates:

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.***

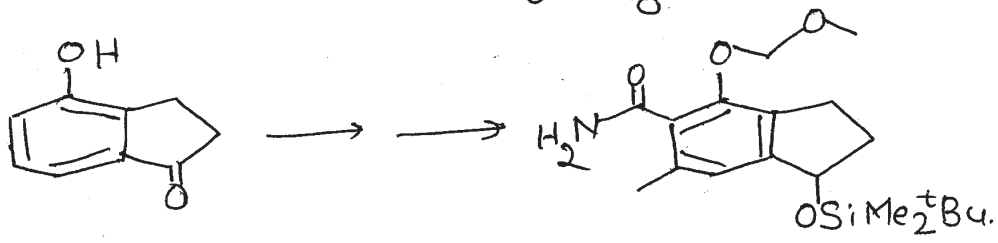
SECTION-I

Q1) Outline the steps involved in the following synthetic sequences. Indicate the reagents used and discuss the mechanism and stereochemistry involved (Any Three): **[9]**

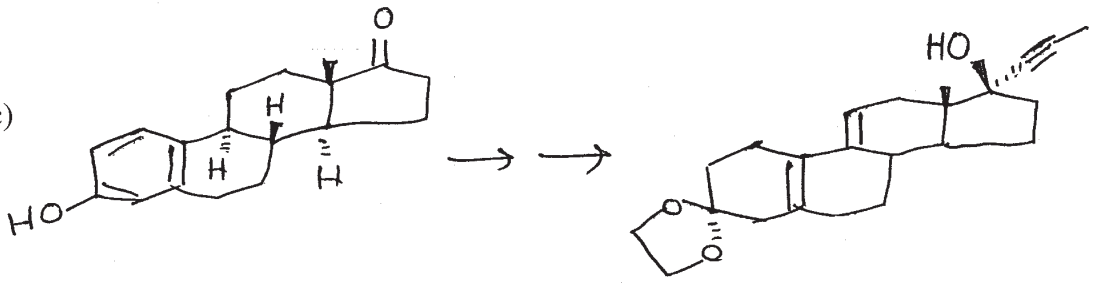
a)



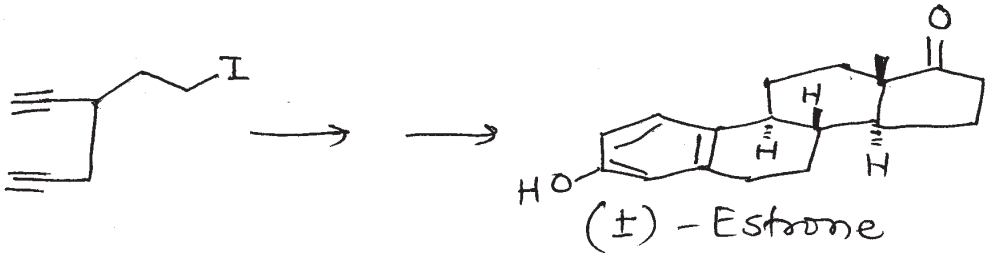
b)



c)



d)



P.T.O.

Q2) Answer the following (Any Two): **[8]**

a) What is the role of ozonolysis reaction in establishing location of C-5 and C-9 methyl in Hardwickiic acid?

b) How will you prove the presence of

i) alcoholic –OH group

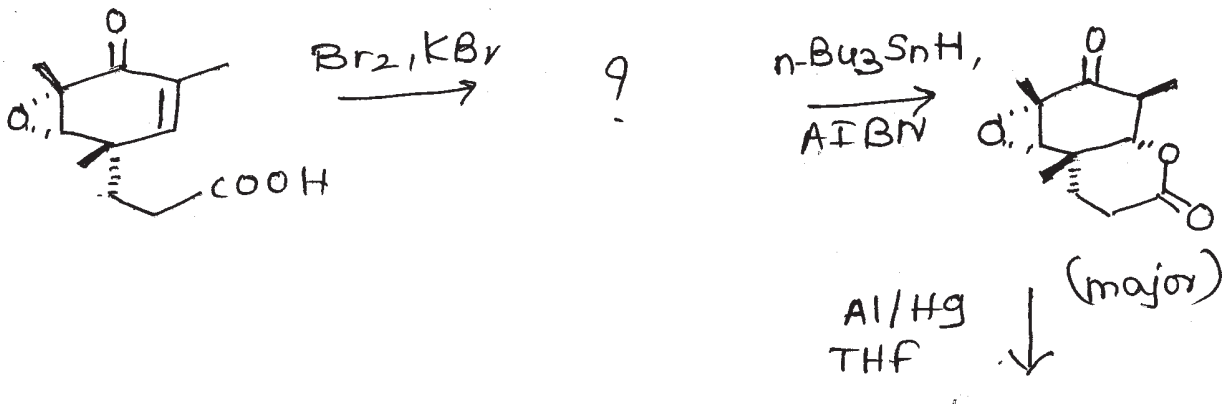
ii) phenolic –OH group

iii) pyridone ring system in hydroxy camptothecin?

c) Establish the stereochemistry of deoxypodophyllotoxin with proper evidences.

Q3) Answer the following (Any Two): **[8]**

a) Complete the following synthetic sequence. Give mechanism and write structures of all the intermediates.

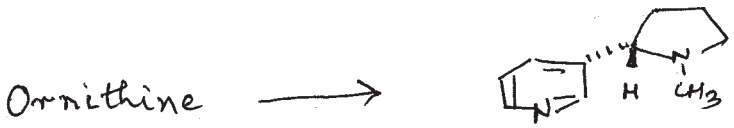


b) Write a note on Shapiro reaction.

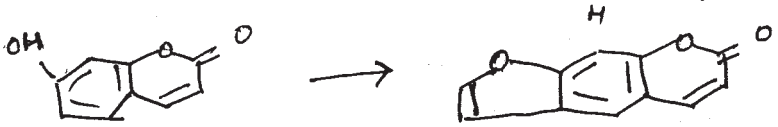
c) Write the two stereoisomers of Juvabione. How will you detect the presence of conjugated methyl ester and carbonyl group in them?

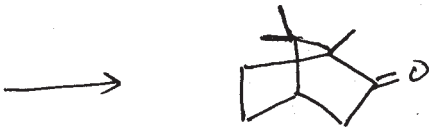
SECTION-II

Q4) Suggest biogenetic scheme for <u>Any Three</u> of the following: **[9]**

a) Ornithine 

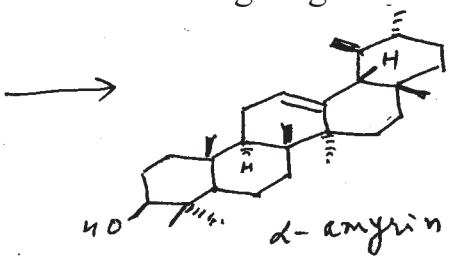
b) FPP 

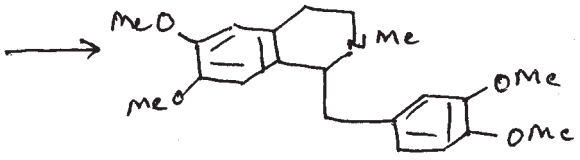
c) 

d) LPP 

Q5) Attempt <u>Any Two</u> of the following: **[8]**

a) Suggest the steps involved in the following biogenetic scheme:

Squalene monoepoxide 

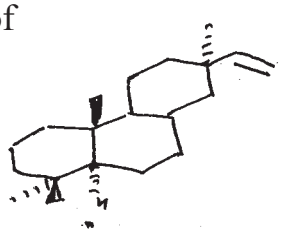
b) Tyrosine 

c) 

Indicate the positions of labelled carbon in GGPP.

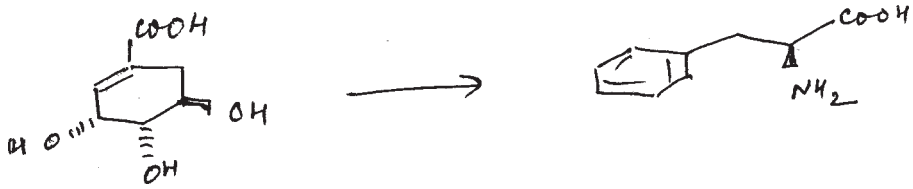
Q6) Attempt <u>Any Two</u> of the following: **[8]**

a) Suggest the biogenesis of



from GGPP.

b) Give the biogenetic steps involved in the following scheme:



c) Write a note on Wagner - Meerwin rearrangements in biogenesis with suitable examples.

●●●●●

Total No. of Questions :6]

SEAT No. :

P2189

[Total No. of Pages : 4

[4823]-411
M.Sc. III
ORGANIC CHEMISTRY
CHO:-451 Advanced Synthetic Organic Chemistry
(2013 Pattern) (Semester-IV)

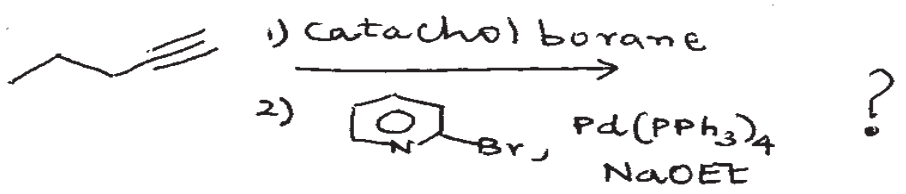
Time : 3 Hours] *[Max. Marks : 50*

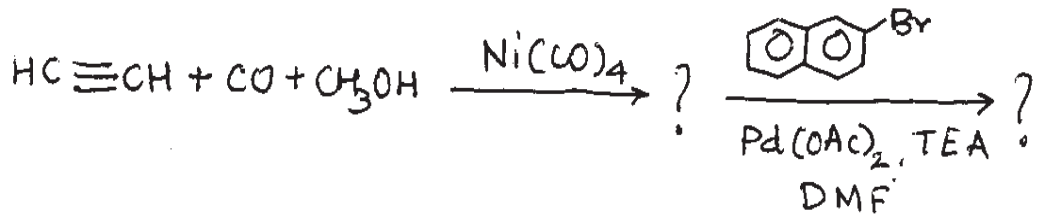
Instructions to the candidates:

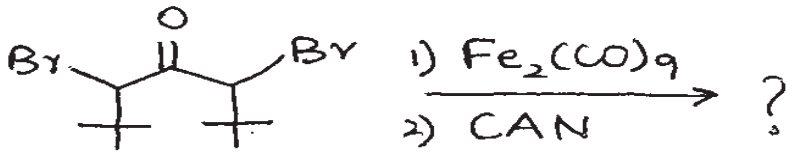
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

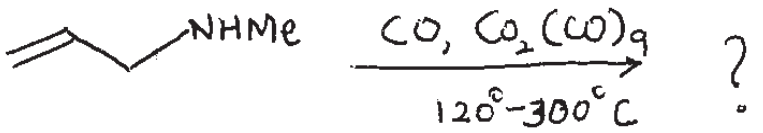
SECTION-I

Q1) Predict the major product/s in any three of the following with appropriate mechanism. **[9]**

a) 

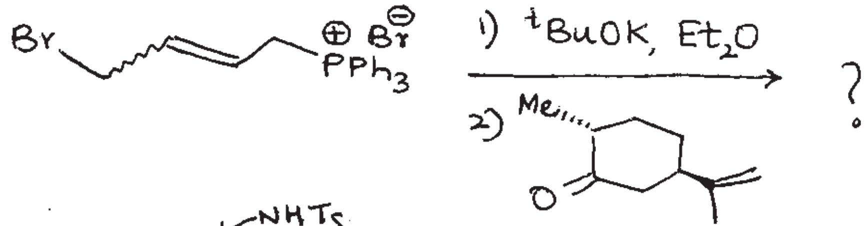
b) 

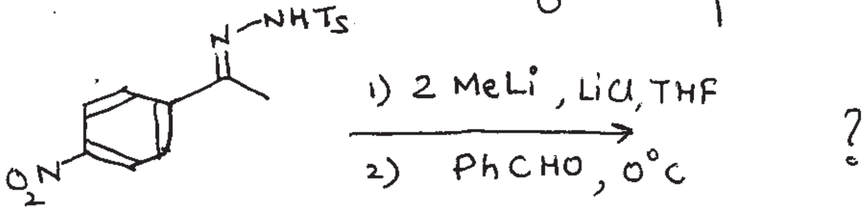
c) 

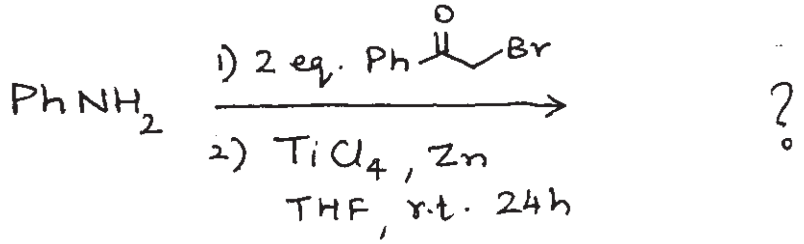
d) 

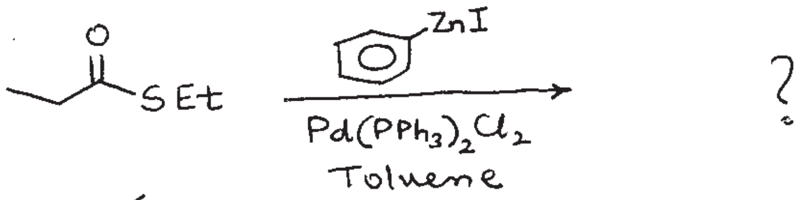
P.T.O.

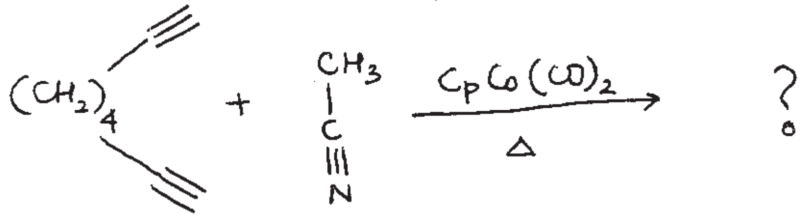
Q2) Predict the products in any four of the following. **[8]**

a) 

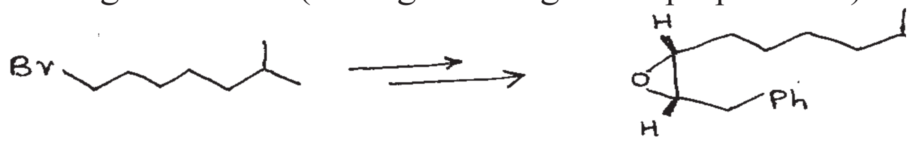
b) 

c) 

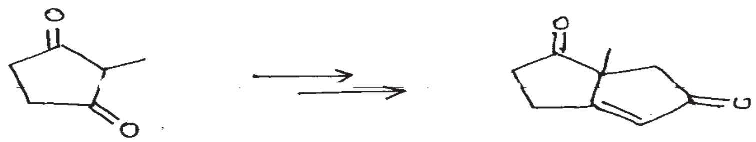
d) 

e) 

Q3) a) Complete the following transformation (any two) using reagents and conditions given below. (Arrange the reagents in proper order). **[4]**

i) 

m-CPBA ; PPh_3 ; BuLi ; $PhCH_2CHO$

ii) 

Ph_3P; K_2CO_3 ; NBS, H_2O ;  , $(Ph_3P)_4Pd$

iii) 

Phthalimide, KOH ; LAH ; $Ni(CO)_4$, MeOH ; TsCl, Py

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

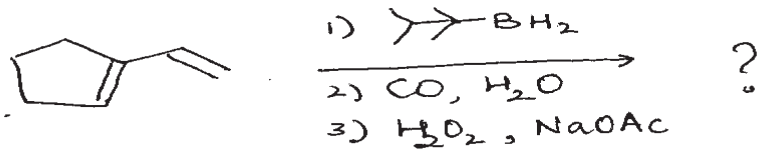
i) Short note on Peterson Olefination

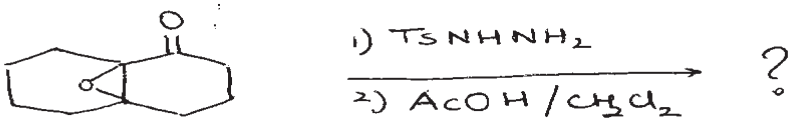
ii) Short note on Witting Horner reation

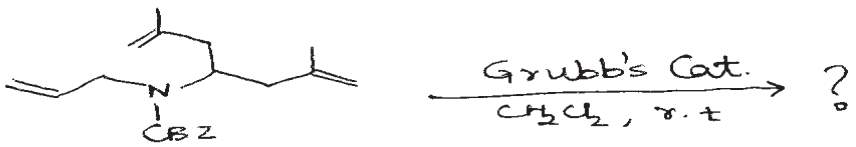
iii) Discuss the role of Pd(o) in Heck reaction.

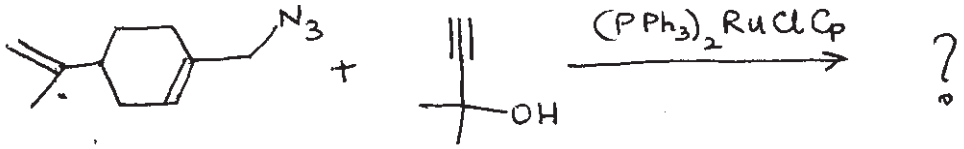
SECTION-II

Q4) Predict the major product in any three of the following with appropriate mechanism. **[9]**

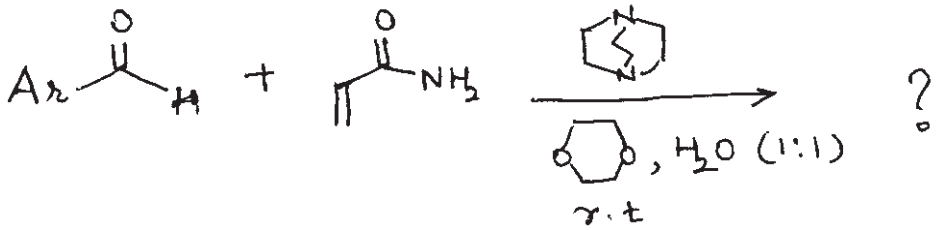
a) 

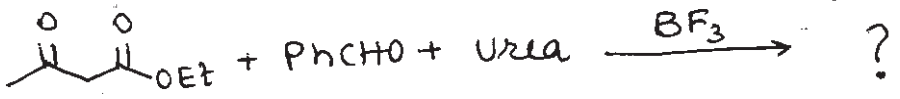
b) 

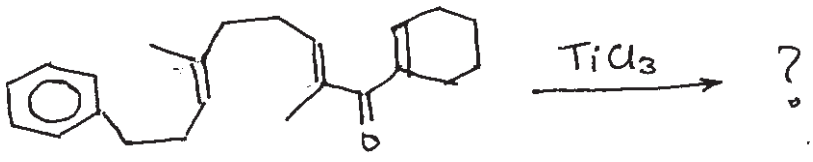
c) 

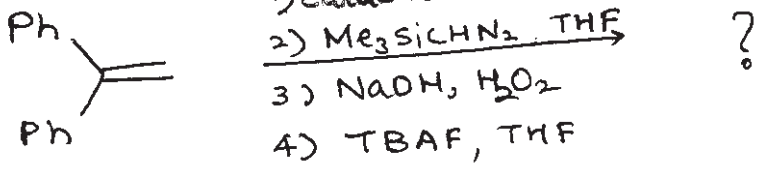
d) 

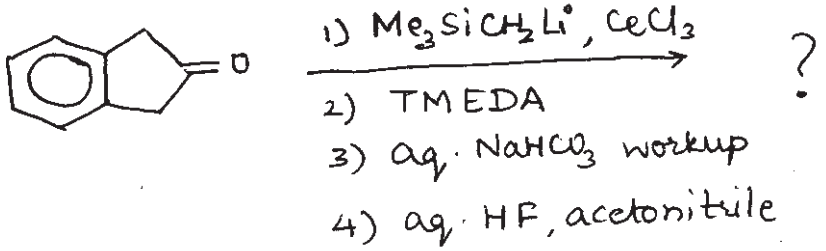
Q5) Predict the products in any four of the following. **[8]**

a) 

b) 

c) 

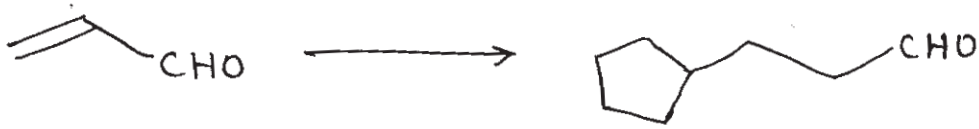
d) 

e) 

Q6) a) Complete the following transformation using organoborane reagent (any two) **[4]**

i) 

ii) 

iii) 

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

i) Short note on Mitsunobu reaction

ii) Short note on Ring opening metathesis

iii) Disscuss the role of chiral organoboranes in organic synthesis

Total No. of Questions : 6]

SEAT No. :

P2190

[Total No. of Pages : 3

[4823]-412
M.Sc.
ORGANIC CHEMISTRY
CHO - 452 : Carbohydrate and Chiron Approach, Chiral Drugs and Medicinal Chemistry
(New Course) (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) Attempt any three of the following: **[9]**

a) Give importance of chiron approach in organic synthesis.

b) Explain the biological activity of Griseofulvin.

c) Draw the structure of α- and β-D-glucopyranose and compare their stabilities.

d) What is the chiral drug? Give its importance with an example.

Q2) a) Attempt any two of the following: **[4]**

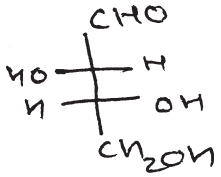
i) Write a note on mutarotation.

ii) Explain eutomer with suitable examples.

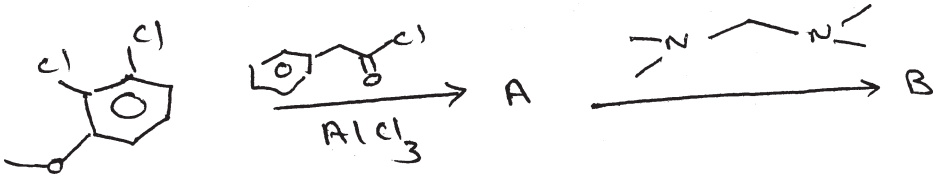
iii) Give retrosynthetic analysis of L(+) alanine.

P.T.O.

b) Identify A and B (any two): **[4]**

i) 

$$\xrightarrow[\text{ii) } H_2O/H^+]{\text{i) HCN}} A \xrightarrow[\text{ii) } NaBH_4]{\text{i) } H_2O/\Delta} B$$

ii) 

iii) D-Mannitol $\xrightarrow[\text{ii) } Pb(OAC)_4]{\text{i) Acetone/H}^+} A \xrightarrow[\text{ii) TSCl/Pyridime}]{\text{i) } NaBH_4} B$ (iii) $H^{\oplus}$)

Q3) Give answers (any two): **[8]**

a) Discuss the pharmacological action of S-metaprolol and give its synthesis.

b) Outline the synthesis of (–) Pentenomycin.

c) Discuss the drug action of (S) - Ibuprofen and explain how (R) isomer is converted into its (S) - isomer in Vivo.

SECTION - II

Q4) Attempt any three of the following: **[9]**

a) How proteins can act as drug target? Explain with suitable examples.

b) Draw the structure of chloramphenicol and explain its biological activity.

c) Give brief account of sulfonamides.

d) Explain drug-receptor interactions with example.

Q5) Solve any Four of the following: **[8]**

a) What are amino glycosides? Give one example.

b) Write note on antimalarial drugs.

c) Give brief account of polypeptides with example.

d) What are sulphones? Explain their mode of action.

e) Draw the structure of cephalosporin-c and name its drug target.

Q6) Give answers (any two): **[8]**

a) What are β-lactam antibiotics? Give its example. Explain the mode of action of β-lactam antibiotics.

b) Define pharmakodynamics of drug action. Explain receptor interactions in brief.

c) Give brief account of antifungal agents with example.

Total No. of Questions :6]

SEAT No. :

P2191

[Total No. of Pages : 4

[4823]-413
M.Sc. -II
ORGANIC 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) ***Answers to the two sections should be written in separate answer books.***

SECTION-I

Q1) Answer in brief any four of the following. **[8]**

a) Use of silicon protecting groups in organic synthesis with suitable example.

b) Use of cyanide ion in umpolung of reactivity.

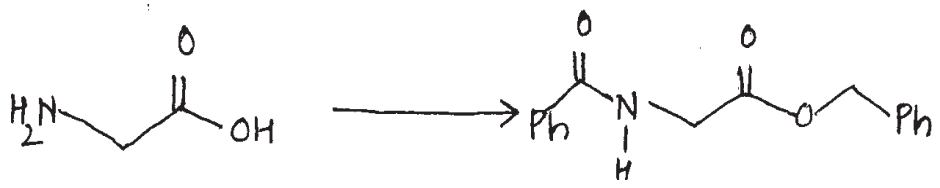
c) Cyclohexanone on enamine followed by dialkylation mainly gives 2,6 dialkyl cyclohexanone over 2,2- dialkyl cyclohexanone.

d) What are disadvantages of linear synthesis explain with suitable example.

e) What are the synthetic reagents for following synthons.

$^{\ominus}COOH$, $RCO^{\oplus}$, ArN_2^+

Q2) a) How will you bring about following transformations (any two) **[4]**

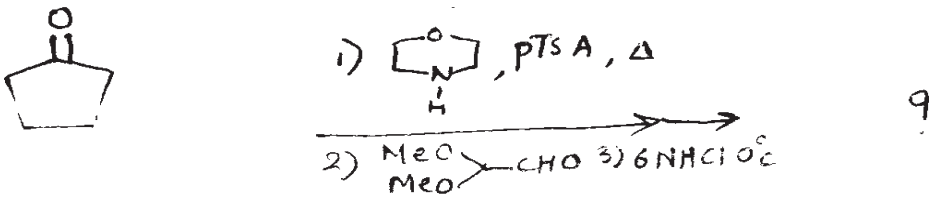
i) 

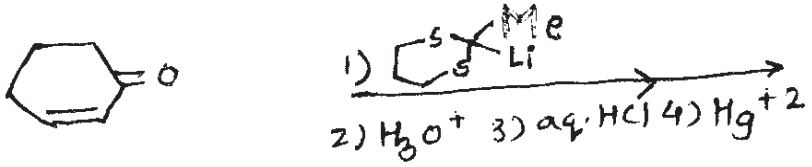
ii) 

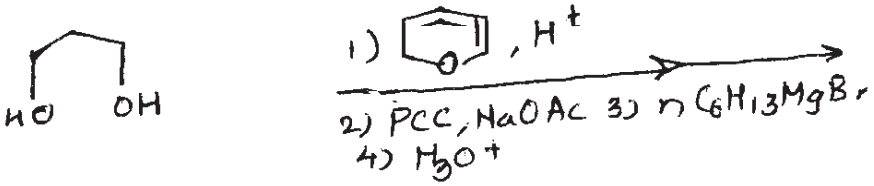
iii) 

P.T.O.

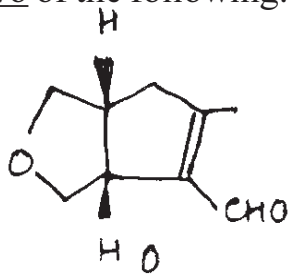
b) Predict the product/s in the following (any two) **[4]**

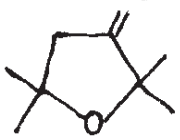
i) 

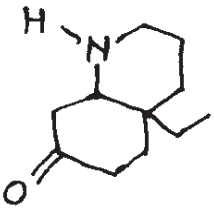
ii) 

iii) 

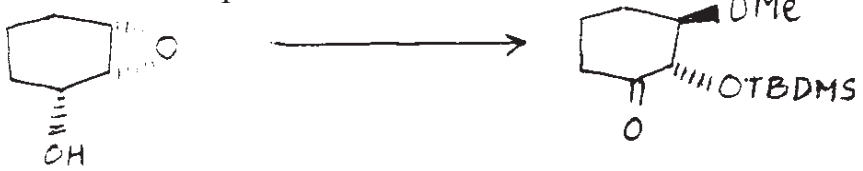
Q3) a) Using retrosynthetic analysis, suggest suitable method to synthesize any two of the following. **[6]**

i) 

ii) 

iii) 

b) You are provided reagents for the following conversion. Arrange them in proper order to achieve the conversion. Write structures of the intermediate compounds. **[3]**



Reagents: TBDMS-Cl, Py ; NaH, BnBr ; H_2/Pd-C ; MeOH, $H^{\oplus}$; PCC, NaOAc.

SECTION-II

Q4) Solve <u>any four</u> of the following. **[8]**

a) "Sodium borohyride reduction of Ph_2 PO CH R_2 COR_1 is controlled by Felkin-Anh selectivity". Explain.

b) Explain how D(–) & L(+) dialkyl tartarates plays key role in the orientatiou of epoxide ring in SAE.

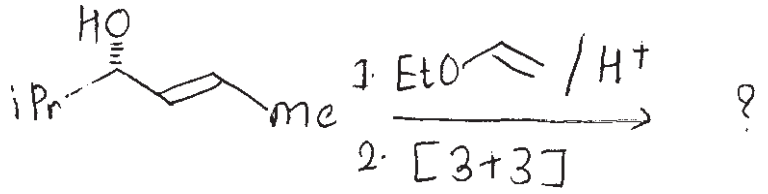
c) Explain "Organocatalysed asymmetic synthesis" with a suitable example.

d) Explain the stereochemistry of the product formed in the reaction of 4-t butyl cyclohexanone and L-Selectride®, LiBH (S-Bu)$_3$ at lower temperature.

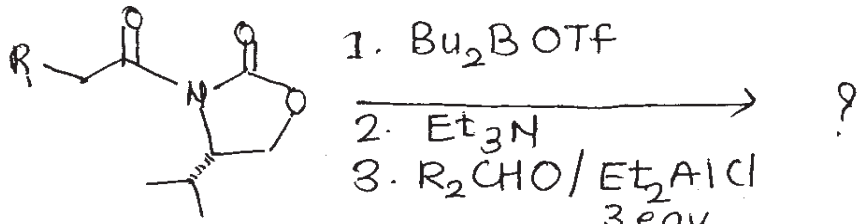
e) Applications of (s) (+)– valine in the asymmetric synthesis.

Q5) Complete the following conversious & discuss the reaction mechanism & stereochemistry (any four). **[8]**

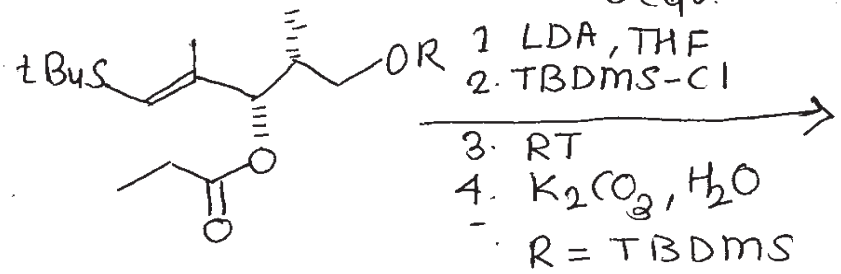
a)



b)



c)



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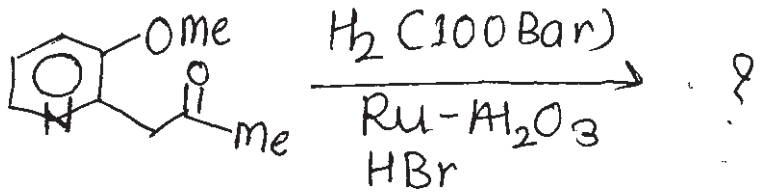

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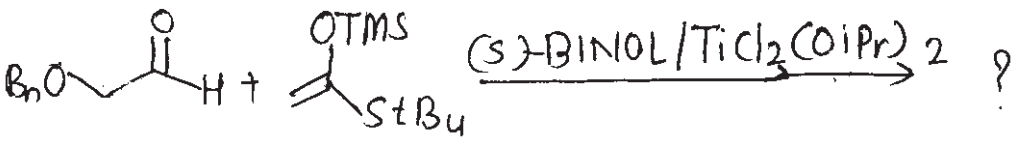
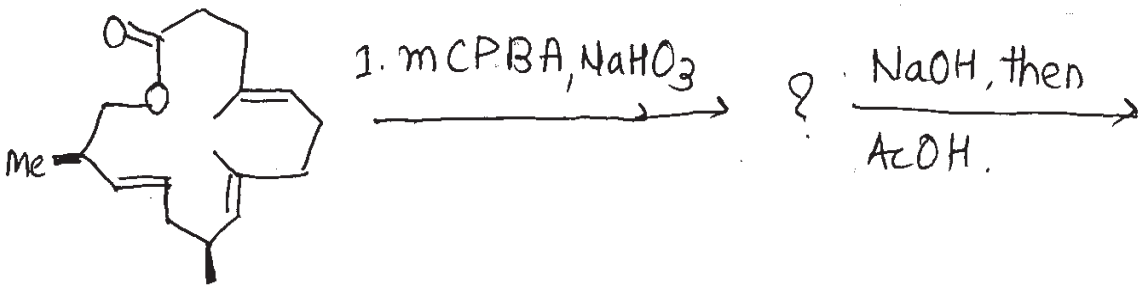
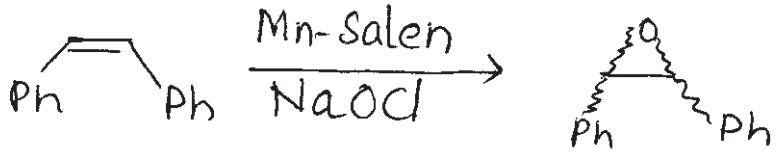
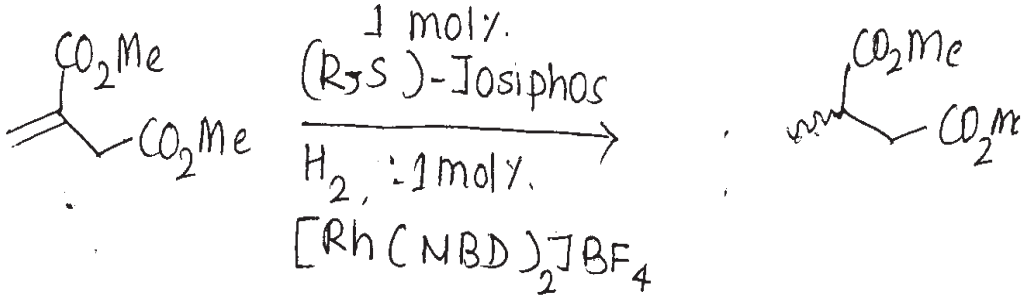


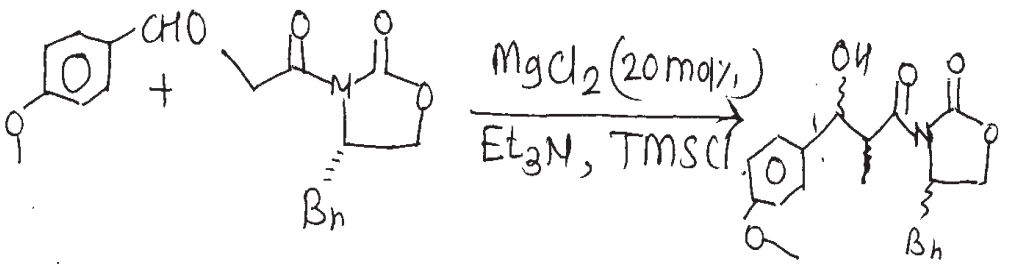
Q6) a) Complete the following reaction sequence and discuss the stereochemistry of intermediates and products. **[3]**

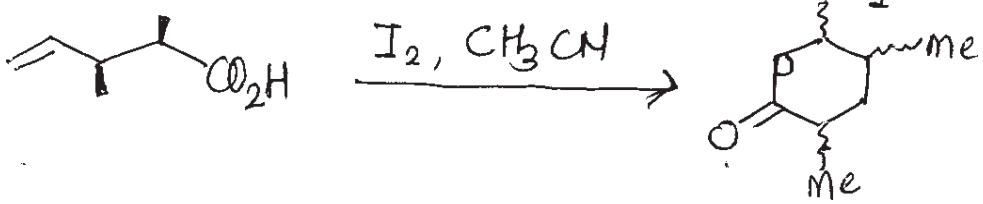


b) Predict the correct stereochemistry of the majon product with help of intermediate or T S (any three). **[6]**

i) 

ii) 

iii) 

iv) 

Total No. of Questions : 6]

SEAT No. :

P2192

[Total No. of Pages : 3

[4823]-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) ***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

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

a) What is coma? Which system used to classify coma?

b) Give the principle of isolation and identification of amphetamine and methamphetamine type C procedure.

c) Define the terms:

i) Opium poppy.

ii) Narcotic drugs.

d) Give the principle of isolation and identification of cocaine and heroin.

e) Explain "Narcoties".

Q2) Attempt Any Two of the following: **[10]**

a) State the principle and explain the technique for extraction of caffeine from biological sample.

P.T.O.

b) Give the procedure for determination of benzodiazapines.

c) How barbiturates are isolated? Explain procedure C in detail.

d) Explain type-B procedure for isolation and determination of amphetamine from urine.

Q3) Attempt Any One of the following: **[5]**

a) Define the terms:

i) Addict ii) Poppy straw

iii) Opium derivatives iv) Narcotic drugs

b) Urine sample is analyzed for caffeine containt by gas chromatographic method. It gaves following results.

i) Concentration of caffeine in reference standard = 20 mg/ml

ii) Peak height of caffeine in sample = 52 min

iii) Peak height of caffeine in reference standard = 78 min

Calculate the concentration of caffeine in given sample.

SECTION-II

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

a) State the principle of estimation of carbohydrate by Fehling's solution.

b) Give the principle for estimation proteins by Kjeldahl's method.

c) How Acid value of oil is determined?

d) Define Iodine value.

e) Give the composition of milk.

Q5) Attempt Any Two of the following: **[10]**

a) Discuss the analytical method for estimation of pectic substances by Gravimetric method.

b) What are amino acids? How are total free amino acids estimated?

c) Explain analytical method for determination of peroxide value of an oil.

d) How is boric acid determined from food sample?

Q6) Solve Any One of the following: **[5]**

a) If nitrogen retained, nitrogen absorbed and nitrogen intake from protein by rat was 1.84 mg, 1.22 mg and 9.30 mg respectively. Calculate NPU, D and BV.

b) Calculate the peroxide value of 2.85 gm ghee sample requiring 17.7 ml of 0.01 m $Na_2S_2O_3$ solution, if blank reading of $Na_2S_2O_3$ solution was 25.2 ml.

●●●●●

Total No. of Questions : 6]

SEAT No. :

P2193

[Total No. of Pages : 3

[4823]-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) ***Answers to the two sections should be written in the 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) Explain ESCA satellite peak.

b) What are analysers? Enlist different type of analyser.

c) State and explain the principle of X-ray fluorescence.

d) Give the applications of X-ray absorption spectroscopy.

e) Discuss the applications of surface characterization technique.

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

a) Describe the Bragg's method for crystal analysis. How the reflection for different order are noted by this technique?

b) Explain the chemical shift in ESCA lines. Describe the use of chemical shift in quantitative analysis.

P.T.O.

c) What is SEM? Discuss the construction and working of SEM.

d) A alloy consist of 30% Ni and 70% Cu at the wavelength corresponding to Kα radiation of Cu. Mass absorptive coefficient at the same wavelength is 45.5 cm^2/g for Ni and 55.9 cm^2/g for Cu. Calculate mass absorptive coefficient of an alloy?

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

a) Write a note on X-ray absorptive edge method.

b) Calculate 1's' electron binding energy of nitrogen in nitrate ion from the incident X-ray photon that was used to create the inner shell vacancy had a wavelength of 834 pm. The work function of spectrometer was 4.71 eV and the kinetic energy of measured electron was 799.0eV.

[Given Plancks constant = 6.625×10^{-34} Js, C = 2.998×10^8 m/s]

SECTION - II

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

a) Explain the principle of chemiluminescence.

b) What is chemical shift? Give its formula.

c) Explain the term fluorescence and phosphorescence.

d) Calculate the luminescent efficiency for a reaction in which 9.5×10^{16} photon were absorbed during the excitation and 4.5×10^{16} photon were emitted during the fluorescence.

e) Give the principle of NMR-Spectroscopy.

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

a) Explain the theory of photoluminescent.

b) What is gas phase of chemiluminescence? How it is used in analysis?

c) Determine the ratio of the number of hydrogen nuclei in the upper energetic level to those in the lower energetic level at 25°C in a magnetic filed with a flux density of 14092G.

[Given : $\mu = 2.7927$ nuclear magnetons.

$\beta = 5.0505 \times 10^{-31}$ J/G; I = $\frac{1}{2}$; K = 1.381×10^{-31} J/K]

d) Write a critical note on 2–D. NMR spectroscopy.

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

a) Explain the factors affecting on photoluminescence.

b) At an excitative wavelength of 420 nm and an emission wavelength of 490nm, the slopes of the plots of relative fluorescent intensity as a function of concentration were 2.5×10^6 and 1.25×10^5 lit mole^{-1} respectively of compound anthracene and perylene. At an excitative wavelength of 280nm and an emission wavelength of 380 nm, the slope were 5.0×10^6 and 0.75×10^5 lit mole^{-1} respectively of compound anthracene and perylene. The sample had a relative fluoresent intensity of 78.2 at 420/490 nm and 40.5 at 280/380 nm.

Calculate the concentration of the two compounds in the sample.

Total No. of Questions : 6]

SEAT No. :

P2194

[Total No. of Pages : 3

[4823]-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) ***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 / nonprogrammable calculator is allowed.***

SECTION - I

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

a) Define C.O.D.

b) Give a list of common water pollutants.

c) What is saponification value?

d) Give standard test method for determination of pH of water.

e) Give principle of any one method used for removal of phosphorus from waste water.

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

a) Describe in detail alkalimetric ammonium molybdophosphate method.

b) Suggest a method for uv spectroscopic analysis of detergents.

c) Give the following tests:

i) Unsulfonated matter from soap.

ii) Total fatty acids from soap.

P.T.O.

d) To complete the reaction 10ml of 0.01M $ZnSO_4$ solution required 9.7ml EDTA. 0.250g of sample containing Magnesium was dissolved in 100ml of acid. An aliquot of 10ml of the same solution required 13ml EDTA solution. Calculate percentage of Magnesium in the sample.

[Given At. wt. Mg = 24.31]

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

a) Discuss anaerobic treatment process for waste water.

b) Phosphate containing detergent weighing 0.350g was ignited to red hot to destroy organic matter. The residue was dissolved in hot HCl and gave H_3PO_4, the phosphate was precipitated as $MgNH_4PO_4\ 6H_2O$ by addition of Mg^{2+} ions followed by aqueous ammonia. After filtration, washing, drying and ignition at 1000ºC, weight of residue, $Mg_2P_2O_7$ was 0.231g. Calculate percentage of Phosphorus in the given sample.

[Given At.wt: P = 30.97, Mg = 24.31, O = 15.99].

SECTION - II

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

a) Explain dielectric constant and loss factor for polymers.

b) Define latex paints and lacquers.

c) What are thermoplastic and thermosetting polymers?

d) How inorganic pigments are identified?

e) Explain softening temperature and flammability of plastics.

Q5) Answer <u>any two</u> of the following: **[10]**

a) What are non-volatile and volatile components of paints? How they are estimated?

b) Explain optical properties of plastics.

c) Explain eubilometric method for molecular weight determination of polymer.

d) A 0.350 g sample of zinc chrome yellow pigment was analysed for K_2O determination. The sample was first decomposed at 600ºC to give ZnO, Cr_2O_3 and K_2CrO_4. The mass was extracted with water and diluted to 100ml. A 25ml of diluted solution was mixed with 0.025 N FAS (ferrous ammonium sulphate) in acetic medium. The unused FAS required 15.3 ml of 0.025 N KM_nO_4 solution. The blank reading of FAS and KM_nO_4 is 25.2ml. Calculate % of K_2O in pigment sample.

[Given : At. wt of O = 16, K = 39.09, Cr = 51.87]

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

a) How binders are identified from paints?

b) 0.692 g of CTAB was dissolved in 25ml mixture of ethyl alcohol and toluene [1:3]. The solution was titrated with 0.12N alcoholic NaOH. The burette reading was 5.9ml. Calculate $\overline{M_n}$ of polymer sample.

[Given Functionality = 2].

Total No. of Questions :6]

SEAT No. :

P2195

[Total No. of Pages : 3

[4823]-417
M.Sc. -II
ANALYTICAL CHEMISTRY
CHA-492: Methods of Analysis and Applications
Pollution Monitoring and Control
Analysis of Body Fluid
Carbon Nanostructures and Applications of Nanotechnology
(2013 Pattern) (Semester-IV)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Attempt any two sections of the following..***
3) ***Answers to the two sections should be written in separate answer books.***
4) ***Use of logarithmic tables, non-programmable calculator is allowed.***
5) ***Neat diagrams must be draw wherever necessary.***

SECTION-I
Pollution Monitoring and Control

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

a) Give advantages of electrochemical methods for removal of heavy metals from waste water.

b) Give the principle of Brownian diffusion.

c) List the types of dust collectors.

d) What are the sources of SO_2 and NO_x?

e) What are commonly used recovery techniques for metals?

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

a) Write a short note on photochemistry of air pollutants.

b) Describe in detail a method used for determination of lead in waste water.

c) Write a short note on cyclones.

d) Describe in detail sources of particulate matter.

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

a) Discuss in detail analytical methods of determination of small amounts of metal pollutants.

b) Write a short note on desulfurization of fuels.

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) What are ketone bodies?

c) Write the principle of ELISA? What are it's applications?

d) Discuss the chemistry of vitamin D with respect to structure, sources and biological functions.

e) A patient has blood urea of 80 mg% and urinary urea of 2400mg% Rate of urine flow is 2 ml/min. Calculate the urea clearance and comment on results.

Q5) Attempt <u>any two</u> of the following: **[10]**

a) Discuss the chemistry of vitamin B1 with respect to structure, sources, biological functions and principle of estimation.

b) Explain principle, instrumentation and any two applications of radioimmunoassay.

c) How serum cholesterol is estimated spectrophotometrically?

d) Explain hippuric acid synthesis test in detail.

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

a) Outline a suitable analytical method for the estimation of serum creatinine.

b) Discuss the determination of xanthuric acid by spectrofluorimetry.

SECTION-III

Carbon Nanostructures and Applications of Nanotechnology

Q7) Answer the following: **[10]**

a) Give various applications of quantumdots.

b) Define i) Biosensors

ii) Carbon Nanotubes

c) Explain measurement system for observing & tracking quantum dots.

d) Enlist different types of bacteria used in synthesis of nanoparticles.

e) How particle shape of nanomaterial causes a potential health hazard?

Q8) Answer any two of the following: **[10]**

a) Explain the following

i) Electrochemical sensors

ii) Bio membrane-based sensors

b) How carbon nanotubes are fabricated?

c) Explain in brief the enhancement of PDT by composite targeting.

d) Write a short note on plant and microbes as nanofactories.

Q9) Answer any one of the following. **[5]**

a) Explain the diagnostic imaging techniques indetail.

b) Describe the application of carbon nanotubes in Fuel cells and catalyst.