Total No. of Questions :6]

SEAT No. :

P1857

[Total No. of Pages :3

[5223] - 101

M.Sc.

PHYSICAL CHEMISTRY

CHP-110: Fundamentals of Physical Chemistry - I

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

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION-I

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

a) Explain de Broglie's wave particle duality hypothesis.

b) What is Bohr's correspondence principle?

c) What is chemical potential? How does it differ from molar free energy?

d) Write Gibb's Helmholtz equation and explain the meaning of each term in it.

e) Write the expression for rotational partition function.

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

a) Define equilibrium constant. Obtain the relation between standard free energy change and equilibrium constant for the reaction $A \rightleftharpoons B$.

b) Define partition function and derive the equation $Q = Q_t \cdot Q_r \cdot Q_v \cdot Q_e$

c) Sketch the first four eigen functions for a particle in a one dimensional box and compare these with the probability density curves.

d) What is meant by normalised wave function? Which of the following functions are normalizable over the indicated intervals?

i) $e^{x}(0,\infty)$

ii) $x\,e^{-x}(0,\infty)$

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

a) Calculate the transition energy when an electron in a box of length 500 pm undergoes a transition from n = 1 to n = 2.

b) Evaluate ΔS_{mix} when 4 gm helium, 30 gm neon and 36 gm argon are mixed at 25°C. [At. Wt. He = 4, Ne = 20, Ar = 40]

SECTION-II

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

a) Determine the half-life for a first order reaction having rate constant 600 S^{-1}.

b) Write the expression for the rate constant for a second order reaction with equal concentrations. Mention its unit.

c) What are consecutive reactions? Give one example.

d) What is the effect of ionic on reaction rates?

e) Write the Michaelis - Menten equation. Draw the Eadie plot for enzyme catalyzed reactions.

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

a) Using the steady state principle, derive the rate law for the formation of HBr.

b) Discuss the secondary salt effect.

c) Discuss the non-competitive inhibition in enzyme catalyzed reactions.

d) Derive the integral rate law for second order reactions with unequal concentrations of reactants.

Q6) Solve any one of the following:

a) The gas phase rearrangement reaction **[5]**

Vinylallyl ether $\rightarrow$ allyl acetone

has a rate constant $6.015 \times 10^{-5}\ s^{-1}$ at 420 K and $2.971 \times 10^{-3}\ s^{-1}$ at 470K. Calculate the values of A and Ea.

b) The protein catalase catalizes the reaction **[5]**

$2H_2O_2\,(aq) \rightarrow 2H_2O\,(l) + \Rightarrow O_2\,(g)$ and has a Michaelis-Menten constant of $2.5 \times 10^{-4}\ ML^{-1}$ and turnover number of $4\times10^{7}s^{-1}$. Deduce the initial rate law of this reaction if the total enzyme concentration is $0.016\times10^{-6}ML^{-1}$ and the initial substrate concentration is $4.32\times10^{-6}ML^{-1}$, and calculate the maximum rate for this enzyme catalysis.

EEE

Total No. of Questions :6]

SEAT No. :

P1858

[Total No. of Pages :4

[5223] - 102

M.Sc. - I

INORGANIC CHEMISTRY

CHI-130: Molecular Symmetry & Chemistry of P-Block Elements

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

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

Instructions to the candidates:

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

SECTION - I

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

a) Assign the appropriate point group to staggered ferrocene molecule. Justify it.

b) Sketch the various planes in ICl_3 molecule.

c) Show that the operations inversion and rotation commute with each other.

d) Draw all possible isomers of $Ma_2b_2c_2$ where M is the central atom and a, b, and c are monodentate ligands. Which of the isomers is optically active?

e) Find the product of C_2^z. S_2^z.

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

a) Sketch and explain proper axes of rotation in $[Co(NH_3)_6]^{3+}$ complex ion.

b) Using similarity transformation classify the symmetry operations of C_{2v} point group into appropriate classes.

P.T.O.

c) Fill the missing entries X, Y, Z, V and W in the following character table. Justify it.

	E	$2C_4$	$C_2(=C_4^2)$	$2C'_2$	$2C''_2$
A_1	1	1	1	1	1
V	1	1	1	X	–1
B_1	1	Y	1	1	–1
W	1	–1	1	–1	1
E	2	0	Z	0	0

d) Find out the irreducible representations of vibrational modes in H_2O molecule.

Given : Character table for C_{2v} point group.

C_{2V}	E	C_2	σ_{v1}	σ_{v2}		
A_1	1	1	1	1	Z	x^2, y^2, z^2
A_2	1	1	–1	–1	R_z	xy
B_1	1	–1	1	–1	x, R_y	xz
B_2	1	–1	–1	1	y, R_x	yz

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

a) For a BrF_5 molecule find the reducible representation for which sigma bonds forms the basis and find out which of the orbitals from the bromine atom will be offered for sigma-bonding.

Given : Character table for C_{4v} point group

C_{4v}	E	$2C_4(z)$	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	R_z	
B_1	1	–1	1	1	–1		$x^2–y^2$
B_2	1	–1	1	–1	1		xy
E	2	0	–2	0	0	$(x,y)(R_x,R_y)$	(xz, yz)

b) Find out the normalized SALC using projection operator of E_4 irreducible representation which operates on σ_1 of the $[ptCl_4]^{2-}$ complex ion.

D_{4h}	E	$2C_4$	C_2	$2C'_2$	$2C''_2$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$
E_4	2	0	–2	0	0	–2	0	2	0	0

SECTION - II

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

a) Give the classification of molecular hydrides with example.

b) Why sodium hydride not exposed to moist air.

c) What is Wurtz coupling reaction? Explain with the help of Grignard reagent.

d) Explain the following species - BH_4^-, CH_4, NH_4^+ are isoelectronic or not.

e) Give the oxoanions of chlorine with name and oxidation state of chlorine.

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

a) Write note on fullerences and metal-fullerene compounds.

b) Give an account of oxyanions of phosphorous.

c) Write short note on interhalogen compounds.

d) Give an account of carborane.

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

a) Explain the structure and bonding in

i) ClF_3.

ii) Sb_5O_{10}.

b) Draw the following structures.

i) $[B_6 H_6]^{-2}$.

ii) XeF_4.

iii) $Al_2 Ph_2 Et_4$.

iv) 2, 2, 2 crypt.

v) $(TeO_4)_2$.

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Total No. of Questions : 6]

SEAT No. :

P1859

[Total No. of Pages : 4

[5223]-103
M.Sc. (Part-I)
ORGANIC CHEMISTRY
CHO - 150 : Basic Organic Chemistry
(2013 Pattern) (Semester - I) (5 - Credits)

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

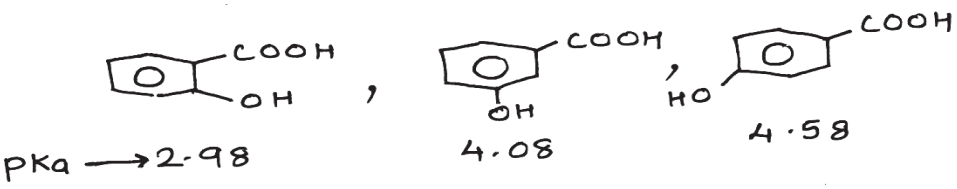
Instructions to the candidates:

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.***

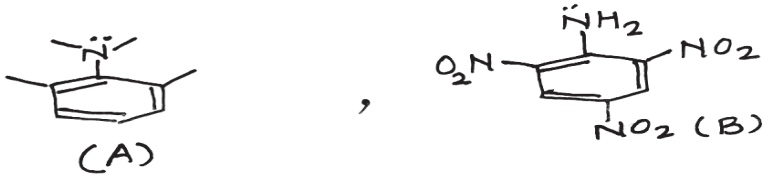
SECTION - I

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

a) Justify pKa of the following acids.



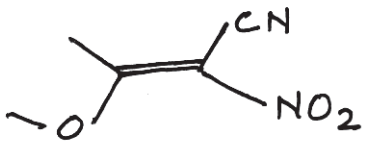
b) Compound (A) is strong base but compound (B) is practically neutral.



c) Discuss structure of Carbene and Carbon free radical with suitable examples.

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

i)



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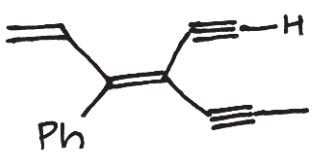
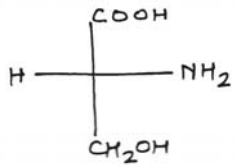
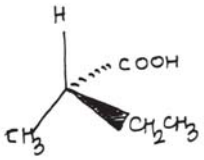


P.T.O.

Q2) a) Assign R/S configurational labels to the following: **[4]**

i) 

ii) 

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

i) Tautomerism.

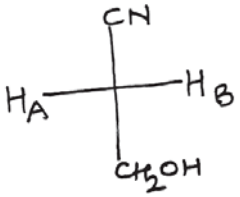
ii) Stereoselective reactions.

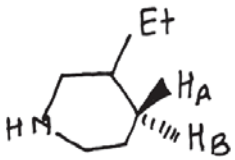
iii) Stability of Carbanion.

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

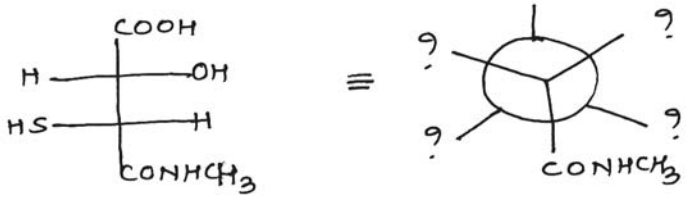
a) Comment on optical activity of the following compound.

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

i) 

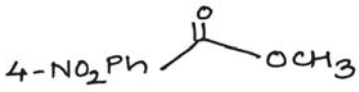
ii) 

c) Convert Fischer projection to Newman projection as shown.



d) Assign Re/Si face labels to the following

i) 

ii) 

e) Trans - 1, 4 - di t butyl cyclohexane exists predominantly in e,e conformation. Justify.

SECTION - II

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

a) Nitrobenzene is commonly used as a solvent in FC acylation reaction.

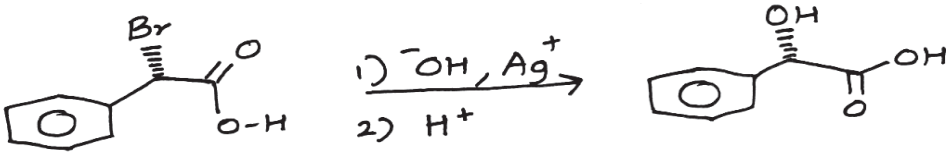
b) Give evidences of formation of benzyne in a reaction.

c) Explain E_1 CB mechanism with a suitable example.

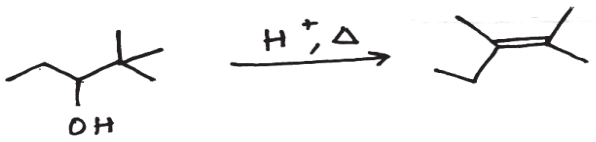
d) Reaciton of 1 - chloro - 2-butene on reaction with cyanide ion gives two isomeric alkenes. Write the structures of these two alkenes.

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

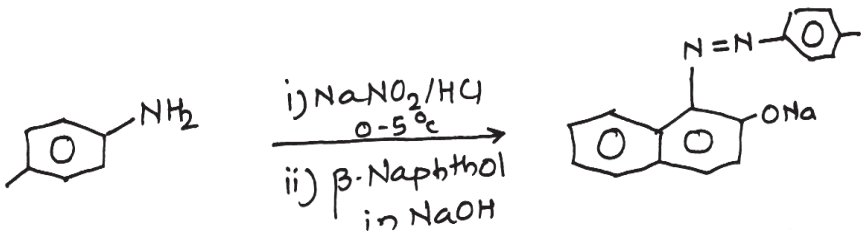
a)



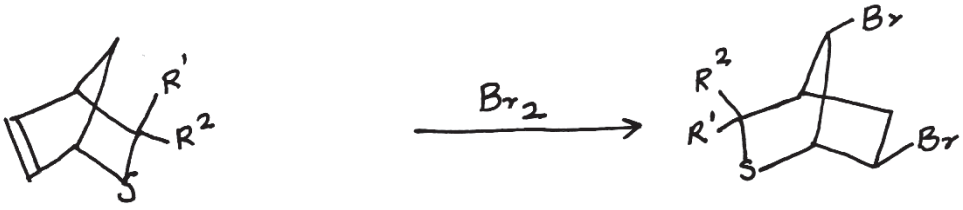
b)



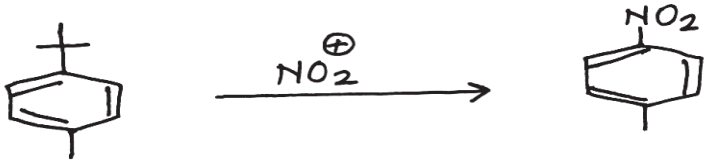
c)



d)



e)



Q6) a) Attempt any two **[4]**

i) Explain Hofmann elimination with suitable example.

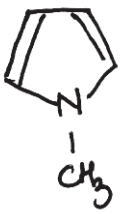
ii) -OH is not good leaving group but - OTs, - OAc are good leaving groups.

iii) Cycloheptatrienyl cation is aromatic while cycloheptatrienyl anion is not.

b) Predict the products: **[4]**

i) 

i) $2Br_2/Fe$
ii) Mg/CO_2 (2equi.)
iii) $H^{\oplus}$
→ ?

ii) 

i) DMF / $POCl_3$, warm
ii) $H_3O^{\oplus}$
→ ?

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Total No. of Questions : 6]

SEAT No. :

P3333

[Total No. of Pages : 2

[5223]-104

M.Sc.

CHEMISTRY

CHA 190 : Safety in Chemical Laboratory and Good Laboratory Practices

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

Time : 2½ Hours] *[Max. Marks : 50*

Instructions to the candidates:

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

SECTION - I

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

a) Enlist the types of fire extinguisher.

b) What is allergen? Give its two examples.

c) What is First aid for contact of chemical through inhalation?

d) Describe the importance of labels and pictograms.

e) What is inventory management?

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

a) Explain corrosive and carcinogenic chemicals.

b) Write a note on importance of safety in chemical laboratory.

c) Explain the role of personnel protective equipments.

d) Describe first aid kit with respect to its content and location.

P.T.O.

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

a) Write a short note on Material Safety Data Sheet.

b) Explain chemical and biological hazards.

SECTION - II

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

a) Mention the reasons for Fire.

b) What is the importance of reagent certification?

c) Define :
   i) Fire
   ii) SOP

d) How the waste material is classified?

e) Give the difference between ISO & NABL.

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

a) Explain any two methods of calibration.

b) Write a note on Good laboratory practices.

c) Explain the following :
   i) Acid spillage.
   ii) Spillage prevention.

d) Give a brief account of inventory management.

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

a) What is waste? Explain hazardous and non hazardous waste.

b) Write a note on OSHAS laboratory standards.

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Total No. of Questions :6]

SEAT No. :

P1860

[Total No. of Pages : 3

[5223]-201
M.Sc. - I
PHYSICAL CHEMISTRY
CHP - 210 : Fundamentals of Physical Chemistry - II
(2013 Pattern) (5 Credit) (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) Why H_2 molecule is microwave and IR inactive but is Raman active?

b) Explain the photoelectron spectrum of N_2O molecule.

c) Show the fluctuations in the dipole moment of carbondioxide during asymmetric stretching Vibrations.

d) Explain why the c = 0 stretching vibration of an aldehyde give rise to a strong absorption in the infra-red yet the absorption due to c = c vibration in an alkane is normally weak.

e) Give the principle of NMR spectroscopy.

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

a) Discuss different processes by which an electronically excited molecule can loose energy.

b) State the Born-Oppenheimer approximation. How do the interactions of rotations and vibrations affect the spectrum of diatomic molecule.

c) Sketch and explain the polarizability ellipsoids for Co_2 molecule. How they decide the Raman activity?

d) Explain Various advantages of Fourier transform spectroscopy.

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

a) If the $^1H^{35}Cl$ molecule is irradiated with 404.7 nm Hg line. Calculate the first two stokes as well as anti-stokes lines observed in the rotational Raman spectrum. The bond distance of $H^{35}Cl$ is 0.1275 nm.

b) Calculate the bond length of the HCl molecule. The frequency difference between successive spectral lines observed for its rotational spectra is 20.7 cm^{-1}.

SECTION - II

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

a) Give natural and artificial preparation of ^{14}c.

b) Give Fick's laws of diffusion.

c) What are the Bravais lattices.

d) Write the secular determinant for ethylene molecule.

e) What are Miller indices.

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

a) How radio - tracer technique is used to assess the volume of blood in the patient.

b) Explain different applications of Neutron activation analysis.

c) Obtain the expression for normalization constant for H_2 molecule using molecular orbital theory.

d) Discuss main assumptions of Huckel theory.

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

a) The diffraction of crystal of sample with X-ray ($\lambda = 1.54\,A^{\circ}$) gives a first order reflection at 26.5°. Calculate the distance between the different planes.

b) Half - life of ^{226}Ra is 1500y. Calculate the activity corresponding to 2.5g of ^{226} Ra. Also determine the time required for ^{226}Ra to reduce to 3.5×10^4 dps if initial activity is 1 curie.

Total No. of Questions :6]

SEAT No. :

P1861

[Total No. of Pages :5

[5223] - 202

M.Sc. - I

INORGANIC CHEMISTRY

CHI - 230 : Coordination and Bioinorganic Chemistry

(2013 Pattern) (Semester - II) (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 seperate answer book.***
3) ***Figures to right side indicate full marks.***
4) ***Given : Atomic number:***

Cr = 24, Fe = 26, Ni = 28, Co = 27, Cu = 29, Eu = 63

SECTION - I

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

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

i) $2\ (s^1\ p^1)$

ii) $^3T_{2g}$

b) Explain how would you justify the magnetic moment for the complex $[Fe\ (CN)_6]^{3-}$; $\mu_{0bs} = 2.40$B.M.

c) In the electronic spectra of d^9 complexes, a shoulder band is observed on main transition band. Why?

d) Determine the ground state term for $[Ni(NH_3)_6]S_2O_3$ complex.

e) Explain the term:

i) Ferrimagnetism.

ii) Paramagnetism.

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

a) Prepare microstate table for s^1p^1 configuration and hence derive the allowed R-S term for the same.

b) Assign the spin multiplicities to the 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) Write short note on quenching of orbital angular momentum.

d) Predict expected electronic transition for the following complexes.

i) $[Co(H_2O)_6]^{2+}$

ii) $[Ni(NH_3)_6]^{2+}$

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

a) Calculate the effective magnetic moment for $[Cr(OX)_3]^{3-}$ complexion using given data:

$\lambda = +90\,cm^{-1}$

$10Dq = 17050\ cm^{-1}$

b) The complex $[Cr(H_2O)_6]Cl_3$ exhibit three spin allowed transitions at 17400, 24600 and 38000 cm^{-1} respectively. Calculate Racah parameter, crystal field splitting parameter and nephelauxetic ratio.

Given : $B_0 = 920\ cm^{-1}$

SECTION - II

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

a) Explain what do you mean by siderophores.

b) Explain the term template effect with suitable example.

c) What do you mean by bio amplification? Explain with suitable example.

d) Discuss the role of inorganic compounds in medicine.

e) Describe the importance porphyrin as ligands in biosystem.

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

a) Give an account amino acids as ligands in biological processes.

b) Explain the role of iron-sulphur clusters.

c) Write note on classification of metalloproteins.

d) Give brief account of acetyl chlorine receptors.

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

a) Match the following:

1)	Porphyrin	i)	Chlorophyll
2)	Siderophore	ii)	Bacteria
3)	Metallothionein	iii)	Control of metal transport
4)	Calmodulin	iv)	Non protein molecule
5)	Coenzyme B_{12}	v)	Calcium binding protein

b) Draw the structure of the following

i) Adenin

ii) Thymine

iii) Aurinofin

iv) 18-crown-6

v) Chlorophyll

DIRECT PRODUCTS

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

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

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

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

   For all groups :

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

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

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

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

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

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

   (*b*) For all groups except D_{6d}, D_{4d}, S_8 :

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

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

   (*c*) For D_{6d} :

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

   irrespective of the suffix on B.

   (*d*) For D_{4d}, S_8 :

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

   irrespective of the suffix on B.

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

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

   (*a*) For O_h, O, T_d, D_{6h}, D_6, C_{6v}, C_{6h}, C_6, S_6, D_{3d}, D_{3h}, D_3, C_{3v}, C_{3h}, C_3 :

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

   (*b*) For D_{4h}, D_4, C_{4v}, C_{4h}, C_4, S_4, D_{2d} :

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

   (*c*) For D_{6d} :

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

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

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

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

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

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

(*d*) D_{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_8.

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

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

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

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

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

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

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

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

6. The complete results for O are :

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

CORRELATION TABLE FOR GROUP O_h

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

Character Table for (o) rotational group

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

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Total No. of Questions : 6]

SEAT No. :

P1862

[Total No. of Pages : 5

[5223]-203

M.Sc. - I

ORGANIC CHEMISTRY

CHO-250 : Synthetic Organic Chemistry & Spectroscopy

(2013 Pattern) (Semester-II) (New - 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) Cyclohexanone on reaction with methylene triphenyl phosphorane gives exo double bond (exo alkene) while reaction with dimethyl sulfonium methylide forms epoxide.

b) Reformatsky reagent is prepared with Zinc (Zn) i.e. $ZnBrCH_2COOE+$ and not with Magnesium(Mg) or Lithium(Li).

c) $Ph_2C(OH)C(OH)MePh$ on treatment with acid catalyst H^+ forms triphenyl methyl, methyl ketone ph_3c co me

d) In P-Nitro acetanilide two doublet J = $8H_2$ are observed, One doublet is observed at higher field than other.

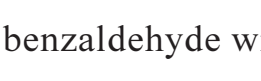
Q2) Attempt any four of the following: **[8]**

a) What is wilkinsons catalyst give its any one selective application.

b) What is MPV reduction explain with suitable example.

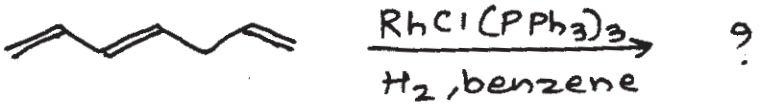
c) How Anthranilic acid is prepared by any one of the rearrangement reaction.

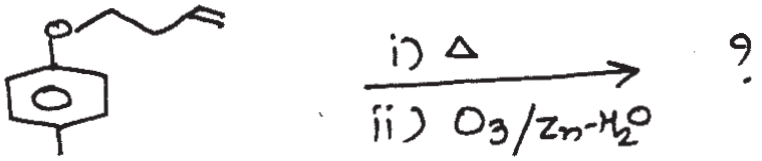
d) R_2CuLi can be used for conjugate addition of enone.

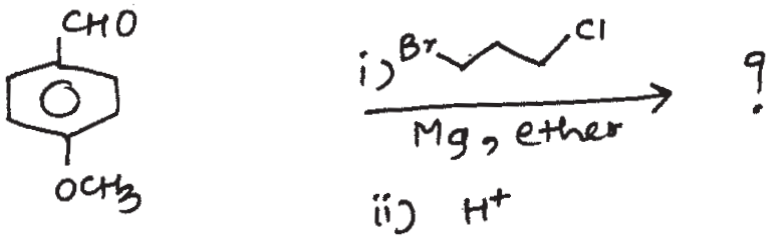
e) Reaction of benzaldehyde with  is much easier than reaction with  Explain.

P.T.O.

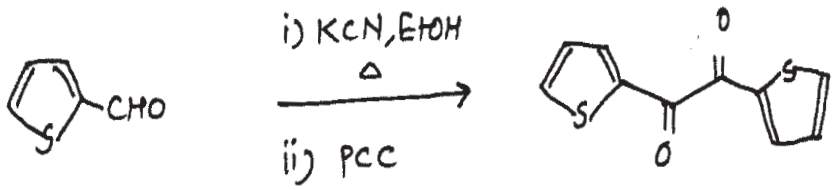
Q3) a) Predict the product (<u>any two</u>). **[4]**

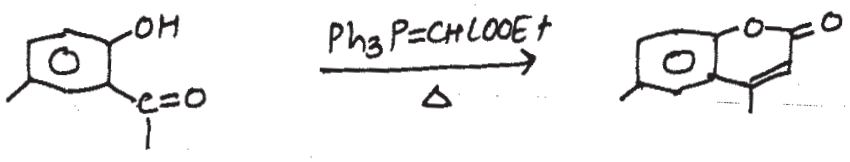
i) 

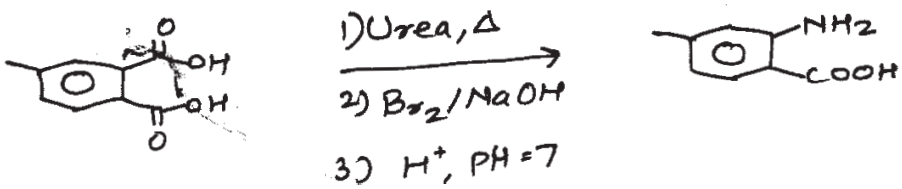
ii) 

iii) 

b) Suggest the mechanism (<u>any two</u>). **[4]**

i) 

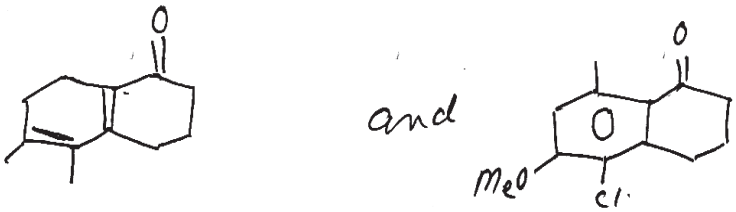
ii) 

iii) 

SECTION-II

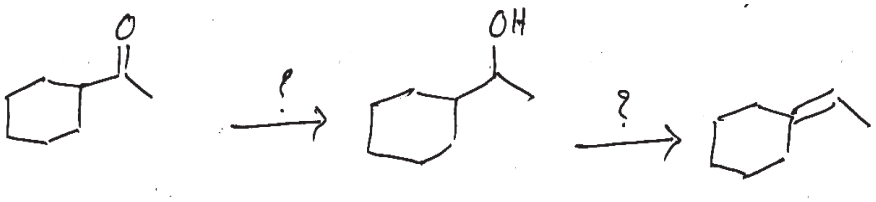
Q4) Attempt the following: **[10]**

a) Calculate the λ max for the following compounds.



b) Write a note on factors affecting chemical shift.

c) How will you monitor the following reaction sequence by IR. Suggest the reagents.



d) Explain with suitable example, the m^+ is stronger in alcohols and weak or absent in amines.

e) How will you distinguish the following compounds by PMR?

Q5) Deduce the structure of any five of the following compounds using spectral data and justify your answer, **[10]**

a) $C_6H_{10}O$

IR : 1710 and 1620 Cm^{-1}

PMR : δ 1.90 (*s*, 30 *mm*) δ 2.10 (*s*, 20 *mm*) δ 6.00 (*s*, 10 *mm*)

b) $C_6H_{10}O_3$

IR : 1740 and 1710 cm^{-1}

PMR : δ 1.28 (*t*, J = 7 Hz, 30 *mm*)

δ 2.21 (*s*, 30 *mm*)

δ 3.24 (*s*, 20 *mm*)

δ 4.20 (*q*, J = 7 Hz, 20 *mm*)

c) $C_8H_{15}NO$

I R : 1715 cm^{-1}

PMR : δ1.08 (*d*, J = 7 Hz, 6H)

δ 2.45 (*t*, J = 5 Hz, 4H)

δ 2.8 (*t*, J = 5 Hz, 4 H)

δ 2.93 (septet, J = 7Hz, 1 H)

d) $C_7H_7NO_3$

U. V. 265 mm

I R : 3600, 1520, 1360 cm^{-1}

PMR : δ 7.6 (*m*, 18 mm)

δ 8.15 (dd, J = 2 and 7Hz, 6 mm)

δ 2.9 (s, 6 mm, e×ch. D_2o)

δ 5 (s, 12 mm)

e) $C_7H_{12}O_4$

IR : 1742cm^{-1}

PMR : δ 2.6 (*s*, 10 mm)

δ 1.3 (*t*, J = 6.5 Hz, 30 mm)

δ 4.16 (*q*, J = 6.5 Hz, 20 mm)

f) Two isomeric compounds with molecular formula $C_{10}H_{12}O$ show following PMR data. Deduce their structures.

Isomer A : δ 1.0 (*t*, 3H), δ 2.45 (*q*, 2H),

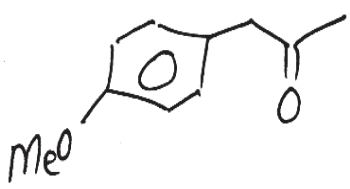
δ 3.7 (s, 3H), δ 7.25 (m, 4 H)

Isomer B : δ 2.1 (*s*, 3H), δ 2.75 (*t*, 2H)

δ 2.85 (*t*, 2H), δ 7.20 (5 H)

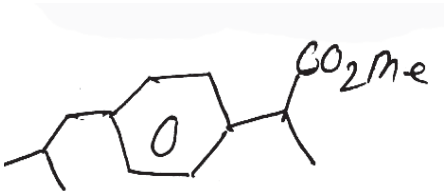
Q6) Attempt <u>any two</u> of the following. **[5]**

a) Assign the chemical shifts reasoning to the various carbon in the following compound.



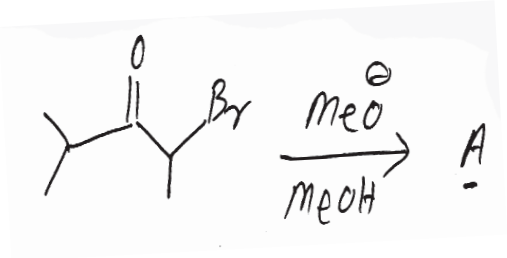
CMR : 29, (*q*), 50 (*t*), 55 (*q*)
114 (*d*), 126 (*s*), 130 (*d*)
150 (*s*), 207 (*s*)

b) Assign the chemical shifts for the following.



δ 0.9 (*d*, J = 7 Hz, 6H)
δ 1.5 (*d*, J = 7 Hz, 3 H)
δ 1.85 (*m*, 1H)
δ 2.45 (*d*, J = 7 Hz, 2H)

c) Suggest the structure for <u>A</u> .



PMR : δ 1.20 (9 H, S)
δ 3.67 (3 H, S)

✡ ✡ ✡

Total No. of Questions : 3]

SEAT No. :

P1863

[Total No. of Pages : 12

[5223]-204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry-II
(2013 Pattern) (Semester - II) (5 Credits)

PART - A : Modern Separation Methods and Hyphenated Techniques(2.5 Credits/ 25 Marks)

PART - B : Basic Biochemistry(5.0 Credits/ 50 marks)

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

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

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

PART - F : Mathematics for Chemists(2.5 Credits/ 25 marks)

PART - G : Pericyclic, Photochemistry and Free Radical Reactions(2.5 Credits/ 25 marks)

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

Instructions to the candidates:

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

PART - A

Modern Separation Methods and Hyphenated Techniques

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

a) What is the principle of Gas chromatography? Explain.

b) What is Normal phase chromatography?

c) How is the resolving power of HPLC column increased?

d) Define:

i) Theoretical plates. ii) Retention time.

e) Differentiate between gradient and isocratic elutions in HPLC.

P.T.O.

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

a) Explain the inductively coupled plasma in Mass Spectrometry?

b) What are the properties of an ideal detector? Classify different types of HPLC detectors and explain the working of refractive index detector.

c) With a proper schematic labelled diagram describe the components of HPLC instrumentation.

d) Give a brief account of:

i) Carrier gases in GC.

ii) Columns used in GC.

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

a) The following data was obtained by a gas-liquid chromatography on a 40cm packed column.

Compound		t_R(min.)	W(min.)
i)	Air	1.7	-
ii)	Methylcyclohexane	9.8	0.59
iii)	Methylcyclohexene	9.9	0.75
iv)	Toluene	10.7	0.98

Calculate:

i) Average number of plates

ii) Plate height

iii) The column resolution

b) What is chromatography? Classify different chromatographic techniques and give suitable explanation.

Total No. of Questions : 6]

P1863

[5223]-204
M.Sc. - I
CHEMISTRY
CH - 290 (B) : Basic Biochemistry
(2013 Pattern) (Semester - II) (5 Credits)
PART-B

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

SECTION-I

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

a) What are ribosomes? Explain prokaryotic and Eukaryotic ribosomes.

b) What is primary active transport? Explain with suitable example.

c) Discuss the reactions in TCA cycle.

d) Give an account of globular proteins.

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

a) Discuss the scope of biochemistry in pharmaceutical sciences.

b) Comment on:

i) Super secondary motifs

ii) Sphingolipids

c) How will you determine end groups of a protein?

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

a) Discuss:

i) Hair can be set into different shapes. Justify.

ii) Formation of peptide bond.

b) Give the structure of Chitin and Starch.

c) Classify proteins with suitable examples.

SECTION-II

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

a) Write a short note on Coenzymes.

b) Explain the post translational modification of protein.

c) Give an overview of diseases related to nutritional deficiencies.

d) Discuss different types of inhibition.

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

a) Explain the flow of genetic information.

b) Discuss in brief:

i) Structure and function of Vitamin A.

ii) DNA as genetic material.

c) What is gene expression? What are the factors involved in gene expression.

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

a) What is enzyme immobilization? Discuss different methods of enzyme immobilization.

b) Comment on:

i) Lagging strand synthesis

ii) Introns

c) Define the following:

i) Genome

ii) Transcription

iii) Replication

Total No. of Questions : 3]

P1863

[5223]-204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2013 Pattern) (Semester - II)
PART - C
Concept of Analytical Chemistry

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

a) Distinguish between accuracy and precision.

b) What is an analytical sample?

c) Explain in brief 'T' test.

d) What is meant by sample handling?

e) Calculate the proper number of significant figures in each of the following.

i) 0.00123

ii) 24.0021

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

a) What is an error? Explain the different types of errors.

b) Describe various steps in sampling operations.

c) Explain in detail the factors affecting the solvent extraction.

d) What is the principle of separation of ions by ion exchange technique. What are ion exchange resins? Give their classification.

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

a) Explain in brief:

i) Confidence limits

ii) Separation by distillation

b) The following results were obtained in the replicate determination of lead content in a waste water sample: 0.891, 0.890, 0.888, 0.889, 0.891 ppm. Calculate the mean and standard deviation of this set of data.

Total No. of Questions : 3]

P1863

[5223]-204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2013 Pattern) (Semester - II)
PART - D
Industrial Methods of Analysis

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

a) What are the benefits of quality system for chemical laboratory.

b) What is common ion effect. Give one example.

c) What is stability constant?

d) Calculate number of millimoles present in 0.2g of $CaCO_3$. (Given atomic weight Ca = 40, C = 12, O = 16).

e) Enlist different types of process analysers.

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

a) Explain different quality systems in chemical laboratories.

b) Write a note on continuous online process control.

c) Explain the term automatic chemical analyser. Explain any one automatic chemical analyser in detail.

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

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

a) What will be the analytical molar Na_2CO_3 concentration in the solution produced when 25.0ml 0.200M $AgNO_3$ are mixed with 0.0800M Na_2CO_3? (Given: Formation of 5.00×10^{-3} mole of $AgNO_3$ will require 2.50×10^{-3} mole of Na_2CO_3 and $n_{Na_2CO_3} = 4.00\times10^{-3}$ mole)

b) Define:

i) Buffer.

ii) Stepwise formation constant.

iii) Quality review.

Total No. of Questions : 3]

P1863

[5223]-204

M.Sc. - I

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry - II

(2013 Pattern) (Semester - II)

PART - E

Organometallic and Inorganic Reaction Mechanism

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

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

i) $\left[(\eta^5 - C_5H_5)_2Co\right]^+$

ii) $\left[(\eta^3\text{-}C_5H_5)(\eta^5\text{-}C_5H_5)Fe(Co)\right]$

b) Define and explain

i) ligand dissociation and substitution reaction

ii) carbonyl insertion reaction

c) Give the rate law for dissociation reaction mechanism.

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

i) $Re(PPh_3)_2\ Cl_2\ N$

ii) $ClMn(CO)_5$

e) Predict the type of reaction.

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

a) Explain the interchange mechanism in substitution reaction.

b) Write a note on : Monsanto acetic acid synthesis.

c) Explain the bonding in metal alkene compounds.

d) Write a note on outer sphere reactions.

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

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

b) Write a note on : Kinetic Chelate effect.

Total No. of Questions : 3]

P1863

[5223]-204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2013 Pattern) (Semester - II)
PART - F
Mathematics for Chemists

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

a) For the matrices

$$A = \begin{bmatrix} 3 & 2 \\ 1 & 3 \end{bmatrix} B = \begin{bmatrix} 4 & -2 \\ 1 & 2 \end{bmatrix} C = \begin{bmatrix} 1 & 3 \\ 2 & -1 \end{bmatrix}$$ evaluate (A + B)C = AB + BC.

b) Give the derivatives of:

i) sec x

ii) cos x

iii) a^x

iv) tan x

v) x^n

c) Give the Kramer's rule.

d) Define transpose of a matrix and give suitable example.

e) Twenty different metals are to be combined in alloys regardless of relative compositions. How many different binary alloys (containing two metals) are possible?

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

a) i) Find the determinant of:

$$\begin{bmatrix} 1 & 2 & 6 \\ 5 & 2 & 2 \\ 8 & 9 & 1 \end{bmatrix}$$

ii) Find the cofactor of:

$$\begin{bmatrix} 3 & 2 & 1 \\ 1 & 8 & 1 \\ 5 & 2 & 1 \end{bmatrix}$$

b) A radioactive sample when measured using a scintillation counter four times, showed the activity 1202, 1206, 1222, 1201 cpm. Find the average activity and standard deviation.

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

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

ii) $y = x^2 \log x$.

d) Evaluate the following:

i) $\int (x^3 + x + 5)dx$

ii) $\int (x^2 - 3)^2 dx$

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

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

i) Straight lines

ii) Slope and intercept

b) Using Falk's scheme evaluate the following:

i) $A = \begin{bmatrix} 2 & 8 & 6 \\ 1 & 2 & 3 \end{bmatrix} \quad x = \begin{bmatrix} 4 \\ 6 \\ 9 \end{bmatrix} \quad Ax = ?$

ii) $B = \begin{bmatrix} 2 & 9 & 1 \\ 8 & 2 & 7 \end{bmatrix} \quad y = \begin{bmatrix} 5 \\ 1 \\ 5 \end{bmatrix} \quad By = ?$

Total No. of Questions : 3]

P1863

[5223]-204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2013 Pattern) (Semester - II)
PART - G
Pericyclic, Photochemistry and Free Radical Reactions

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

a) What do you mean by quantum yield, explain it's significance in photochemical reactions.

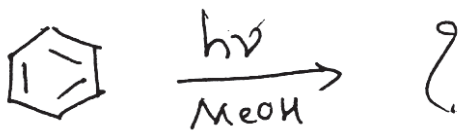
b) Irradiation of o-xylene yields mixture of m- and p-xylenes.

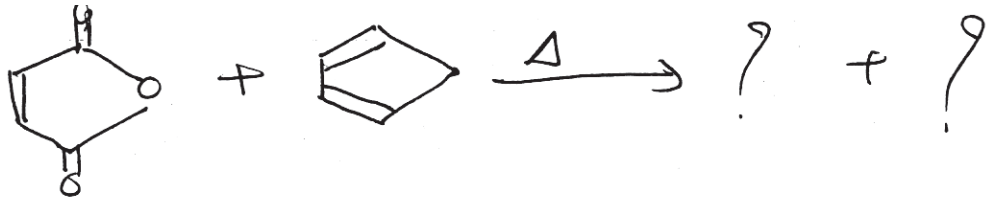
c) Discuss Sandmeyer reaction with suitable example.

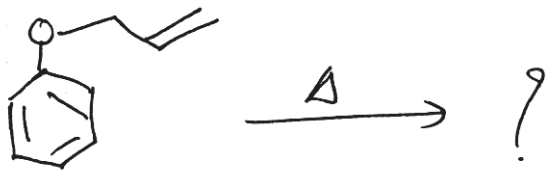
d) What is sigmatropic rearrangement? Suggest suitable example.

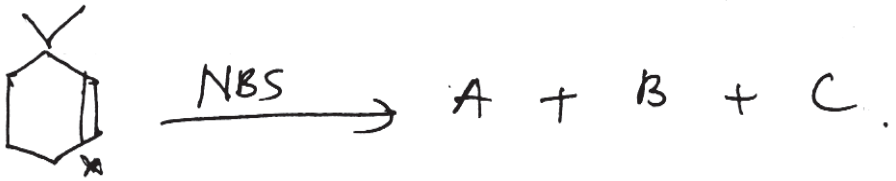
e) Triplet oxygen shows free radical reactivity, while singlet oxygen behaves like neutral molecule.

Q2) Predict the product/products indicating mechanism in any two of the following: **[10]**

a) 

b) 

c) 

d) 

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

a) Explain with the help of FMO approach whether $\left[\pi^4 s + \pi^2 s\right]$ cycloaddition reaction is thermally allowed or photochemically allowed.

b) Write a short note on Norrish Type-I process.

c) Explain photochemistry of aromatic compounds with suitable examples.

Total No. of Questions :6]

SEAT No. :

P1864

[Total No. of Pages :3

[5223] - 301

M.Sc.

PHYSICAL CHEMISTRY

CHP-310: Quantum Chemistry and Solid State Chemistry

(2013 Pattern) (Semester - III)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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 precisely the following: **[10]**

a) State the postulates of quantum mechanics.

b) Define linear operator giving an example.

c) Find the term symbol for

i) L = 2, S = ½ and

ii) L = 1, S = $\frac{3}{2}$

d) Which of the following functions are eigen functions of d^2/dx^2 ? Give their eigen values.

i) e^x

ii) $4x^2$

iii) $\sin x$

iv) $3 \cos x$

v) $\cos x + \sin x$

e) State variation theorem.

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

a) Deduce the secular equations for benzene and hence sketch the MO energy level diagram.

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

c) State Hückels (4m+2) rule. Explain the mnemonic model used for monocyclic conjugated polyenes to deduce the separation of MO energy levels.

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

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

a) Derive the equation for linear momentum operator (P_x).

b) Formulate the Hamiltonian operators for

i) Be^{+2} ion and

ii) H_2 molecule, explain the terms involved in it.

SECTION-II

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

a) What are intrinsic and extrinsic semi-conductors?

b) Define point defect. Give its classification.

c) State Donnay and Hawker rule.

d) Explain the formation of F and V colour centres.

e) Enlist various steps in photographic process.

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

a) Explain photoconductivity in ionic crystals.

b) Derive the expression for number of Frenkel defects present in a crystal at a given temperature.

c) Draw and describe the various α-t plots for the decomposition of a single solid.

d) Discuss any two methods with their merits and demerits of growing crystal from its melt.

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

a) Calculate the mean free time for an electron in a semiconductor crystal having drift mobility 626 cm^2/volt. sec.

b) If the average energy required to create a vacancy in a metal is 1eV, calculate the ratio of vacancies in the metal at 300 and 800 K.

EEE

Total No. of Questions :6]

SEAT No. :

P1865

[Total No. of Pages : 3

[5223]-302
M.Sc.
PHYSICAL CHEMISTRY
CHP - 311 : Nuclear, Radiation and Photo-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 and calculator is allowed.*
5) *Neat diagrams must be drawn wherever necessary.*

Physico - Chemical Constants

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			=	6.626×10^{-34} J s
4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
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 fissile & fissionable nuclide? Give it's example.

b) What is critical energy for Nuclear fission?

c) Discuss the principle of PIXE technique.

d) Draw the schematic diagram of Li-drifted detector.

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

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

a) Discuss with the help of a typical fission yield curve, the distribution of fission fragments.

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

c) Discuss the merits & demerits of shell model of nucleus.

d) Explain the construction & Working of surface barrier detector.

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

a) Calculate the energies of the two peaks in the RBS spectrum correspond to ^{65}Cu & ^{197}Au assuming on incident $^{4}He^{+}$ ions of 2MeV energy & a scattering angle of 160°.

b) If the number of uranium atoms fissioning per three seconds are 9.51×10^{17}, find the power generated in MW, Given : Energy released per uranium nuclear fission is 200 MeV.

SECTION - II

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

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

b) Calculate the frequency of ultraviolet light having wavelength of 3000 $\mathring{A}$.

c) Explain lifetimes of excited electronic states of atoms and molecules.

d) Explain the terms stimulated emission and spontaneous emission.

e) Give two important characteristics of fluorescence.

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

a) Discuss the phenomena of fluorescence and phosphorescence with the help of Jablonski diagram.

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

c) Discuss the theory of fluorescence.

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

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

a) A certain system absorbs 3.0×10^{16} quanta of light per second. On irradiation for 10 minutes, 0.002 mol. of reactant was found to have reacted. Calculate quantum efficiency.

b) On irradiation of propionaldehyde at 30ºC with light $\lambda = 3020\ \mathring{A}$, the quantum yield for CO is found to be 0.54. The intensity of the incident light is 15,000 erg/sec. What is the light intensity in Einstein's per second? Also find rate of formation of CO.

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Total No. of Questions : 6]

SEAT No. :

P1866

[Total No. of Pages : 3

[5223]-303

M.Sc.

PHYSICAL CHEMISTRY

CHP-312 : Physico-Chemical Methods of Analysis

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

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

Instructions to the candidates:

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

Physico - Chemical Constants

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6.	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}
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8.	Speed of light	c	=	2.997×10^{10} cm s^{-1}
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			=	4.184 J
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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) Why does weight of empty crucible change when it is heated upto 1000°C in TGA technique.

b) Define the terms binding energy and work function used in ESCA.

c) Define absorptive edge. State its use.

d) What is meant by short-wavelength cutoff. Write Duane-Hunt equation and explain the terms involved therein.

e) Show glass transition temperature, crystallisation, melting and oxidation on a typical DTA curve.

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

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

b) Describe the spherical electrostatic field analyzer used in ESCA.

c) Discuss the applications of DTA technique.

d) Explain the various factors which affect thermogravimetric analysis.

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

a) What is the thickness of foil of the alloy having absorption coefficient 631.75cm^2/g at 0.436nm. The detector recorded 10,848cpm of transmitted X-rays when foil was not in the path of X-rays and 1023cpm when foil was placed in the path. The density of alloy is 8.01g/cm^3.

b) The thermal curve corresponding to a sample that contain Al (OH) $(HCOO)_2$ 0.5 H_2O shows stepwise weight loss at temperatures of 200, 260 and 350°C and decomposes to Al_2O_3. A 25mg sample had total loss of 22.5% of the initial mass of the sample. Determine the percentage of Al (OH) $(HCOO)_2$ 0.5 H_2O in the sample.

Given: Atomic weights of Al = 27, C = 12, O = 16, H = 1.008.

SECTION-II

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

a) Briefly describe quantitative analysis by chemiluminesance.

b) What are the different excitation signals used in voltammetry technique?

c) State the principle of coulometry.

d) Define plasma and give the advantages of using plasma is atomic emission spectroscopy.

e) Briefly describe hydrodynamic voltammetry.

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

a) Discuss briefly the factors affecting the photoluminescence.

b) Discuss the applications of pulse voltammetry.

c) Describe H_2 - O_2 Coulometer.

d) Explain the sample introduction in ICP spectrometer.

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

a) The initial current is go mA and decreases exponentially with k = 0.0058 sec^{-1}, the titration time is 714 sec. How many milligrams of uranium (VI) are reduced to uranium (IV)?

b) Potassium ferrocyanide (n = 1) has a diffusion coefficient of 6.5×10^{-6} cm^2/s during its oxidation in 0.1Mkcl. It was used to measure the area of 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.

Total No. of Questions :6]

SEAT No. :

P1867

[Total No. of Pages : 3

[5223]-304
M.Sc.
PHYSICAL CHEMISTRY
CHP - 313 : Polymer Chemistry
(2013 Pattern) (Semester - III)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) State the assumptions of the Krigbaum theory.

b) Explain the term 'excluded volume'.

c) State Stress - strain equation for a polymer.

d) Define the terms morphology and rheology.

e) Explain relative and reduced viscosities.

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

a) Explain Newtonian and non-Newtonian behaviour of polymers with a diagram.

b) Explain the copolymer equation.

c) Write a note on vulcanization.

d) Explain the WLF equation. Give its applications.

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

a) Calculate the viscosity of a polymer at 0.5 g/dl concentration

[Huggins constant = 0.33, $k = 1.2 \times 10^{-4}$, $\alpha = 72$ and $M = 10^5$].

b) Explain the effect of radiation on polymers.

SECTION - II

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

a) Define conducting polymers, giving examples.

b) Distinguish between hot and cold molding.

c) Explain glass transition temperature.

d) Distinguish between thermosetting and thermoplastic polymers.

e) Explain re-inforcement.

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

a) Explain injection molding giving a diagram.

b) Write a note on additives in polymers to improve the properties.

c) Write a note on step polymerization.

d) Explain the sedimentation velocity method of molecular weight determination.

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

a) Explain conduction mechanism in conducting polymers.

b) Explain DTA in polymer analysis.

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Total No. of Questions :6]

SEAT No. :

P1868

[Total No. of Pages : 3

[5223]-305

M.Sc.

PHYSICAL CHEMISTRY

CHP - 314 : Modern Trends in Physical Chemistry

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

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) State the phase rule and describe the terms involved in it.

b) Define the term upper critical solution temperature. Give its examples.

c) Write the mass balance on phosphate in 0.1 MH_3PO_4.

d) Write the charge balance for 0.1 MH_2CO_3.

e) Write the proton condition for H_2Se.

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

a) Describe upper and lower critical solution temperature with examples.

b) Discuss one component system with a neat labelled diagram.

c) Derive the equation showing the relation between total vapour pressure of the mixture, P_1 to the composition of the vapour Y_A.

d) Calculate pH and concentration of all species for 0.1 $NN_{a2}CO_3$ (Given $k_{a1} = 4.47 \times 10^{-7}$, $k_{a2} = 5.62 \times 10^{-11}$).

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

a) The pH of a 0.1 M solution of a salt of phosphoric acid is 12.56. Find the concentration of H_3PO_4, $H_2PO_4^-$, HPO_4^{2-} and PO_4^{3-}.

[Given: $k_{a1} = 5.89\times10^{-3}$, $k_{a2} = 6.10\times10^{-8}$ and $k_{a3} = 4.78\times10^{-13}$].

b) Draw a logarithmic concentration diagram for 0.01 NCH_3COOH.

[Given : $k_a = 1.8 \times 10^{-5}$].

SECTION - II

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

a) Which are the principal images produced in SEM?

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

c) How does a biosensor work?

d) Define Ferrofluids and Magneto rheological fluids.

e) How is the exciton formed in semiconductor nanoparticles?

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

a) Calculate the limiting resolution that can be achieved by a microscope using a wavelength 200 nm, refractive index of the medium 0.61 & the glancing angle 30º.

b) Write a note on Carbonnanotubes:

c) What is passive smart materials? Explain with two examples.

d) Write a note on Ceramics.

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

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

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

❄ ❄ ❄

Total No. of Questions :4]

SEAT No. :

P1869

[Total No. of Pages :2

[5223] -306

M.Sc. -II

INORGANIC CHEMISTRY

CHI-326: Organometallic Chemistry and Homogeneous Catalysis

(2013 Pattern) (Semester - III)

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

Instructions to the candidates:

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

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

a) Give properties of cyclobutadienes compounds.

b) What are the general features of homogeneous catalysis?

c) Consider the $18\,\bar{e}$ rule as a guide and determine the value of 'n' in the following . Complexes.

i) $(\eta^5.\ C_5H_5)\ V\ (CO)_n$

ii) $Na_2\ Fe(CO)_n$

d) Give industrial applications of Heck reaction.

e) Define-activity and selectivity catalysis.

f) What is Fenton reagent? Mention its advantages.

g) What is oxidative addition reaction?

h) Comment on the therapeutic properties of-

i) Salvarsan

ii) Silatrane

i) What are the difference between Suzuki and Heck coupling reaction?

j) What is Tollman cone angle?

P.T.O.

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

a) Give synthesis, bonding, properties and applications of phosphine compounds.

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

c) Explain, with the help of suitable example of the role of organometallic compound as a activating agents.

d) The variable temperature $^{1}H_{nmr}[(\eta^{5}\text{-}C_5H_5)\ Fe(CO)_2]_2$. Shows one sharp signal at +28°C, while two sharp signals are seen in the $^{1}H_{nmr}$ at – 70°C. Explain.

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

a) Write an account of application of OM is in agriculture and horticulture.

b) Explain the Dewar-Chatt-Dunconson model for bonding in metal olefin complexes.

c) Give, synthesis, bonding and properties of metal-cyclopentadienyls.

d) What is olefin epoxidation? What transition metal complexes plays important role in it?

Q4) a) Write short note (any one): **[5]**

i) Cativa process.

ii) Metal-cycloheptatrienyls complexes.

b) Draw the structures: **[5]**

i) $[Ir(PPh_3)_2\ (CO)\ (NO)\ Cl]^{+}$

ii) $(Cpd)_2\ MoH_2$

iii) Bis Π Cpd allyl titanium (III)

iv) Dimeric $Mn_2(CO)_{10}$

v) $[Ru\ (PPh_3)_2\ (NO)_2\ Cl]^{+}$

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Total No. of Questions :4]

SEAT No. :

P1870

[Total No. of Pages :3

[5223] - 307

M.Sc. - II

INORGANIC CHEMISTRY

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

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

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

Instructions to the candidates:

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

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

a) What do you mean by inert and labile complexes.

b) Propose an efficient route for the synthesis of cis & trans [Pt $Cl_2(NH_3)(pph_3)$] starting from $[Pt\ Cl_4]^{2-}$.

c) What do you mean by atom or group transfer reactions? Explain with suitable example.

d) Explain the mechanism of cis - trans isomerization in the following metal complexes.

$$cis\left[Co(en)_2Cl_2\right]^+ \rightarrow Trans\left[Co(en)_2Cl_2\right]^+$$

e) Arrange the following metal complexes according to the increasing order of their rate of aquation. Justify your answer.

trans$[Co(NH_3)_4\ Cl_2]^+$, trans$[Co(en)_2Cl_2]^+$, trans$[Co(en)\ (NH_3)_2\ Cl_2]^+$

f) List out the characteristics of inner sphere electron transfer reaction.

g) Describe the phenomenon of fluoroscence.

P.T.O.

h) Describe the mechanism for halogenation of nitrogen atom of coordinatel ligand.

i) Find out R.S. term symbol for Ti^{3+} & Co^{3+}.

j) Define the terms

i) Ferromagnetism.

ii) Antiferromagnetism.

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

a) Compare SN^1 and SN^2 mechanism in octahedral substitution reactions.

b) What do you mean by acid hydrolysis? Explain with suitable example.

c) Solvent plays an important role in the substitution reactions of square planer complexes? Explain.

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

i) Mn^{3+} μ_{expt} = ~ 4.9 BM

ii) Co^{2+} μ_{expt} = 4.1 to 5.2 BM.

(Given at No. Mn = 25, Co = 27)

Q3) Attempt the following : **[10]**

a) Discuss the intra molecular mechanism proposed for the racemization reaction of tris chelate complex.

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

c) What is outersphere electron transfer reactions? Discuss its mechanism with suitable example.

d) What are mixed valence compounds? How they are classified? Comment on their magnetic behaviour.

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

a) Chellate effect.

b) Photochemical reactions of Cr (III) complexes.

c) Insertion Reactions.

d) Solute - solvent interaction.

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Total No. of Questions : 4]

SEAT No. :

P1871

[Total No. of Pages : 2

[5223]-308

M.Sc. - II

INORGANIC CHEMISTRY

CHI-331 : Physical Methods in Inorganic Chemistry

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

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

Instructions to the candidates:

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

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

a) How many number of ESR - signals and Intensity ratio shown by HD radical?

b) Why XPS - required UHV condition?

c) Explain the centre shift in Mössbauer spectroscopy.

d) Which of the following molecules or ions shows ESR-spectrum? Justify your answer.

$O_2, O_2^+, O_2^-, Cu^+, Cu^{2+}$ & Zn^{2+}

e) Draw the schematic diagram of DSC instrument.

f) What is cyclic voltammetry? Which standard compound used in cyclic voltammetry?

g) Write the selection rule for allowed transition in Mössbauer spectroscopy.

h) Draw the miller indices for [100], [110].

i) Name the thermocouple used in TGA.

j) Define lattice.

P.T.O.

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

a) A cubic crystaline material of cell length 10.60A° is to be examined by using cukα radiation ($\lambda = 1.54A°$). At what angle would you expect to get the maximum reflection from the fourth order of (100) plane?

b) Explain the use of cyclic voltammetry for detection of 1, 2, 3, 4 tetrachlorobenzen.

c) How the quadrupole splitting occurs in the molecules? Explain whether the natural ^{57}Fe shows quadrupole splitting.

d) Explain the ESR-spectrum for benzene radical.

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

a) A mixture of CaO & $CaCo_3$ only is to be analysed by thermo gravimetry. The resultant curve indicate one decomposition between 600°C to 900°C during which the weight of sample decreases from 250. 6mg to 190. 8mg. What is the percent of $CaCO_3$ in mixture by weight.

b) The crystal of unit cell of MgO is a cubic 4.2A° an edge. The structure is interpenetrating face centered. What is the density of crystalline MgO? Given (At Wt. Mg = 24).

c) Calculate the 'g' value for a electron.

d) Explain the synergism by using mössbauer spectroscopy with suitable example.

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

a) Explain zero-field splitting & kramers degeneracy.

b) Discuss the principle, instrumentation of XPS.

c) Explain the role of supporting electrode in C.V.

d) Write any two application of TGA.

Total No. of Questions :4]

SEAT No. :

P1872

[Total No. of Pages :2

[5223] - 309

M.Sc. - II

INORGANIC CHEMISTRY

CHI - 332 : Bioinorganic and Inorganic Medicinal Chemistry

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

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

Instructions to the candidates:

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

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

a) Which element is present at the active centre of carboanhydrase? What is the function of carboanhydrase?

b) Name the type - 1 Copper proteins. What are the pathological disorders caused due to Cu deficiency?

c) Enlist the functions of blue - copper proteins.

d) What is the role of super oxide dismutase in a biological system?

e) Which element is present at the active site centre of tyrosinase? Give the functions of tyrosinase.

f) What is the function of Mo - dependent nitrogenase? Give the overall reaction catalyzed by Mo - dependent nitrogenase.

g) Mention any four biological conversions in which iron - sulfur plays important role.

h) Which technique can be used for production of ^{67}Ga nuclide? Explain in brief.

i) Explain the process of decay of ^{131}In.

j) Which oxidation states of Mn are accessible in biology? Why Mn^{+2} is biologically important?

P.T.O.

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

a) Write a note on: Tyrosinase as non blue oxidases.

b) Explain the role of Manganese in peroxidases.

c) Explain the antagonism of Cu and Mo.

d) What is the oxidation state of Vanadium in amavadin? Explain the structural features of amavadin.

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

a) What is the function of carboxypeptidase? Explain in brief the structural features of carboxypepsidase.

b) Give an account of differences between type 1 and type 2 copper proteins.

c) Explain the mutase activity of coenzyme B12.

d) Name the metallo enzyme responsible for removal of H_2O_2. Discuss its active site, structure and functions.

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

a) Give an account of functions of L-Dopa.

b) Write notes on

i) Antitumor agents.

ii) MRI.

c) Write a note on gamma scintigraphy and its applications.

d) Write a note on hypoxia imaging agents.

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Total No. of Questions :6]

SEAT No. :

P1873

[Total No. of Pages :4

[5223] - 310

M.Sc. -II

ORGANIC CHEMISTRY

CHO-350: Organic Reaction Mechanism

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

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

Instructions to the candidates:

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

SECTION-I

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

a) Discuss cross Aldol-condensation with suitable example.

b) Illustrate anchimeric assistance by 6 bond.

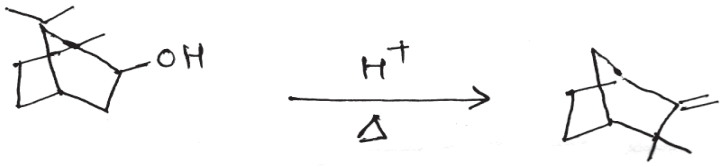
c) Explain the role of NADH in biological reactions.

d) Explain the Dickmann cyclisation with suitable example.

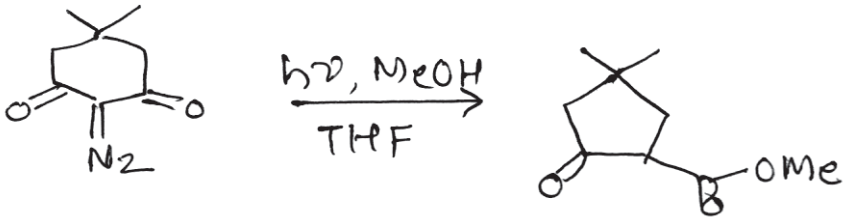
e) Give the importance of enamine reactions.

Q2) A) Suggest the mechanism for any three: **[6]**

a)



b)



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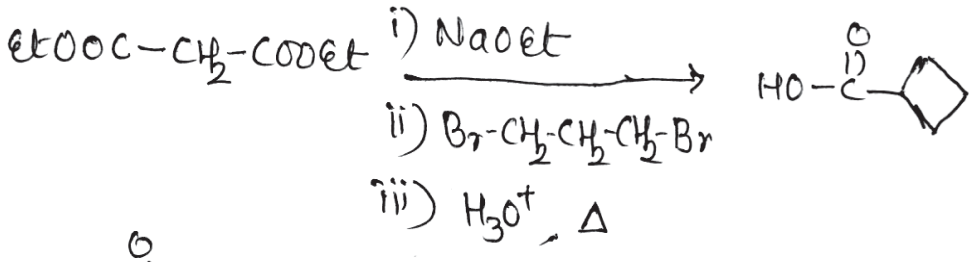
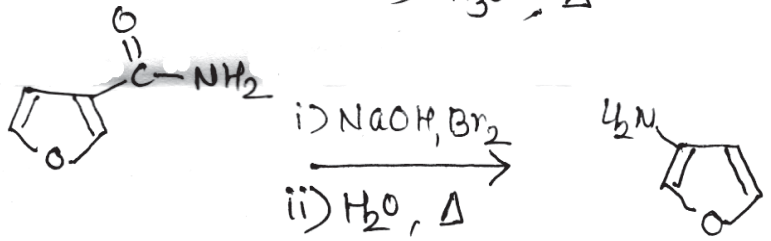
c) 

d) 

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

a) Discuss factors affecting stability of carbanions.

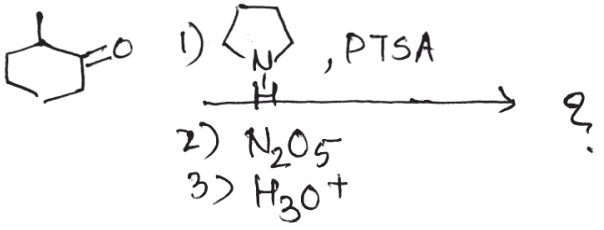
b) Discuss neighbouring group participation of sulphur atom with suitable example.

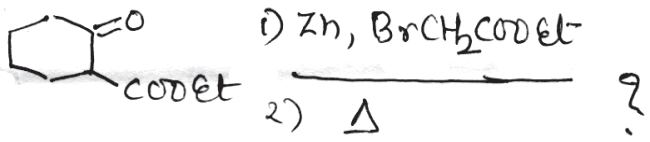
c) Discuss the mechanism of Perkin reaction.

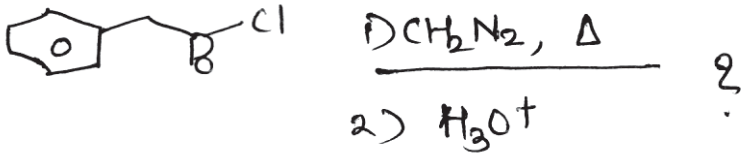
Q3) Answer any one of the following: **[5]**

a) Explain Wittig reaction with detail mechanism. Discuss the recent modifications in Wittig reactions.

b) Predict the products in any two:

i) 

ii) 

iii) 

SECTION-II

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

a) Discuss SNAr with suitable example.

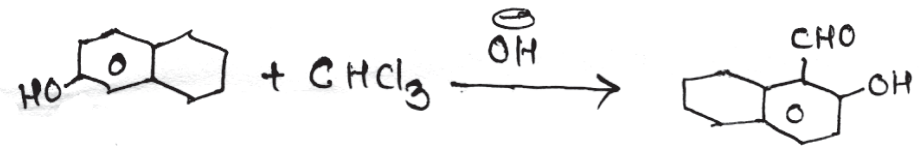
b) Discuss peroxide effect with suitable example.

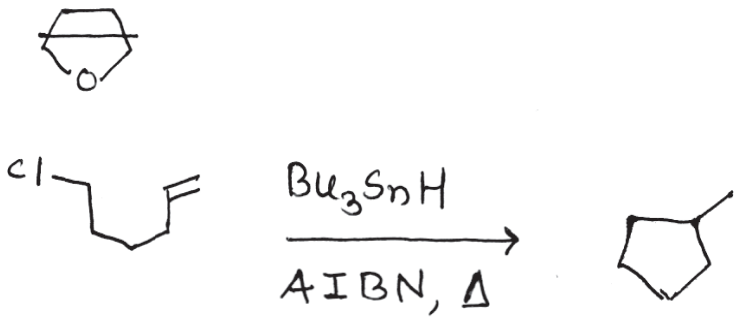
c) Discuss the role of Bu_3SnH in the formation of ring compounds.

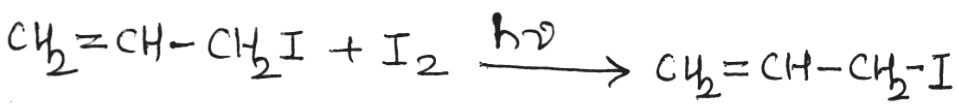
d) Explain the radical coupling giving suitable example.

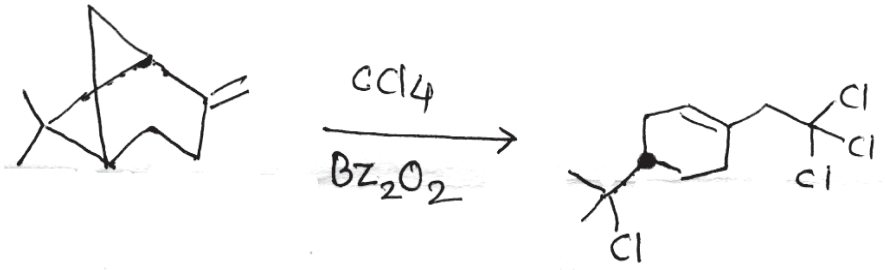
e) Explain the role of NADH in biological reactions.

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

a) 

b) 

c) 

d) 

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

a) Dimerisation of 1,3-butadiene.

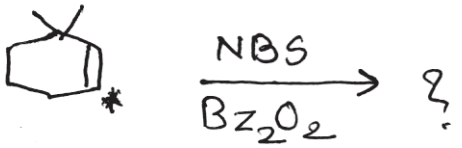
b) Transannualar Reaction.

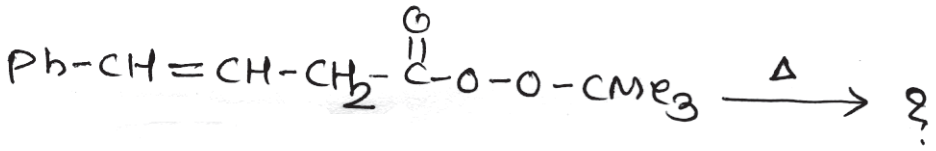
c) Role of pyridoxal phosphate.

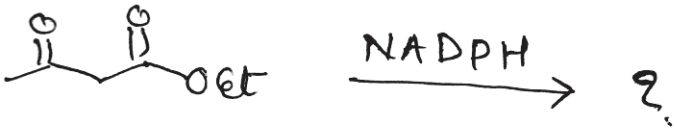
Q6) Answer any one: **[5]**

a) Explain the thermal and photochemical decomposition of peroxides with suitable examples.

b) Predict the products in any two: **[5]**

i) 

ii) 

iii) 

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Total No. of Questions :6]

SEAT No. :

P1874

[Total No. of Pages :7

[5223] - 311

M.Sc.

ORGANIC CHEMISTRY

CHO-351: Spectroscopic Methods in Structure Determination

(2013 Pattern) (Semester - III)

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

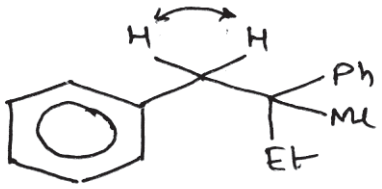
Instructions to the candidates:

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

SECTION - I

Q1) A) Answer any three of the following : **[6]**

a) The J values for the compounds are as shown below Explain.



14 Hz

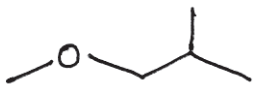
4.8 Hz

b) The ^{1}H NMR spectrum of monofluoro acetone shows a doublet for methyl protons with J = 4.3 Hz, Explain.

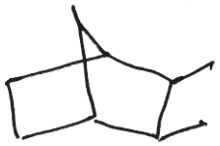
c) Explain the significance of metastable ions in MS.

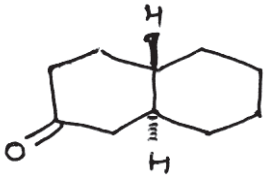
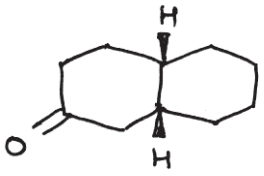
d) DEPT is preferred over off - resonance experiment for ^{13}C signal assignments. Explain.

B) Distinguish the following pairs by spectral method indicated (any two):**[3]**

a)  and  mass

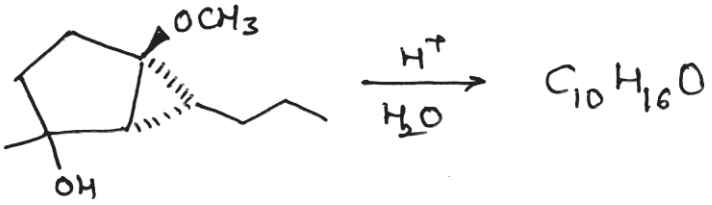
P.T.O.

b)  and  CMR

c)  and  PMR

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

a) Assign the structure.



CMR : 14(q) 19.8(q) 23(t) 30.8(t) 34.7(t) 37.4(t) 48.1(d) 123.7(d) 134.2(s) 213.2(s)

PMR : 0.88(t, 7.2Hz, 3H) 1.2-1.6(m, 4H) 1.75(s, 3H) 2.3-2.5(m, 4H) 2.71(bs, 1H) 5.37(m, 1H)

b) Predict the structure

M.F. : $C_9H_{16}O$

IR : 1680, 1635 cm^{-1}

PMR : 0.9(d, 7Hz, 6H) 1.0(t, 7Hz, 3H) 1.77(m, 1H) 2.09(t, 7Hz, 2H) 2.49(q, 7Hz, 2H) 5.1(d, 16Hz, 1H) 6.71(dt, 16 & 7Hz, 1H)

c) Deduce the structure

M.F. : $C_{11}H_{12}O$

IR : 1708 cm^{-1}

Mass : 160, 145

CMR : 205(s, w) 165(s, w) 136(d) 135(s, w) 129(d) 123(d) 122(d) 52(t) 39(s) 30(q, str.)

d) Deduce the structure :

M.F. : $C_6H_6O_2$

IR : 1600, 1500, 1705 cm^{-1}

PMR : 2.3 (s, 3H) 5.85 (d, 2Hz, 1H) 6.2 (dd, 1.5 & 2Hz, 1H) 7.2(d, 1.5 Hz, 1H)

CMR : 198, 156, 145, 130, 125, 23

DEPT 135 : 145, 130, 125, 23 up 198, 156 absent

e) Predict the structure

M.F. : $C_7H_7O_3N$

UV(λ_{max}) : 265 nm (ϵ = 15,000)

IR : 3600, 1600, 1530, 1495, 1360cm^{-1}

PMR : 2.9(s, 6mm, exch.) 5.0(s, 12 mm) 7.6(m, 18 mm) 8.15(dd, 2 & 7Hz, 6 mm)

Q3) Write short note on any three of the following : **[6]**

a) Factors affecting geminal coupling constants in PMR.

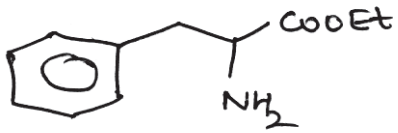
b) Contact shift reagents.

c) Various analyzers used in MS.

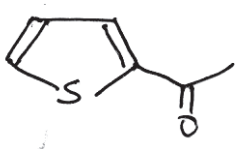
d) Correlated Spectroscopy.

SECTION - II

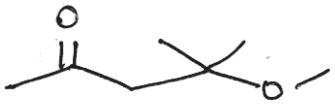
Q4) A) Write the genesis of the ions indicated below (any three) : **[6]**

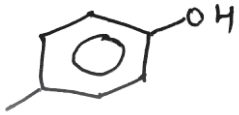
a) 

193, 120, 102, 91

b) 

126, 111, 83, 39

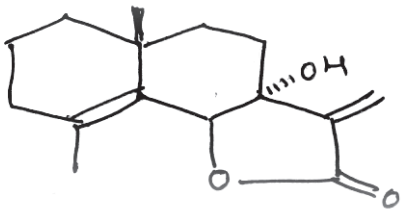
c)  130, 115, 100, 73, 43

d)  108, 107, 79, 77

B) A compound with molecular formula $C_{11}H_{14}O$ shows following peaks in its MS. Deduce its structure. **[2]**

m/e : 162, 134, 119, 91, 77, 71, 43

Q5) A) Assign the signals to various carbon atoms in the following compound. **[3]**



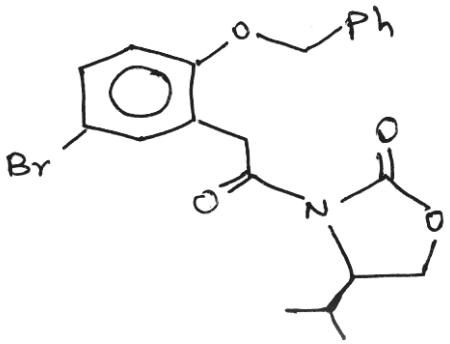
17.9 (t) 19.1(q) 25.8(q) 31.1(t)

32.4(s) 32.8(t) 34.6(t) 38.4(t)

75.5(s) 81.3(d) 121.0(t) 126.7(s)

140.0(s) 144.7(s) 169.7(s)

B) Assign the signals given below to the various protons in compound X. Justify your answer. **[5]**



7.35-7.28(m, 7H) 6.79(d, 8.7 Hz, 1H)

5.05(d, 11.7Hz, 1H) 5.0(d, 11.7Hz, 1H)

4.21(d, 17.5Hz, 1H) 4.30(m, 1H)

4.18(d, 17.5 Hz, 1H) 4.14(dd, 9.1 & 3Hz, 1H)

4.07(t, 9Hz, 1H) 2.29(m, 1H)

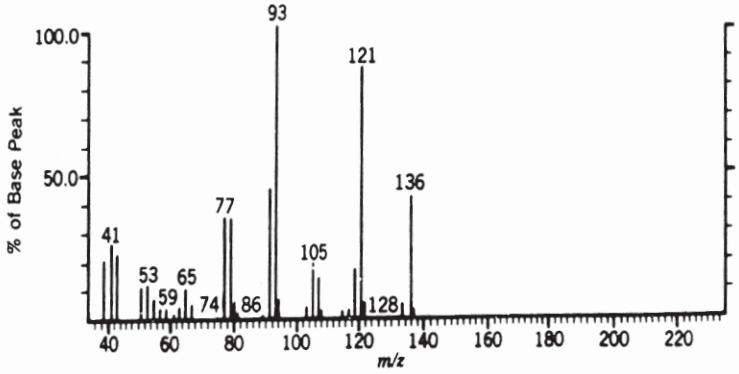
0.85(d, 7.1Hz, 3H) 0.77(d, 7Hz, 3H)

Decoupling Expt :

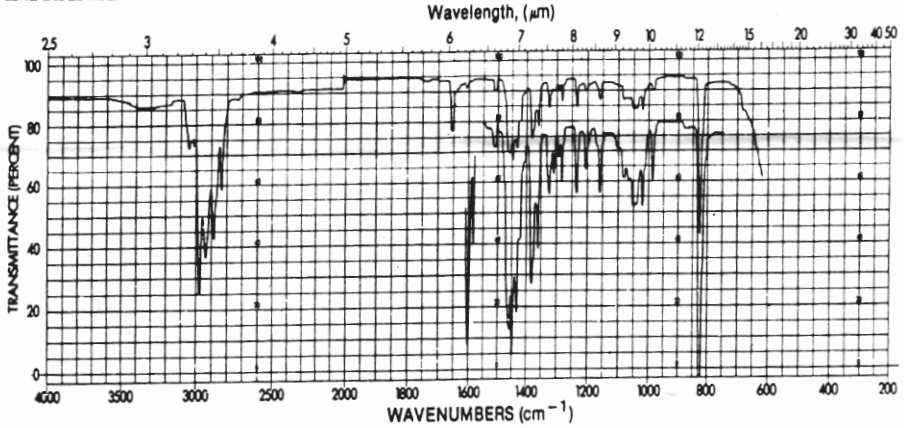
Irradiate at	Change at
4.30 δ	i) 2.29(m) $\rightarrow$ septet
	ii) 4.14(dd) $\rightarrow$ d(9.1Hz)
	iii) 4.07(t) $\rightarrow$ d(9.1Hz)

Q6) A compound exhibits following spectral data shown on the attached sheet. Suggest the structure and explain the observed spectral data. **[9]**

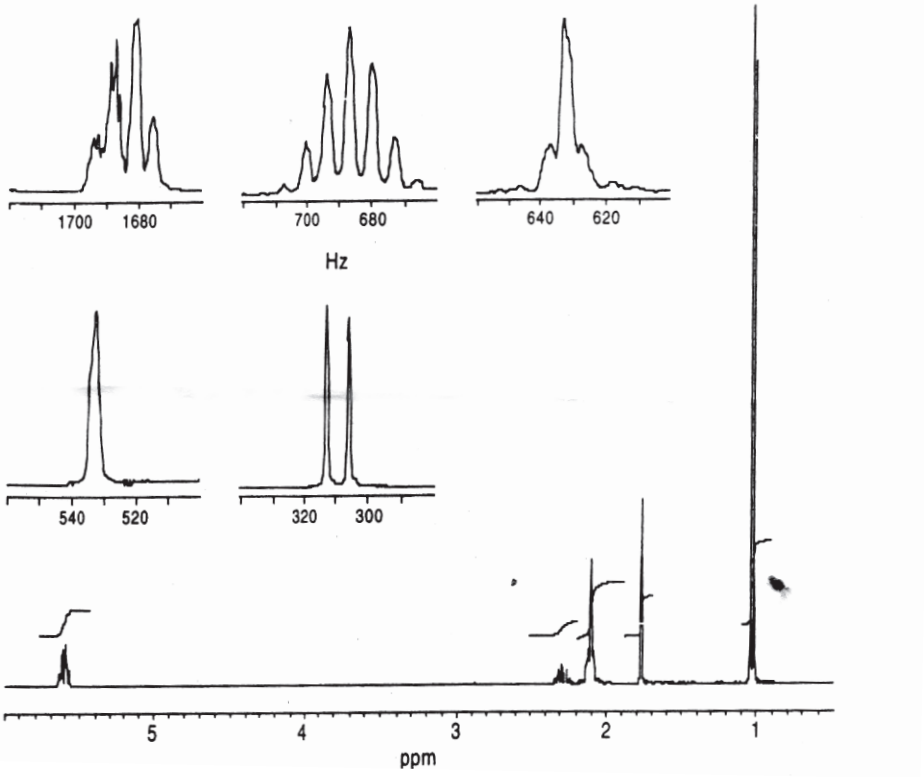
MASS

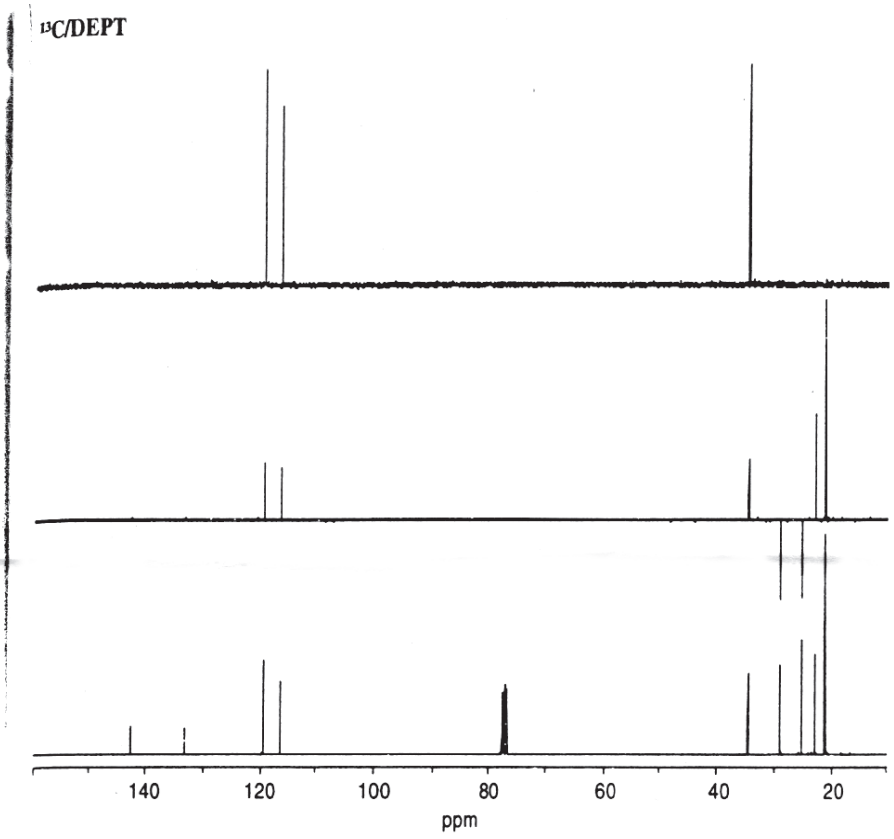


INFRARED

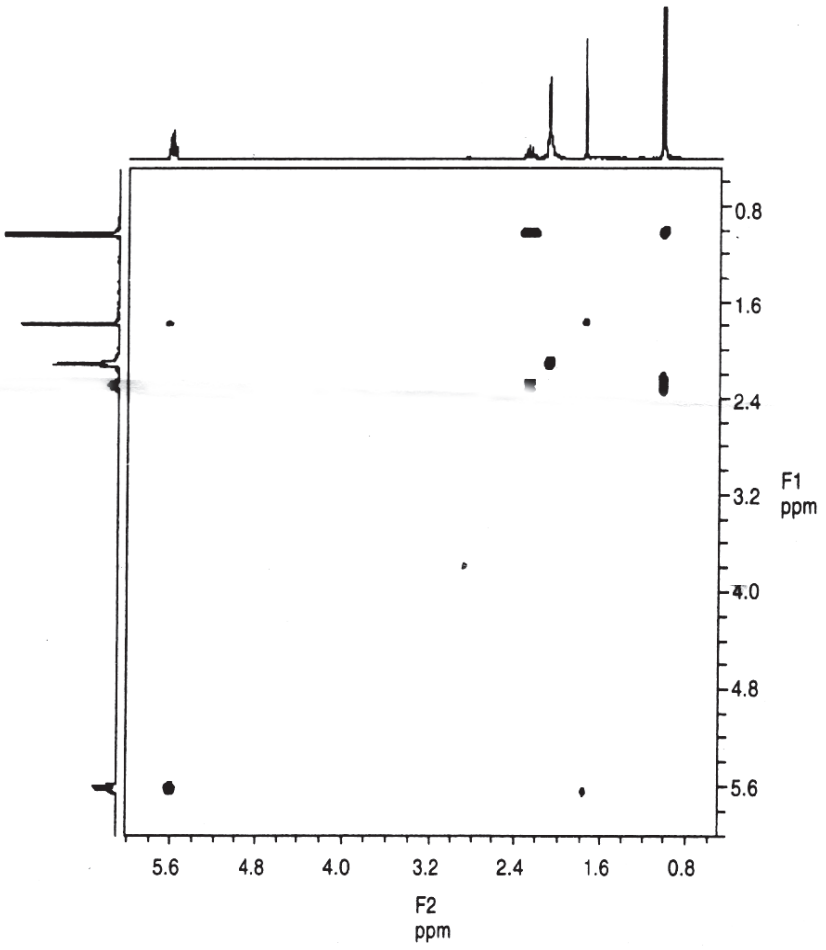


^{1}H NMR

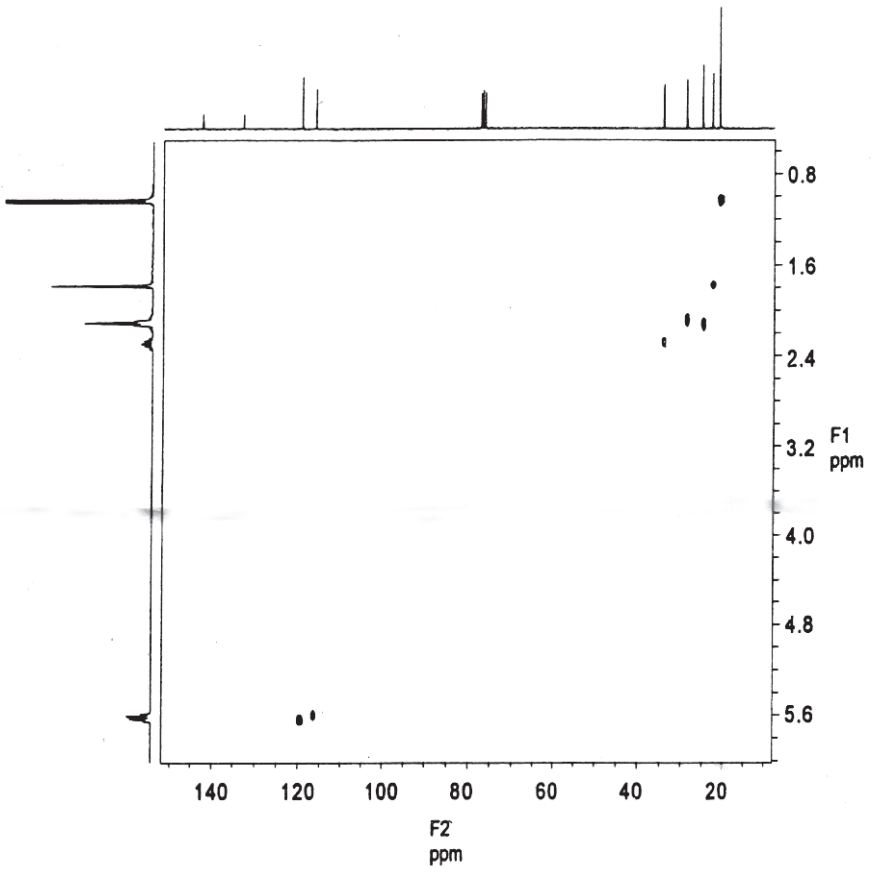



^{13}C/DEPT
140
120
100
80
60
40
20
ppm

COSY


0.8
1.6
2.4
3.2
4.0
4.8
5.6
F1
ppm
5.6
4.8
4.0
3.2
2.4
1.6
0.8
F2
ppm

HETCOR



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Total No. of Questions :6]

SEAT No. :

P1875

[Total No. of Pages :4

[5223] - 312

M.Sc.

ORGANIC CHEMISTRY

CHO-352: Organic Stereochemistry

(2013 Pattern) (Semester - III)

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

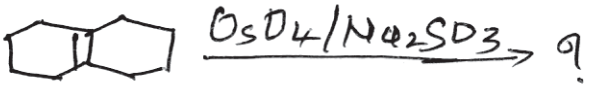
Instructions to the candidates:

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

SECTION-I

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

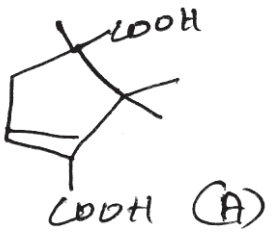
a) How many stereoisomers are possible in the following reaction? Discuss about their optical activity.



b) Trans - 4 - t - butylcyclohexanol is more strongly adsorbed on alumina than cis isomer. Explain.

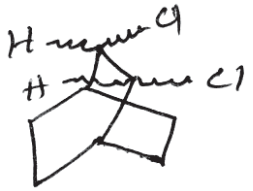
c) Draw the stereo structures of most stable and least stable conformation of perhydroanthracene. Give nomenclature of these isomers.

d) Compound (A) do not form anhydride on normal dehydration where as under vigourous condition, it forms anhydride with difference in structure. Explain why?

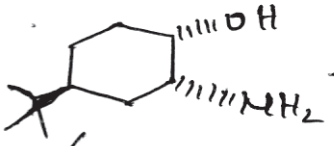


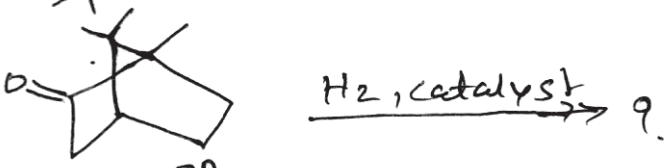
P.T.O.

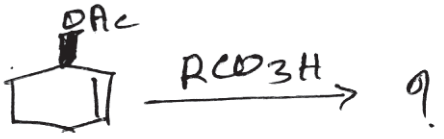
e) Write the two different isomers for compound (B). One of the isomer show rapid dehydrochlorination than other isomer. Explain.

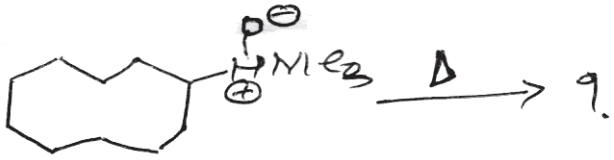


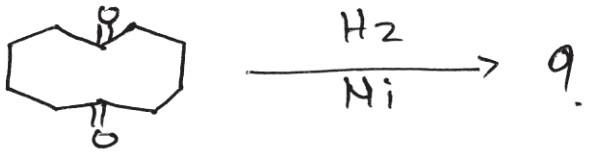
Q2) Predict the product in <u>any four</u> of the following and explain stereochemical principles involved. Justify: **[8]**

a) 

b) 

c) 

d) 

e) 

Q3) Answer <u>any three</u> of the following: **[9]**

a) Acetolysis of optically active trans - 3 - chloro - s -methylcycohex - 1-ene gives racemic mixture of cis and trans acetate. Explain.

b) Describe the stability of hydrindanes as a function of temperature. Justify.

c) Explain I-strain with examples.

d) What is steric assistance. Discuss with suitable example.

SECTION-II

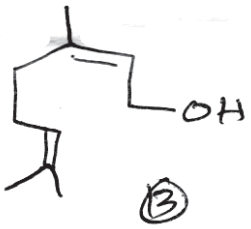
Q4) Answer the following (any three): **[9]**

a) Explain few reaction with examples involving formation of racemic products.

b) Explain the optical purity and enantiomeric excess.

c) Explain the Markovnikov orientation in addition reaction.

d) Nero (B) is a naturally occuring compound. Assign stereochemistry to its double bond.



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

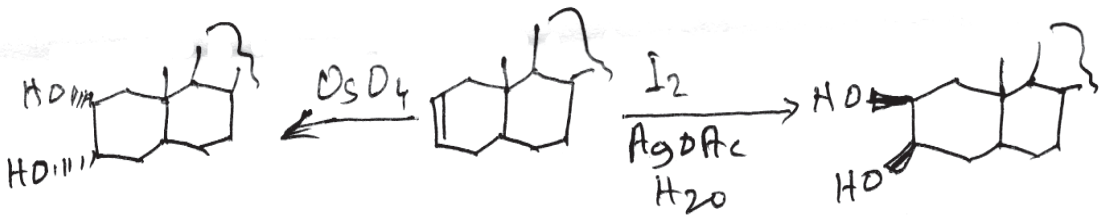
a) Draw stereochemical diagram for (Z) - 3- bromo-hexa-1, 3 diene and 2-chloropent - Z ene.

b) Explain the terms.

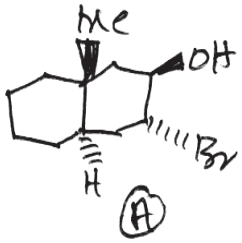
i) Plain curves

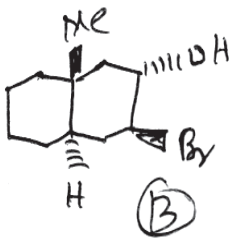
ii) Cotton effect curves

c) Explain the following observations.



d) Explain which of the following compound form an epoxide on treatment with base

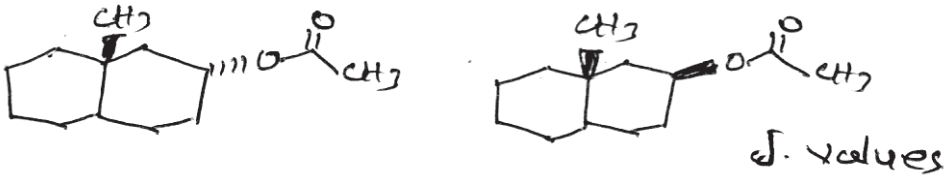




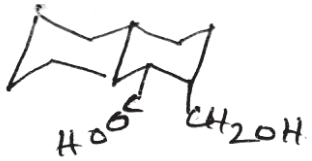
e) How will you determine the stereochemistry of o-amino cinnamic acid.

Q6) a) Answer <u>any two</u> of the following: **[4]**

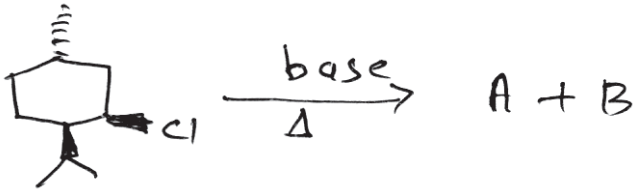
i) Distinguish the following pair of structures by the method indicated.



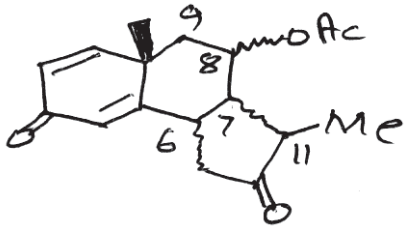
ii) What is the stereochemical relation between the carboxylacid and hydroxymethyl group in following compound by using NMR technique.



iii) Predict the product and explain the stereochemical principles involved in the following reaction.



b) The PMR spectrum of <u>A</u> show vicinal coupling constants as $J_{6,7}$ = 5.7 Hz, $J_{8,9}$ (ax) = $J_{8,7}$ = 10.5 Hz, $J_{7,11}$ = 0 Hz. Determine the structure of <u>A</u> with correct stereochemistry at C_6, C_7, C_8, & C_{11}. Explain your answer. **[4]**



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Total No. of Questions :6]

SEAT No. :

P1876

[Total No. of Pages :3

[5223] - 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]**

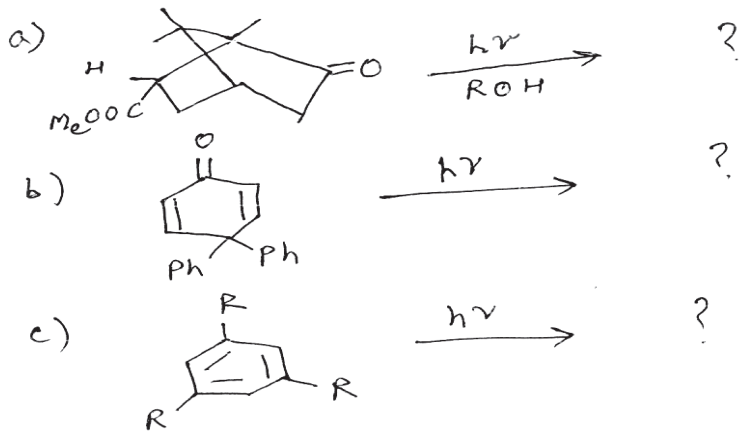
a) Cyclobutanone undergoes three types of photoreactions.

b) Molecular orbitals of pentadienyl system and comment on their symmetry and C_2 axis of symmetry.

c) Irradiation of benzene yields a mixture of three products.

d) Correlation diagram of disrotatory interconversion of cyclobutene - butadiene system.

Q2) Predict the product/s suggesting suitable mechanism for any two: **[8]**



P.T.O.

Q3) Write notes on <u>any two</u>: **[8]**

a) Photochemical synthesis of Isocomene.

b) 1,3 - dipolar additions.

c) Photoenolisation.

SECTION - II

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

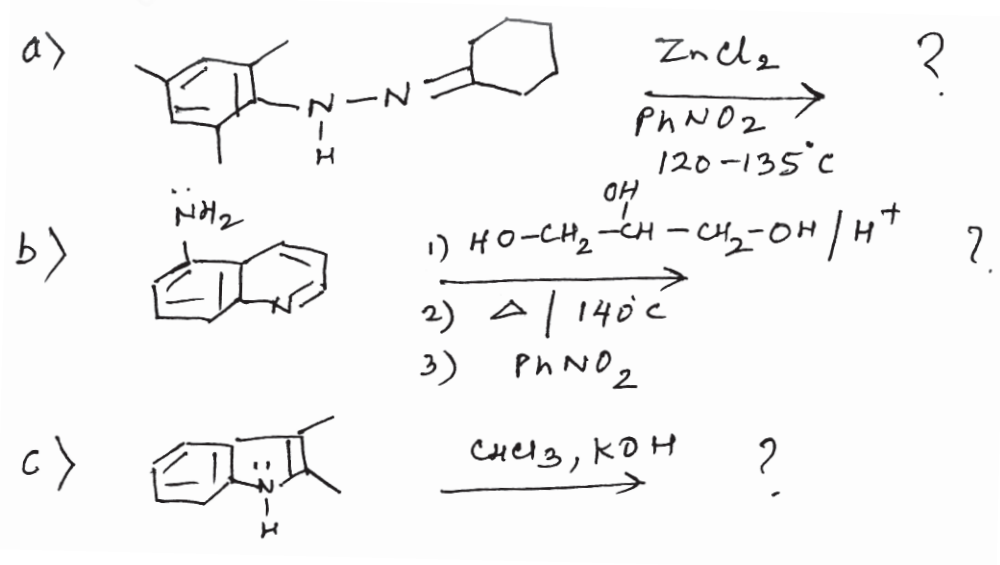
a) 4-amino pyridine has larger dipole moment (4.4 D) than 4-cyanopyridine.

b) Imidazole undergoes electrophilic substitution only under vigorous conditions.

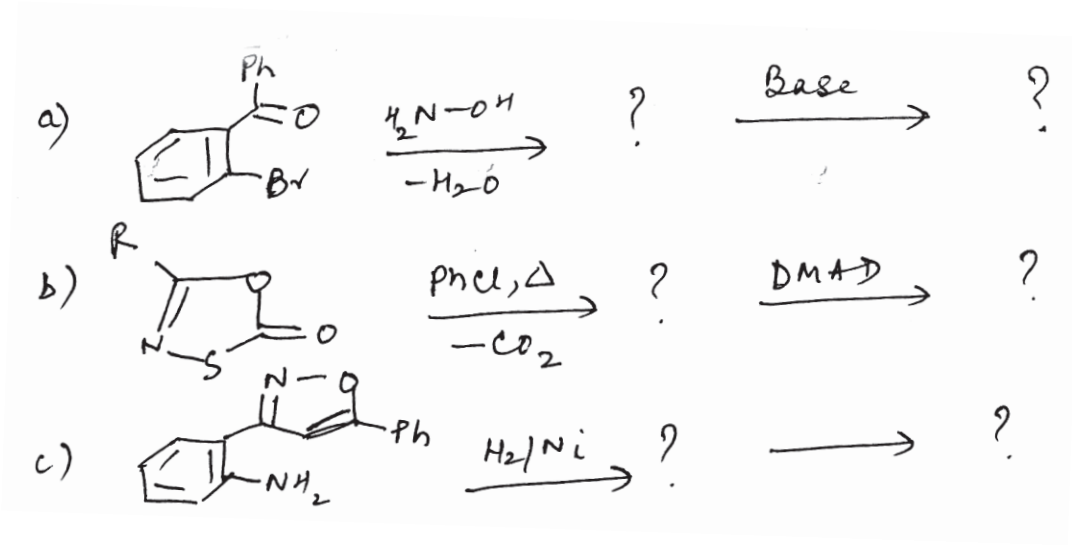
c) The boiling point of pyrrole (130°C) is higher than furan (32°C) and thiophene (84°C).

d) In Doebner - Miller synthesis, aldehydes R_1 CH_2 CHO and R_2 CH_2 CHO give four products.

Q5) Predict the product/s suggesting suitable mechanism for <u>any two</u> of the following:



Q6) A) Complete the following sequence of reaction for <u>any two</u>: **[4]**



B) Write notes on <u>any two</u>: **[4]**

a) The Hinsberg synthesis.

b) The Bischler synthesis.

c) The Pictet synthesis.

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Total No. of Questions :6]

SEAT No. :

P1877

[Total No. of Pages :3

[5223] - 314

M.Sc. -II

ANALYTICAL CHEMISTRY

CHA-390: Electroanalytical and Radioanalytical 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 written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagrams must to be drawn wherever necessary.***
4) ***Use of logarithmic table, non programmable calculator is allowed.***

SECTION-I

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

a) State and explain the Faradays first law of electrolysis.

b) State the principle of coulometry. Give two limitations of coulometric titrations.

c) Why, it is necessary to remove oxygen from the solution in polarographic analysis?

d) State two differences between chrono-amperometry and chrono-potentiometry.

e) State the principle of polarography. Enlist, microelectrodes used in polarography.

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

a) State the principle of differential pulse polarography. Give its advantages over classical polarography.

b) Describe the applications of hydrodynamic voltammetric detectors used in chromatography.

P.T.O.

c) State the principle of square-wave polarography. Explain, the estimation of Cu and Zn from tap water by square-wave polarography.

d) Reduction of 5.0 mM nitrate in dimethyl formamide at 25°C was studied by polarographic analysis. The drop time was measured at the rate of 3.49 sec per drop. The mercury flow rate was 1.86 mg per sec and the diffusion current was 14.25 μA. Calculate the diffusion coefficient of electroactive species. [Given: n = 1]

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

a) Sketch and explain the cyclic voltammogram of parathion.

b) A controlled potential coulometric assay was performed at a potential on the plateau of the voltammetric wave of Pb^{2+}. The area under the current-time curve was 18.7 mA. min for 20.0 ml sample solution was assayed. Calculate the concentration of the Pb^{2+} in the solution.

[Given: 1 F = 96487 coulomb]

SECTION-II

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

a) Explain the steps involved in neutron activation analysis.

b) State and explain the principle of inverse isotope dilution analysis.

c) Explain the technique of radiometric titration based on precipitation formation.

d) State the principle of thermal method of analysis. Enlist, the methods of thermal analysis.

e) Explain the thermogram of quantitative analysis of sulfur.

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

a) Explain the absolute method used in neutron activation analysis.

b) Explain the construction and working of modern thermo balance.

c) State the principle of DSC. Draw and describe the DSC curve for isothermal crystallization of polyethylene.

d) An impure sample of calcium oxalate monohydrate was analysed using TGA technique. The TG curve of the sample indicates total mass change from 100 mg to 45 mg, when the sample was heated upto 900°C. Calculate the percentage purity of the sample.

[Given: At. Wt. of Ca = 40, C = 12, O = 16 and H = 1]

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

a) State the principle of differential thermal analysis. Describe the DTA technique for the analysis of mixture of polymer.

b) A 0.5 g sample of the alloy and 1.0 g sample of standard alloy known to contain 5.93% Ni are irradiated with neutrons in a nuclear reactor under identical conditions. When irradiation is complete, the smaple and standard are allowed to cool and the gamma.-ray activities are measured. The measured activities of alloy sample and standard alloy are 1020 cpm and 3540 cpm, respectivley. Calulate the percentage of Ni in alloy sample.

EEE

Total No. of Questions :6]

SEAT No. :

P1878

[Total No. of Pages :3

[5223] - 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) ***Answer to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic table, non - programmable calculator is allowed.***

SECTION - I

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

a) What is principle of Karl Fischer's titration?

b) What is assay design?

c) What is stability of drugs?

d) Define drug?

e) What are limit tests? Why these are taken?

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

a) Describe biological assay of heparin sodium.

b) Explain limit test of lead and arsenic.

c) Explain in detail process of development of new drugs.

d) Give dissolution test for tablets.

P.T.O.

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

a) What is sterilization? Explain dry heat sterilization and sterilization by filtration.

b) Write note on "undue toxicity".

SECTION - II

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

a) Define cross contamination.

b) What are gel and magma?

c) Give determination of acid insoluble ash in vegetable drug.

d) Give the classification of ointment bases.

e) What are inadequate storage conditions for pharmaceutical product.

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

a) Explain in detail two phase system in Aerolysis.

b) Write a note on 'atomspheric contamination'.

c) Give an analytical method for determination of ferrous fumarate.

d) 100 ml saline sample was titrated with 0.2 N $AgNO_3$ in presence of potassium chromate as a indicator. The burette reading was 40 ml. Calculate the amount of sodium chloride present in the 500 ml bottle. [Given Na = 23; Cl = 35.5; Ag = 108; N = 14; O = 16]

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

a) Write a note on impurities in Pharmaceutical preparations.

b) 0.3gm of Paracetamol ($C_8Hg\ NO_2$) tablet was dissolved in 30 ml 2N H_2SO_4 and 10ml water. Reflux this mixture for 1 hour. It is then cooled and diluted to 100 ml with water. 20ml of this solution is transferred to titration flask. To the same flask 40ml of water, 40gm of ice, 15ml 2N HCl, 0.1ml ferroin sulphate solution and resultent solution is titrated wit 0.1N cerric ammonium sulphate. Burette reading was 7.2 ml. Calculate the percentage of paracetamol is given tablet.

[Given C = 12, H = 1, N = 14, O = 16]

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Total No. of Questions :6]

SEAT No. :

P1879

[Total No. of Pages :3

[5223] - 316

M.Sc. -II

ANALYTICAL CHEMISTRY

CHA-392: Advanced Analytical Techniques

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

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

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate 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) What is emulsion in liquid - liquid extraction?

b) Give the stages of solid phase extraction.

c) Name the component present in microwave system.

d) Give the operating conditions for MAE.

e) Give the applications of SFE.

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

a) Explain major components of SPE instrumentation with diagram.

b) What is liquid-liquid extraction? Explain the theory of liquid - liquid extraction.

c) What is microwave assisted extraction? Explain its theoretical basis.

d) Explain the advantages of CO_2 supercritical fluid.

P.T.O.

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

a) Explain applications of MAE.

b) Give the applications of SFE.

SECTION-II

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

a) What is Resonant Ionisation Spectroscopy [RIS]?

b) State two application of AES.

c) Explain the effect of temperature on FES.

d) Explain the term mass to charge ratio.

e) What is direct current plasma emission spectroscopy?

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

a) What is mass analyzer? Explain the construction and working of quadrupole mass analyzer.

b) Mention the importance of micronutrients for the growth of plants. Explain the estimation of Boron from soil sample.

c) State the principle of AAS and explain its instrumentation with block diagram.

d) Enlist the sources used in atomic Fluorescence Spectroscopy. Explain any one in detail.

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

a) In determination of Mn at 403.3 nm the analyte gives a meter reading 45. The analyte solution with 100 µg/ml of standard Mn gives meter reading 83.5. Calculate the amount of Mn in analyte.

b) A soil sample was analysed for determination of Fe at 535 nm in air-acetyle flame by AAS. The observation is as follows:

Fe (ppm)	0.0	0.1	0.2	0.3	0.4	0.5	Sample
Absorbance	0.004	0.032	0.065	0.098	0.131	0.164	0.078

Determine the concentration at Fe in sample.

EEE

Total No. of Questions : 9]

SEAT No. :

P1880

[Total No. of Pages : 3

[5223]-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) (Semester - III) (Credit System)

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

Instructions to the candidates:

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

SECTION - I

(Analytical Method Development and Validation)

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

a) What is assay? Why it is validated?

b) Explain selectivity parameter with respect to dissolution studies.

c) Define specificity and precision.

d) Give factors affecting on dissolution test.

e) Explain inter-laboratory qualification process.

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

a) Explain the terms Ruggedness and Robustness.

b) Explain with neat labelled diagram USP type 3 apparatus.

c) How systematic error is reduced?

d) The mean $\bar{x}$ of four determinations of copper content of a sample of alloy was 7.87% with standard deviation S = 0.15% calculate 95% confidence limit for true value [Given : t = 3.18]

P.T.O.

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

a) Describe European community guideline.

b) Percentage of chloride in $MgCl_2$ was reported by different persons as 32.64, 32.54, 32.61 and 32.53% Calculate mean deviation, standard deviation and relative standard deviation.

SECTION - II

(Geochemical and alloy Analysis)

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

a) What is composition of nichrome and steel alloy?

b) Give the principle for estimation of Fe from Hematiteore.

c) Enlist the constituent of brass alloy and mention the procedure used for their estimation.

d) How carbonate from soil is determined?

e) What is cation exchange capacity of soil?

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

a) Outline an analytical procedure for estimation of aluminium from bauxite.

b) Explain the procedure used for determination of nickel from nichrome alloy.

c) Discuss the method used for estimation of nitrogen from soil sample.

d) 0.225 gm of brass sample was dissolved in 20ml of conc HCl and diluted to 100ml. A 10ml aliquote of this solution is withdrawn and 5% 10ml KI is added to it. The liberated iodine is titrated with 0.025N $Na_2S_2O_3$ and the titre value obtained is 9.6ml. Calculate the percentage of copper in given sample. [Given : At.wt cu = 63.54, O = 16, I = 127, Na = 23, S = 32]

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

a) Discuss the outline for estimation of tin from solder alloy.

b) 0.250 gm of sample containing magnesium was dissolved in 5 ml of conc HCl and diluted to 100 ml. A 10ml Aliquote of this solution titrated against 0.01 m EDTA solution and the titre value obtained is 13.5ml Calculate the percentage of magnesium in given sample. [Given At. wt Mg = 24.31g].

SECTION - III

(Laboratory Automation & Sensor Based Techniques)

Q7) Answer the following: **[10]**

a) Give advantages of automation.

b) Define chemical sensors.

c) State any four achievements of biotransduction.

d) What is automatic titrations?

e) What is polymer replication?

Q8) Attempt any two of the following: **[10]**

a) With the help of schematic diagram explain the construction and working of discrete sample analyser.

b) Write a note on optical sensor.

c) Define microfabrication. Explain silicon and glass micromatching.

d) What is biosensor? Explain the role of biosensor in analysis.

Q9) Attempt any one of the following: **[5]**

a) Write a note on potentiometric sensors.

b) Explain in brief electrochemical sensors and give its applications.

Total No. of Questions :6]

SEAT No. :

P1881

[Total No. of Pages : 3

[5223]-401
M.Sc. -II
PHYSICAL CHEMISTRY
CHP - 410 : Molecular Structure & 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

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) Discuss factors influencing coupling constant.

b) Explain the theory of spin-spin interaction for an ABC type molecule.

c) Explain principle of esr.

d) State and explain Mc connell relation. Explain the terms there in.

e) What are quadrupole nuclei and quadrupole moments in nqr spectroscopy?

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

a) Write a note on ^{13}C nmr spectroscopy.

b) State the characteristics of high resolution nmr instrumentation.

c) Describe the working of esr spectrometer using block diagram.

d) Explain applications of nqr. Give examples.

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

a) Calculate the frequency separation of nuclear spin states in ^{13}C nucleus with magnetic field.

14.4 T. The magnetogyric ratio is $6.73\times10^{7}\ T^{-1}s^{-1}$. [I = $\frac{1}{2}$ for ^{13}C]

b) Compare the number of lines in esr of radicals

$\bullet XH_2$ and $\bullet XD_2$ $\left[\dot{X}\text{spin state is } {}^{5}\!/_{2}\right]$.

SECTION - II

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

a) Describe the theory of paramagnetism.

b) State limitations of Bragg's method.

c) Explain principle of XRD.

d) What causes electron diffraction patterns to occur?

e) Differentiate between neutron and electron diffraction.

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

a) Derive the Langevin equation for magnetic suceptibility.

b) Compare Guoy and Faraday techniques.

c) Discuss the applications of XRD in structural analysis.

d) Describe electron diffraction analysis technique giving a diagram and indicate how the wierl equation is used to deduce molecular geometry.

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

a) Calculate the volume and mass paramagnetic suceptibilities of a sample of a complex salt with 3 unpaired electrons, at 25°C.

[Density = 3.24 g cm^{-3}, molar mass = 200g mol^{-1}]

b) A beam of X-rays having 154.1 pm wavelength is reflected at 22.2° by a silver crystal. Deduce the interplanar spacing in the silver crystal.(n=1).

Total No. of Questions :6]

SEAT No. :

P1882

[Total No. of Pages : 3

[5223]-402
M.Sc.
PHYSICAL CHEMISTRY
CHP - 411 : Surface Chemistry and Electrochemistry
(2013 Pattern) (Semester - IV) (New)

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

Instructions to the candidates:

1) *All questions are compulsory.*
2) *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}
			=	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

(Surface Chemistry)

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

a) Write the equation for Gibbs monolayer and explain the terms involved in it.

b) What is froth flotation technique?

c) What is integral heat of adsorption? Write its equation.

d) State the assumptions of potential theory.

e) Explain 'ink bottle pores' in solids.

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

a) Describe with a neat sketch, the states of monomolecular films.

b) Discuss the mechanism of detergency.

c) Describe with a neat labelled diagram, the gravimetric method of measurement of adsorption.

d) Give a critical comparison of various multilayer models of adsorption.

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

a) One gram of activated charcoal has surface area of 1000 m^2, considering complete coverage as well as monomolecular adsorption, how much ammonia in cm^3 at STP would be adsorbed on the surface of 25 g charcoal? Diameter of ammonia molecule is 0.3nm.

b) The surface tension of ethanol-water mixture follows the equation-

$\gamma = 75 - 0.48C + 0.15C^2$, where 'C' is ethanol concentration in moles per litre. Calculate 'Γ' in moles cm^{-2} for 0.5 M solution at 25°C.

SECTION - II

(Electro Chemistry)

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

a) Write Bernal-Fowler equation for heat of solvation and explain the forms involved in it.

b) Define ionics and electrodics.

c) Write the equation for thickness of ionic atmosphere.

d) Explain the ways of transport of ions.

e) Explain the terms faradic efficiency, voltage efficiency maximum efficiency and over all efficiency.

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

a) Discuss the local cell theory of corrosion.

b) Describe Helmholtz model of double layer at electrode solution interface.

c) Write Butler -Volmer equation and explain the terms involved in it.

d) Write a short note on electro synthesis.

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

a) If the Tafel constants a and b have values 1.54 V and 0.119 V respectively for reduction of hydrogen ion at lead electrode, calculate the transfer coefficient α and exchange current density at 298K.

b) Calculate mean activity coefficient of KNO_3 in ethyl alcohol at 25ºC when ionic strength is 0.01. Dielectric constant of ethyl alcohol is 24.3 ion size parameter 'a' is 3 $\mathring{A}$.

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Total No. of Questions : 6]

SEAT No. :

P1883

[Total No. of Pages : 3

[5223]-403

M.Sc. - II

PHYSICAL CHEMISTRY

CHP-412 : Materials Chemistry and Catalysis

(2013 Pattern) (Semester-IV) (New)

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

Instructions to the candidates:

1) *Answers to the two sections should be written in separate answer books.*
2) *All questions are compulsory.*
3) *Figures to the right 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) Draw the schematic cross sectional diagram of the RF-sputtering system.

b) What are the characteristics of 2-1-4 material?

c) Define rectifiers & draw the diagram of half wave rectifier.

d) What is Langmuir-Blodgett film?

e) Which are optical properties of solid devices?

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

a) Explain the term anyzotropy.

b) Explain the normal state properties of 1-2-3 & 2-1-4 materials.

c) What are the applications of LB film?

d) What is P-N-P transistor? Explain the three modes of it's operation.

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

a) Explain Sol-gel method for preparation of thin film.

b) Write note on optical photon modes in hitech materials.

SECTION-II

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

a) Differentiate between physical and chemical adsorption.

b) Define 'catalytic activity'.

c) Define 'support' and 'promoters' with example.

d) Define 'functionality' with example.

e) Write the principles of green chemistry.

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

a) Discuss hydrothermal method of preparation of catalyst.

b) Describe a method to determine pore size.

c) Discuss the FTIR method to determine solid particle size.

d) How are organic pollutants degraded using photocatalyst?

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

a) The data given below are for the adsorption of CO on charcoal at 273K. Confirm that they fit the Langmuir isotherm, and find the constant K and the volume corresponding to complete coverage. In each case V has been corrected to 1.00 atm (101.325 KPa).

P/KPa	13.3	26.7	40.0	53.3	66.7	80.0	93.3
V/cm^3	10.2	18.6	25.5	31.5	36.9	41.6	46.1

b) Define 'catalyst deactivation'. Explain the factors which affect the activity of catalyst.

Total No. of Questions : 6]

SEAT No. :

P1884

[Total No. of Pages : 3

[5223]-404

M.Sc. - II

PHYSICAL CHEMISTRY

CHP-413 : Biophysical Chemistry

(2013 Pattern) (Semester-IV) (New)

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

Instructions to the candidates:

1) ***Answers to the TWO sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Figures to the right 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}
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			=	1.38×10^{-23} J K^{-1} molecule^{-1}
3.	Planck Constant	h	=	6.626×10^{-27} erg s
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4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
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7.	Faraday Constant	F	=	96487 C equiv^{-1}
8.	Speed of light	c	=	2.997×10^{10} cm s^{-1}
			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION-I

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

a) Explain Henderson's equation and its role in preparing buffers.

b) State and explain Bragg's law.

c) Distinguish between active and passive transport.

d) Define electrophoresis and give one application.

e) Differentiate between reverse osmosis and osmosis.

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

a) Explain problems of protein folding.

b) How is osmometry used to determine protein molecular weight?

c) Write a note on bilayer phase transition in lipids.

d) Explain 'DNA Sequencing'.

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

a) Discuss the role of ATP in cell biology.

b) How does blood buffering mechanism work in human body?

SECTION-II

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

a) Explain the terms:

i) Channel proteins and

ii) Carrier proteins

b) Define - Axolemma and endocytosis.

c) Enlist the factors affecting enzyme activity.

d) Explain the term 'flow birefringence'.

e) Draw a neat labelled diagram of a cross-section of cell membrane.

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

a) Derive Michaelis - Mention equation for enzyme catalysis.

b) What are biopolymers? State their characteristics and applications.

c) Discuss the applications of CD spectroscopy.

d) Discuss the Danielli and Davson model to describe the structure of a cell membrane.

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

a) At $\lambda = 5461$ Å and at 25°C, the following observations were obtained for a sucrose sample. Calculate the molecular weight if $\alpha = 1.00$ and $\beta = 0.935$.

c(g/cc)	0.0352	0.0614	0.106	0.163
$\frac{HC}{\tau} \times 10^3$	2.84	2.91	3.08	3.32

b) A polymer sample contains equal number of molecules with molecular weights 15,000 and 25,000. Calculate $\bar{M}n$ and $\bar{M}w$.

Total No. of Questions : 6]

SEAT No. :

P1885

[Total No. of Pages : 3

[5223]-405

M.Sc. - II

PHYSICAL CHEMISTRY

CHP-414 : Special Topics in Nuclear and Radiation Chemistry

(2013 Pattern) (Semester-IV) (New)

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

Instructions to the candidates:

1) *Answers to the TWO sections should be written in separate answer books.*
2) *All questions are compulsory.*
3) *Figures to the right 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}
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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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			=	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}
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9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION-I

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

a) Explain the terms hot atom and recoil atom.

b) Explain the term transfer reaction with example.

c) Explain Bethe's notation with example.

d) Calculate geometric cross-section of ^{125}Sn.

e) Complete the following reactions by writing equation.

i) $^{40}_{20}Ca\,(n,\alpha)$ _____

ii) $^{27}_{13}Al\,(\gamma,n)$ _____

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

a) Explain the working of a technetium generator.

b) Explain carbon cycle and proton-proton chain involved in thermonuclear reactions of main sequence stars.

c) What is difference between somatic and genetic effects of radiation?

d) Explain the construction and working of Van de Graaff accelerator.

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

a) Evaluate Q-value for the reaction.

$$^{7}_{3}Li + ^{1}_{1}H \rightarrow ^{4}_{2}He + ^{4}_{2}He$$

Given:- $^{7}Li = 7.01822\,amu$

$^{1}_{1}H = 1.00814\,amu$

$^{4}_{2}He = 4.00387\,amu$

b) Discuss how compound nucleus theory is verified experimentally.

SECTION-II

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

a) What are the key conditions for characterizing a geological environment required for radioactive waste disposal.

b) Explain the term geminate recombination.

c) What are the advantages of radiometric titration method.

d) Explain the term neutron star.

e) What is the advantages of using radical scavenging technique?

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

a) Explain with a schematic diagram the extraction radiometric titration apparatus used by Duncan and Thomas.

b) State possible radiolysis reactions for organic compounds.

c) Explain competition kinetics with a suitable example.

d) Write a note on solar nutrino problem.

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

a) 25ml labelled KI were titrated with 0.01m $AgNO_3$ radiometrically. Addition of 2ml of $AgNO_3$ showed a reduction in initial activity from 20,000 counts for 2min to 8000 counts per minute. Find out amount of KI in the mixture. Background counts are 100 for 10min.

[Given: At. wts: k = 39.1, I = 127]

b) Describe the radiometric titration curve for the titration of a mixture of three ions in which ions precipitating first and last are labelled.

Total No. of Questions :4]

SEAT No. :

P1886

[Total No. of Pages :2

[5223] - 406

M.Sc. II

INORGANIC CHEMISTRY

CHI-430: Inorganic Polymers & Heterogeneous Catalysis

(2013 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

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

a) What do you mean by catalyst deactivation? List out various processes of catalyst deactivation.

b) Write any four commercial industrial processes along with the heterogeneous catalyst used in them.

c) What is chemical reactor? Mention their importance in chemical industry.

d) What do you mean by porous material? Give their classification.

e) Draw the flow sheet diagram for the synthesis of ZSM - 5.

f) Explain in short the synthesis of pd/Al_2O_3 catalyst.

g) What do you mean by interculated clays? Explain.

h) Which properties of Tio_2 makes it very good photocatalyst.

i) Draw the structure of tetrameric phosphazene.

j) Explain the difference between polymolybdate and polytungstate.

P.T.O.

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

a) Give an account of various post synthetic treatment given to heterogeneous catalysts.

b) Explain the application of zeolite as hydrocracking catalyst.

c) Describe the commerical application of HPA as catalyst.

d) Discuss in detail following methods of preparation of heterogeneous catalysts.

i) Precipitation & coprecipitation method.

ii) Impregnation method.

Q3) Attempt the following (Any two) **[10]**

a) Give an account of use of X - ray diffraction technique in the characterization of zeolites.

b) Discuss the role of Bismuth - molyblate in the oxidation and ammoxidation of olefins.

c) What are Perovaskites? Discuss their use as a catalyst in pollution control.

d) Discuss various methods of Immobilization of transition metal complexes.

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

a) Sulphur - nitrogen compounds.

b) Role of support in supported metal catalyst.

c) SOD and MEL type zeolites.

d) Polysilanes.

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Total No. of Questions :4]

SEAT No. :

P1887

[Total No. of Pages :2

[5223] - 407

M.Sc. - II

INORGANIC CHEMISTRY

CHI - 431 : Material Science - I : Inorganic Solid State Materials

(2013 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

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

a) What is plane defect? Explain its types.

b) Give four important applications of superconducting materials.

c) What is paramagnetism? Explain with suitable example.

d) What are intermetallic superconductors?

e) Define : i) Sol and ii) Ageing.

f) What is Asphalt? What is mean by Asphalt mixes?

g) Give the full forms of C_3S and C_3AF.

h) Explain the orthopaedic applications of biomaterials.

i) What is portland cement?

j) A piece of wood containing moisture weighed 210.3 gram and after oven drying shared constant weight of 190.2 gram. Calculate the moisture content.

P.T.O.

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

a) State and explain Fick's laws of diffusion.

b) What is hysteresis loop? Explain it for ferromagnetic materials.

c) Explain Meissner effect. What are type-I and type-II super conductors?

d) Derive the expression, $X=\frac{C}{T-V_c}$.

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

a) What are ferrates? How they are prepared? Explain hard and soft ferrates.

b) The saturation magnetization of FCC iron is 1700 kA/m^2.Calculate the net magnetic moment per iron atom in crystal.

[Given : Lattice parameter is 2.87 Aº]

c) What are biomaterials? How they are classified?

d) What is blended cement? What are the different types of blended cement?

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

a) Kirkendall effect.

b) Schottky and Frenkel defect.

c) BCS Theory.

d) Peizo and Piro electric materials.

❄ ❄ ❄

Total No. of Questions : 4]

SEAT No. :

P1888

[Total No. of Pages : 2

[5223]-408

M.Sc. - II

INORGANIC CHEMISTRY

CHI-432 : Material Science - II (Nanomaterials)

(2013 Pattern) (Semester-IV) (4 Credits)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Use of calculators allowed.***

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

a) Define nanotechnology. Give two examples each of materials naturally occurring at nanoscale and man made nanomaterials.

b) What are the methods that can be used to stabilise collidal nano-suspensions?

c) What is quantum sheet? Give its aspects?

d) Explain the piezo electricity in ZnO nanoparticle.

e) Why do carbon nanotubes have very high tensile strength.

f) How silver nanoparticle acts as a drug? Give its mechanism to kill the microbes.

g) Define - Ray leigh line.

h) Give the applications of the sensors?

i) Write about hydrothermal method for preparation of nanoparticles.

j) Write any two role of surfactant used in synthesis of nanomaterials? Give two examples of surfactant.

P.T.O.

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

a) What is nanoparticles? Name the various chemical & physical methods for synthesis of nanoparticles.

b) Discuss the chemical reduction method for the synthesis of zero valent iron nanoparticle.

c) Draw the typical Raman spectra for single wall carbon nanotube & explain.

d) What is electronic effects? Explain with reference to nanostructural metal oxide films.

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

a) Explain the principle, construction and working of scanning electron microscope.

b) What are biosensor? Write the applications of biosensor with suitable example.

c) Give the advantages and disadvantages of nanoporous materials.

d) Explain the sono chemical synthesis process of amorphous long silver sulphied nanowire.

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

a) Explain any two size dependent properties of nanomaterials.

b) Write short note on photonic crystals.

c) What are Inorganic nanotubes? Give example and describe the synthesis of any one?

d) List the methods for producing carbon nanotubes and explain any one of the method.

Total No. of Questions : 9]

SEAT No. :

P1889

[Total No. of Pages : 3

[5223]-409

M.Sc. - II

INORGANIC CHEMISTRY

CHI - 445 : 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 diagram must be drawn wherever necessary.***
6) ***Use of logarithmic table or calculators is allowed.***

SECTION-I

(Applications in Industry)

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

a) What is pigment? Write the classification of pigments on the basis of its origin.

b) What is purpose of food colour?

c) Draw the structure of anthocyanine and give its application.

d) Write the composition of tetrachromate electrolytic bath.

e) What is meant by sherardizing?

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

a) Explain the industrial manufacturing process of Prussian blue and write its applications.

b) Explain the role of co-ordination complexes in electroplating industries.

c) What is nation? Explain the methods for electrodeposition of nation on metal to get modified surface of metals.

d) Discuss the mechanism of medially metallized dyes with suitable example.

P.T.O.

Q3) Write a note on any one. **[5]**

a) Addition agents.

b) Extender pigment.

c) Use of precious metal in electroplating.

SECTION-II

(Environment)

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

a) Define primary standard and secondary standard for surface drinking water act.

b) How solar energy is the source of future energy?

c) What is powerball? How is the power ball manufactured.

d) Define active and passive solar heating system?

e) Explain the primary and secondary sludge process.

Q5) Answer the following (any two). **[10]**

a) Compare aerobic and anerobic treatment for waste water.

b) Draw a schematic diagram of molten carbonate fuel cell (MCFC). What reactions are occuring at the cathode and anode and show overall reaction.

c) Explain in detail removal of phenol and cyanide from waste water.

d) Name the instrumental methods for determination of Hg, Cd, As and Pb. Explain cold - vapour atomic absorption for determination of Hg from polluted water.

Q6) Write a note on any one. **[5]**

a) Activated sludge process.

b) Tidal power and wind power.

c) Sources and effect of cd.

SECTION-III

(Applications of Metal ions in Medicine)

Q7) Answer the following. **[10]**

a) Name any two gold complexes that are used to treat HIV.

b) Cisplatin acts as an anticancer drug while transplatin does not why?

c) Define Prodrug.

d) What are the adverse effects of lithium?

e) Give the names of any four radionuclides which are used as diagnostic agents.

Q8) Answer the following (any two). **[10]**

a) Explain the hydrolytic reactions of metal complexes with DNA.

b) How lithium gets distributed in body cell?

c) Explain the effect of binding of metal complexes to DNA with respect to structure of DNA with the help of gel electrophoresis observations.

d) Explain the coordination interaction of metal complexes with nucleic acid.

Q9) Write a note on any one. **[5]**

a) Helicobacter pylori bacterium.

b) Enzyme inhibition activity.

c) Draw the structure of $[Au\ (DPPE)_2]+$ and $[Au_2\ (DPPE)\ cl_2]$

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Total No. of Questions :6]

SEAT No. :

P1890

[Total No. of Pages :4

[5223] - 410

M.Sc. -II

ORGANIC CHEMISTRY

CHO-450: Chemistry of Natural Products

(2013 Pattern) (Semester - IV) (New Course)

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

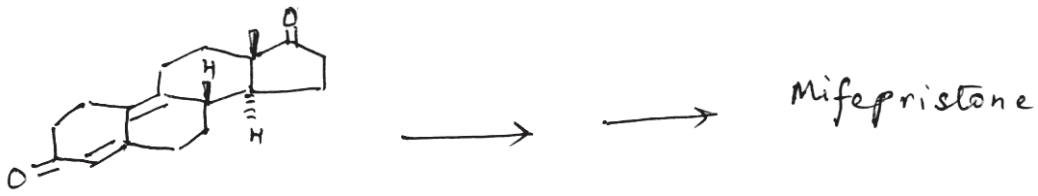
Instructions to the candidates:

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.***

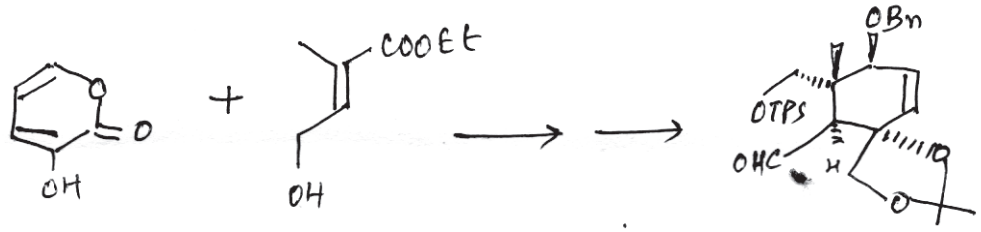
SECTION - I

Q1) Outline the steps involved in the following sequences : **[10]**

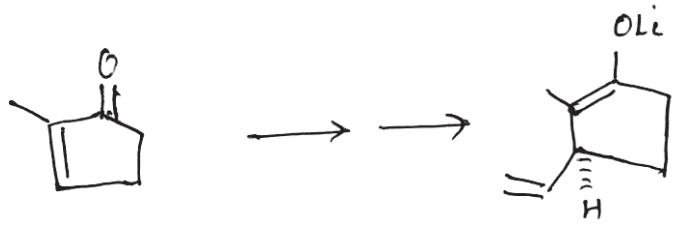
a)

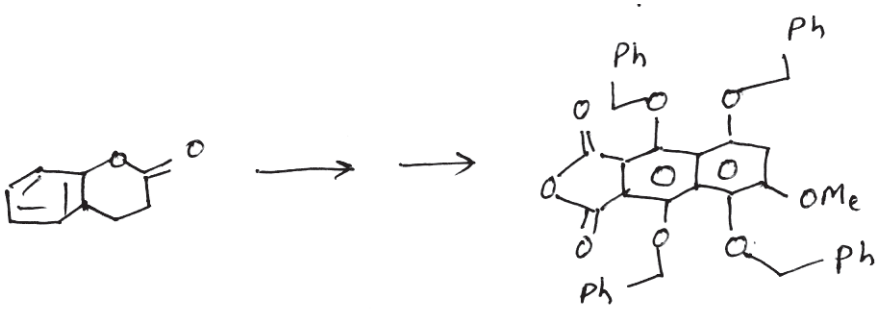


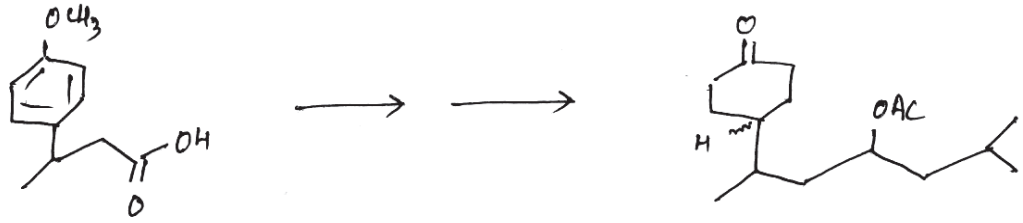
b)



P.T.O.

c) 

d) 

e) 

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

a) Discuss the importance of Deuterium exchange reaction in determination of structure of hydroxy camptothecin.

b) Describe evidences to establish presence of C_9 methyl group in Hardwickiic acid.

c) Give evidence for the following in podophyllotoxin.

i) Presence of lactone ring.

ii) Presence and nature of –OH group.

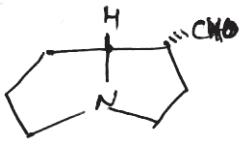
Q3) Attempt any one of the following : **[5]**

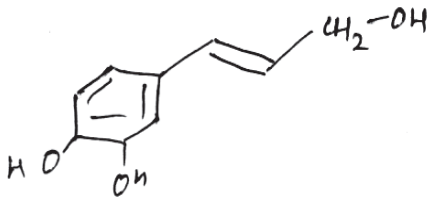
a) Highlight the importance of carbonate formation and oxetane formation in synthesis of Taxol.

b) Give a brief account of protecting groups involved in Fredericamycin.

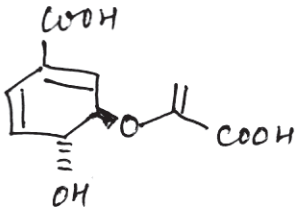
SECTION - II

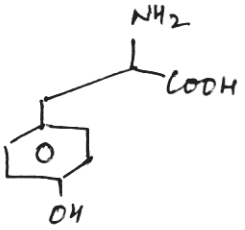
Q4) Suggest biosynthetic scheme for the following : **[10]**

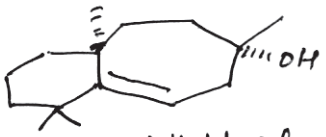
a) L-ornithine ⟶ ⟶ 

b) L-phenylalanine ⟶ ⟶ 

c) GPP ⟶ ⟶ 

d) 

⟶ ⟶ 

e) 2Z, 6E, FPP ⟶ ⟶ 

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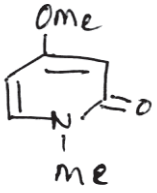
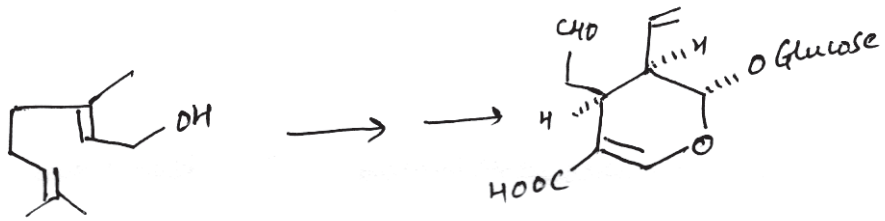
Q5) Answer the following (Any Two) : **[10]**

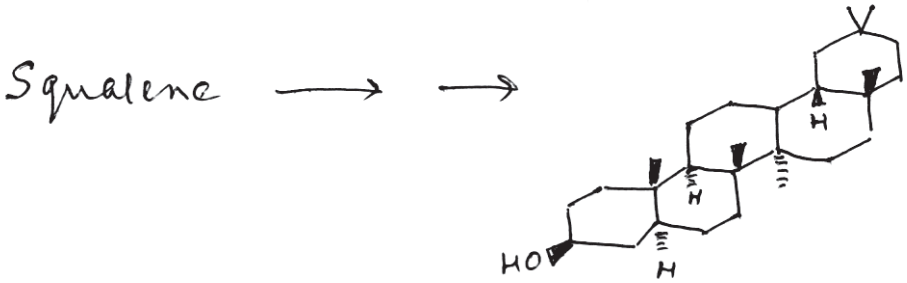
a) Give the steps involved in the following conversion.

Nicotinic acid ⟶ ⟶ 

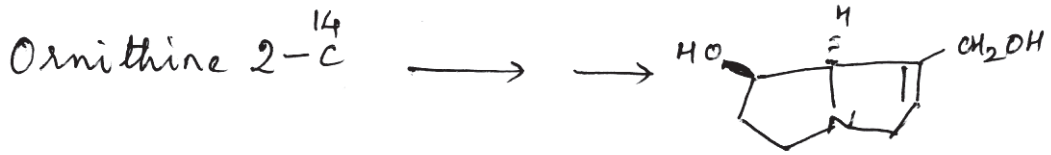
b) Complete the following biogenetic conversion :



c) Write the steps in the following biogenetic conversion :



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

a) 

Indicate the position of label in each step.

b) Give the steps involved in the conversion of $^{13}CH_3COSCoA$ to geranyl geranyl pyrophosphate.

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Total No. of Questions :6]

SEAT No. :

P1891

[Total No. of Pages :4

[5223] - 411

M.Sc. - II

ORGANIC CHEMISTRY

CHO - 451 : Advanced Synthetic Organic Chemistry

(2013 Pattern) (Semester - IV)

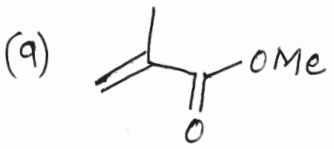
Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

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

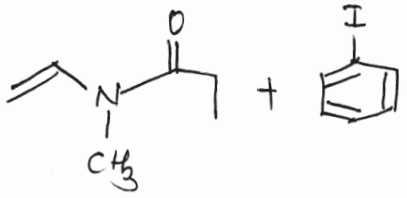
SECTION - I

Q1) Predict the product/s of the following: **[10]**

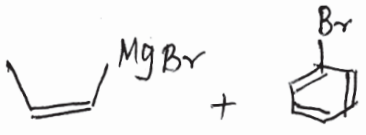
(a) 

① [Rh]Ln / CO, H_2, 165°C
② MeOH, $H^{\oplus}$
?

(b) $H-C\equiv C-H + CO + CH_3OH$ ① $Ni(CO)_4$ ② H_2O/H^+ ?

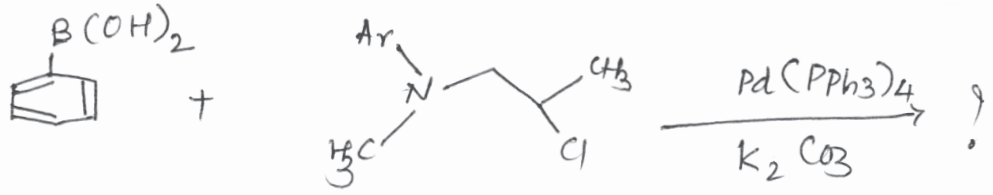
(c) 

① $PdCl_2$
② $LiAlH_4$ / ether ?

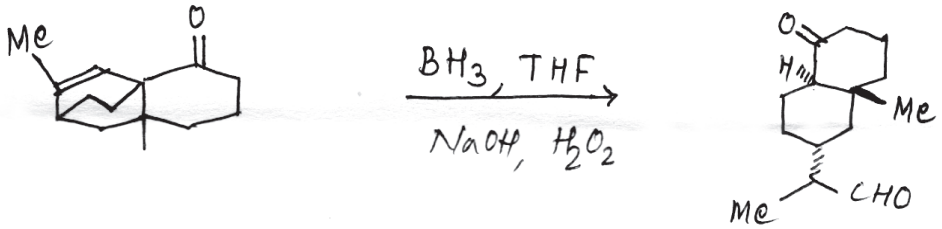
(d) 

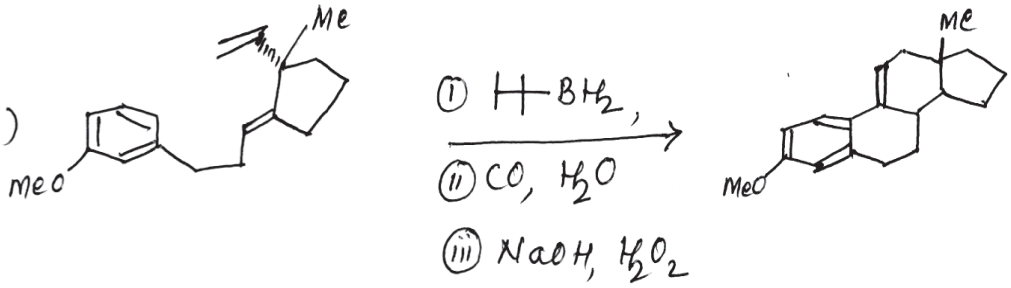
① ?
(ii) B_2H_6/H_2O_2, NaOH

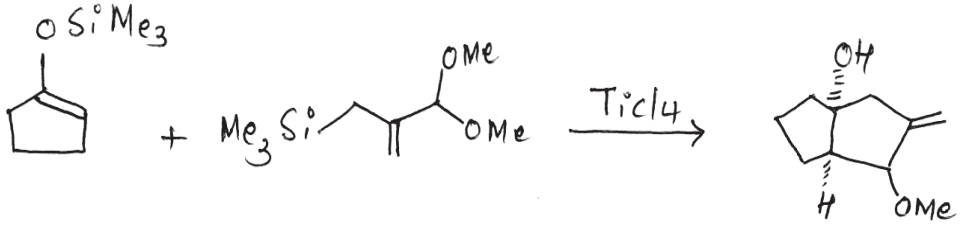
P.T.O.

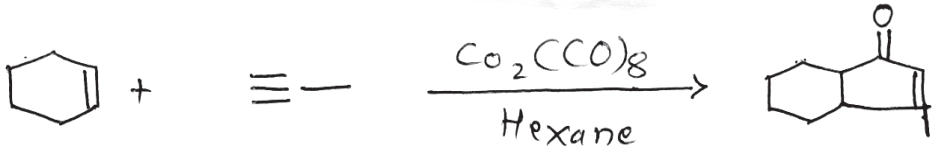
(e) 

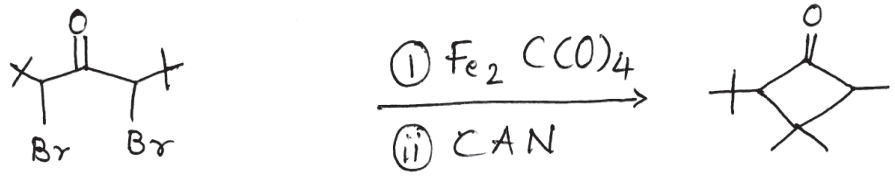
Q2) Suggest the mechanism in <u>any four</u> of the following. **[10]**

(a) 

(b) 

(c) 

(d) 

(e) 

Q3) Answer <u>any two</u> of the following: **[5]**

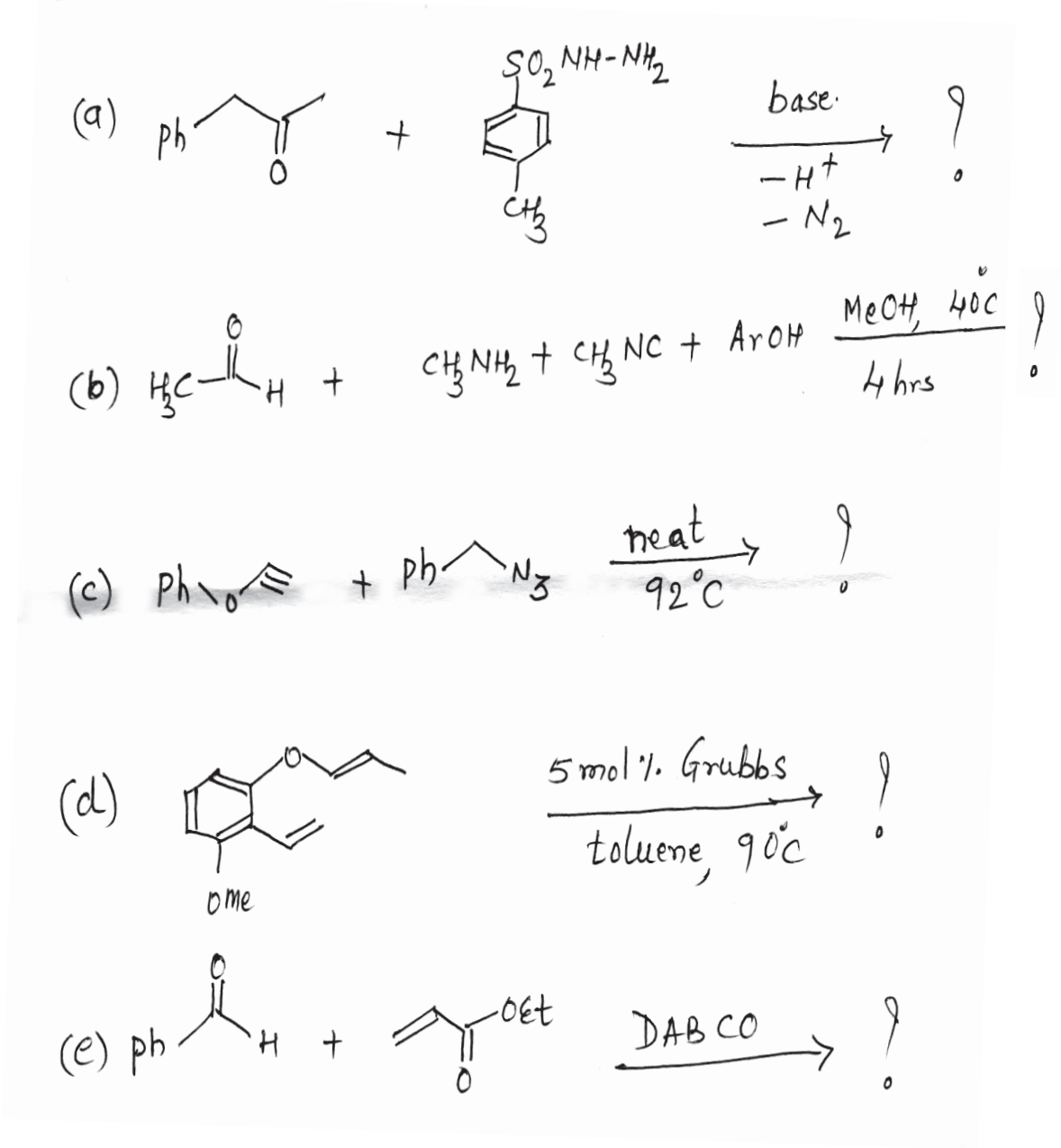
a) Chiral organoborane in Organic Synthesis.

b) Discuss the mechanism of Heck arylation reaction.

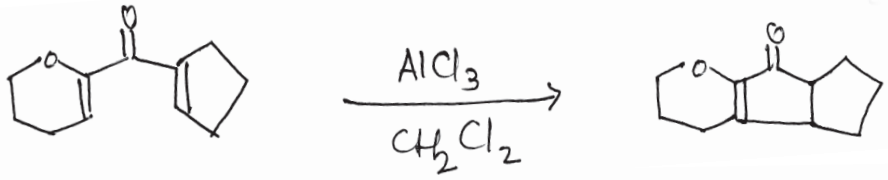
c) Explain Negishi Coupling reaction.

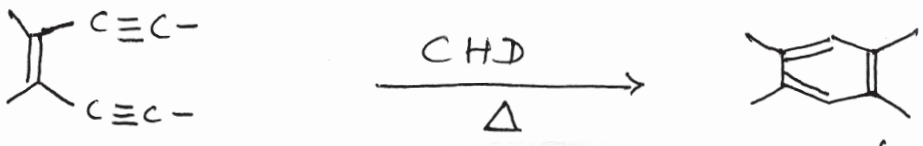
SECTION - II

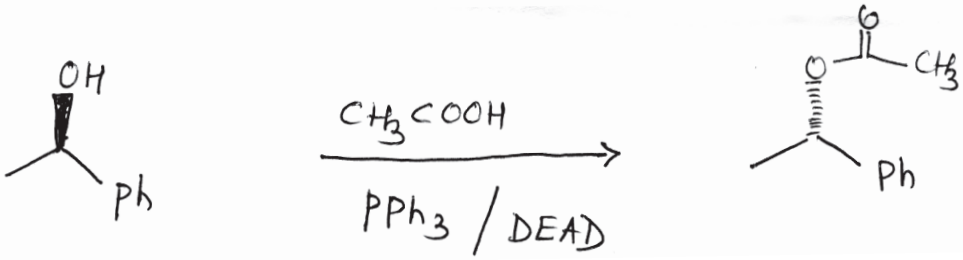
Q4) Predict the product/s of the following: **[10]**

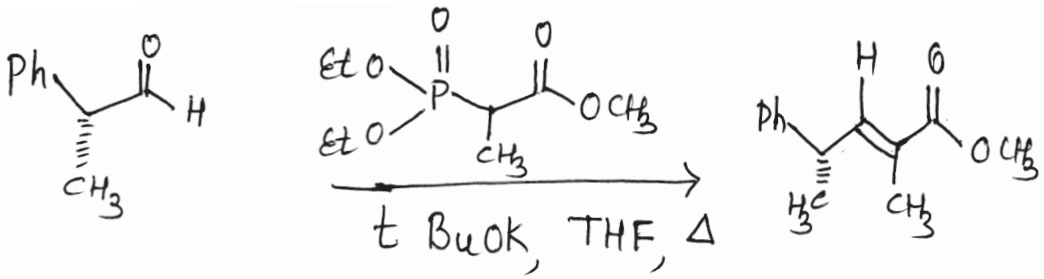


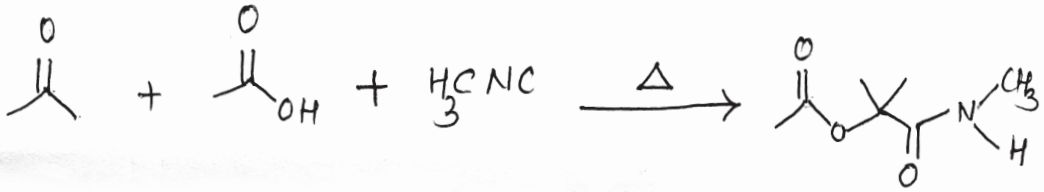
Q5) Suggest the Mechanism <u>any four</u> of the following: **[10]**

(a) 

(b) 

(c) 

(d) 

(e) 

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

a) Discuss Tebbe Olefination.

b) Explain Mc_Murry reaction.

c) Discuss Mannich reaction.

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Total No. of Questions : 6]

SEAT No. :

P1892

[Total No. of Pages : 3

[5223] - 412
M.Sc. - II
ORGANIC CHEMISTRY
CHO - 452 : Carbohydrate, Chiron Approach, Chiral Drugs and Medicinal Chemistry
(Semester - IV) (2013 Pattern)

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

Instructions to the candidates:

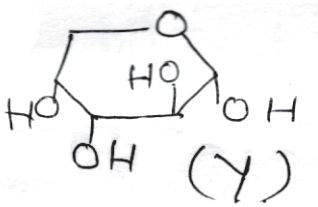
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer - books.***

SECTION - I

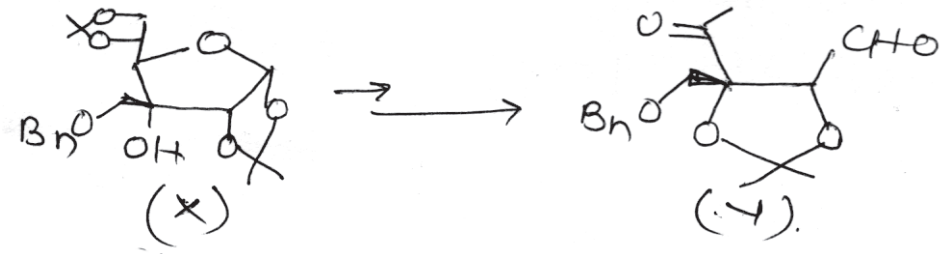
Q1) a) "(S) - (+) - propanediol is prepared from D-mannitort rather than D-glucitol." Explain. **[10]**

b) Draw $^1C_4$ and $^4C_1$ conformations of D-(+) - Mannose and D-(+) - Galactose.

c) How will you convert D-arabinose (Y) into a pair of isomeric aldohexoses?



d) Complete the following sequence from (X) to (Y)



How will you distinguish between the two types of carbonyl goups?

e) Define and explain the term eudesmic ratio.

P.T.O.

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

i) Explain the biological activity of Grieseofulvin.

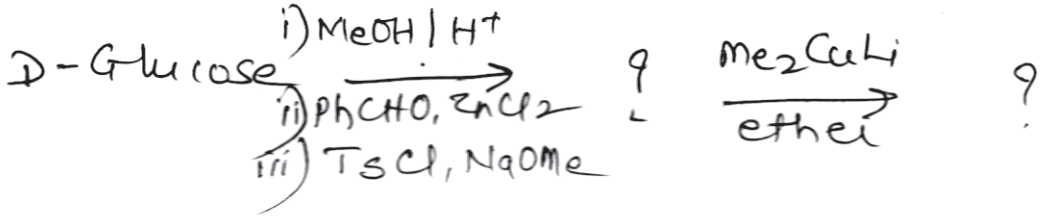
ii) Define Distomer. Explain distomer possessing undesirable side effects with suitable examples.

iii) Describe the side effects of Indinavir.

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

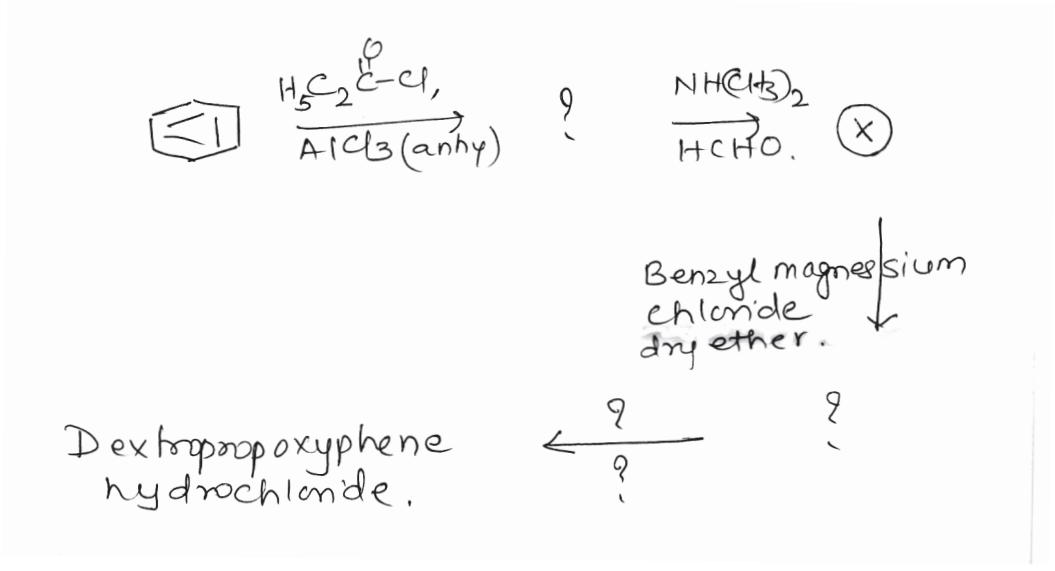
i) Write the retrosynthesis for L- (+) - alanine.

ii) Identify the intermediates formed in the following sequence of reactions and rewrite the sequence again.



iii) Write the mode of action of (S) - captopril on ACE.

Q3) Complete the following sequence using appropriate reagents. **[5]**



Explain the formation of ⊗ with possible mechanism. Write any two biological applications of Dextropropoxyphene hydrochloride.

SECTION - II

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

a) What is Lipnski Rule of Five?

b) What are tetracyclins?

c) Give SAR of cephalosporin - C.

d) Explain non-covalent bonding involved in drug-receptor interactions.

e) How penicillin - G gets deactivated under acidic pH?

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

i) Name any two viral diseases and discuss antiviral agents with examples.

ii) Explain SAR with stereochemistry of chloramphenicol and its mode of action.

iii) Discuss in brief anti fungal agents and selective toxicity.

b) Explain the following (any two) **[4]**

i) Give mode of action of penicillin.

ii) Write note on antimalerial agents.

iii) Factors affecting absorption of drug.

Q6) What are sulphonamides? Give a comprehensive account of mode of action of sulphonamides. **[5]**

Total No. of Questions : 6]

SEAT No. :

P1893

[Total No. of Pages : 5

[5223]-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) ***Answer to the two sections should be written in separate answer books.***

SECTION-I

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

a) Why convergent method is more useful than the linear method for the synthesis of a target molecule?

b) What is the use of t - Boc protecting group in organic synthesis?

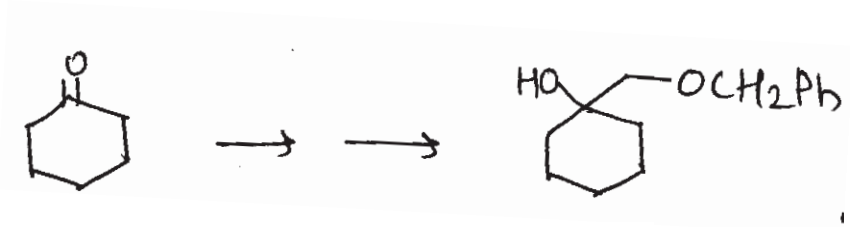
c) Reaction of the pyrrolidine enamine of 2 - methyl cyclohexanone with methyl iodide gives 2, 6 – dimethyl cyclohexanone, explain.

d) Define umpolung. Explain acyl anion derived from nitroalkanes.

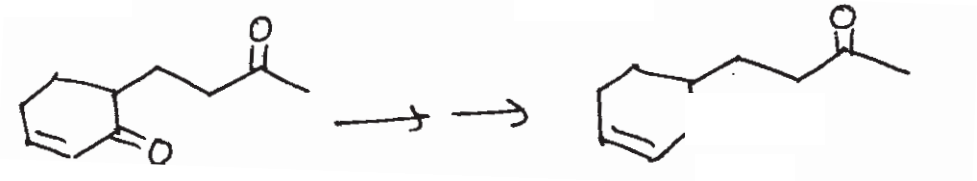
e) Give the synthetic equivalent to the following synthons.

Q2) a) How will you bring about following transformations (<u>any two</u>). **[5]**

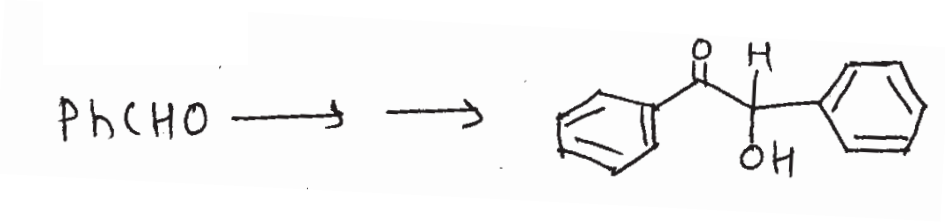
i)



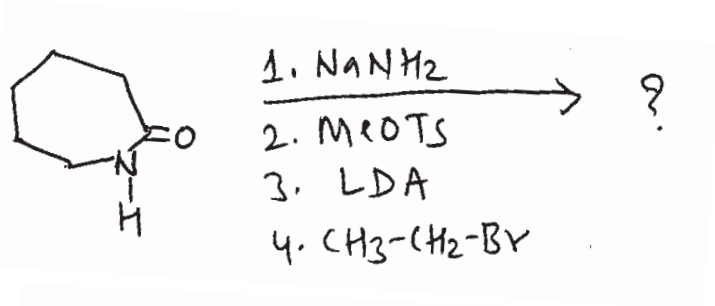
ii)

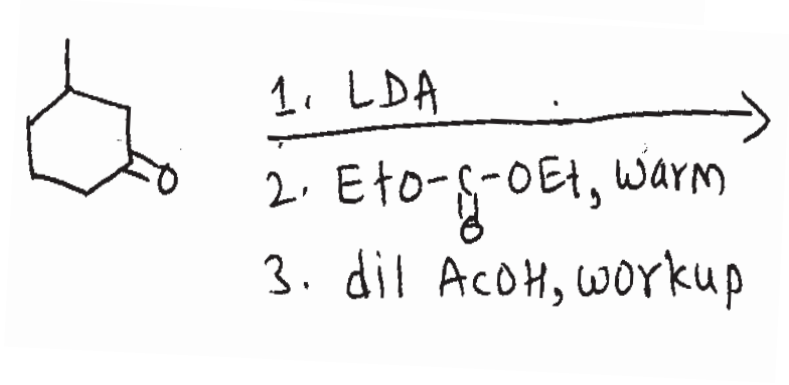


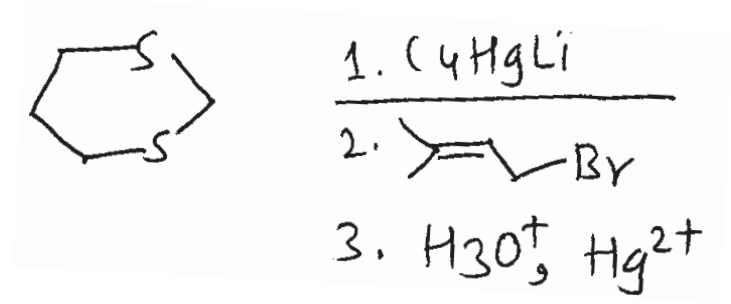
P.T.O.

iii) 

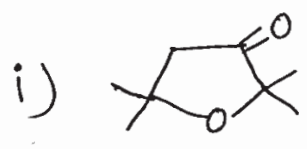
b) Predict the product/s in <u>any two</u> of the following. **[5]**

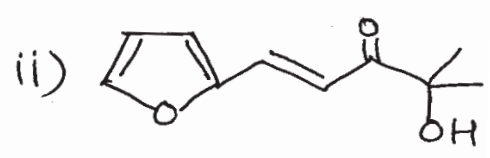
i) 

ii) 

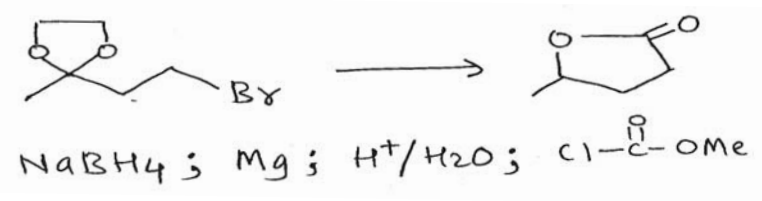
iii) 

Q3) a) Using retrosynthetic analysis, suggest suitable method to synthesise <u>any one</u> of the following. **[3]**

i) 

ii) 

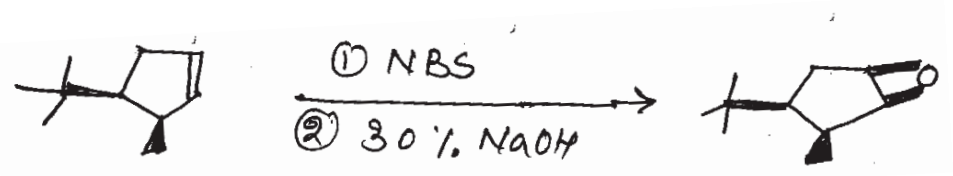
b) Arrange the given reagents in proper order to accomplish the following conversion write the structures of the intermediates. **[2]**



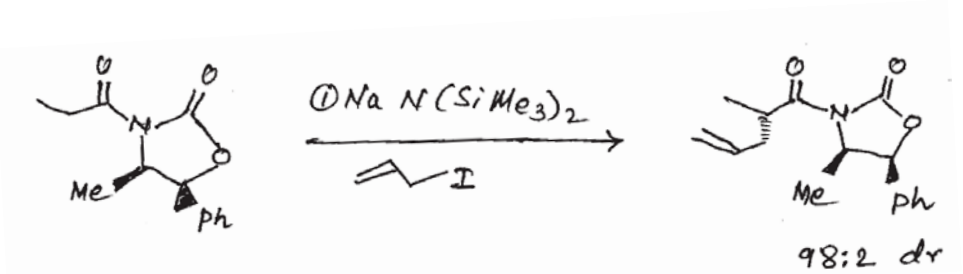
SECTION-II

Q4) a) Explain the following transformations with respect to stereochemical outcome of the reaction (any two). **[6]**

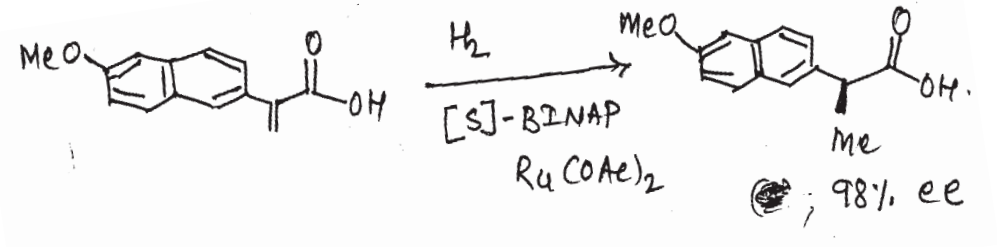
i)



ii)

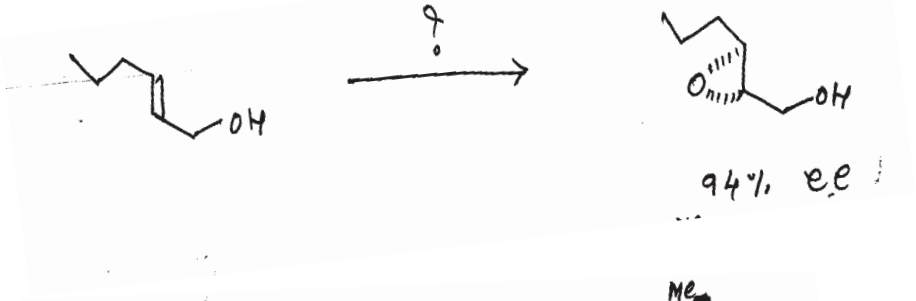


iii)

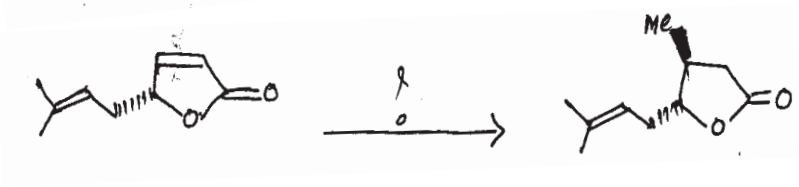


b) Name the suitable reagent for the following transformations and comment on the formation of the product (any two). **[4]**

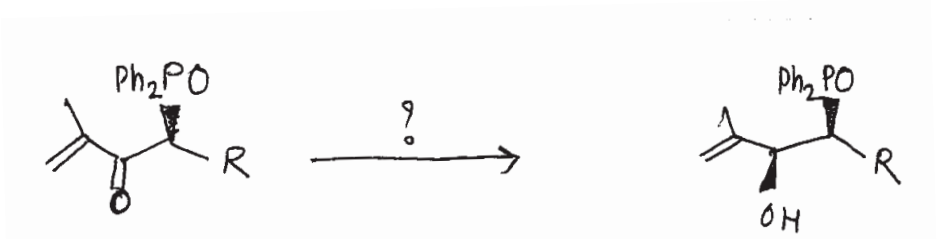
i)



ii)



iii)



Q5) a) Write a short note on (any two). **[6]**

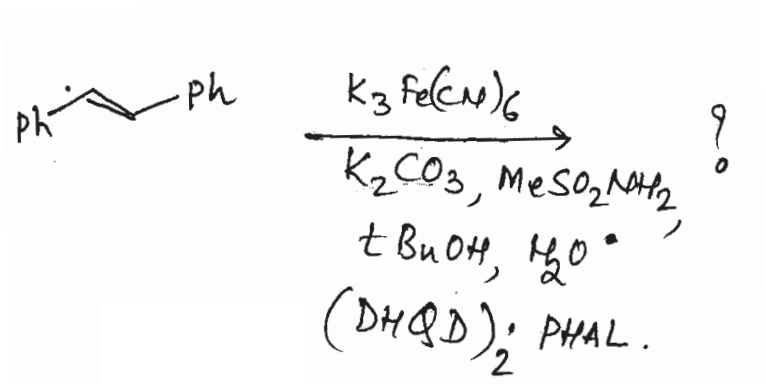
i) CBS - catalyst.

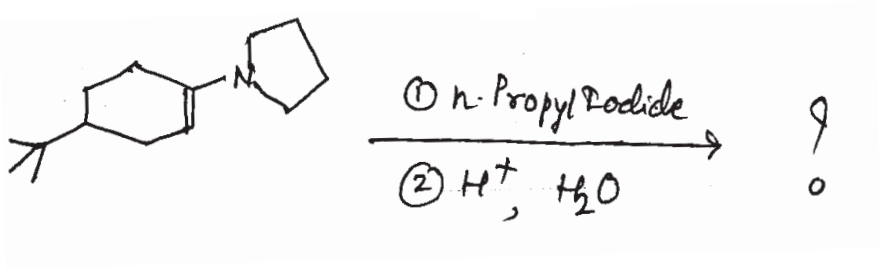
ii) Cram's chelate model.

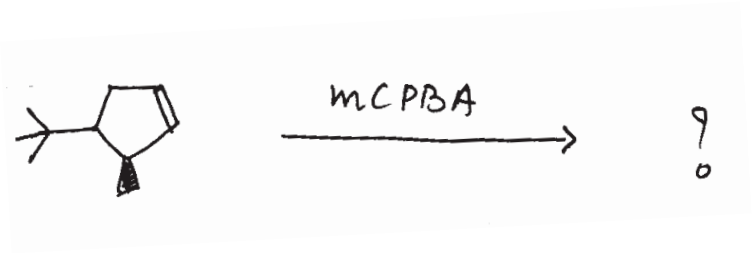
iii) Asymmetric Die/s. Alder reaction.

b) Predict the product/s and comment on the following transformation (any two). **[4]**

i)



ii) 

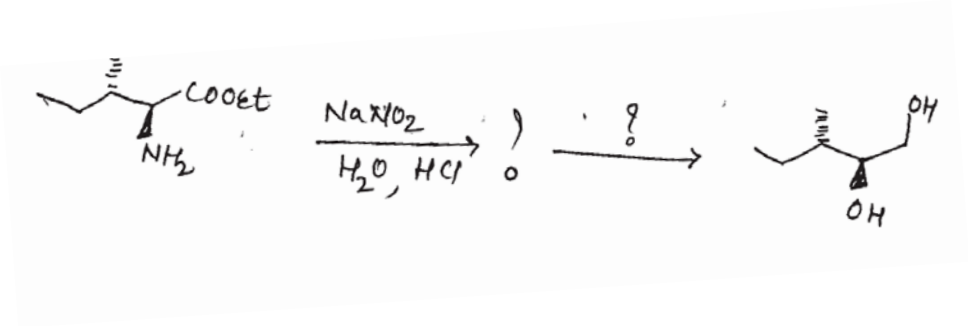
iii) 

Q6) a) Define the following terms (<u>any one</u>). **[2]**

i) Jacobsen epoxidation.

ii) Iodo lactonization.

b) Complete the following multistep synthesis using appropriate reagents or intermediates. **[3]**



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Total No. of Questions :6]

SEAT No. :

P1894

[Total No. of Pages :3

[5223] - 414

M.Sc. - II

ANALYTICAL CHEMISTRY

CHA-481: Analytical Toxicology and Food Analysis

(2013 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

SECTION - I

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

a) What is antidote?

b) State the principle for determination of barbiturate by procedure A.

c) Define the terms :

i) Psychotropic substance.

ii) Opium.

d) Explain "Narcotics".

e) State principle of determination of caffeine.

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

a) Explain type 'C' procedure for isolation and determination of amphetamine and metamphetamine for urine.

b) Outline the analytical procedure for determination of benzodizepines.

c) Write a short note on treatment of acute poisoning.

d) Give detail procedure for adsorption and elution of cocaine.

P.T.O.

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

a) Define the terms :

i) Coca leaf.

ii) Addict.

iii) Cannabis.

iv) Poppy straw.

v) Narcotic drugs.

b) By using gas chromatographic method a sample of barbiturate was analysed. Following data is obtained:

i) Concentration of known barbiturate = 2.3 mg/ml.

ii) Peak area of drug in sample = 5.9 min.

iii) Peak area of internal standard = 4.2 min.

iv) Peak area of known drug in reference = 2.8 min.

v) Peak area of internal standard in reference barbiturate solution = 7.9 min.

Calculate concentration of barbiturate in the sample.

SECTION - II

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

a) How Acid value of an oil is determined?

b) Define carbohydrate. Give the classification of carbohydrates.

c) How pasteurization of milk is verified?

d) State the principle for estimation of protein by kjeldahl method.

e) Give structure of saccharin and cylamate.

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

a) What are amino acids? How are total free amino acids estimated?

b) Describe a method for determination of 4 - hydroxybenzene.

c) Explain analytical method for determination of peroxide value of an oil.

d) How methionine in food grains is estimated?

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

a) A food sample containing sulphite as preservative 27.00gm was subjected to Tanner method and the titre value obtained with 0.01M NaOH was 6.92ml. Calculate the amount of SO_2 in the sample.

b) Biological sample was determined for net protein utilization, digestibility and biological value gives following results:

i) In take nitrogen (I) = 15.3 mg.

ii) Faecal nitrogen (F) = 6.9 mg.

iii) Endogenous faecal nitrogen (F_k) = 2.8mg.

iv) Urinary nitrogen (U) = 5.43mg.

v) Endogenous urinary nitrogen (U_k) = 3.65mg.

Calculate NPU, D and BV.

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Total No. of Questions :6]

SEAT No. :

P1895

[Total No. of Pages :3

[5223] - 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 separate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic table / non-programmable calculator is allowed.***

SECTION - I

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

a) State and explain the principle of XPS.

b) Explain the term electron shake up and electron shake off.

c) Discuss the role of collimator in X-ray analysis.

d) Draw the schematic diagram of X-ray tube.

e) Give the advantages of electron microscopy.

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

a) What is SEM? Discuss the construction and working of SEM.

b) Explain the principle of Auger electron spectroscopy. How is Auger electron spectroscopy used for chemical analysis?

c) What is detector? Enlist the detectors used for x-ray analysis. Explain any one in detail.

d) What is x-ray diffraction? Draw labled diagram and discuss major components of x-ray diffraction method.

P.T.O.

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

a) In ESCA electron was found to have kinetic energy of 1073.5 eV, when MgKα source was used. (λ = 9.89 Å) The electron spectrometer had a work function of 14.7 eV. Calculate the Binding energy of an electron.

[Given Planks Constant : h = 6.626×10^{-34} I.s, $\in$ - velocity of light C=3×10^{8}m/s]

b) Calculate the mass absorptive coefficient of an alloy which consist of 85% Fe, 5.0% Ni, 9.0% Cu and 1.0 % Zn. The mass absorptive coefficient for pure elements at 436 nm are 610, 715, 760 and 910 cm^2/gm respectively for Fe, Ni, Cu and Zn.

SECTION - II

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

a) Define the term chemiluminescene.

b) What is Fluorescent label? Enlist different Fluorescent compounds.

c) Explain the term bioluminescence.

d) What is magnetic anisotropy?

e) Define the term shift reagents with suitable example.

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

a) Discuss liquid-phase chemiluminescent analysis with suitable example.

b) Explain the factors affecting on photoluminescence.

c) Write a note on relaxation in NMR.

d) The spin quantum number for a proton is ½, the allowed orientations in the magnetic field correspond to M_{IL} = +½ and M_{IH} = –½, calculate ν for allowed orientation.

$$\left[\begin{array}{l}\text{Given : } \mu = 2.7297 \quad \beta = 5.0505\times10^{-31}\,\text{J/G} \\ \qquad\quad B_o = 14092\text{G} \;\; h = 6.626\times10^{-34}\,\text{J.S}\end{array}\right]$$

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

a) Write short note on HETCOR and COSY.

b) The ^{1}H NMR of a compound with empirical formula C_3H_6O shows singlet at δ 3.6 and doublet at δ 4.0, 4.0 and 6.5. The integration of each peak shows 3:1:1:1 ratio respectively. Identify the compound.

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Total No. of Questions : 6]

SEAT No. :

P1896

[Total No. of Pages : 3

[5223] - 416

M.Sc. - II

ANALYTICAL CHEMISTRY

CHA - 491 : Analytical Methods for Analysis of Fertilizers, Detergents, Water, Polymer, Paint and Pigment

(Semester - IV) (2013 Pattern)

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

Instructions to the candidates:

1) ***All questions of respective section are compulsory.***
2) ***Figures to the 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) ***Write the answers of two sections on separate answer books.***

SECTION - I

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

a) Define BOD and COD.

b) Enlist the methods used for determination of cyanide from polluted water.

c) What is active ingredient in detergent?

d) Explain the term-Iodine value.

e) What is citrate insoluble phosphate?

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

a) Give the analytical method for the estimation of chromium from waste water.

b) Discuss any one method for the determination of phosphorus from fertilizer.

P.T.O.

c) Write a short note on "Biodegradability of detergents".

d) 0.9428g sample of fertilizer containing phosphorus as $Ca_3(PO_4)_2$ was disintegrated completely and the solution was diluted to 250ml. The gravimetric determination of phosphorus using molybdate method gave 0.3518 g ($P_2O_5.24MoO_3$) from an aliquot of 25ml. Calculate percentage of phosphorus as P_2O_5.

(Given At.wt. O = 15.99, P = 31, Ca = 40, Mo = 96).

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

a) Give the estimation of lead from waste water.

b) What is meant by sampling? What are different steps involved in sampling of different materials?

SECTION - II

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

a) Define - Elastomers and fibres.

b) Explain transmittance and reflectance observed in plastic.

c) Define "Degree of polymerisation".

d) Explain the terms

i) Pigment

ii) Binder

e) Enlist the electrical properties used for analysis and testing of polymer.

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

a) Differentiate between

i) Natural polymer and synthetic polymer.

ii) Thermoplastic and thermosetting polymer.

b) Describe in detail an ebulliometric method used for the determination of $\overline{M_n}$ of polymer.

c) Give a full account of mechanical properties of polymer.

d) Calculate $\overline{M_n}$ and $\overline{M_w}$ for polymer consisting of three fractions with molecular weight 1×10^5, 2×10^5 and 3×10^5. The mole fraction of each of these fractions are found to be 0.1, 0.6 and 0.3 respectively.

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

a) Discuss the analytical method for the estimation of zinc from pigment sample.

b) A 0.500g sample containing zinc is dissolved in 100 ml of acid. An aliquot of 10ml is needed 15.00 ml of 0.0125M EDTA. Calculate percentage of zinc in sample.

[GIven At.wt. : Zn = 65.33]

Total No. of Questions : 9]

SEAT No. :

P1897

[Total No. of Pages : 3

[5223]-417

M.Sc. - II

ANALYTICAL CHEMISTRY

CHA - 492 : Method of Analysis and Application; Pollution Monitoring and Control, Analysis of Body Fluids, Carbon Nanostructures and Applications of Nanotechnology

(2013 Course) (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 the questions are compulsory***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of logarithmic tables/ non-programmable calculator is allowed.***

SECTION-I

(Pollution Monitoring and Control)

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

a) Discuss the sources of organic particulate matter.

b) What are the commonly used recovery techniques for the metals.

c) Mention any two methods for analysis of carbon monoxide (Co).

d) List the photochemical reactions in atmosphere.

e) Explain the role of zeolites in ion exchange method.

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

a) Write a short note on electrostatic precipitators.

b) Discuss the control measures of SO_x pollution.

c) Describe a suitable method for the estimation of mercury (Hg).

d) Describe the process of recovery of Cu from waste water.

P.T.O.

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

a) Outline the analytical method for the estimation of nitrates and nitrites.

b) Discuss the mechanisms involved during the separation of particulate matter from polluted air.

SECTION-II

(Analysis of Body Fluid)

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

a) Give principle of RIA.

b) Discuss physical characteristics of Urea.

c) Give any two functions and deficiency diseases of vit D_3.

d) Give the structure of the following.

i) Vitamin B_6.

ii) Retinoic acid.

e) Give a brief account of preservation and storage of blood.

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

a) Outline a suitable analytical method for the estimation of serum tocopherol.

b) Discuss the Fluorometric determination of Nicotinic acid and Niacin.

c) Explain how the liver function tests are carried out.

d) Discuss the suitable method for determination of uric acid from Urine.

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

a) Discuss principle, types and applications of ELISA.

b) Describe the method in detail for the determination of serum creatinine by Folin Wu method.

SECTION-III

(Carbon Nanostructures and Applications of Nanotechnology)

Q7) Answer the following. **[10]**

a) Enlist different types of bacteria used in the synthesis of nano particles.

b) How are the quantum dots synthesized?

c) What are the chemical and physical sensors?

d) Explain super conductivity in C_{60}.

e) Discuss vibrational properties of CNTs.

Q8) Answer any two of the following. **[10]**

a) Explain the following ;

i) Electrochemical sensors.

ii) Bio - membrane based sensors.

b) Describe the application of CNT in the fuel cells and catalysts.

c) Give applications of quantum dot technology in cancer treatment.

d) Explain the synthesis of nanoparticles by using Fungi.

Q9) Answer any one of the following. **[5]**

a) Explain the applications of Biosensors.

b) Write a short note on blinking behaviour of quantum dots. And thermal as well as phase transition sensors.

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Total No. of Questions :6]

SEAT No. :

P1898

[Total No. of Pages :3

[5223] -1001

M.Sc. -I

PHYSICAL CHEMISTRY

CHP-110: Fundamentals of Physical Chemistry - I

(2014 Pattern) (Semester - I)

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) Distinguish between exact and inexact differentials.

b) Explain the fundamental equation for a closed system.

c) Write Schrodinger wave equation for a particle in a three dimensional box. What is Laplacian operator? Explain the terms there in.

d) Explain Euler's criterion for exactness, for two independent degree of freedom.

e) What is phase equilibria? Explain it with respect to solid-liquid phase boundary.

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

a) What are partial molar quantities? Discuss one of the method for the determination of partial molar quantities.

b) What is meant by thermodynamic equilibrium? Discuss the equilibrium between a liquid and its vapour and hence deduce clasius- clapeyron equation.

c) Write the combined mathematical statement for first and second law of thermodynamics. What are the inadequacies of first law.

d) What is Heisenburg's uncertainty principle? Give its experimental evidence.

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

a) Calculate the degree of a quantum particle in a cubic box having energy four times that of the lowest energy.

b) Calculate the osmatic pressure of a solution at $37^{o}C$ containing 6.0 g urea, 12.0g of glucose and 34.2 g of cane sugar in a 3.1 litre of water. [At.wt. N=14, H = 1, 0 = 16].

SECTION-II

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

a) Give, the main advantages of the stopped flow technique over continuous flow method.

b) Define the term quantum yield. Give the processes on which high quantum yield depends.

c) Distinguish between first and second order reaction with respect to rate equation, unit and half-life.

d) What is stirling approximation. Calculate the value of ln 98!.

e) Write down equation for diffusion controlled reactions? What are diffusion controlled limits.

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

a) Using Bodenstein and Lind mechanism, obtain the rate equation for the formation of HBr.

b) Obtain the expression for the rate constant of a reaction using collision theory of bimolecular reactions.

c) Considering following enzymatic reaction.

$$E + S \underset{k_1'}{\overset{k_1}{\rightleftharpoons}} [ES] \xrightarrow{k_2} P + E$$

Where, E is an enzyme and S is substrate, derive the rate expression for above reaction

d) Using Boltzmann distribution law, derive the relation among partition function energy and heat capacity.

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

a) A first order reaciton has k = 1.5 $\times 10^{-6} s^{-1}$ at 200°C. If the reaction is allowed to run for 10 hours, what percentage of the initial concentration would have changed in the product? What is the half-life of this reaction?

b) The Collision theory expression and following the data to calculate the rate constant for the reaction.

$$2HI \rightleftharpoons H_2(g) + I_2(g)$$

energy of activation Ea = 44.6 k cal/mole

Collision diameter of HI = 3.5 $\times 10^{-8}$ cm. Find out the rate constant at 508°C. [At.wts, I = 127, H=1]

EEE

Total No. of Questions :6]

SEAT No. :

P1899

[Total No. of Pages :3

[5223] - 1002

M.Sc. - I

INORGANIC CHEMISTRY

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

(2014 Pattern) (Semester - I) (4 Credit System)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answer 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 in cyclopentadienyl anion ($C_5H_5^-$) and Benzene?

b) When n is odd, $S_n^n \equiv \sigma$. Prove this.

c) Draw the structure of PCL_5 molecule and identity different types of planes in it.

d) Find out the product of $C_3^1 \times C_3^2$ in BF_3 molecule and also find whether they commute with each other or not.

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

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

a) Explain all the symmetry elements present in the molecule $XeOF_4$ and assign the correct point group.

b) Define Abelian group. Prove that C_{2v} point group is an Abelian group.

P.T.O.

c) Derive the character table for D_2 point group using great orthogonality theorem and assign Mulliken symbols to the irreducible representations.

d) Give the matrix representation for improper axis of rotation and using matrix multiplication prove,

$$S_2 = C_2(z) \times \sigma_{xy} = i$$

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

a) Find the reducible representation for $[PdCl_4]^{2-}$ molecule considering σ - bond as a basis of representation and thus find out the orbitals offered for σ - bond formation in the molecule.

b) Find out the normalized SALC using projection operator of E^1 irreducible representation on σ_1 orbitals of CO_3^{2-} ion.

D_3h	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$
E′	2	–1	0	2	–1	0

SECTION - II

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

a) Alkali metal solution is a good conductor of electricity in liquid ammonia. Explain.

b) Give classification of hydrides of Boron.

c) Give the preparation methods for dihydrogen.

d) What are allotropes of carbon? Draw the structure of Metal - fullerene.

e) What is activation of nitrogen? Explain any two methods of activation.

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

a) Write a note on interhalogen compounds.

b) What are organometallic compounds? Explain organometallic compounds of Lithium with synthesis, properties, structure and uses.

c) Write a note on carbon nano tubes.

d) What are oxyacids? Explain oxyanions of halogens.

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

a) Explain the structure and bonding in

i) Ammonia.

ii) B_4H_{10}

b) Draw the structures of following :

i) ClF_5

ii) B_5Hg

iii) 18 - crown - 6

iv) $Li_4(CH_3)_4$

v) PH_3

Character table for D_{4h} point group.

D_{4h}	E	$2C_4$	C_2	$2C_2'$	$2C_2''$	L	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$		
A_{1g}	1	1	1	1	1	1	1	1	1	1		x^2+y^2,z^2
A_{2g}	1	1	1	–1	–1	1	1	1	–1	–1	R_z	
B_{1g}	1	–1	1	1	–1	1	–1	1	1	–1		$x^2–y^2$
B_{2g}	1	–1	1	–1	1	1	–1	1	–1	1		xy
Eg	2	0	–2	0	0	2	0	–2	0	0	(R_x,R_y)	(xz,yz)
A_{1u}	1	1	1	1	1	–1	–1	–1	–1	–1		
A_{2u}	1	1	1	–1	–1	–1	–1	–1	1	1	z	
B_{1u}	1	–1	1	1	–1	–1	1	–1	–1	1		
B_{2u}	1	–1	1	–1	1	–1	1	–1	1	–1		
E_u	2	0	–2	0	0	–2	0	2	0	0	(x,y)	

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Total No. of Questions : 6]

SEAT No. :

P1900

[Total No. of Pages : 4

[5223]-1003

M.Sc. (Part-I)

ORGANIC CHEMISTRY

CHO-150 : Basic Organic Chemistry

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

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

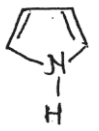
Instructions to the candidates:

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

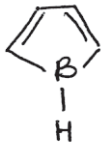
SECTION-I

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

a) The stability of A is greater than B. Explain.



(A)



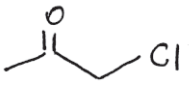
(B)

b) Mustard gas (Cl - CH_2 CH_2 $5CH_2$ CH_2 Cl) undergoes rapid hydrolysis. Justify.

c) Naphthalene undergoes nitration at α-position and Sulphonation at β-position. Explain.

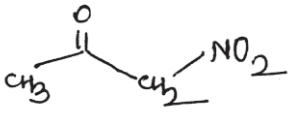
d) 3-bromopropanal undergoes base catalysed dehydrobromination at a faster rate than 2-bromopropanal. Explain.

e) Explain -



pKa = 16·5

and

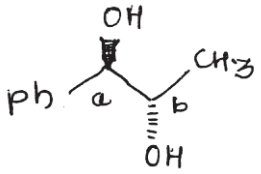


pKa = 5·1

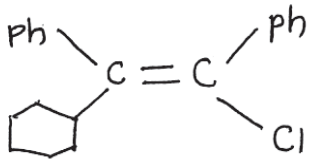
P.T.O.

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

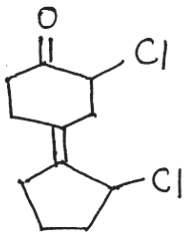
a) Determine the absolute configuration of chiral centres a & b in the following.



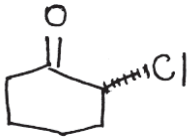
b) Comment on chirality and optical activity of the following.



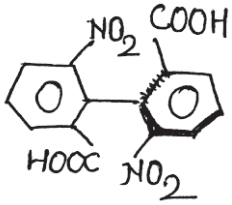
c) Assign E/Z configuration to the following and justify.



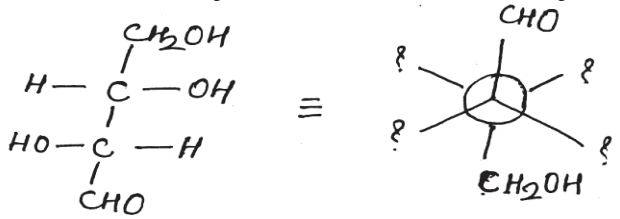
d) Assign Re/Si face to the following.



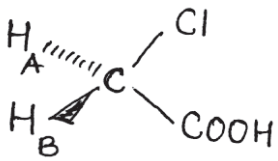
e) Determine the absolute configuration.



f) Convert Fischer Projection to Newman Projection as shown.



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



Q3) Write note on: (any two) **[5]**

a) Structure and stability of carbanions.

b) Hyperconjugation.

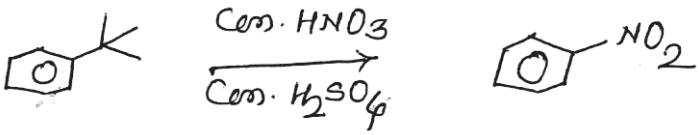
c) Huckel's Rule.

SECTION-II

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

a) Neomenthyl Chloride reacts several times faster than menthyl chloride in E_2 elimination. Explain.

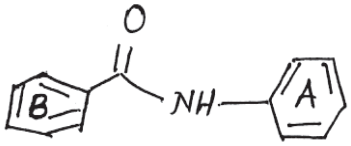
b) Explain the reaction -



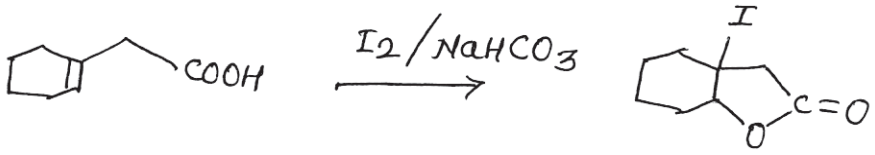
c) During benzylation of phenols with Benzyl Chloride in K_2CO_3/Acetone, Sodium iodide acts as a catalyst. Explain.

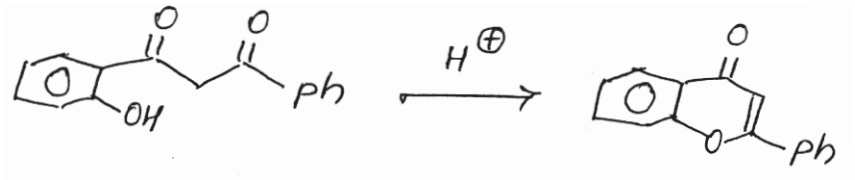
d) Phenacyl chloride reacts with KI in acetone 12000 times faster than 2-phenyl-ethyl chloride. Explain

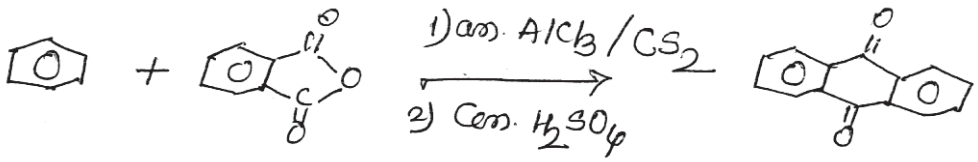
e) In the following compound, ring A is prone to electrophilic aromatic substitution. Justify.

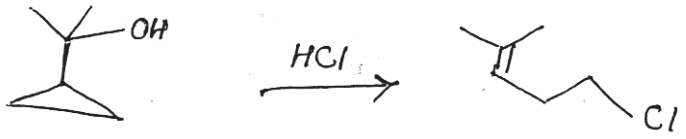


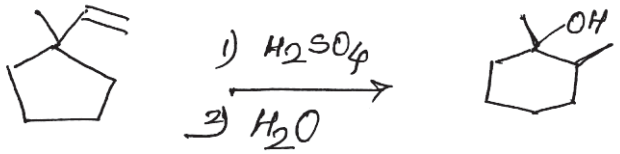
Q5) Suggest the mechanism: (<u>any four</u>) **[10]**

a) 

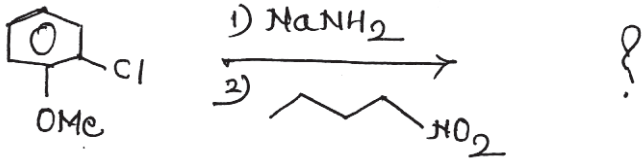
b) 

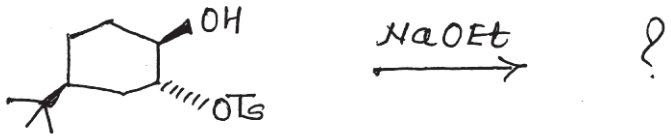
c) 

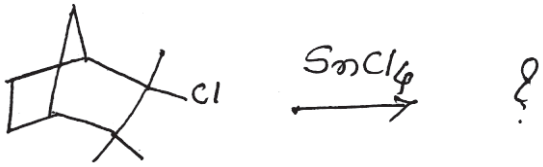
d) 

e) 

Q6) Predict the products (<u>any two</u>) with mechanism: **[5]**

a) 

b) 

c) 

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Total No. of Questions :6]

SEAT No. :

P1901

[Total No. of Pages : 2

[5223] - 1004

M.Sc. - I

ANALYTICAL CHEMISTRY

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

(2014 - Pattern) (Semester - I) (Credit System) (4-Credits)

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

Instructions to the candidates:

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

SECTION - I

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

a) Give any four responsibilities of students and workers.

b) How does exposure to toxic chemicals takes place through ingestion.

c) Describe what are heat and smoke detectors.

d) Define : i) Carcinogen.

ii) Irritants.

e) Mention the different types of gloves.

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

a) Explain the use of safety googles, safety showers and eyewash units.

b) Write a short note on role of personnel clothing as personnel protective equipments.

c) Give an account of storage of flammable and combustible liquids.

d) Give the steps in securing chemical of concern.

P.T.O.

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

a) Explain the types and disposal methods for various hazards.

b) Write a short note on fire safety equipments.

SECTION - II

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

a) Enlist various disposal options.

b) Describes the safety measures for corrosive gases.

c) Define and explain stock register.

d) Give the methods for reducing chemical exposure.

e) What are the steps for managing wastes?

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

a) Give the general precautions for working with electrical equipments.

b) What are the different types of hazards? Explain the safety measures while working with flammable chemicals.

c) Write a short note on GLP.

d) What type of accidents may occur in laboratory? Mention the precautions to avoid it.

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

a) Explain in brief handling spills of elemental mercury.

b) Write a short note on sop system overview.

Total No. of Questions :6]

SEAT No. :

P1902

[Total No. of Pages : 3

[5223]-2001
M.Sc.
PHYSICAL CHEMISTRY
CHP - 210 : Fundamentals of Physical Chemistry - II
(2014 Pattern) (Semester - II) (New 4 Credit)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) What is signal to noise ratio? Give its minimum value.

b) What is the condition for a molecule to be microwave active. Give an example.

c) Explain the Jacquinot advantage in FTIR spectroscopy.

d) State the rule of mutual exclusion. Give an example.

e) State the Franck - Condon principle.

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

a) Explain, principle and applications of NMR spectroscopy.

b) Deduce the relation $V_{max} = \frac{1}{2xe} - 1$.

c) Sketch and explain the polarizability ellipsoids for CO_2 molecule.

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

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

a) Determine the bond length of CO_2 molecule from the following data.

B = 192.118m^{-1}, At Wt : C = 12, O = 16.

b) The vibrational frequency of $^1H^{35}C1$ is 2990.6cm^{-1}. Estimate the frequency of $^1H^{37}C1$ assuming force constant to be the same.

SECTION - II

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

a) How many atoms of 1μCi $^{38}C1$ will remain after 75m if its half life period is 37.3m?

b) What is meant by spur, track and δ - rays?

c) How are thermalized neutrons obtained in the nuclear reactor?

d) Explain the use of radioisotope in solubility measurement of sparingly soluable salt.

e) Define elementary separation factor.

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

a) What are the modes of interraction of γ - rays with matter? Explain the photo - electric effect in detail.

b) What is meant by tracer and self diffusion? Explain use of radioisotopes in diffusion studies.

c) Explain the principle and working of a breeder reactor.

d) How is the fractional distillation be used to separate heavy water from ordinary water?

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

a) 0.98 g of copper containing superoxide dismutase with 5% Cu was irradiated for 8h in APSARA reactor with thermal neutron flux of $1.6\times10^{11} ncm^{-2}s^{-1}$.Calculate the activity due to 64Cu

i) at the end of irradiation and

ii) after cooling period of 7.5h.

[Given : At. weight of Cu = 63, $^{64}Cu_{(t_{1/2})}$ = 12.7h, σ = 4.5h, isotopic abandance = 69.17%]

b) Calculate the number of atoms of ^{226}Ra remaining after four half lives if 1g of it is present intially.

[Given $t_{1/2}(^{226}Ra)$ = 1600y, activity of 1g ^{226}Ra = 1 Ci]

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Total No. of Questions :6]

SEAT No. :

P1903

[Total No. of Pages :6

[5223] - 2002

M.Sc. - I

INORGANIC CHEMISTRY

CHI - 230 : Coordination and Bioinorganic Chemistry

(2014 Pattern) (Semester - II)

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

Instructions to the candidates:

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

SECTION - I

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

a) state and explain Hund's rule to determine the ground state term symbols.

b) Define the terms curie temperature and Neel temperature.

c) "The electronic spectral bands of Lanthanides and their complexes are almost the same". Explain.

d) Calculate the degeneracy for the following terms / configuration / states.

i) $^4A_{2g}$

ii) ^3H

e) Give the selection rules for electronic transitions.

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

a) Prepare a table of microstates and hence derive the allowed R.S. terms for vanadium (III) ion in ground state.

P.T.O.

b) Give the splitting of ^2D R.S. term in weak cubic field using character table for pure rotational point group and reduction formula.

c) i) State non crossing rule? Where it is useful.

ii) "Molar absorptivity for Tetrohedral complexes is 100 times greater than octahedral complexes". Justify your answer.

d) Predict the expected electronic transitions in the following complexes.

i) $[Ni(H_2o)_6]^{+2}$

ii) $[CoCl_4]^{-2}$

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

a) For a tetrahedral cobalt (II) complex effective magnetic moment is 4.87 Bm. The ν_2 transition of this complex is observed at 5300 cm^{-1}. Calculate the spin orbital coupling constant of cobalt(II) in this complex. (Given, $\nu_2 = 18\ D_9$).

b) The free gas ion Ti^{+2} has a $^3F_\lambda$ ground R.S. term. The ^1D and ^3P terms are above ^3F by 10642 cm^{-1} and 12920 cm^{-1} respectively. The energies of the terms are given in terms of Racah parameters.

$$E_{(^3F)} = A - 8B$$

$$E_{(^3P)} = A + 7B$$

$$E_{(D)} = A - 3B + 2C$$

Calculate the values of B and C for Ti^{+2} ion.

SECTION - II

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

i) Explain the role of cobalt in biological system.

ii) Draw the structure of RNA.

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

i) Chlorophyll.

ii) Uracil.

iii) 4 Fe - 4S.

iv) Cardiolyte.

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

a) Irving - William Series.

b) Transferrin.

c) Structure of proteins.

d) Metals in medicine.

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

a) Match the following:

i)	Cobalt	1)	Electron Carrier
ii)	Arsenic	2)	Vit. B_{12}
iii)	3 Fe - 4S	3)	Hard - acid
iv)	Enterobactin	4)	Toxic
v)	H^+ ion	5)	Siderophore

b) Give an account of voltage - gated channels for Na - transport.

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_{2d}, 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: $A \times E_i = E_i$ irrespective of the suffix on A.
   (b) For all groups except D_{4h}, D_{4d}, S_4:
   $B \times E_1 = E_2$, $B \times E_2 = E_1$
   irrespective of the suffix on B. (If the group has only one B representative put $B_1 = B_2 = B$.)
   (c) For D_{4h}:
   $B \times E_1 = E_2$, $B \times E_2 = E_1$, $B \times E_3 = E_4$, $B \times E_4 = E_3$, $B \times E_5 = E_5$
   irrespective of the suffix on B.
   (d) For D_{4d}, S_4:
   $B \times E_1 = E_3$, $B \times E_2 = E_4$, $B \times E_3 = E_1$
   irrespective of the suffix on B.

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

(*d*) D_{5d}, D_{3h}, D_3, C_{3v}, C_{2h}, 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.

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

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

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

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

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

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

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

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

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_1	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	Td	D_{4h}	D_{2d}	C_4^v	C_3^v	D_{3d}	D_3	C_{2h}
A_{1g}	A_1	A_1	A_{1g}	A_1	A_1	A_1	A_{1g}	A_1	A_g
A_{2g}	A_2	A_2	B_{1g}	B_1	B_1	A_2	A_{2g}	A_2	B_g
E_g	E	E	$A_{1g}+B_{1g}$	A_1+B_1	A_1+B_1	A_1+A_2	E_g	E	A_g+B_g
T_{1g}	T_1	T_2	$A_{2g}+E_g$	A_2+E	A_2+E	A_2+E	$A_{2g}+E_g$	A_2+E	A_g+2B_g
T_{2g}	T_2	T	$B_{2g}+E_g$	B_2+E	B_2+E	$A_1+B_1+B_2$	$A_{1g}+E_g$	A_1+E	$2A_g+B_g$
A_{1u}	A_1	A_2	A_{2u}	B_2	A_2	A_2	A_{1u}	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_1+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	$A_2+B_1+B_2$	$A_{2u}+E_u$	A_2+E	A_u+2B_u
T_{2u}	T_2	T_1	$B_{2u}+E_u$	A_2+E	B_2+E	$A_2+B_2+B_2$	$A_{2u}+E_u$	A_2+E	$2A_u+B_u$

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Total No. of Questions : 6]

SEAT No. :

P1904

[Total No. of Pages : 4

[5223] - 2003

M.Sc. - I

ORGANIC CHEMISTRY

CHO - 250 : Synthetic Organic Chemistry and Spectroscopy

(Semester - II) (2014 Pattern)

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 books.***

SECTION - I

Q1) Explain any five of the following: **[10]**

a) Swern oxidation involves sulfur ylide.

b) Use of Wolff rearrangement in preparation of higher homologue of starting acid.

c) B-hydroxy esters are prepared by organo zinc reagents and not organo magnesium reagent.

d) Epoxidation of double bond.

e) Nitrogen ylides are less stable than phosphorus ylides.

f) β- Naphthol-allyl ether on heating at 200^{o}C gives 1-allyl - 2 -naphthol as the major product and not 3-allyl - 2-naphthol.

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

a) Birch reduction. Write a note.

b) Favorskii rearrangement. Write a note.

c) Use of organo lithium reagents in organic synthesis.

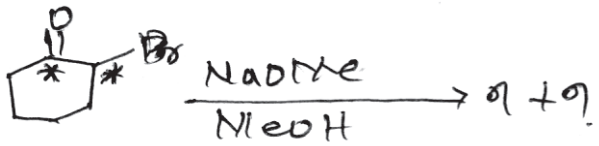
P.T.O.

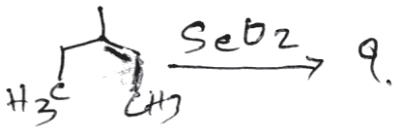
d) Write a note on Beckmann rearrangement.

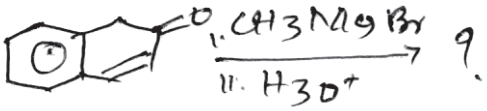
e) Explain Bayer Villiger oxidation with suitable example.

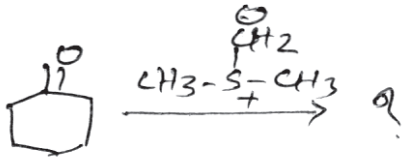
f) Write a note on Wilkinson's catalysis.

Q3) Predict the products and suggest the mechanism any two. **[5]**

a) 

b) 

c) 

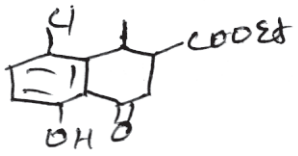
d) 

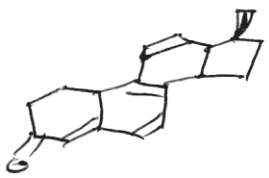
SECTION - II

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

a) Explain the fundamental vibrations and overtones in IR.

b) Calculate λ_{max} for following:

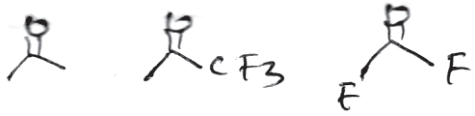
i) 

ii) 

c) Explain Bathochromic shift with suitable example.

d) The mass spectrum of n-propyl benzene has a base peak at m/z 91 (M - 29). However the mass spectrum of o-nitropropyl benzene exhibits no M-29 peak.

e) Assign the IR absorption values 1720, 1769, 1928cm^{-1}., to the following compounds with proper justification.



f) Explain the principle of Mass spectrometer in brief.

Q5) Deduce the structure of any five of the following compounds using spectral data and justify your answer. **[10]**

a) MF : $C_4H_7BrO_2$

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

PMR : δ 1.08 (t, J = 7Hz, 3H); 2.07(m, 2H), 4.23,

(t, J = 7Hz, 1H); 10.97 (s, 1H, Exchangeable with D_2O).

b) MF : $C_8H_8O_2$

IR : 1735 cm^{-1}

PMR : 4.0 (s, 3H); 7.3 (s, 5H)

c) MF : $C_5H_8O_2$

IR : 1695, 1620, 990 and 910cm^{-1}

PMR : δ 1.6 (t, J = 6Hz, 3H); 4.3 (q, J = 6Hz, 2H)

5.8 (dd, J = 4Hz & 10Hz, 1H); 6.11 (dd, J = 10 & 16Hz, 1H);

6.4 (dd, J = 4Hz & 16Hz, 1H)

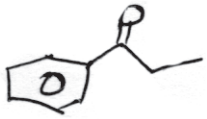
d) Two isomeric hydrocarbons A & B with MF : C_5H_{10}

shows following CMR data.

A : 13 (q) ; 17 (q); 26(q), 118(d), 132(s) ppm

B : 13(q), 22(q), 31(t), 108(t), 147 (s) ppm.

e) How will you differentiate the following by M.S.

i)  & ii) 

f) MF : $C_8H_{10}O$

UV : 250, 260nm

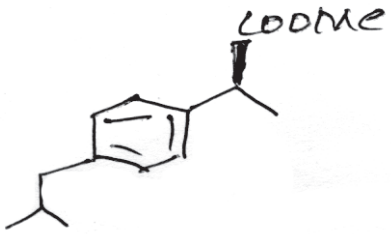
IR : 3360 cm^{-1}

PMR : 1.6 (br.s, 4mm); 2.8 (t, J = 7Hz, 8mm);

3.9 (t, J = 7 Hz, 8mm); 7.20 (s, 20mm).

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

a) Assign the chemical shift for the following compound



0.9, d, 7Hz, 6H

1.5, d, 7Hz, 3H

1.85, m, 1H

2.45, d, 7Hz, 2H

b) Explain in brief the factors affecting chemical shift in PMR.

c) Deduce the structure of the compounds from the data provided.

i) A compound with Molecular formula C_4H_6O exhibits IR : 1620cm^{-1}.
CMR : 146, d; 100,d, 70, t, 38t.

ii) A compound exhibits MS : 53 (M^+), 27, 26.
IR : 2250, 1610cm^{-1}
CMR : 138, 116, 107.

Total No. of Questions : 3]

SEAT No. :

P1905

[Total No. of Pages : 14

[5223]-2004
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry-II
(2014 Pattern) (Semester - II) (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 the 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 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 books.***

PART - A

Modern Separation Methods and Hyphenated Techniques

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

a) Give any two applications of GLC.

b) What is meant by column switching technique in Gas Chromatography?

c) Compare the process of isocratic and gradient elution.

d) Explain the principle of MS.

e) How resolving power of HPLC column is increased.

P.T.O.

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

a) What are the characteristics of an ideal detector? Classify different HPLC detectors and explain the working and limitations of the refractive index detector.

b) Explain the inductively coupled plasma in Mass Spectrometry.

c) Compare GC and HPLC on the basis of following points

i) Principle

ii) Sample injection system

iii) Column

iv) Detector

v) Application

d) With a labelled schematic diagram explain the working of mass spectrometer.

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

a) The following data was obtained by a gas-liquid chromatography on a 40cm packed column

Compound		t_R(min.)	W(min.)
i)	Air	1.7	-
ii)	Methylcyclohexane	10.2	0.78
iii)	Methylcyclohexene	10.9	0.86
iv)	Toluene	14.3	1.08

Calculate

i) Average number of plates from the data

ii) The column resolution

iii) The plate height

b) Write a short note on high speed gas chromatography.

♦ ♦ ♦

Total No. of Questions : 6]

P1905

[5223]-2004
M.Sc. - I
CHEMISTRY
CH - 290 (B) : Basic Biochemistry
(2014-15 Pattern) (Semester - II) (4 Credits)
PART - B

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

Instructions to the candidates:

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

SECTION-I

Q1) Answer any three of the following: **[12]**

a) What are the different methods for determination of end terminals of peptide chain? Explain one method each for the amino & carboxy terminal.

b) Discuss the different forces responsible & thus the structural differences between secondary & tertiary structures.

c) Discuss the structural features & function of Mitochondria and Endoplasmic reticulum.

d) Give the important functions of lipids. Briefly elucidate their metabolism.

Q2) Differentiate & distinguish between the following (any four): **[8]**

a) Active & passive transport.

b) Essential and non essential amino acids.

c) Prokaryotes and Eukaryotes.

d) Glycogen and cellulose.

e) α-helix and β-pleated sheets.

f) Saturated and unsaturated fatty acids.

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

a) Write in brief

i) Characteristics of peptide bond

ii) Acid base properties of a,a

b) Describe Eukaryotic cell with its subcellular components and their role in the cell.

c) Classify amino acids with suitable examples.

SECTION-II

Q4) Answer any three of the following: **[12]**

a) Derive Michaelis Menten equation and give its significance to understand enzyme kinetics.

b) Explain what is Genetic code. Discuss different characteristics of Genetic code.

c) Explain in brief DNA replication.

d) Describe the effects of competitive & non competitive inhibitors on the kinetics of enzyme reactions.

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

a) Summarize the key features of active site of enzyme.

b) Describe different types of RNA's & their function.

c) Discuss the role of enzyme in industry.

d) Name different components of balanced diet and discuss briefly role of any three.

e) Define the terms translation and transcription. Relate these processes to the flow of genetic information.

f) Describe major experiment that give evidence of DNA as the genetic material .

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

a) Write a note on

i) DNA polymerases

ii) Gene therapy

b) Write in brief

i) Factors involve in initiation complex formation during protein synthesis

ii) Enzyme immobilization

c) Write short account on nutritional diseases.

♦ ♦ ♦

Total No. of Questions : 3]

P1905

[5223]-2004
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2014 Pattern) (Semester - II)
PART - C
Concept of Analytical Chemistry

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

a) Give any two properties of nanomaterials.

b) Differentiate between batch extraction and continuous extraction.

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

i) 0.00298

ii) 25.0069

d) Define:

i) Gross sample

ii) Analytical sample

e) What is automated sample handling?

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

a) Describe various steps involved in sampling operations.

b) Describe the synthesis of nano-materials by sol-gel method.

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

d) Explain the following terms:

i) Standard deviation

ii) Confidence limits

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

a) The following results were obtained in the replicate determination of the lead content of a blood sample : 0.613, 0.618, 0.615, 0.613 and 0.616 ppm. Calculate the mean and standard deviation of this set of data.

b) Discuss the characterization of nano materials by

i) SEM-EDAX and

ii) TEM.

♦ ♦ ♦

Total No. of Questions : 3]

P1905

[5223]-2004
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2014 Pattern) (Semester - II)
PART - D
Industrial Methods of Analysis

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

a) Define:

i) gmole

ii) ppb

b) Define instability constant.

c) How will you prepare 25 ppm sodium solution from NaCl(mol. wt. of NaCl = 58)

d) What is a buffer? Give types of buffers.

e) Give any two types of quality standards for laboratories.

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

a) Write a short note on industrial process analyser.

b) What is chromatography? Explain the principles of gas chromatography.

c) Give a brief account of

i) quality audits

ii) qualities reviews

d) Write a note on continuous online process control.

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

a) 0.310 g of steel sample was dissolved by acid treatment. The solution was diluted to 100 ml. From an aliquot of 25ml, Fe(III) ions are precipitated as $Fe(OH)_3$.The precipitate of $Fe(OH)_3$ was ignited, finally it gave 0.095g of Fe_2O_3. Calculate the percentage of iron in the sample. (Given : at. wt. Fe = 55.85, O = 16)

b) What is common ion effect? Explain in detail giving suitable examples.

♦ ♦ ♦

Total No. of Questions : 3]

P1905

[5223]-2004
M.Sc. - I
ANALYTICAL CHEMISTRY
CH - 290 : General Chemistry - II
(2014 Pattern) (Semester - II)
PART - E
Organometallic and Inorganic Reaction Mechanism

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

a) Predict the product

$$[PtCl_4]^{2-} + NO_2 \rightarrow ? + NH_3 \rightarrow ?$$

b) Explain the term outer sphere reaction mechanism with suitable example.

c) Calculate charge on the complex using $18e^-$ rule

i) $[\eta^5 - C_5H_5\ Fe(CO)_4]^x$

ii) $[Co(CO)_4\ PPh_3]^x$

d) Explain the difference in IR spectra of $Mo(PF_3)_3(CO)_3$ vs $Mo(PMe_3)_3\ (CO)_3$.

e) How carbonyl compounds are synthesized by metallation?

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

a) Write short note on Wacker process.

b) Discuss the evidences for dissociative mechanism.

c) Explain with the help of suitable examples 'Insertation reactions'.

d) Discuss the stereochemistry of substitution reaction in trans octahedral complexes.

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

a) Draw the structure of the following:

i) $[Ir(CO)\ Cl(PPh)_2]$

ii) $[Cp - Mn(CO)_3]$

iii) $[Fe_2\ (CO)_9]$

iv) $[\eta^5 - C_5H_5 - Fe - \eta^5C_5H_5]$

v) $[(CO)_5 - Mn_2 - (CO)_5]$

b) Determine valence shell electronic count for the following:-

i) $[Fe(CO)_4]^{2-}$

ii) $[(\eta^5 - C_5H_5)_2\ Co]^+$

iii) $[(\eta^3 - C_5H_5)\ (\eta^5 - C_5H_5)\ Fe(CO)]$

iv) $Co_2(CO)_8$

v) $ClMn(CO)_5$

♦ ♦ ♦

Total No. of Questions : 3]

P1905

[5223]-2004
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2014 Pattern) (Semester - II)
PART - F
Mathematics for Chemists

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

a) Define : Conjugate of a complex matrix with suitable example.

b) What is point of inflexion and inflexion tangent? Illustrate.

c) Give the transpose of the matrices:

i) $A = \begin{bmatrix} 1 & 3 & 5 \\ -2 & 5 & 6 \\ 7 & 0 & 3 \end{bmatrix}$

ii) $A = \begin{bmatrix} 2 & 8 & 5 \\ 4 & 0 & 6 \\ 3 & 2 & 7 \end{bmatrix}$

d) Give derivatives of :

i) a^x

ii) $\tan x$

iii) $\sin^{-1} x$

iv) x^n

e) Differentiate the following function with respect to x

$y = x^2 \log x$.

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

a) What is a cusp? Describe the types of cusps.

b) Evaluate the following:

i) $\int x(x^2+3)^5\,dx$

ii) $\int \tan^2 x\,dx$

c) Find differential coefficients of the following:

i) $(x^3+2x-5)(x-3)$

ii) $y=(5x+4x^2)^5$

d) Using Falk's scheme evaluate the following:

i) $A=\begin{bmatrix}2 & 3 & 8\\ 9 & 6 & 7\end{bmatrix}$ $x=\begin{bmatrix}2\\3\\4\end{bmatrix}$ $Ax=?$

ii) $B=\begin{bmatrix}7 & 1 & 1\\ 2 & 5 & 2\end{bmatrix}$ $y=\begin{bmatrix}4\\8\\2\end{bmatrix}$ $By=?$

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

a) Write a short note on Taylor and Mc Laurin Theorem.

b) Define the following:

i) Periodic function

ii) Trigonometric series

iii) Fourier series

♦ ♦ ♦

Total No. of Questions : 3]

P1905

[5223]-2004
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2014 Pattern) (Semester - II)
PART - G
Pericyclic, Photochemistry and Free Radical Reactions

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

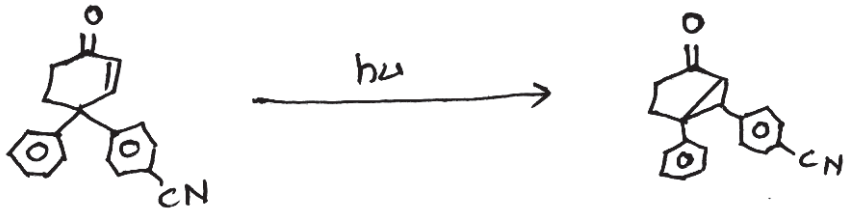
a) Draw the correlation diagram for conrotatory cyclization of 1,3,5-hexatriene to cyclohexadiene and predict whether it will be thermally or photochemical allowed.

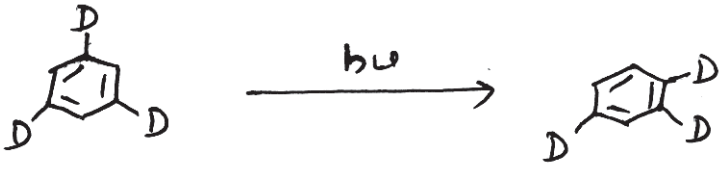
b) Discuss the mechanism of Norrish type II process of 2-hexanone and predict the product formed.

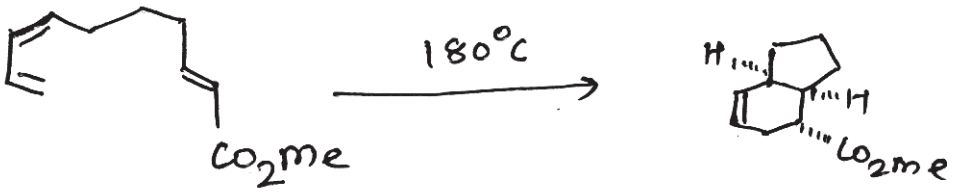
c) Irradiation of benzophenone in the presence of $(Ph)_2$ CHOH gives benzpinacol as the only product.

Q2) Explain the mechanism for any three of the folloiwng: **[9]**

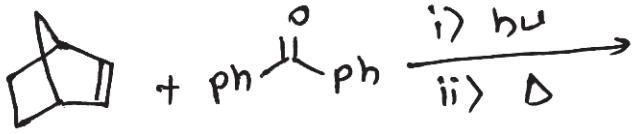
a) 

b) 

c) 

d) 

Q3) a) Predict the products for any two of the following indicating the mechanism involved. **[4]**

i) 

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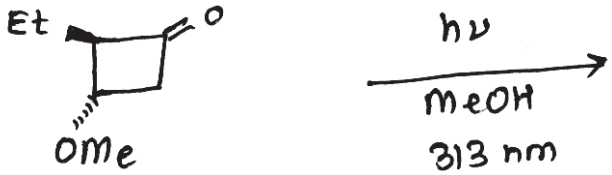
ii) 

?

iii) 

? + ?

iv) 

?

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

i) Free radical chlorination of both n-propyl and isopropyl bromide give the same product, 1-bromo-2-chloropropane. Explain.

ii) Write short note on photoreduction.

iii) Write short note on cope rearrangement.

♦ ♦ ♦