Total No. of Questions : 6]

SEAT No. :

P1986

[Total No. of Pages : 4

[4923]-101

M.Sc.

PHYSICAL CHEMISTRY-I

CHP-110 : Fundamentals of Physical Chemistry-I

(2013-14 Pattern) (Semester-I)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION-I

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

a) State Heisenberg's uncertainty principle and its mathematical form.

b) State Bohr's correspondence principle.

c) What is Maxwell' - Boltzman distribution law? Explain the terms involved in it.

d) What is the criterion for spontaneity of a process in terms of entropy?

e) What is the physical significance of Gibb's free energy?

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

a) What is photoelectric effect? What are the observations of it?

b) Write down the expression for energy of a particle in three dimensional box. Explain the degeneracy of energy levels in the cubical box.

c) Define partition function. Derive the expression for vibrational partition function.

d) Define chemical potential. Derive the expression for the change in Gibb's free energy of mixing of ideal gases.

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

a) An electron travels 2000 km in a ms. Calculate its de Broglie wavelength.

b) 89 of N_2 is expanded reversibly from 1 lit to 10 lit at 300 K. Calculate ΔS, ΔH and ΔG (At. mass N = 14).

SECTION-II

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

a) Distinguish between order and molecularity.

b) What is an essential condition of a chain reaction to occur?

c) Give weakness of collision theory.

d) Give equation for second order reaction with unequal concentration.

e) Write a note on Eadie plots for enzyme catalyzed reaction.

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

a) Using Bodenstein and Lind mechanism for chain reactions, obtain the rate for the formation of [HBr].

b) Derive Michaelis- Menten equation for enzyme catalyzed reactions. How is Michaelis constant determined?

c) Explain the occurance of the explosion limits in case of an explosive reaction.

d) For the parallel reactions

$$A \xrightarrow{K_1} B ,$$

$$A \xrightarrow{K_2} C$$

$$A \xrightarrow{K_3} D$$

Determine the concentration of B, C and D.

Q6) Solve Any One of the following: **[5]**

a) The relaxation time for the fast reaction is 10 μS and the equilibrium constant is 1×10^{-3}. Calculate the rate constants for the forward and backward reactions.

b) A reaction is of the first order and 60% complete in a minute. How long will it take for 80% of it to be completed?

●●●●●

Total No. of Questions : 6]

SEAT No. :

P1987

[Total No. of Pages : 4

[4923]-102

M.Sc.-I

INORGANIC CHEMISTRY

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

(2013 Pattern) (Semester-I)

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) Define symmetry operation and symmetry elements.

b) Give all associative operations in S_4 axis.

c) List out symmetry elements of the molecule and classify into appropriate point group

d) Find whether the following operation is commutative or non-commutative in NH_3 molecule.

$$C_3^1 \times \sigma_v^1$$

e) Find the order of group and number of classes in $PtCl_4^{2}$.

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

a) Give the matrices for C_2^x, C_2^y and C_2^z and find the product of the following using matrix multiplication.

P.T.O.

i) $C_2^x \times C_2^y$

ii) $C_2^y \times C_2^z$

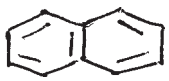
iii) $C_2^x \times C_2^z$

b) Derive the character table for cis-dichloroethylene molecule.

c) Label the following irreducible representations with appropriate Mulliken symbols and justify.

D_{4h}	E	$2C_4$	C_2	$2C_2'$	$2C_2''$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$
T_1	1	1	1	1	1	1	1	1	1	1
T_2	1	1	1	–1	–1	1	1	1	–1	–1
T_3	1	–1	1	1	–1	1	–1	1	1	–1
T_4	1	–1	1	–1	1	1	–1	1	–1	1
T_5	2	0	–2	0	0	2	0	–2	0	0

d) Explain all the symmetry elements and classify it into appropriate point group.



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

a) Find out irreducible representations of vibrational modes in BF_3 molecule (Given: character table).

b) Find out the normalized SALC using projection operator E′ irreducible representation which operates on σ_1 orbital of CO_3^{2-}

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) What are the different types of hydrides? Give one example of each type.

b) How alkali metals are extracted by using crown ethers? Give example.

c) Give classification of boron hydrides with example.

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

e) What are interhalogen compounds? Mention the various types.

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

a) Write a note on phosphazenes.

b) Give an account of zeolites.

c) What are intercalation compounds? Explain with the examples.

d) Write a note on oxoanions of nitrogen.

Q6) Attempt Any One of the following: **[5]**

a) Explain the structure and bonding in-

i) NH_3

ii) AS_4O_{10}

b) Draw the structures of following:

i) IF_5

ii) $B_3N_3H_3Cl_3$

iii) S_4N_4

iv) $Li_4(CH_3)_4$

v) P_4O_{10}

Given:

Character table for D_{3h} point group.

D_{3h}	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$		
A_1'	1	1	1	1	1	1		$x^2 + y^2, z^2$
A_2'	1	1	–1	1	1	–1	R_z	
E'	2	–1	0	2	–1	0	(x, y)	$(x^2 – y^2, xy)$
A_1''	1	1	1	–1	–1	–1		
A_2''	1	1	–1	–1	–1	1	z	
E''	2	–1	0	–2	1	0	(R_x, R_y)	(xz, yz)

●●●●●

Total No. of Questions :8]

SEAT No. :

P1988

[Total No. of Pages :5

[4923]-103
M.Sc. - I
BAS/C ORGANIC CHEMISTRY
CHO -150: Organic Reaction Mechanism and Stereochemistry
(2013 Pattern) (Semester - I)

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

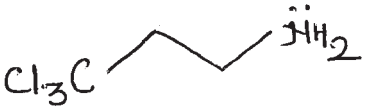
Instructions to the candidates:

1) ***Attempt three questions from each section. Q.1 and Q.5 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) Assign the pKa values 5.2 and 9.65 to the following compounds and justify.

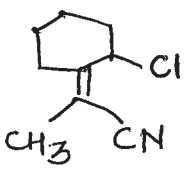


b) Explain the terms enantiomers and diastereomers with suitable examples.

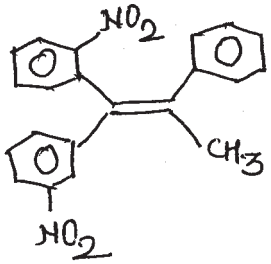
c) What are the characteristics of Hard Acids?

d) Determine E/Z configuration of the following.

(i)



(ii)



P.T.O.

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

i) Nucleophilicity and basicity

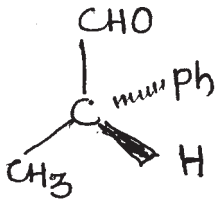
ii) Stability of free radicals.

iii) Reactivity of $\rangle C=O$ group by MOT

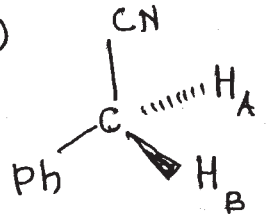
b) Assign R/S configuration to the following. **[4]**

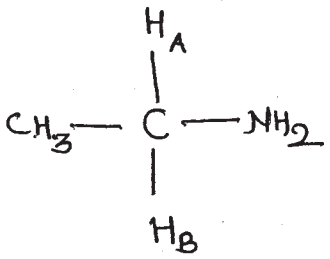
Justify.

(i) 

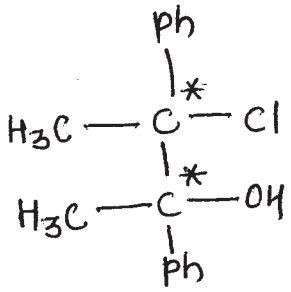
(ii) 

Q3) a) Assign pro-R and pro-S labels to H_A & H_B. **[4]**

(i) 

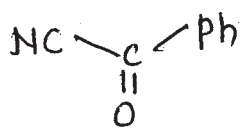
(ii) 

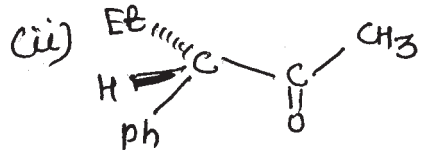
b) Assign R & S labels to **[4]**



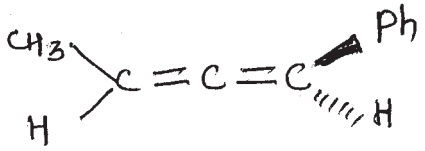
Q4) Attempt any four. **[8]**

a) Assign Re and Si face labels to the following.

(i) 

(ii) 

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

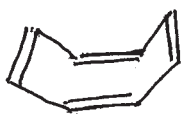


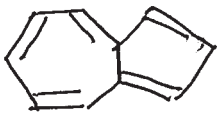
c) Arrange in decreasing order of acid strength & justify.

H_2O, CH_4, HF & NH_3

d) Draw all possible conformational isomers of 1-chloro-3-methyl cyclohexane.

e) Comment on aromaticity of the following.

(i) 

(ii) 

SECTION - II

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

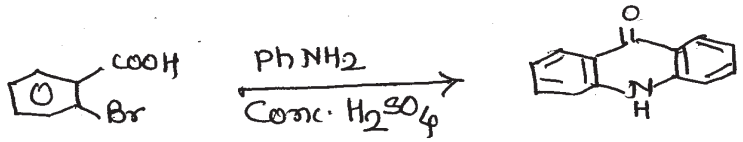
a) Explain the effect of leaving group on S_N^2 reaction with suitable examples.

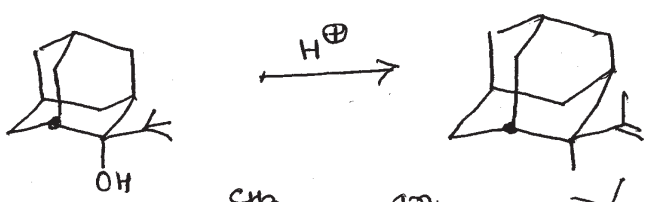
b) Acetolysis of both 4-methoxy-1-pentyl brosylate and 5-methoxy-2-pentyl brosylate give the same product. Explain.

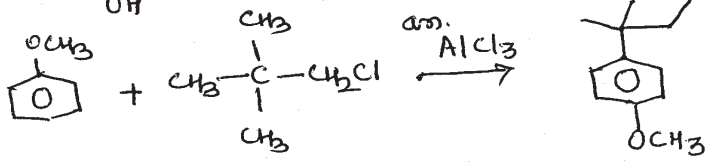
c) Explain the term 'Ambient Nucleophile'.

d) Elimination of HBr from meso-1,2-dibromo-1,2-diphenyl ethane gives cis-2-bromostilbene. Explain.

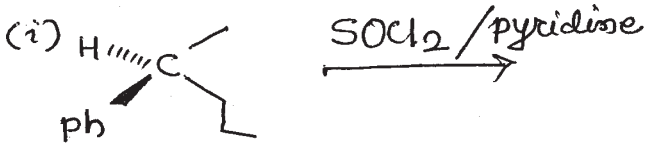
Q6) a) Suggest the mechanism (any two). **[4]**

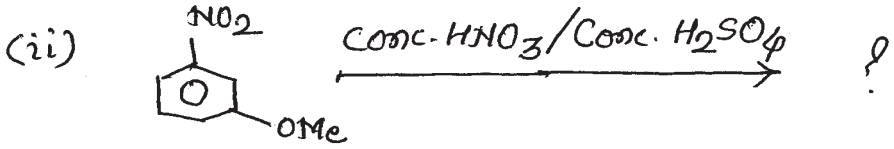
(i) 

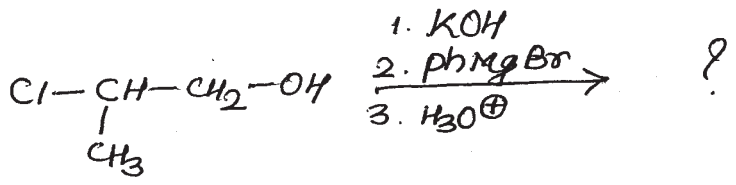
(ii) 

(iii) 

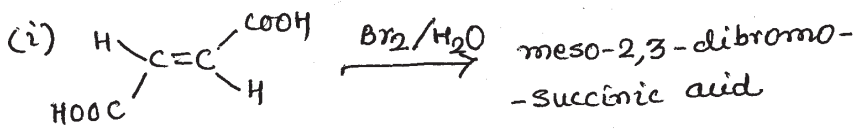
b) Predict the products with mechanisms. (any two) **[4]**

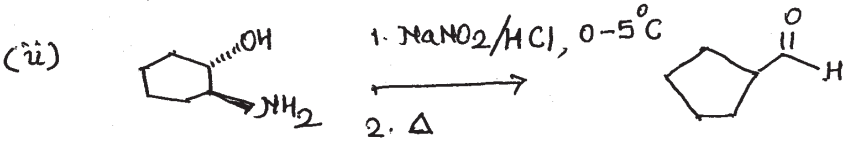
(i) 

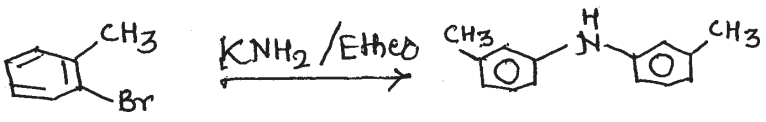
(ii) 

(iii) 

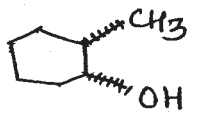
Q7) a) Suggest the mechanism.(any two) **[4]**

(i) 

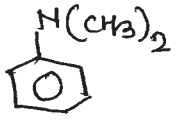
(ii) 

(iii) 

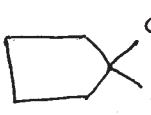
b) Predict the product. (any two) **[4]**

(i) 

$H^{\oplus}$ → major + minor.

(ii) 

1) DMF / $POCl_3$
(ii) H_2O
?

(iii) 

$NaNO_2/HCl$?

Q8) Attempt any four. **[8]**

a) Write short note on chloromethylation of aromatic compounds.

b) What is Hoffman elimination reaction? Explain with suitable example.

c) Write short note on 'Conjugate addition'.

d) Nucleophilic substitution reactions at bridge-head carbons are almost impossible. Explain.

e) Addition of HBr to propene in presence of hydrogen peroxide gives 1- bromopropane. Explain.

X X X

Total No. of Questions :6]

SEAT No. :

P1989

[Total No. of Pages :2

[4923]-104
M.Sc. I
ANALYTICAL CHEMISTRY
CHA-190: Safety in Chemical Laboratory and Good Laboratory Practices
(Credit System) (2013 Pattern) (Semester - I) [5 Credit]

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

Instructions to the candidates:

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

SECTION- I

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

a) Why the safety and security is required in chemical laboratory?

b) Define allergen. Give any two examples of allergens.

c) Give the significance of first aid kit in chemical laboratory.

d) Explain the term good house keeping.

e) What is meant by NFPA? Give symbols of NFPA code with proper meaning

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

a) Write a note on Inventory management.

b) How will you classify the waste material?

c) Explain the various type of materials used in laboratory for safety.

d) Write a note on corrosive and carcinogenic chemicals.

P.T.O.

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

a) Explain the various types of disposal methods of hazardous chemicals.

b) Write a note on Do's and Don'ts in chemical laboratory .

SECTION- II

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

a) Define stock register for chemicals.

b) Define GLP for chemistry laboratory.

c) Give the difference between ISO and NABL.

d) What are the abbreviations of MSDS and OSHA?

e) What to do in case of mercury spillage?

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

a) Write a note on action to be taken in case of fire in laboratory.

b) Explain the principle of SOP, How is it implemented in laboratory?

c) Give the importance of material safety data sheets.

d) What types accidents may occur in laboratory? What are the precautions to be taken?

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

a) Explain any two methods of calibration of equipments.

b) Distinguish between hazardous and non hazardous waste. .

Total No. of Questions :6]

SEAT No. :

P1990

[Total No. of Pages :3

[4923]-201

M.Sc.

PHYSICAL CHEMISTRY

CHP -210: Fundamentals of Physical Chemistry-II

(2013-2014 Pattern) (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	$= 6.022 \times 10^{23} mol^{-1}$
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} $molecule^{-1}$
			$= 1.38 \times 10^{-23}$ J K^{-1} $molecule^{-1}$
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ $ergK^{-1}$ mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C $equiv^{-1}$
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997 \times 10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ JT^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

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

a) H_2 does not show a pure rotational spectrum whereas HF does show. Explain why?

b) Why is collision broadening the most important factor in case of liquids than Doppler broadening?

c) What is a hot band? Why is it called so?

d) What is Franck condon principle?

e) What is the criterion for the molecule to be Raman active?

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

a) Explain the factors affecting the intensity of the spectral lines.

b) Explain the rule of mutual exclusion and its converse.

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

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

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

a) The fundamental and first overtone transitions of $^{14}N\ ^{16}O$ are centered at 1876. 06 cm^{-1} and 3724.20 cm^{-1} respectively. Evaluate the equilibrium vibrational frequency and anharmonicity constant of the molecule.

b) The rotational constant for $^{79}Br\ ^{19}F$ molecule is 0.3517 cm^{-1}. What is the value of J for which most intense line will be seen?

SECTION - II

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

a) Explain the boundry conditions for a diffusing species in one diamentional gel column.

b) Explain the preparation and one application of ^{22}Na.

c) State any two laws of crystallography.

d) What is the wavefunction of H_2 molecule in valence bond theory?

e) Write the secular determinant for ethylene molecule.

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

a) Derive the expression for normalization constant for H_2 molecule using molecular orbit theory.

b) Explain the huckel theory of cyclobutadiene.

c) Explain use of radioisotopes to determine the surface area of a powdered sample.

d) How radioisotopes are used to determine the diffusion coefficient of diffusing species?

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

a) Activity of 1 g of ^{226}Ra is found to be 3.7×10^{10} dps. Calculate its half life period.

b) An element crystallizes having cubical unit cell having one atom on each corner of the cube and two atoms on one of its diagonals. of volume and density are 24×10^{-24} cm^3 and 7.2 g/cm^3 respectively, calculate the number of atoms present in 200 g of the element.

Total No. of Questions :6]

SEAT No. :

P1991

[Total No. of Pages :6

[4923]-202
M.Sc. - I
INORGANIC CHEMISTRY
CHI -230: Coordination and Bioinorganic Chemistry
(2013 Pattern) (New 5 Credits)

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

Instructions to the candidates:

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

SECTION - I

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

a) Why an aqueous solution of $[Mn(H_2O)_6]^{2+}$ complex is pale pink in color.

b) Give the spin-only magnetic moment and the spectroscopic ground state term symbol of manganese ceutre in $[MnF_6]^{3-}$ ion.

c) State hand's rules to determine the ground state term symbols.

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

i) Mn^{3+} (Z = 25) ii) Ce^{3+} (Z = 58)

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

i) $2.{}^3B_{2g}$ ii) $2(p^1d^1)$

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

a) Derive the allowed R-s terms and hence prepare a table of microstates for us^1up^1 configuration.

b) Write a note on luminescence spectra.

c) Give the splitting of ^2G R.S. term in weak cubic field using character table for pure rotational point group and reduction formula.

P.T.O.

d) Co (II) tetrahedral complex shows 23% increase in magnetic moment compared to its spin only value. Calculate spin orbit coupling constant λ for Co (II) ion. If crystal field splitting parameter (10Dq) is 3000 cm^{-1}

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

a) Calculate the position of 2^{nd} absorption band for Ni (II) complex ion in octahedral symmetry using following data.

Gives:

i) $B = 912{\cdot}21\ cm^{-1}$

ii) $60\ Dq = 11363{\cdot}6\ cm^{-1}$

iii) $\nu_2 = \frac{1}{2}(15B + 30Dq) - \frac{1}{2}[(15\ B - 10\ Dq)^2 - (12\ B - 10\ Dq)]^{\frac{1}{2}}$

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

SECTION - II

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

a) Explain the role of Iron in biological system.

b) Draw the structures of proteins and explain in brief.

c) Cis-platin is an antitumor drug. Explain.

d) What are metallo-enzymes? Give their any two important functions.

e) Give the process of co-agulation of blood.

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

a) Write a note on calcium pump.

b) Explain Ferritin compounds.

c) Explain how proteins acts as a ligand?

d) Explain role of zinc binding domain in zinc fingure.

Q6) Draw structures (Any five): **[5]**

a) Deoxyhemoglobin.

b) Alanine.

c) Fe_4 S_4.

d) Corrin.

e) Guanine.

f) Porphyrin.

Character Table for O rotational group

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

Correlation Table for the Group O_h

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

=

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

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

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_{2i} where

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

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

   (*a*) For all groups : $A \times E_i = E_i$ 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 $E_1 = E_2 = E$.)

   (*c*) For D_{4h} :

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

   irrespective of the suffix on B.

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

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

   irrespective of the suffix on B.

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

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

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

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

   (*b*) For D_{2h}, D_2, C_{2v}, C_{2h}, C_2, S_4, D_{2d} :

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

   (*c*) For D_{4h} :

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

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

   $E_5 \times E_5 = A_1 + A_2 + B_1 + B_2$,

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

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

   $E_1 \times E_5 = B_1 + B_2 + E_5$; $E_2 \times E_5 = B_1 + B_2 + E_5$.

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

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

$E_1 \times E_2 = E_1 + E_2$.

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

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

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

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

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

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

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

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

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

6. The complete results for O are :

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

× × ×

Total No. of Questions : 6]

SEAT No. :

P1992

[Total No. of Pages : 5

[4923] - 203
M.Sc. - I
ORGANIC CHEMISTRY
CHO - 250 : Synthetic Organic Chemistry and Spectroscopy
(2013 Pattern) (Semester - II) (5 Credits)

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

Instructions to the candidates:

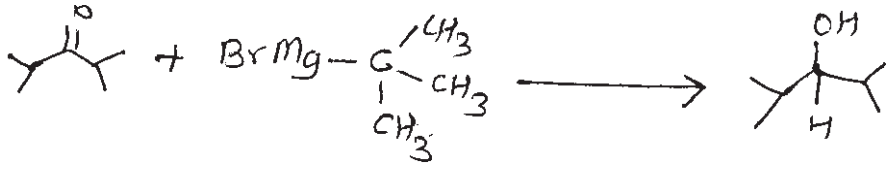
1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Figures to the right indicate full marks.***

SECTION - I

Q1) Attempt any Five of the following: **[10]**

a) β-hydroxy esters are synthesized by using organo zinc compounds.

b) A Grignard reaction between hindered ketone A with B often leads to reduction. Explain.



c) Organocopper reagents are prefered for conjugate addition (1,4-addition) reaction. Explain.

d) Write any two applications of

i) MnO_2 and

ii) $NaIO_4$

e) Write the importance of SeO_2 in organic synthesis.

f) Write any two applications of

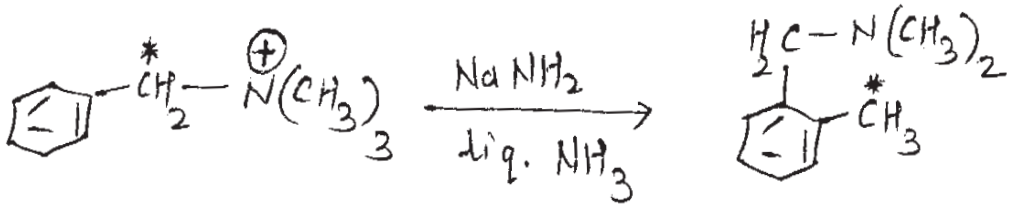
i) $NaCNBH_3$ and

ii) DIBAL

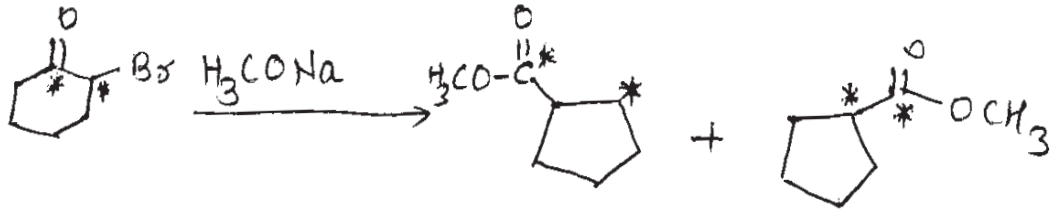
P.T.O.

Q2) Suggest the mechanism (Any Five) **[10]**

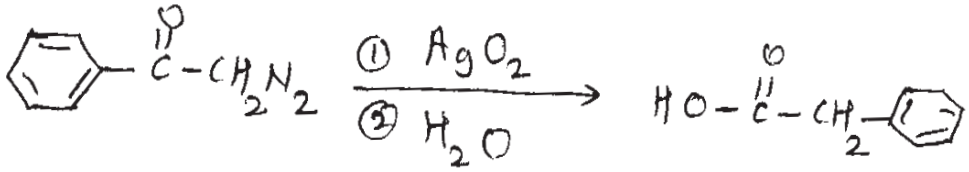
a)



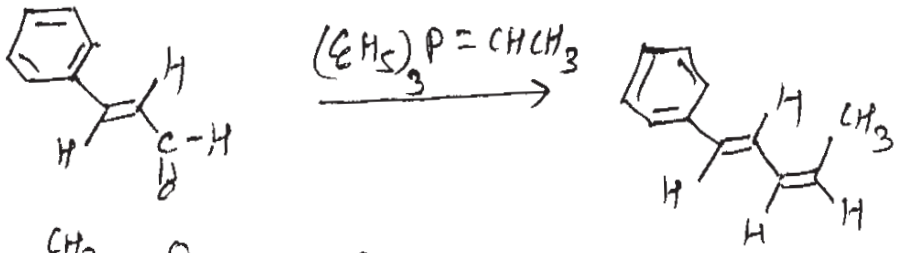
b)



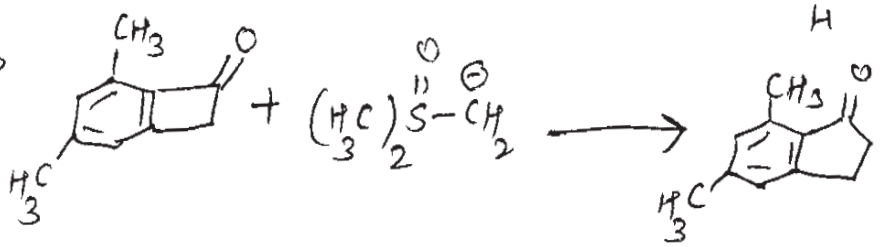
c)



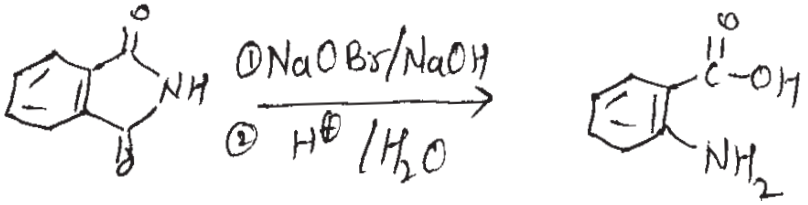
d)



e)



f)



Q3) Write a short note on any two: **[5]**

a) Beckmann rearrangement.

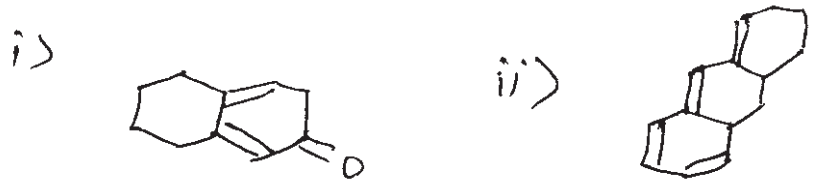
b) MPV reduction.

c) Bayer-Villiger rearrangement.

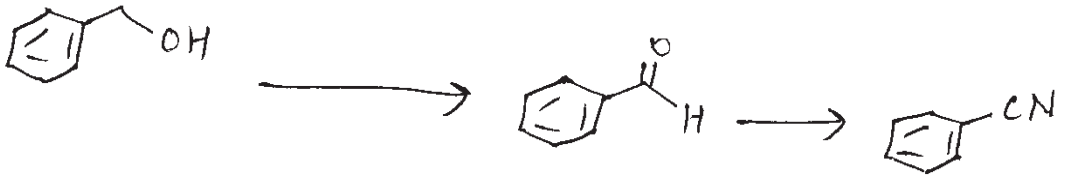
SECTION - II

Q4) Answer Any Five of the following: **[10]**

a) Calculate the λmax.

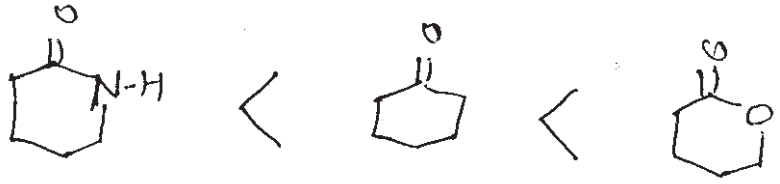


b) How will you follow the following reaction using IR spectroscopy technique.

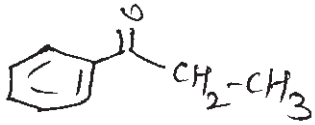


c) Ethylacetoacetate shows IR bands at 3300, 1750, 1720, 1660 and 1620 cm^{-1}. Explain.

d) Carbonyl stratching frequency increases in the following order. Explain.



e) Suggest the fragments for compound 'A' that shows molecular ion peak at m/z 134, 105, 84.



A

f) Explain how ^{13}C NMR spectrum can be used to differentiate the following bicyclo-octanes.

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

a) M.F. C_8H_8O

IR : 2720, 1690 cm^{-1}

PMR δ - 2.3 (3H, s) 7.0(2H, d, J = 8Hz) 7.8(2H, d, J = 8Hz)

9.9 (1H, s)

b) M.F. $C_{12}H_{14}O_2$

UV = 272

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

PMR δ 1.25 (t, J = 7Hz, 3H), 2.4(s, 3H), 4.1 (q, J = 7Hz, 2H)

6.29 (d, J = 18Hz, 1H), 7.1 (d, J = 8Hz, 2H)

7.5 (d, J= 8Hz, 2H), 7.8 (d, J = 18Hz, 1H)

c) M.F. C_8H_{10}

IR 3000-2900, 1600, 1500, 1430, 750, 690cm^{-1}

PMR δ 1.0(t, J = 7Hz, 3H), 2.6(q, J = 7Hz, 2H)

7.4 (m, 5H).

d) M.F. $C_{10}H_{15}N$

IR 3350, 1600, 1500 cm^{-1}

PMR δ 1.1(d, J = 7Hz, 6H) 1.5(bs, Exchangeable by D_2O, 1H)

2.75 (Septate, J = 7Hz, 1H) 3.7 (s, 2H) 7.25(s, 5H).

e) M.F. C_5H_6O

UV = 220nm

IR = 1600, 1500, 780 cm^{-1}

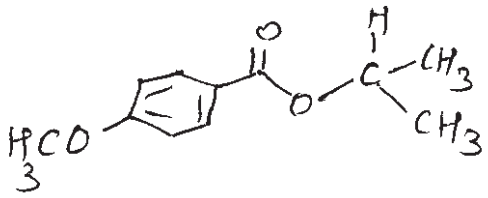
PMR δ 2.3(s, 15mm) 5.85(d, J = 2Hz, 5mm)

6.2 (dd, J = 1.5 and 2Hz, 5mm) 7.2 (d, J = 1.5Hz, 5mm).

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

a) Write a note on factors affecting on chemical shift.

b) Assign the chemical shift for the following structure.



PMR δ 1.5(d, J = 7Hz, 6H)

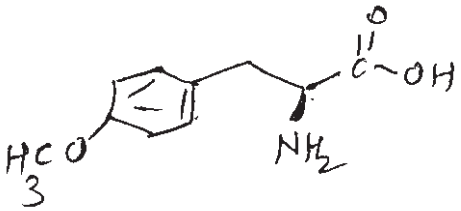
3.54 (m, J = 7Hz, 1H)

3.78 (s, 3H)

7.0 (d, J = 8Hz, 2H)

7.30 (d, J = 8Hz, 2H)

c) Assign the chemical shift for the following structure:



CMR δ 21(t), 46(d) 55(q)

127(d) 129(d) 132(s)

150(s) 185(s).

Total No. of Questions : 3]

SEAT No. :

P1993

[Total No. of Pages : 14

[4923]-204
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II (2013 Pattern) (2.5 Credits)
New Course Based on Credit & Semester System

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

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

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

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

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

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

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

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

Instructions to the candidates:

1) ***All questions of respective section / part are compulsory.***
2) ***Figures to right hand side indicate full marks.***
3) ***Neat labelled diagram must be drawn wherever necessary.***
4) ***Use of log table / non programmable calculator is allowed.***
5) ***Students should attempt <u>any two</u> parts from Part-A, C, D, E, F and G or full paper of biochemistry (Part-B) of 5 credit/50 marks.***
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 the applications of HPLC.

P.T.O.

b) State and explain the principle of gas chromatography.

c) Define the following:

i) Metastable ion.

ii) Molecular ion peak.

d) Differentiate between Normal phase and reverse phase in HPLC.

e) Sketch and label the diagram of time of flight mass analyzer.

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

a) Explain in detail, " Supercritical Fluid Chromatography".

b) Explain GC - Ms technique.

c) Enlist the pressure pumps in HPLC. Explain any one of them in detail.

d) Write short note on Inductively coupled plasma in Mass Spectrometry.

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

a) The Gas Chromatographic Spectrum was obtained after, analysis of xylene. The recorder speed was 3.68 cm/min. The carrier gas flow rate was 50.0ml/min. The retention time for xylene was 4.0cm and that of air was 6.2 cm calculate -

i) The uncorrected retention time in minutes.

ii) The uncorrected retention volume in ml.

iii) The adjusted retention time.

iv) The adjusted retention volume for xylene under these conditions.

b) Compare the GC and HPLC with respect to the following points:

i) Principle.

ii) Sample injection system.

iii) Column.

iv) Detector.

v) Application.

Total No. of Questions : 3]

P1993

[4923]-204
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2013 Pattern ; 2.5 Credits)
PART-C
Concept of Analytical Chemistry

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

a) Define surface plusmon resonance.

b) Distinguish between Accuracy and precision.

c) Define

i) Mean.

ii) Deviation.

iii) Average deviation.

iv) Relative mean deviation.

d) Explain in brief student 'T' test.

e) Give the difference between GSC and GLC.

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

a) What are hyphenated gas chromatographic methods? Briefly describe three hyphenated techniques.

b) Write a note on rejection of result the 'Q' test.

c) Describe sol-gel method for synthesis of nanomaterials.

d) What are ion exchange resin? Give the principle of separation of ions by ion exchange process.

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

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

b) The Manganese sample was analysed by volumetric method. The following different readings are obtained by different persons. Calculate Mean, Mean deviation, standard deviation.

Sr.No.	Burette reading
1	22.5 ml
2	22.7 ml
3	22.4 ml
4	22.3 ml
5	22.8 ml

Total No. of Questions : 3]

P1993

[4923]-204
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA-290 : General Chemistry - II
(2013 Pattern ; 2.5 Credits)
PART-D
Industrial Methods of Analysis

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

a) Mention the various bulk properties used in process analyzer.

b) What is meant by continuous online process.

c) How will you prepare 10ppm sodium solution from sodium chloride. Given molecular weight of NaCl - 58.5.

d) Give examples of acidic and basic buffer.

e) Give the principle of automatic elemental analyzer.

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

a) Draw a schematic diagram of near IR reflectance analyzer. Explain it's working.

b) Explain the term 'total quality management' in detail.

c) Describe the concept of mmole and gmole with suitable examples.

d) Write a note on quality audits.

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

a) Explain electroanalytical method in oxygen analyzer.

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

[Given : Relative molecular mass of silver chloride = 143.3 and silver chromate = 331.7].

Total No. of Questions : 6]

P1993

[4923]-204
M.Sc.-I (Semester-II)
CHEMISTRY
(2013 Pattern ; 5 Credits)
PART-B
CH - 290 B : Basic Biochemistry

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

SECTION - I

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

a) Differentiate between prokaryotic & Eukaryotic cell.

b) Discuss the methods for determining 'N' - Terminal aminoacid.

c) What are compound lipids? Mention brief classification of compound lipids.

d) What is meant by active transport? Explain Na^+–K^+ pump.

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

a) What are different structural levels of proteins? Give details of secondary structure of proteins.

b) Give the reactions of Glycolytic pathway.

c) What are the general mechanisms for translocation of drugs across cell membrane?

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

a) Energetics of β - oxidation.

b) Peptide bond formation.

c) Structure and importance of starch.

d) Advantages of protein Engineering.

e) Titration curve of amino acids.

f) Mitochondrion : Power house of the cell.

SECTION - II

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

a) Give experimental proof to substantiate DNA replication is semi conservative.

b) What is enzyme inhibition? Discuss irreversible inhibition.

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

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

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

a) Derive Michaelis Menten equation.

b) Classify vitamins. Enlist water soluble vitamins and their deficiency diseases.

c) Discuss translation process in prokaryotes.

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

a) Gene therapy.

b) Enzyme Immobilization.

c) Functions of vitamin K.

d) Therapeutic uses of enzymes.

e) Okazaki fragments.

f) Stop codons & initiation codon.

Total No. of Questions : 3]

P1993

[4923]-204
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2013 Pattern ; 2.5 Credits)
PART-E
Organometallic and Inorganic Reaction Mechanism

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

a) Write a short note on carbonyl insertion reaction.

b) State the complex $Fe(CO)_4$ obeys $18e^{\ominus}$ rule or not.

c) Define and explain hydride elimination reaction.

d) Explain the role of Willkinson's catalyst in organometallic reactions.

e) Explain Kinetic Chelate effect with suitable examples.

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

a) Explain the bonding in metal alkene compounds.

b) Write a short note on - Wacker Process.

c) Explain the stereochemistry of substitution reactions in square planar complexes.

d) Explain the hydroformylation reaction in organometallic compounds with reaction mechanism.

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

a) Differentiate between inner sphere and outer sphere mechanism in coordination compounds.

b) Draw the following structures-

i) Cis - Platin.

ii) Mo $(PF_3)_3$ $(CO)_3$

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

iv) $\left[\left(\eta^5 - Cp\right)Mo(CO)_3\right]_2$

v) $\left[\left(\eta^5 - C_5H_5\right)_2 Fe\right]$

Total No. of Questions : 3]

P1993

[4923]-204
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2013 Pattern ; 2.5 Credits)

PART-F
Mathematics for Chemists

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

a) Define :

i) Permutation.

ii) Unit Matrix.

b) Give the polynomial rule for differentiation.

c) Enlist two rules about scalar multiplication.

d) Give the transpose of following matrices.

i) $\begin{bmatrix} 7 & 8 & 2 \\ 6 & 5 & 9 \end{bmatrix}$

ii) $\begin{bmatrix} 3 & -1 & 3 \\ 0 & 7 & 2 \\ -1 & 8 & 0 \end{bmatrix}$

e) Give the statement of any two probability theorems.

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

a) Give an account of the method of least squares to determine the best fit line to data.

b) i) $y = x^{11}e^{6x}, \ \frac{dy}{dx} = ?$

ii) $y = \frac{e^{4x}}{x^7 + 8}, \ \frac{dy}{dx} = ?$

c) The following values were obtained for the heat of vaporisation of benzene. What is to be taken as the best value for this quantity? What is average error, probable error and the mean error?

94.40, 94.37, 94.30, 94.22, 94.24, 94.48, 94.44 and 94.38.

d) Find the probability that in 100 tosses of a coin we get between 45 and 55 heads?

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

a) Evaluate the following:

i) $\int \left(3x^3 + 5x^2\right) dx = ?$

ii) $\int_0^2 e^x dx = ?$

b) Evaluate the following:

i) Carry out the following matrix - vector multiplication using Falk's Scheme.

$$A = \begin{pmatrix} 8 & 1 & 1 \\ 4 & 2 & 6 \end{pmatrix} \qquad B = \begin{pmatrix} 3 \\ 7 \\ 4 \end{pmatrix}$$

ii) Find out the matrix inverse of:

$$X = \begin{pmatrix} 1 & -1 & 2 \\ -3 & 1 & 2 \\ 3 & -2 & -1 \end{pmatrix}$$

Total No. of Questions : 3]

P1993

[4923]-204
M.Sc.-I (Semester-II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2013 Pattern ; 2.5 Credits)
PART-G
Pericyclic, Photochemistry and Free Radicals

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

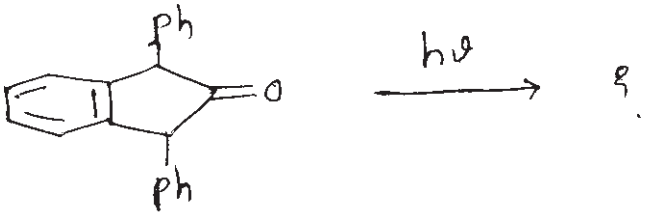
a) Explain the quenching process with suitable examples.

b) Write a short note on Norrish - I & II processes.

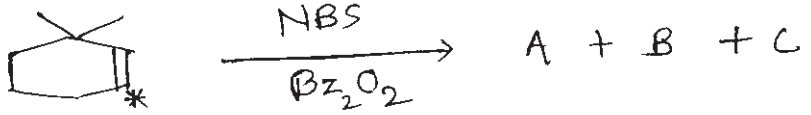
c) Explain the role of antioxidant in inhibition of autoxidation with examples.

d) Discuss the use of $SnBu_3H$ in organic synthesis.

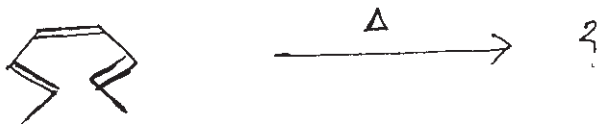
Q2) Predict the product for any four of the following : **[8]**

a) 

b) 

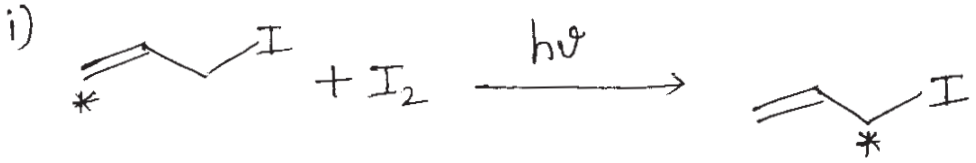
c) 

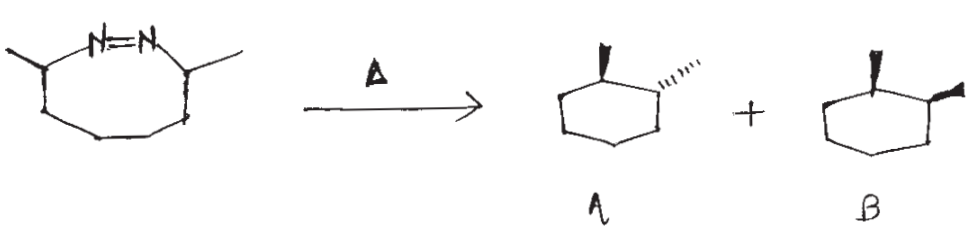
d) 

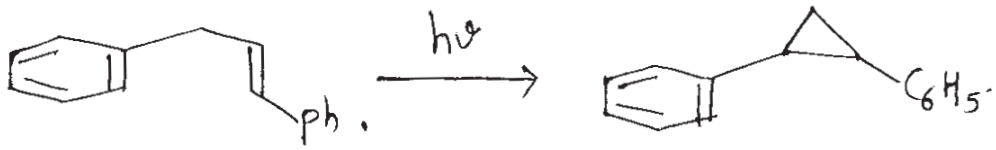
e) 

Q3) 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. **[4]**

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

i) 

ii) 

iii) 

Total No. of Questions : 6]

SEAT No. :

P1994

[Total No. of Pages : 3

[4923] - 301

M.Sc.

PHYSICAL CHEMISTRY

CHP - 310 : Quantum 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 diagram must be drawn WHEREVER necessary.***

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) State true or false with reason.

i) State function ψ is real.

ii) If Z = Z*, then Z must be real.

b) If $\psi(x,t) = e^{-iEt/\hbar} . \psi_{(x)}$

then is $\psi(x,t)$ an eigenfunction of the energy operator $\hat{H}$?

c) Applying conditions, classify the following operators as linear or non-linear.

i) exp and ii) ( )^2

d) Define ladder operator and give its properties.

e) Explain which information is obtained from term symbols.

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

a) State and prove the variation theorem.

b) Explain the following:

i) Perturbation Operator

ii) Hermitian Operator

c) Sketch and explain the MO for benzene. Give the secular equation based on HMO for benzene.

d) Explain Hess-Schaad modifications to Huckel's rules.

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

a) If $\hat{A}=3x^2$ and $\hat{B}=\frac{d}{dx}$, show that $\hat{A}$ and $\hat{B}$ do not commute.

b) Show that Hermitian operators yield real eigenvalues.

SECTION - II

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

a) Distinguish between plastic and elastic deformations.

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

c) Give the factors affecting rates of solid-solid reactions.

d) Define climb, jog and kink.

e) Explain Hall Effect.

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

a) Discuss the kinetic rate laws for deceleratory solid phase decomposition reactions.

b) Derive the expression for the number of Schottky defects produced in a crystal at temperature.

c) Write a note Kirkendall effect.

d) Explain the thermal properties of a crystal.

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

a) Calculate the Fermi energy in eV for a solid having 10^{25} electrons per m^3 at 25^oC.

b) The average energy required to create a Frenkel defect in an ionic crystal $A^{+2}B^{2-}$ is 1.4eV. Calculate the ratio of the number of Frenkel defects at 20^oC and 300^oC in 1g of the crystal.

Total No. of Questions :6]

SEAT No. :

P1995

[Total No. of Pages :3

[4923] - 302

M.Sc.

PHYSICAL CHEMISTRY

CHP - 311 : Nuclear, Radiation and Photochemistry

(2013 Pattern) (Semester - III)

Time : 2 Hours] *[Max. Marks :50*

Instructions to the candidates:

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

<u>Physico - Chemical Constants</u>

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 the role of pulse height analyzer in a scintillation counter?

b) Explain the term neutron evaporation.

c) Write various reactions occurring in radiolysis of Fricke solution.

d) What are the limitations of liquid drop model?

e) Draw the schematic diagram of Rutherford back scattering experiment.

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

a) Discuss in brief the theory of nuclear fission.

b) What is the significance of four factor formula? Explain each term init.

c) Write a note on Flash photolysis.

d) Discuss the nuclear shell model with its merits & demerits.

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

a) On the basis of the semi - empirical mass equation, predict stable nuclide of the isobaric series A = 180.

b) Calculate the approximate critical dimensions of a nuclear reactor to function in a steady state when the reactor is cubical shaped. Given K = 1.04, migration area = 0.028 m^2.

SECTION - II

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

a) State the principle of photochemical activation.

b) Explain population inversion.

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

d) Define a triplet state and a singlet state. Write the characteristics of each.

e) What is meant by quenching?

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

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

b) Describe the working of Ruby and Nd/YAG laser.

c) Discuss nanosecond laser flash photolysis.

d) Discuss the Einstein's treatment on absorption and emission phenomena.

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

a) A certain system absorbs 2×10^{18} quanta of light per second. At the end of 20 minutes it is observed that 0.005 mole of the irradiated substance has reacted. What is the quantum yield of the process?

b) Calculate the energy in calories per mole for radiation of wavelength 1500 A°. Also calculate the wavelength in cm and hence find wave number $(\bar{v})$ of the light.

Total No. of Questions :6]

SEAT No. :

P1996

[Total No. of Pages :3

[4923] - 303

M.Sc.

PHYSICAL CHEMISTRY

CHP - 312: Physico-Chemical Methods of Analysis (New)

(Semester - III) (2013 Pattern)

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

Instructions to the candidates:

1) ***Answer to the TWO sections should be written in SEPARATE answer books.***
2) ***ALL questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicate FULL marks.***
4) ***Use of logarithmic table and calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Define X-ray fluorescence. Write the equation for the intensity of the fluorescent radiation and explain the terms involved in it.

b) Define the terms Fermi level and binding energy used in ESCA.

c) What is meant by dynamic and isothermal thermogravimetry.

d) Find the short-wavelength cutoff in X-ray tube having a potential difference 1250 V between the filament and target.

e) Draw a neat labeled diagram of DTA apparatus.

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

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

b) Discuss the applications of ESCA technique.

c) Write a note on ESCA satellite peaks.

d) Explain chemical analysis by X-ray absorption.

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

a) The mass absorption coefficient for nickel measured with a cu k_α line is 49.2 cm^2/g. Calculate the thickness of a nickel foil that was found to absorb 52.2% of the incident beam of cu k_α radiation. The density of nickel is 8.90 gm/cm^3.

b) 120 mg sample containing a mixture of NaCl [mol. wt. 58.5] and $CaC_2O_4.H_2O$ (mol. wt. 146.0) showed a loss of 7.00 mg at 140°C on TG curve. Determine the percentage of calcium oxalate in the sample.

SECTION - II

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

a) How are radical anions and radical cations formed in Electrochemiluminescence?

b) Define plasma. State its types.

c) State Faraday's first law of electrolysis. Write the equation relating the weight of the substance and the quantity of electricity passed through the solution.

d) Give the principle of hydrodynamic voltammetry.

e) Define the terms:

i) Voltammogram and

ii) Potentiostat.

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

a) Discuss the environmental factors affecting the intensity of photoluminescence.

b) Compare ICP technique with the conventional atomic emission techniques.

c) Enlist the advantages of coulometric titrations.

d) Draw a neat labelled diagram of a typical cyclic voltammogram and state its characteristics.

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

a) During the forward scan of a triangular wave Voltammogram at a disk electrode a peak current of 25.4 μA was observed at a scan rate of 0.250 V/s. Estimate the peak current at a scan rate of 50.0 mV/s assuming a reversible electrochemical reaction.

b) How many seconds will it take for a current of 0.5 A to deposit 0.500g of silver considering 80% current efficiency. (At. wt. of Ag = 107.88).

Total No. of Questions :6]

SEAT No. :

P1997

[Total No. of Pages :3

[4923] - 304

M.S.C.

PHYSICAL CHEMISTRY

CHP - 313: Polymer Chemistry

(Semester - III) (2013 Pattern)

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.***

<u>Physico - Chemical Constants</u>

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) Define 'living polymer'.

b) Explain 'degree of polymerization.

c) Compare homo and hetero chain polymers.

d) Define glass transition temperature.

e) Define polydispersity index.

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

a) Explain why a 100% crystalline polymer cannot be made.

b) Write a note on Ziegler - Natta catalyst.

c) Deduce the rate equation in step polymerization in the presence of a catalyst.

d) Explain the Flory theory for polymer solutions.

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

a) Calculate the viscosity of a polymer given,

C = 0.4 g/dl, Huggins constant = 0.33

$k = 1.2 \times 10^{-4}$, $\alpha = 0.2$ M = 120000

b) Compare Voigt and Maxwell models of polymer viscoelasticity.

SECTION - II

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

a) State the principle of ultracentrifugation.

b) Define vulcanization.

c) Explain reinforcement. Give its advantages.

d) State the SI unit of viscocity.

e) Give two applications of conducting polymers.

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

a) Write a note on determination of molecular weight of a polymer by light scattering.

b) Give an accout of extrusion molding.

c) Define calendering, wet spinning and dry spinning.

d) Discuss the effects of radiation on polymers.

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

a) Write a note on XRD analysis of polymers.

b) Discuss DTA in polymer analysis.

Total No. of Questions :6]

SEAT No. :

P1998

[Total No. of Pages :3

[4923] - 305

M.Sc.

PHYSICAL CHEMISTRY

CHP - 314 : Modern Trends in Physical Chemistry

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

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

Instructions to the candidates:

1) ***Answer to the TWO sections should be written in SEPARATE answer books.***
2) ***ALL questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicate FULL marks.***
4) ***Use of logarithmic tables calculator is ALLOWED.***
5) ***Neat diagram must be drawn WHEREVER necessary.***

<u>Physico - Chemical Constants</u>

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

P.T.O.

SECTION - I

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

a) Define the term constituent. Give its example.

b) What is meant by eutectic? Give its example.

c) Write proton condition for $Na_2C_2O_4$.

d) Write charge balance for 0.1 M $NaHCO_3$.

e) Write the mass balance on potassium and carbonate in 0.01 M K_2O_3.

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

a) Calculate pH and concentration of all species for 0.1M H_2CO_3. [Given : $Ka_1 = 4.47\times10^{-7}$, $Ka_2 = 5.62\times10^{-11}$].

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

c) Explain system which shows lower critical solution temperature as well as system with upper and lower critical solution temperatures.

d) Explain one - component system with phase diagram.

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

a) Draw a logarithmic concentration diagram for 0.1 N sodium acetate. [Give Ka = 1.8×10^{-5}].

b) Find the fractions of H_3PO_4, $H_2PO_4^-$, HPO_4^{2-} and PO_4^{3-} . [Given :pH of 0.1 M phosphoric acid is 2.54, $Ka_1 = 5.89\times10^{-3}$, $Ka_2 = 6.10\times10^{-8}$ and $Ka_3 = 4.78\times10^{-13}$].

SECTION - II

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

a) Which are the principal images produced in SEM?

b) How is the exciton formed in semiconductor nanoparticles?

c) Define Magnetorehological & Electrorehological Fluids.

d) What is meant by biomineralisation?

e) Calculate the wavelength of an electron emitted in cathode ray tube operating at 10KV.

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

a) What are passive smartmaterials? Explain with two examples.

b) Discuss the properties of nanoparticles.

c) Write note on ceramics.

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

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

a) Write the applications of nanoparticles in the field of defence & space.

b) Describe briefly electron beam lithography.

Total No. of Questions :4]

SEAT No. :

P1999

[Total No. of Pages :2

[4923] - 306

M.Sc. - II

INORGANIC CHEMISTRY

CHI - 326 : Organometallic Chemistry and Homogeneous Catalysis

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

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

Instructions to the candidates:

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

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

a) Mention any two commercial applications of homogeneous catalysis along with catalyst used.

b) "Homogeneous catalysis is Tailor made." Explain in short.

c) Discuss enantioselectivity with suitable example.

d) Draw the structure for Grubbs 1st and 2nd generation catalyst.

e) Which are the basic steps involved in polymerization reaction.

f) Give an example of synthesis of carbyne complex.

g) What is protecting agent? Give one example.

h) What is insertion reaction? Give one example.

i) $Co_2(CO)_8$ complex in solid form, shows two separate band above and below 2000 cm^{-1}. Draw the structure of the complex.

j) Which of the following complex obey 16 or 18 $\bar{e}$ rule.

i) $Mn(CO)_5$

ii) $(\eta^5\text{-}Cp_2Co)^+$

P.T.O.

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

a) Describe bonding in metal alkenes. Explain with suitable example.

b) How are metal carbonyls prepared? Discuss the properties of metal carbonyls.

c) Discuss the mechanism for olefin metathesis reaction.

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

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

a) Give synthesis, bonding and properties of cycloheptatrienyls.

b) Give an account of carbonyl polymers.

c) What is Negishi coupling? Describe its mechanism.

d) What is olefin epoxidation? Which homogeneous transition metal catalyst play's important role in it?

Q4) Write short notes any two: **[10]**

a) Triphenyl phosphine transition metal complexes.

b) Activation of small molecules by organometallic compounds.

c) Importance of homogeneous catalysis in synthesis of high value chemicals.

d) Cativa process.

Total No. of Questions :4]

SEAT No. :

P2000

[Total No. of Pages :2

[4923] - 307

M.Sc. - II

INORGANIC CHEMISTRY

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

(Semester - III) (2014 Pattern) (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). Answer the following: **[20]**

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

b) Four coordinated tetrahedral or square planar complexes. Reacts faster than six coordinated octahedral complexes. Explain.

c) What is trans effect? Explain with suitable example.

d) Explain the mechanism of the following reaction.

$$\text{Cis}\left[\text{Co(en)}_2\text{Cl}_2\right]^+ \rightarrow \text{Trans}\left[\text{Co(en)}_2\text{Cl}_2\right]^+$$

e) What do you mean by atom or group transfer reaction? Give an example.

f) Arrange the following metal complexes according to their increasing order of rate aquation. Cis $[Co(en)_2 Cl_2]^+$, Cis- $[Co(trien)Cl_2]^+$, Cis-$[Co(NH_3)_4 Cl_2]^+$, Justify your answer.

g) List out the reactions of coordinated ligands.

h) Describe the phenomenon of fluorescence.

i) Find out the R.S. term symbol for Co^{3+} and Cr^{3+}.

j) Define the terms.
   i) Magnetic domain
   ii) Canting

P.T.O.

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

a) Nucleophilic substitution in square planer complexes takes place with retention of configuration. Explain.

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

c) Discuss the mechanism of structural isomerism in octahedral complexes.

d) What are mixed valance compounds? How they are classified, comment on their magnetic behaviour.

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

a) Discuss the relationship between d electron configuration of the metal and labillty of the complexes.

b) Complete the following innersphere reaction. Explain which reaction is faster. Justify your answer.

i) $[Cr\ (H_2o)_6]^{2+} + [Co\ (NH_3)_5\ H_2O]^{3+} \rightarrow ? + ?$

ii) $[Cr\ (H_2o)_6]^{2+} + [Co\ (NH_3)_5\ (Rcoo)]^{2+} \rightarrow ? + ?$

c) Discuss photochemical reactions of co (III) complexes.

d) Differentiate between magnetically dilute and magnetically concentrated systems.

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

a) Insertion reactions.

b) Solute - solvent interactions.

c) Thermodynamic and kinetic template effects in chelate ring forming reactions.

d) Two electron transfer reactions.

Total No. of Questions :4]

SEAT No. :

P2001

[Total No. of Pages :3

[4923] - 308

M.Sc. - II

INORGANIC CHEMISTRY

CHI - 331 : Physical Methods in Inorganic Chemistry

(2014 Pattern) (Semester - III)

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

Instructions to the candidates:

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

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

a) State Mosley's Law.

b) Give reason: $C_6H_6^+$ is ESR active while C_6H_6 is ESR silent.

c) Mössbauer spectra are recorded for $FeSO_4$. $7H_2O$ and $K_4Fe(CN)_6$. Which of the two will show a single line and why?

d) Name the parameters in cyclic voltametry which are used to identify the different types of electrochemical reactions. Explain their significance.

e) State selection rule in ESR.

f) Draw the following crystallographic planes : (110), (002).

g) Draw a typical DTA curve. List the different changes that can be detected by DTA.

P.T.O.

h) Which Mö ssbauer nuclei will be useful to determine the structures of

i) $CsIF_6$

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

i) Predict the number of lines expected in the ESR spectrum of

i) $VO(acac)_2$

ii) $[C_6H_6]^-$

j) Define :

i) isomer shift

ii) quadrupole splitting in Mö ssbauer spectroscopy.

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

a) Explain the ESR transitions in the ligh spin $d^5M_n(11)$ system.

b) What is magnetic splitting in Mö ssbauer spectroscopy. Explain with the help of example and energy level diagram.

c) Draw energy level diagram and ESR transitions for a single unpaired electron in an external magnetic field

i) with no coupling

ii) with coupling with a nucleus having spin $\frac{1}{2}$.

d) Explain the principle, working and applications of XPS.

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

a) Distinguish between TGA, DTA and DSC.

b) Powder diffraction pattern was recorded for lead using CuK_{α} radiation with $\lambda = 1.59 \text{ Å}$ what will be the interplanar distance if a first order line is obtained at $\theta = 0.9410$.

c) Sodium carbonate when heated decomposed between 100 – 225° C with the evolution of water and CO_2. Total weight loss was recorded to be 36.6% while 25.4% of weight loss was recorded due to loss of CO_2. Write chemical reaction and draw the thermogram for the same.

d) ESR spectrometer working at 9300 MHz shows two lines at 3570 G and 3044 G in the ESR of a hydrogen atom. Calculate the hyperfine splitting for Hydrogen atom.

Q4) Write a note on (any two): **[10]**

a) Principle and applications of cyclic voltametry.

b) Mö ssbauer spectroscopy for structural elucidation.

c) Principle & applications of XRD.

d) Zero field splitting.

Total No. of Questions :4]

SEAT No. :

P2002

[Total No. of Pages :3

[4923] - 309

M.Sc. - II

INORGANIC CHEMISTRY

CHI - 332 : Bioinorganic and Inorganic medicinal Chemistry

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

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

Instructions to the candidates:

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

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

a) Give any four biological functions of inorganic elements.

b) Write the chemical reaction which is catalyzed by carboxypeptidase.

c) Give the names and functions of any four copper proteins.

d) What is the effect of two electron reduction of C_0^{III} methylcobalamin.

e) Name the two molybdenum containing enzymes and mention their typical functions.

f) Give the biological role of vanadium which is the stable oxidation state of vanadium?

g) What is meant by leaching of metals by microorganisms?

h) What is the role of zinc fingers? Explain in brief

i) Name two Fe-s proteins and mention their functions.

j) Which reaction is catalyzed by dopamine - β - mono oxygenase.

P.T.O.

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

a) Explain the role of carbonic anhydrase with the mechanism in

$$H_2O + CO_2 \rightleftharpoons H^+ + HCO_3^-$$

b) Write note on enzyme containing the molybdopterin cofactor.

c) How does nitrogen fixation take place by molybdenum.

d) Write note on non - Tc based renal imaging agents.

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

a) Explain role of Type 2 and Type 3 copper centers in O_2 activating proteins.

b) Write note on model compounds of coenzyme B_{12}.

c) Write note on metalloenzymes in biological nitrogen cycle.

d) Explain the structure and function of Fe - Mo - cofactor.

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

a) Match the following

	A		B
i)	Vit. B_{12}	1)	DNA - cleavage
ii)	Cytochrome	2)	Hydrolysis
iii)	SOD	3)	Reduction of Ribose to deoxyribose
iv)	$[Ru\ (py)_3]^{2+}$	4)	Electron transfer
v)	Carboxypeptidase	5)	$O_2 \underset{-1e^-}{\overset{+1e^-}{\rightleftharpoons}} O_2^-$

b) Complete the table

Enzyme	function	Metal present
1) Plastocyanin		
2) Nitrate reductase		
3) Carbonic anhydrase		
4) Concanvalin - A		

OR

Write notes on

a) Copper proteins

b) Model compounds of iron.

Total No. of Questions :6]

SEAT No. :

P2003

[Total No. of Pages :4

[4923] - 310

M.Sc. - II

ORGANIC CHEMISTRY

CHO - 350 : Organic Reaction Mechanism

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

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) Enamine formation is favoured by nitromethylsilyl derivative.

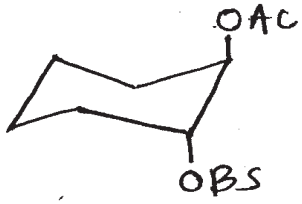
b) For the α - substitution of cyclic Ketones enamine approach is preferred.

c) Factors affecting the stability of carbanions.

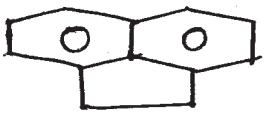
d) Oxidative coupling reactions involving free radicals.

P.T.O.

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

a) 

$\xrightarrow{EtOH}$?

b) 
$\xrightarrow[Bz_2O_2, CCl_4]{NBS}$?

c) $PhCH_2COCH_3 + PhCHO \xrightarrow{OEt}$?

d) 
$\xrightarrow[Et_3N]{1.\ Me_3SiCl}$?

2. 

e) 

$\xrightarrow[2.\ BuLi \\ 3.\ CH_3Cl \\ 4.\ HgCl_2 \cdot H_2O]{1.\ \text{  }, H^{\oplus}}$?

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

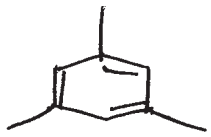
a) Formation and stability of carbenes.

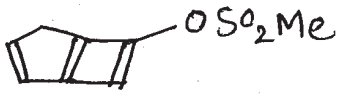
b) Halogenation of alkanes.

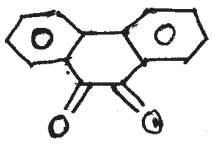
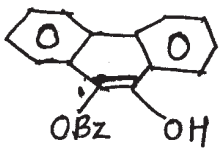
c) SNAr reactions.

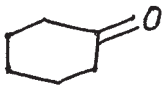
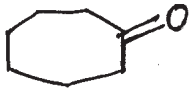
SECTION - II

Q4) Suggest the mechanism for any three of the following: **[9]**

a) $3\,Me_2CO \xrightarrow{H_2SO_4}$ 

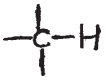
b)  $\xrightarrow{AcOH}$  $+ MeSO_2H$

c)  $+ PhCHO \xrightarrow{h\upsilon}$ 

d)  $+ CH_2N_2 \longrightarrow$ 

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

a) Discuss the nature's Enol equivalent agents with suitable examples.

b) Explain with suitable examples  insertion reactions of carbenes.

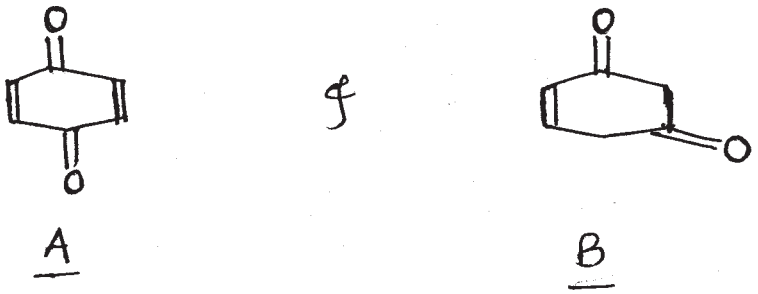
c) Pyridoxal Transamination in biochemical reactions.

d) Use of FAD in biotransformations.

e) Various methods for generation of free radicals.

Q6) Answer any four of the following: **[8]**

a) Predict which member in the following pair is more extensively enolised.



A & B

b) Explain the role of biotin as carbon dioxide carrier.

c) Explain the use of AIBN in organic synthesis.

d) Write a short note on Cannizzaro's reaction.

e) Explain the role of Benzoyl peroxide in organic synthesis.

Total No. of Questions : 6]

SEAT No. :

P2004

[Total No. of Pages : 6

[4923]-311
M.Sc. - II
ORGANIC CHEMISTRY
CHO - 351 : Spectroscopic Methods in Structure Determination
(2013 Pattern) (4-Credits) (Semester - III)

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

Instructions to the candidates:

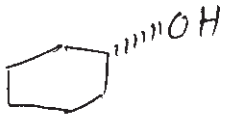
1) ***All questions are compulsory.***
2) ***Figures to the right indicates full marks.***
3) ***Answer to the two sections should be written in the separate answer books.***

SECTION - I

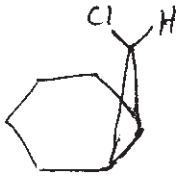
Q1) Distinguish between the following pairs by using the indicated spectral methods: **[5]**

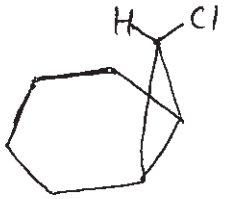
a) $C_6H_5OCH_2CH_3$ and $C_6H_5CH_2OCH_3$ CMR

b) 

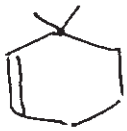
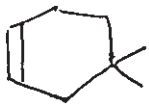
and 

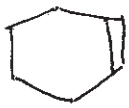
PMR

c) 

and 

CMR

d) 
and 
Mass

e) 
and 
PMR

P.T.O.

Q2) Derive the structure from given spectral data: (Any two) **[10]**

a) $C_6H_{10}O$

CMR : 30, 32, 48, 52, 115, 138

DEPT 90 : 138, 52↑

115, 48, 32, 30↓

b) $C_7H_{14}O_2$

M/Z : 130, 115, 100, 73, 43

CMR : 208(s), 75(s), 54(t), 50(q), 33(q), 25(q, strong)

PMR : 1.3δ(6H, s), 2.2δ(3H, s), 2.5δ(2H, s), 3.2δ(3H, s)

c) C_5H_8O

IR : 1705, 1635, 2750 cm^{-1}

PMR(δ) : 1.1(3H, t, J = 7Hz), 2.2(2H, dq, J = 4 and 7Hz)

5.9(1H, dd, J = 6 and 13Hz)

6.78(1H, dt, J = 4 and 13Hz)

9.35(1H, d, J = 6Hz)

d) $C_9N_{11}NO$

CMR : 39.7(q, str), 110.8(d, str), 124.9(s, weak)

131.7(d, str), 154.1(s, weak), 189.7(d, mod.)

Q3) Write short notes on any two of the following: **[10]**

a) FT-NMR benefits and applications.

b) Off resonance technique in CMR.

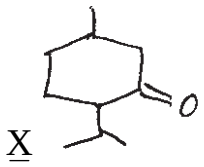
c) Meta stable ions.

d) 2D resolved spectroscopy.

SECTION - II

Q4) Answer any five of the following: **[5]**

a) Explain the genesis of peaks in compound X.



X

m/z = 112, 69

b) How will you differentiate following compounds based on Mass data.

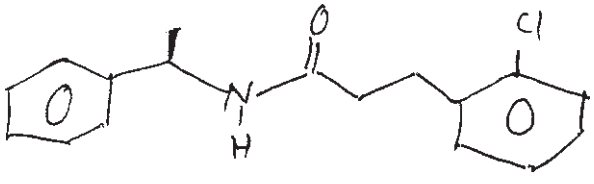
c) Explain the formation of ions at m/z 91(100%) and m/z 93(33%) in the formation of mass spectrum of n-$C_7H_{15}Cl$.

d) The mass spectrum of CH_3-CH_2-CH_2-$COOCH_3$ shows strong peaks at m/z 74, 71 and 59. Explain.

e) In the mass spectrum of compound Y, the intensity of peak at m/z 59 is more than that of m/z 30. However, for compound Z, ion at m/z 30 is more intense than the ion at m/z 31. Explain.

f) n-butylbenzene shows a peak at m/z 92 in mass spectrum, whereas t-butylbenzene does not show this peak. Explain.

Q5) a) Assign the signals to different protons in compound A on the basis of the decoupling experiment. Justify your answer. **[6]**



A

1.4(3H, d, J = 7Hz)

2.49(2H, t, J = 8Hz)

3.08(2H, t, J = 8Hz)

3.79(3H, s)

5.07(quintet, 1H, J = 7Hz)

5.56(1H, d, J = 7Hz)

6.78(1H, dd, J = 2 and 1.8Hz)

6.8-6.82(2H, m)

7.13-7.15(3H, m)

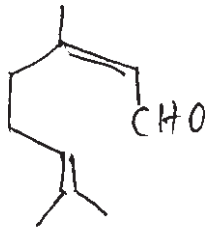
7.27(1H, td, J = 2.1 and 8Hz)

7.30(1H, dd, J = 2.1 and 8Hz)

Spin decoupling experiment

	Irradiation at	Change at
i)	6.78	6.8-6.82(pair of dd J = 2 and 8Hz)
ii)	7.3	7.27(t, J = 8Hz) 7.13-7.15(Simplification)

b) Assign CMR signals to the various carbons of compound B. Justify your assignments. **[4]**



B

189(d), 132.9(s), 128.7(d)

162.1(s), 123.1(d), 32.5(t)

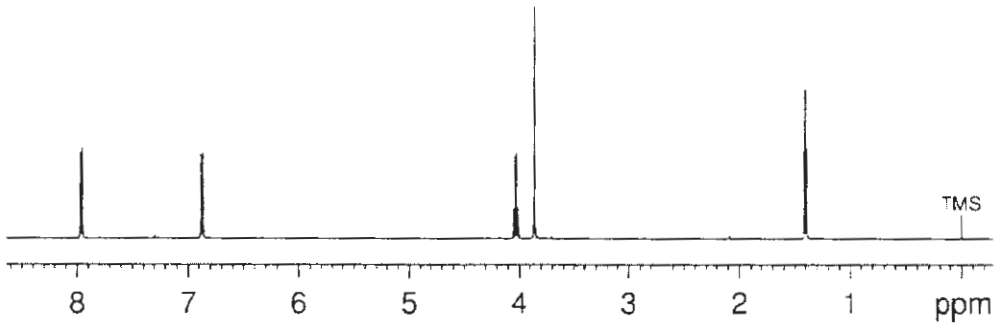
27.2(t), 25.3(q), 24.4(q)

17.4(q)

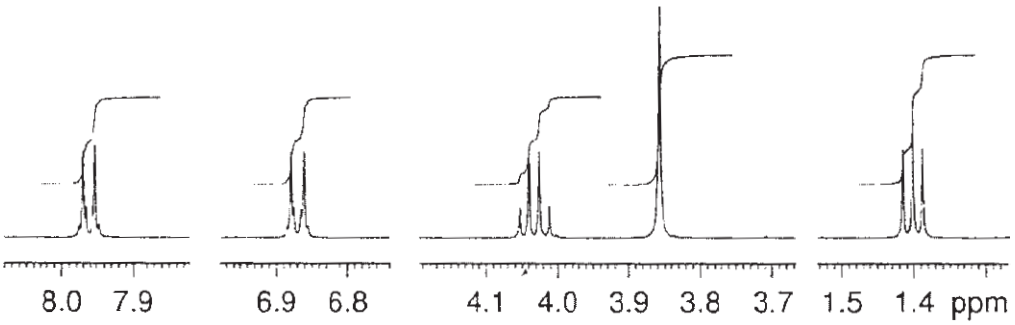
Q6) The spectra of an unknown compound are shown on the adjacent page. Analyse the spectra and use the data to arrive at a structure with justification. **[10]**

Molecular formula $C_{10}H_{12}O_3$.
IR: 1720cm^{-1}

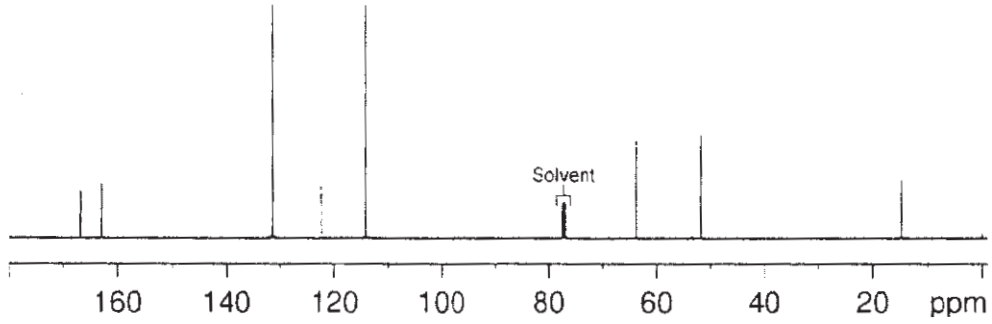
^{1}H NMR Spectrum
($CDCl_3$, 500 MHz)

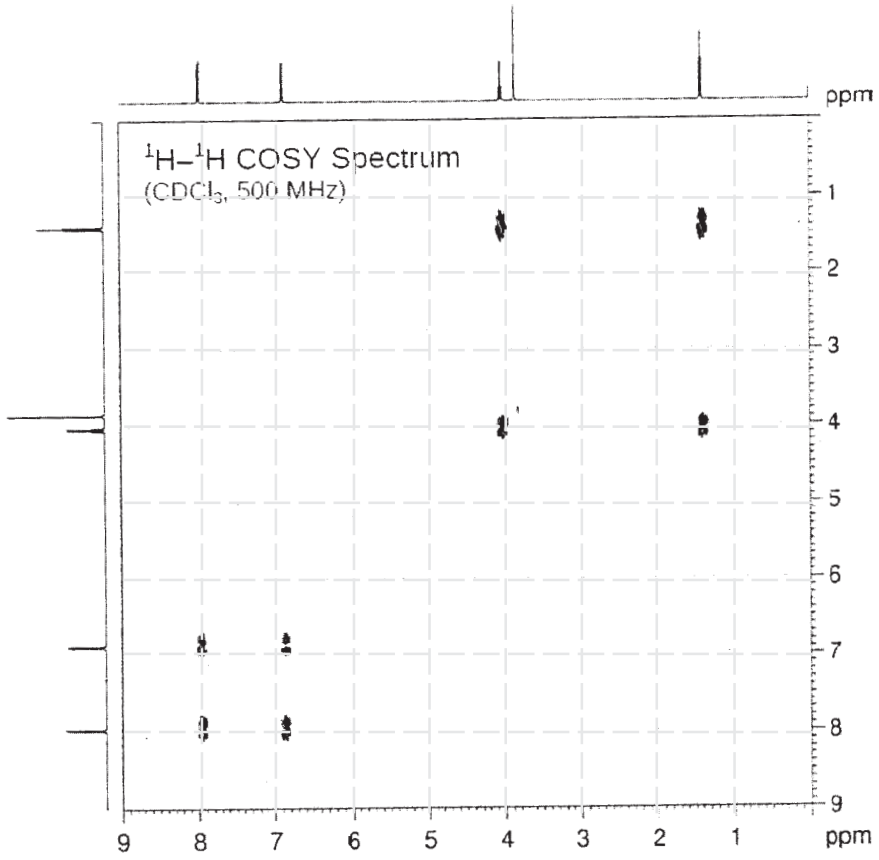


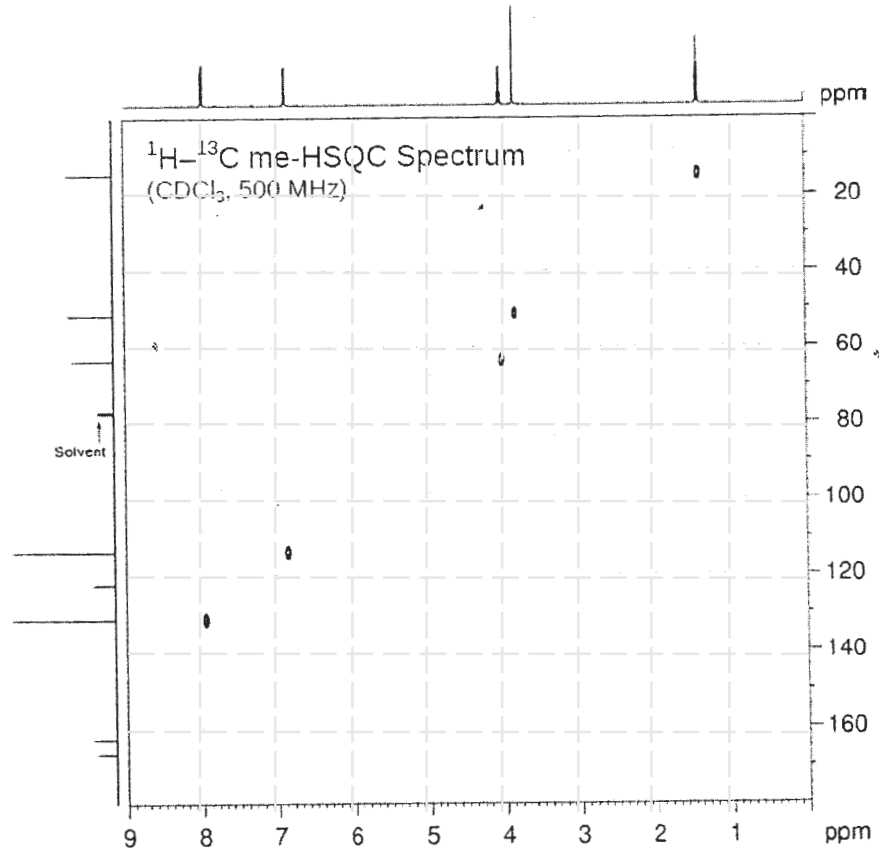
^{1}H NMR Expansion
($CDCl_3$, 500 MHz)



^{13}C{^{1}H} NMR Spectrum
($CDCl_3$, 125 MHz)




^{1}H–^{1}H COSY Spectrum
($CDCl_3$, 500 MHz)
ppm
1
2
3
4
5
6
7
8
9
9 8 7 6 5 4 3 2 1 ppm


^{1}H–^{13}C me-HSQC Spectrum
($CDCl_3$, 500 MHz)
ppm
Solvent
20
40
60
80
100
120
140
160
9 8 7 6 5 4 3 2 1 ppm

Total No. of Questions : 6]

SEAT No. :

P2005

[Total No. of Pages : 3

[4923]-312
M.Sc.
ORGANIC CHEMISTRY
CHO - 352 : Organic Stereo 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 book.***

SECTION - I

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

a) Give any two methods for preparation of Fused ring systems.

b) Why trans - 4 - t - butyl cyclohexane carboxylic acid is stronger than its cis derivative?

c) Draw the various conformations of cycloheptane. Comment on their stability.

d) What is Bredt's rule? Explain with suitable example.

e) What is termed as pseudorotation in cyclopentane?

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

a) What is trans annular effect. Give any two examples to prove its presence.

b) Explain the mechanism involved in pyrrolysis of cis and trans - z - phenyl cyclohexyl xanthate to form corresponding olefins.

c) Draw the conformations of cis - anti - trans and trans - syn - trans perhydrophenanthrene. Calculate their energies. Which is more stable amongst these two.

d) Explain the stereochemistry of the product formed for addition of HBr to cholestane -2, 3 - α -epoxide to give 2 β -3 α - bromo hydrine with the help of mechanism.

P.T.O.

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

a) Explain the concept of I-strain in detail.

b) Draw the structure of 1, 2, 2, 6, 6 - penta methyl - 4 - hydroxy - 4 - phenyl piperidine. Comment on its stereo chemistry. Which is the most stable conformation & give reason for its stability.

SECTION - II

Q4) Answer Any Three of the following: **[9]**

a) Describe various conditions for a good resolving agent.

b) Explain the terms with example.

i) Circular dichroism.

ii) Positive Cotton effect.

c) Explain the method of resolution for optically active carbonyl compounds.

d) Explain the stereochemical principle involved for addition reactions of olefins.

Q5) Answer Any Four of the following: **[8]**

a) Explain the methods of synthesis of chiral alcohol from olefins.

b) Explain the role of tartranilic acid as a resolving agent.

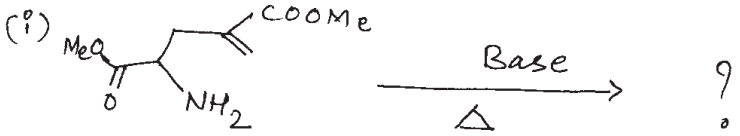
c) Explain the term "Optical Purity" with example.

d) Describe the method of resolution by biochemical transformation.

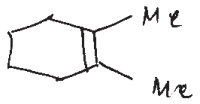
e) Reduction of butan - 2 - one by $NaBH_4$ gives eacemic butan 2-ol. Explain the stereochemical principle and mechanism of the reaction.

Q6) a) Predict the product/s in <u>Any Two</u> of the following and explain stereochemical principles involved. Justify. **[4]**

(i)



(ii)

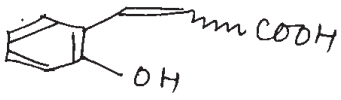


+ HX ⟶ ? + ?

X = OH, H_2O, HNO_3

X = Cl HCl in CH_2Cl_2

(iii)

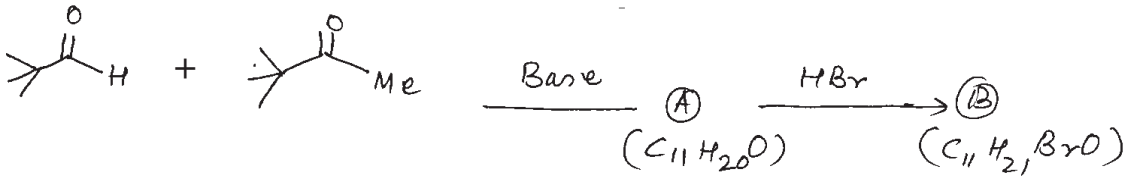


Base, Δ ⟶ ?

cis ⟶ cyclic ring closure product

trans isomer ⟶ No product.

b) How would you determine the stereochemistry of the following reaction using PMR data given below: **[4]**



<u>PMR data</u>:

A : 1.1 (S, 9H) 1.17 (S, 9H), 6.4(d, 15Hz, 1H), 7.0(d, 15Hz, 1H)

B : 1.08(S, 9H) 1.13(S, 9H), 2.71(dd, 17.7 & 1.9Hz, 1H)

3.25(dd, 17.7 & 10Hz, 1H) 4.38(dd, 1.9 & 10Hz, 1H).

Total No. of Questions : 6]

SEAT No. :

P2006

[Total No. of Pages : 4

[4923]-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) Answer all the questions: **[10]**

a) Cyclopentadiene on standing spontaneously dimerises to dicyclopentadiene, where endo-dicyclopentadiene is the major product rather than the exo-isomer.

b) Predict the structure of 2, 4 - hexadiene produced by the photochemical ring opening of Trans -3, 4-dimethylcyclobutene.

c) 1, 3, 5 tri-t-butyl benzene and 1, 2, 4 - tri-t-butyl benzene are interconvertible.

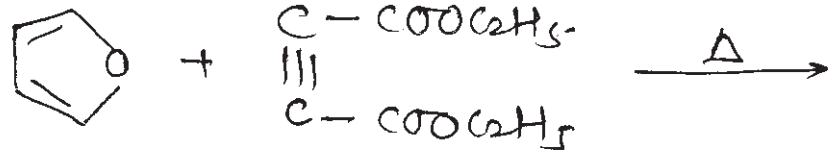
d) Give the mechanism of Barton reaction with suitable example.

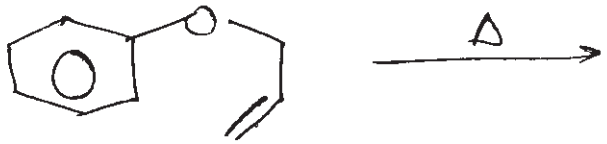
e) Explain the dimerisation of butadiene in presence of benzil as a sensitiser.

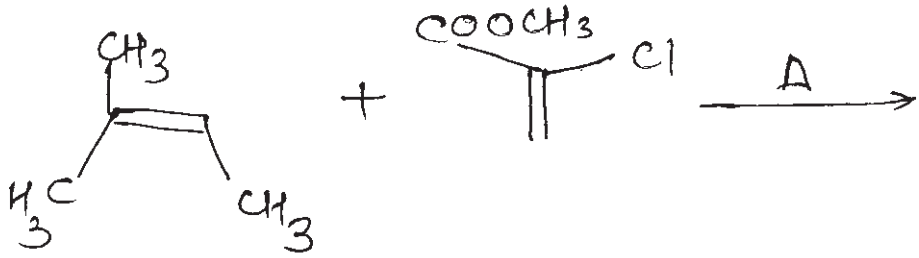
Q2) Predict the product/s and suggest the mechanism for any five: **[10]**

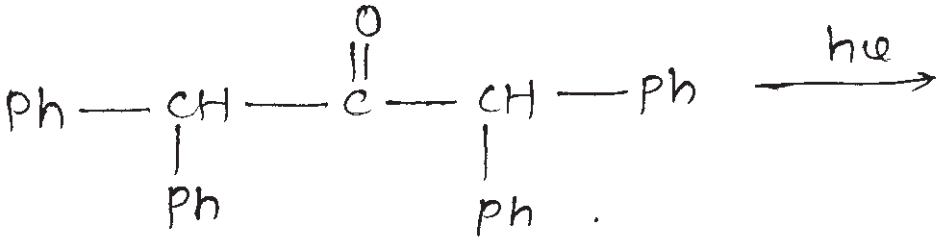
a) E, Z, E –2, 4, 6 - octatriene $\xrightarrow{132^{\circ}C}$

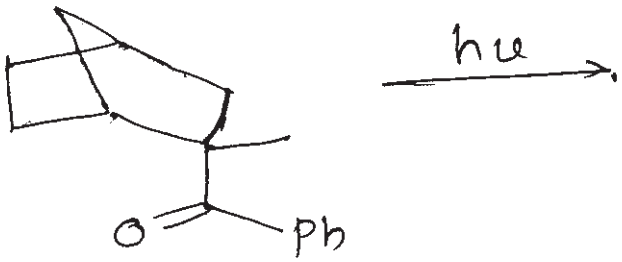
P.T.O.

b) 

c) 

d) 

e) 

f) 

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

a) Photosensitizer.

b) With the help of FMO, predict whether addition of allyl carbanion and ethylene to give cyclopentyl anion will be thermally allowed or photochemically allowed.

c) Photochemical synthesis of cedrene.

SECTION - II

Q4) Answer all the questions in brief: **[10]**

a) How salicylaldehyde can be converted into benzofuran.

b) Indole undergoes electrophilic substitution at 3-position rather than at 2-position.

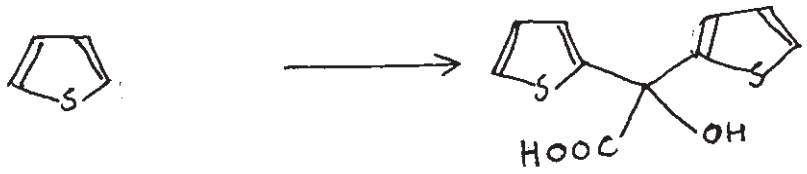
c) Pyridine is a stronger base than Pyrimidine.

d) What is the product of reaction between Purine and Iodomethane in methanol at 100ºC.

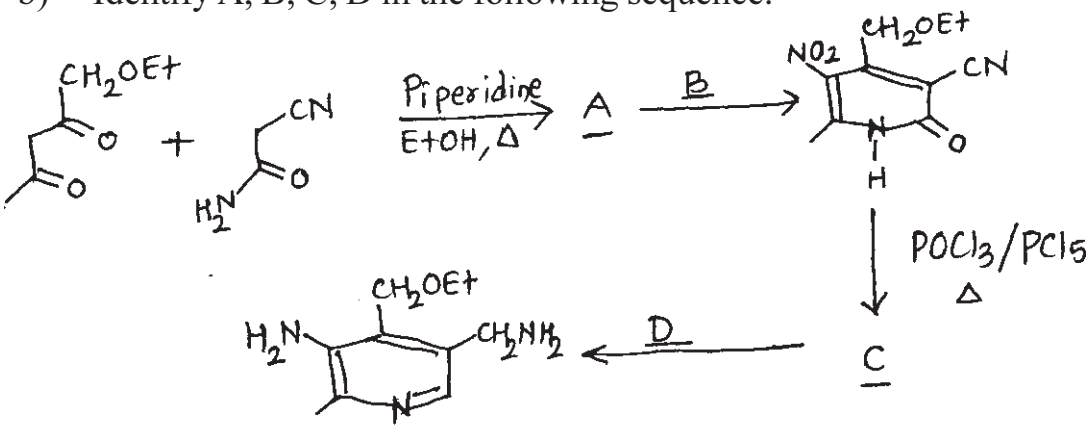
e) What is the product of the reaction between O-phenylenediamine and benzil in suitable solvent.

Q5) Do as directed Any two of the following: **[10]**

a) How the following conversion is achieved.



b) Identify A, B, C, D in the following sequence.



c) Draw structures of tautomers of Purine - (1H-, 3H-, 7H-, 9H-)

d) Complete the following sequence

$$PhCH_2NH_2 \xrightarrow{PhCOCl,\ aq.NaOH} ? \xrightarrow[rt]{Conc.H_2SO_4} ? \xrightarrow{-H_2O}$$

Q6) Write a note on <u>any one</u> of the following: **[5]**

a) Fiest Benary Furan synthesis.

b) Friedlander synthesis.

c) Bischler Napieralski synthesis.

Total No. of Questions : 6]

SEAT No. :

P2007

[Total No. of Pages : 2

[4923]-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 be drawn wherever necessary.***
4) ***Use of logarithmic table, non-programmable calculator is allowed.***

SECTION - I

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

a) Explain the term amperometry.

b) Explain the significance of working electrode in polarography.

c) State and explain Faraday's second law of electrolysis.

d) State any two applications of coulometry.

e) Define forward scan and reverse scan.

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

a) Sketch and explain the amperometric titration curve when only titrant is reduced.

b) Explain the application of differential voltammetry in detecting vitamin C.

c) Explain the instrumentation of potentiostatic coulometry.

d) The polarogram of a 1.25 mM solution of lead (II) had an instantaneous diffusion current of 7.12 μA . The capillary characteristics are t = 3.47s and m = 1.42 mg/s. Determine the diffusion coefficient of lead (II) in the solution.

P.T.O.

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

a) State Ilkovic equation and explain the terms involved in it.

b) During the forward scan of a triangular wave voltammogram at a disk electrode, a peak current of 25.4 μA was observed at a scan rate of 0.250 V/s. Estimate the peak current at a scan rate of 50 mV/s assuming a reversible electrochemical reaction.

SECTION - II

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

a) Explain the technique of neutron activation analysis.

b) Explain the principle of direct isotope dilution analysis.

c) State and explain the principle of thermogravimetry.

d) State and explain the principle of differential scanning calorimeter.

e) Give the different applications of D.T.A. technique.

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

a) Describe the comparator method used in neutron activation analysis.

b) Describe the technique of double isotope dilution analysis.

c) Explain the different factors affecting on T.G.A. curve.

d) The technique of isotope dilution was used for analysis of mercury in a catalyst sample A 1.0g sample of catalyst was added to a 1.0g of mixture containing 1.0% ^{203}Hg with a specific activity of 2400 cpm/g. Then 0.1g of mixture was separated which showed an activity of 30cpm. What is the percentage of mercury in the catalyst?

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

a) State the principle of radiometric titration and explain the precipitation and complex formation radiometric titration.

b) An oxide of potassium formed by reaction $2KO_3 \xrightarrow{\Delta} 2KO_2 + O_{2(g)}$

If 0.254g sample was heated at 70ºC for one hour, weight was found to be 0.212 g, calculate the percentage of potassium ozonide in sample.

[Given: At. wt. K = 39, O = 16].

Total No. of Questions : 6]

SEAT No. :

P2008

[Total No. of Pages : 2

[4923]-315
M.Sc. - II
ANALYTICAL CHEMISTRY
CHA - 391 : Pharmaceutical 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 be drawn wherever necessary.***
4) ***Use of logarithmic table, non-programmable calculator is allowed.***

SECTION - I

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

a) What is gross error? Explain with suitable example.

b) What is dry heat sterilization?

c) Give limit test for chloride.

d) What is sulphated ash?

e) What is a test organism and inoculum?

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

a) Explain analytical method used for dissolution tests with suitable diagram.

b) Define:-

i) Standard Preparation.

ii) Units of activity.

iii) Total Microbial Count.

c) Give biological assay of Heparin Sodium.

d) Describe limit tests for lead and Sulphate in detail.

P.T.O.

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

a) Describe different phases in the development of new drug.

b) Explain the 'Turbidimetric assay receptacles".

SECTION - II

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

a) Give advantages of suspension.

b) Explain role of diluents in tablet preparation.

c) What is vegetable drug?

d) Give classification of ointment base with suitable example.

e) What is non-aqueous titration?

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

a) What are atmospheric and microbial contaminants associated with pharmaceutical chemicals?

b) Explain in brief the sampling of vegetable drugs.

c) What are aerosols? State advantages and disadvantages of aerosols.

d) From 500ml saline bottle, 100ml saline was titrated with 0.2N Silver nitrate solution in presence of potassium chromate as an indicator. The burette reading recorded was 30ml. Calculate the amount of NaCl present in the whole sample.

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

a) What are emulsions? How are they prepared?

b) 0.2g sample of ferrous fumarate ($C_4H_2FeO_4$) was dissolved in 15ml dilute sulphuric acid. The solution was boiled for 5-10 minutes, after cooling it was diluted to 100ml with distilled water using ferrion indicator. Calculate percentage of ferrous fumarate in given sample.

Total No. of Questions : 6]

SEAT No. :

P2009

[Total No. of Pages : 2

[4923]-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) In LLE, what is emulsion?

b) What is phase diagram?

c) Mention applications of SPE.

d) How long the fibre be exposed in desorbed mode?

e) Give the typical operating conditions for pressurized MAE?

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

a) Explain problems and remedies in liquid-liquid extration process.

b) Describe method for SPE operation.

c) Give the applications of reverse phase SPE.

d) What is SFE? Explain the role of CO_2 in it.

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

a) Give the applications of SPME. How pesticide is analyzed from aqueous sample?

b) Explain healing effect of microwaves in microwave assisted extraction.

P.T.O.

SECTION - II

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

a) State and explain the principle of RIS?

b) Explain the term mass to charge ratio.

c) Explain the chemical interferences occur in AAS.

d) What are the limitations of the flame emission spectroscopy?

e) Explain the phenomenon of stimulated emission.

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

a) Describe the different components involved in atomic absorbance spectrometry with suitable diagram.

b) Enlist the type of mass analyzer. Explain any one in detail.

c) Mention the importance of microneutrients for the growth of plants. Describe suitable method for the determination of Zn from soil sample.

d) Explain the line source with suitable example for AFS.

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

a) The AAS method was used to determine the concentration of strontium in sample. Determine the amount of strontium from the following data.

Solution	Flask A	Flask B	Flask C	Flask D	Flask E
sample/ml	20	20	20	20	20
Standard strontium (5×10^{-3} mg/ml)	0	1	2	3	4
Water (ml)	5	4	3	2	1
Absorbance	0.311	0.470	0.630	0.788	0.949

b) A time of flight mass spectrometer has a flight path of 100.0 cm and uses an accelerating potential of 2500V. Calculate the time required for ionic fragments with m/z 100 and 101 to strike the detector. Calculate the difference in time of arrival of the two ions at the detector.

Total No. of Questions : 9]

SEAT No. :

P2010

[Total No. of Pages : 3

[4923]-317
M.Sc.-II
ANALYTICAL CHEMISTRY
CHA - 380 : I - Analytical Method Development and Validation
II - Geochemical and Alloy Analysis
III - Laboratory Automation and Sensor Based Techniques
(2013 Pattern) (Credit System) (Semester - III)

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

Instructions to the candidates:

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

SECTION - I

(Analytical Method Development and Validation)

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

a) Define the terms : limit of detection and limit of quantification.

b) How to estimate the reliability of results?

c) What are the physico - chemical properties of drug substances, which affect the dissolution characteristics?

d) Explain the linearity parameter with respect to dissolution studies.

e) What is assay? Why it is validated?

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

a) Enlist the essential principle of method transfer. Explain it with respect to communication and documentation.

b) What is linear regression? How to estimate slope and the intercept by statistical analysis?

c) Explain, the terms: Robustness and ruggedness.

d) A new procedure for the rapid determination of phosphate (ppb) in a sample of river water, gave the following results: 20.7, 27.5, 30.4, 23.9 and 21.7. Calculate the 95% confidence limit of the true value.

[Given: t-table = 2.78 for 4 degree of freedom]

P.T.O.

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

a) Explain with neat labelled diagram of USP type - 2 apparatus.

b) From the following data:

X :	6	2	10	4	8
Y :	9	11	?	8	7

If arithmatic mean of Y series is 8. Find the missing value. Compute correlation coefficient between X and Y.

SECTION - II

(Geochemical and Alloy Analysis)

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

a) What are major and minor constituent's of soil?

b) What are the different constituents present in pyrolusite and bauxite ore?

c) How is organic Carbon of soil is determined?

d) What are Major and Minor constituents of dolomite and haematite ore?

e) Give the principle of estimation of iron from bauxite ore.

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

a) Discuss the method used for determination of nitrogen from soil.

b) Outline analytical procedure for estimation of titanium from ilmenite ore.

c) Outline the analytical procedure used for estimation of nickel from nichrome alloy.

d) 0.715 gm of haematite ore was disintegrated with con.HCl. After filtering and removing SiO_2, the filtrate was diluted to 100ml. An alignut of 25ml requires 40ml of 0.025 NKM_nO_4. Calculate percentage of Fe as Fe_2O_3.

[Given At Mass gma^{-1} Fe = 55.85, 0 = 15.99]

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

a) How magnesium estimated from dolomite ore?

b) 0.540 g of shipnail brass gave 0.0289 got S_nO_2 and 0.130 g $pbSO_4$. Calculate the percentage of S_n and p_b in the alloy.

[Given At. mass g ma^{-1} :- S_n = 118.7, 0 = 15.99, pb = 206, S = 32]

SECTION - III

(Laboratory Automation and Sensor Based Techniques

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

a) What is continuous Flow analysis?

b) List the optical sensors.

c) Define 'Chemical Sensors'.

d) State any Four achievements of biotransduction.

e) List different types of mass sensors.

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

a) Explain the electrical sensors in brief and give its application.

b) Explain the process control analyzer.

c) What is serial integration and parallel integration?

d) Discuss continuous flow analyzer in detail.

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

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

b) Explain the pirroelectric quartz crystal resonator.

Total No. of Questions : 6]

SEAT No. :

P2011

[Total No. of Pages : 3

[4923]-401

M.Sc.

PHYSICAL CHEMISTRY

CHP - 410 : Molecular Structure and Spectroscopy

(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) Define Chemical Shift in nmr spectroscopy.

b) Give the advantages of FT-nmr.

c) Explain phase problems in XRD.

d) Define Kramer's degeneracy.

e) Write the application of nqr.

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

a) Discuss the quantum mechanical theory of nmr.

b) Explain the principle of esr spectroscopy. Why are microwave radiations used to observe esr signals?

c) State and explain the importance of Mc Connel equation.

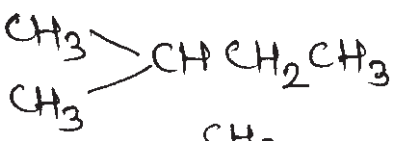
d) Compare single crystal and powder method techniques used in X-ray diffraction methods.

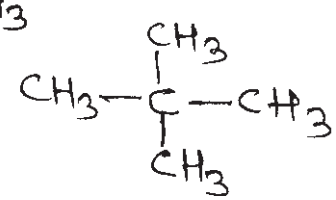
Q3) Solve <u>any one</u> of the following: **[5]**

a) Calculate the frequency, required to excite proton from $m_1 = 1/2$ to $m_1 = -1/2$ at magnetic field applied 1.5T. (Given : $g_N = 5.585$).

b) How will you distinguish among using PMR spectra?

i) $CH_3CH_2CH_2CH_2CH_3$

ii) 

iii) 

SECTION - II

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

a) What are the two effects took into account by Van Vleck to derive a general equation for susceptibility.

b) What are the advantages and disadvantages of Gouy method.

c) Define the terms - scattering factor and structure factor.

d) Write any four applications of electron diffraction technique.

e) Define the terms - constructive and destructive interferences observed in X-ray diffraction.

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

a) Discuss the applications of X-ray diffraction.

b) Give remarkable differences between X-ray diffraction and electron diffraction.

c) Explain the characteristic properties paramagnetic and diamagnetic substances.

d) Derive the equation for the susceptibility of a liquid sample relative to a liquid sample.

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

a) Calculate the volume and mass paramagnetic susceptibilities of a sample of a complex salt with two unpaired electrons at 20ºC.

[Given : Density = 1.67gcm^{-3} and molar mass = 176 g mole^{-1}]

b) Calculate the length of the unit cell of the potassium chloride cubic crystal having density 1.984gcm^{-3}.

[Given : Atomic weight of K = 39.1, Cl = 35.5]

Total No. of Questions : 6]

SEAT No. :

P2012

[Total No. of Pages : 3

[4923]-402

M.Sc.

PHYSICAL CHEMISTRY

CHP - 411 : Surface Chemistry and Electrochemistry

(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 indicate full marks.***
5) ***Use of logarithmic table / calculator is allowed.***

<u>Physico - Chemical Constants</u>

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

P.T.O.

SECTION - I

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

a) Give the characteristics of a liquid monomolecular film.

b) What is cmc? Give the structure of micellas.

c) State two limitations of BET theory.

d) What are 'ink-bottle' pores?

e) Write Gibbs equation for adsorption and define the terms therein.

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

a) Describe the tracer method for verification of the Gibbs equation.

b) Stating the assumptions, derive the Langmuir equation for adsorption.

c) Derive the two dimensional ideal gas law for the film of adsorbed solute in dilute solutions.

d) Discuss the Zsigmondy's theory for adsorption hysteresis.

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

a) A solid in contact with gas at 12kPa and 28ºC adsorbs 2.5×10^{-3}g of the gas and obeys the langmuir isotherm. The enthalpy change when 1.0 mmol of the adsorbed gas is desorbed is +10.2J. What is the equilibrium pressure for the adsorption of 2.5mg of the gas at 40ºC?

b) The adsorption of butane vapour on 1.85g catalyst was studied at 0ºC. The data when fitted in BET equation yielded a linear plot with the slope of 3.895×10^{-2} ml^{-1} and intercept of 1.85×10^{-3} ml^{-1}. The area occupied per molecule of butane is 44.6 $\mathring{A}^2$. Determine the specific surface area of the catalyst.

SECTION - II

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

a) Define true electrolyte and potential electrolyte.

b) Write equation for heat of hydration of positive ion having co-ordination number four based on Bernal - Fowler model. Explain the terms involved in it.

c) Define the term flux and enlist the names of three types of fluxes.

d) Define the terms drift velocity and absolute mobility of ion.

e) Write the equation for corrosion current and explain the terms involved in it.

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

a) Derive the Fick's first law for steady-state diffusion.

b) Derive the D.H. equation for activity coefficient considering the ion size parameter 'a'.

c) Write a note on any one fuel cell.

d) Discuss the stern theory of electrical double layer.

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

a) If the Tafel constants a and b have values 0.64 and 0.123 respectively for reduction of hydrogen ion. Calculate the transfer coefficient 'α' and exchange current density i_o at 298K.

b) Calculate the thickness of ionic atmosphere at 25ºC in 0.05M solution of LiCl.

[Given: Dielectric constant of water = 78.54].

☛ ☛ ☛

Total No. of Questions : 6]

SEAT No. :

P2013

[Total No. of Pages : 3

[4923]-403

M.Sc.

PHYSICAL CHEMISTRY

CHP - 412 : Materials Chemistry and Catalysis

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

a) What is coherent length?

b) Draw the cross-sectional diagram of the DC sputtering system.

c) What are capacitors?

d) Draw the pairing modes of hitech materials.

e) State the optical properties of solid devices.

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

a) Explain the preparation of 1-2-3 material.

b) Discuss the applications of LB films.

c) What is P-N-P transistor? Explain the three modes of its operation.

d) Write a note on anyzotropy.

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

a) Discuss the applications of superconductors.

b) Describe the theory and working of rectifiers.

SECTION - II

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

a) Define physical adsorption. Give one example.

b) State the assumptions of Langmuir equation.

c) Define the term 'calcination'.

d) Draw a neat labelled diagram of FTIR spectrometer.

e) Give the mechanism of decomposition of Ozone.

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

a) Draw and describe the various types of physical adsorption isotherms.

b) What is deactivation of a catalyst? Explain the causes of deactivation.

c) Describe the mercury porosimeter method for pore size determination.

d) Discuss photocatalysis in semiconductors.

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

a) The following table gives the number of millilitres of N_2 absorbed per gram of active carbon at 0ºC at series of pressures

P/pa	524	1731	3058	4534	7497
V/cm^3	0.987	3.04	5.08	7.04	10.31

Plot the data according to Langmuir isotherm and determine the constants - K and V_∞.

b) The adsorption of nitrogen on pt surface is described by the Langmuir isotherm with $K = 0.65\ kPa^{-1}$. Calculate the pressure when the fractional surface coverage is 0.25.

Total No. of Questions : 6]

SEAT No. :

P2014

[Total No. of Pages : 3

[4923]-404

M.Sc.

PHYSICAL CHEMISTRY

CHP - 413 : Biophysical Chemistry

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

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Give the colour tests for proteins.

b) Define biological cell. Mention its constituents.

c) State the principle of XRD technique.

d) Distinguish between Exogenic and Endorgonic reactions.

e) Discuss types of electrolysis.

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

a) Discuss the role of ATP in biological systems.

b) Compare RNA and DNA.

c) Explain denaturation of proteins.

d) How is Bragg's equation used to analyze the crystal structure?

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

a) Glucose l-phosphatase $\underset{\rightleftharpoons}{\overset{\text{catalyst}}{\rightarrow}}$ glucose 6-phosphate. Starting with 100% 20mM reactant the equilibrium mixture contains 1mM reactant and 19mM product. Find the standard free energy change for the reaction.

b) Discuss the components of a plant cell and compare with those of an animal cell.

SECTION - II

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

a) What is Donnan membrane equilibrium?

b) Define the terms - Nerve impulse and action potential.

c) How is the size of biopolymer particles determined by Tyndall effect?

d) Explain the effect of temperature on enzyme activity.

e) Draw a neat labelled diagram of the apparatus for circular dichroism.

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

a) With a neat labelled diagram, describe the fluid mosaic model for cell membrane.

b) Explain the role of Na^+/k^+ pump during the development of an impulse.

c) What is enzyme inhibition? Explain briefly the reversible inhibition.

d) Discuss the theory of optical rotatory dispersion.

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

a) A biopolymer sample contains equal weights of molecules with molecular weight 10,000 and 20,000. Calculate $\bar{M}n$ and $\bar{M}w$.

b) The following relative viscosities were measured for a polymer in a given solvent at 25°C.

C(g/100cc)	0.152	0.271	0.541
η_r	1.226	1.425	1.983

Find the intrinsic viscosity of the polymer.

Total No. of Questions : 6]

SEAT No. :

P2015

[Total No. of Pages : 3

[4923]-405

M.Sc.

PHYSICAL CHEMISTRY

CHP-414: Special Topics in Nuclear and Radiation Chemistry

(2013 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Give one example of evaporation and spallation reaction.

b) Enlist various natural and manmade sources of radiations.

c) Explain the term annealing.

d) What you understand by the terms in-vivo and in-vitro techniques. Give one application of radiopharmaceutical.

e) Write MPD values for various organs.

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

a) Write a note on conservation in nuclear reaction.

b) Draw & explain linear accelerator.

c) What are the various stages of interaction of radiations with biological cells.

d) Discuss the chemistry of recoil atoms.

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

a) ^{7}Li is bombarded with 6 MeV protons calculate the energy of protons scattered through an angle at 90^{o}.

b) Find out the dose due to 200 mCi ^{60}Co source at a distance at 3 meters. Given: Energy of gamma is 2.5 Mev.

SECTION - II

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

a) Give AERB guidelines for classification of liquid waste.

b) Explain the term G-value.

c) Write properties of GUT era.

d) Write products formed in radiolysis of alcohol.

e) What are the advantages of radiometric titration based on interaction of β^- particles?

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

a) Write a note on stellar nucleosynthesis.

b) Write a note on radiolysis of alkane.

c) How does high level radioactive waste is managed?

d) Write a note on radiometric titration based on precipitate formation wherein ion precipitating second is labelled.

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

a) 25 mL of K^*Br was titrated with 0.01m $AgNo_3$ radiometrically. Addition of 2 mL of $AgNo_3$ showed loss in initial activity from 24000 counts/4 min to 2000 counts/5 min. Find the amount of K^*Br if background counts are 50 counts/5 min.

[Given : At. wts: K=39.1, Br=79.9]

b) Find the thickness of Pb required to reduce activity from 17500 cpm to 6700 cpm.

[Given: μ_e=0.211 b/e^-, Z=82, A=207, density=11.35 g/cm^3.]

ζ ζ ζ

Total No. of Questions : 4]

SEAT No. :

P2016

[Total No. of Pages : 2

[4923]-406
M. Sc. - II
INORGANIC CHEMISTRY
CHI-430: Inorganic Polymers and Heterogeneous Catalysis
(2014 Pattern) (Semester - IV) (Credit - 4)

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.***

Q1) Answer the following questions. **[20]**

a) Give the basic principle of heterogeneous catalysis.

b) Define chemical reactors. State their importance in industry.

c) Give the classification of zeolites on the basis of pox size and chemical composition.

d) Organic templates are structural directing agent in zeolite synthesis. Explain.

e) Define promoter, modifier and poison.

f) Discuss in brief incipient wetness method of preparation of supported metal catalysts.

g) Which properties of TiO_2 makes it a very good photocatalyst.

h) How $BiMOO_4$ is useful as a catalyst in ammoxidation of propylene?

i) Draw the structure of keggins heteropolyanion.

j) Draw the structure of tetrameric phosphazene.

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

a) What is adsorption? Discuss various types of adsorption phenomena along with Langmuir isotherms.

b) Give an overview on post synthetic treatment given to supported metal catalyst.

P.T.O.

c) What do you mean by shape selective catalysts? How zeolites are used as a shape selective catalyst. Illustrate with suitable example.

d) Give an account of various processes of deactivation of heterogeneous catalyst.

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

a) Discuss in detail application of perovskite type oxide as a catalyst for vehicular emission control.

b) Give an account of use of IR & NMR techniques for characterisation of heterogeneous catalyst.

c) Describe various methods of finding out the number and nature of acidic sites in solid catalysts.

d) How will you prepare S_4N_4? Explain its properties and structure.

Q4) Write a short note (Any two). **[10]**

a) Intercalated compounds as a catalyst.

b) ZSM-5.

c) Role of support in supported metal catalysts.

d) Heteropolyanions of Mo & W.

ζ ζ ζ

Total No. of Questions : 4]

SEAT No. :

P2017

[Total No. of Pages : 2

[4923]-407
M. Sc. - II
INORGANIC CHEMISTRY
CHI-431: Material Science - I
Solid State and Other Inorganic Materials
(2014 Pattern) (Semester - IV) (New Credits 4)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat and labelled diagrams must be drawn 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) What is paramagnetism? Explain with suitable example.

c) What are ferrites? How they are prepared?

d) What is effect of temperature on magnetic susceptibility value of antiferromagnetic materials. Explain with graphical representation.

e) Explain fullerenes.

f) Explain classification of superconductors.

g) A piece of wood containing moisture weighed 210.3 gm and after oven drying showed constant weight is 190.2 gm. Calculate the moisture content.

h) Explain dielectric properties of ceramic materials.

i) Explain the classification of biomaterials.

j) Explain the composition of portland cement.

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

a) What is Kirkendall effect? Explain with the help of pure copper and brass alloy.

P.T.O.

b) Derive the expression, $x = \frac{c}{T - r_c}$.

c) Explain orthopaedic and cardiovascular applications of biomaterials.

d) i) Gelation.

ii) Ageing.

iii) Bioactive glasses.

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

a) What is Hysteresis loop? Explain with retentivity and corecivity.

b) Explain Meissner effect. Explain different types of superconductors.

c) What are superconductors? Explain critical temperature and critical field in superconductors.

d) The saturation magnetisation of FCC iron is 1700 KA/m. Calculate the net magnetic moment per iron atom in crystal. [Given lattice parameter is 2.87 $\mathring{A}$].

Q4) Write a short note on (Any two). **[10]**

a) Pyroelectric materials.

b) Portland cement.

c) i) Special cement products.

ii) Oil well cement.

d) Concrete & its mixes.

ζ ζ ζ

Total No. of Questions : 4]

SEAT No. :

P2018

[Total No. of Pages : 2

[4923]-408
M. Sc. - II
INORGANIC CHEMISTRY
CHI-432: Material Science - II (Nanomaterials)
(2014 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 is allowed.***

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

a) Why nanoparticles have more importance than bulk particles?

b) Give the important properties of carbon nanotube.

c) Explain the different types of porous nanomaterials.

d) Zno nanoparticles are key technological materials as compared to TiO_2 nanoparticles.

e) Explain how Al_2O_3 nanoparticles are synthesized using aluminium sulphate?

f) What do you mean by targeted drug delivery?

g) What is recombinant current?

h) Write about solvothermal method for preparation of nanoparticles.

i) What is meant by stokes and Antistokes in Raman spectroscopy?

j) Give the limitation TEM.

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

a) What is nanosensor? Explain with suitable examples use of nanomaterials in sensor devices.

b) Explain the photoconductivity with the help of band energy diagram.

P.T.O.

c) Explain the mechanism of adsorption of impurity on the zero valent iron nanoparticles.

d) Write a note on physical methods of nanoparticle synthesis.

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

a) Explain the principle, construction and working of scanning electron microscope.

b) What are inorganic nanotubes? Give example and describe the synthesis of any one of them.

c) What is luminescence? Explain different types of luminescence.

d) Discuss the chemical reduction method for the synthesis of Fe-Cu bimetallic nanoparticle.

Q4) Answer the following (any two). **[10]**

a) What is transistor? Give the working of any one type of transistor with the help of-band energy diagram.

b) What is nano-composite? Give their important applications.

c) List out various methods of producing carbon nanotubes and discuss any one in detail.

d) Explain the electrical and optical properties of nanoparticles.

ζ ζ ζ

Total No. of Questions : 9]

SEAT No. :

P2019

[Total No. of Pages : 3

[4923]-409
M.Sc. II
INORGANIC CHEMISTRY
CHI-445: Inorganic Chemistry: Applications in Industry, Environment and Medicine
(2014 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 calculator is allowed.***

SECTION - I

(Applications in Industry)

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

a) Which type of isomerism are seen in Cr & Co complexes of tridentate AZO compounds?

b) Give two examples and draw structure of -

i) Metallized dyes ii) Addition reagent.

c) What is meant by synthetic pigments? Give two examples.

d) What is meant by term electroplating?

e) What are formazans? Give two examples.

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

a) How are redox centres are ligand to PVP electrode coating? Explain the effect of increasing the positive potential of the platinum electrode on electro deposition.

P.T.O.

b) What are the general properties of pigment? Explain any two of them.

c) How do pigment size, shape, oilabsorption, bulking value and pigment concentration affect the quality of a pigment coating?

d) Discuss the different processes available for electroplating of zinc.

Q3) Write a note on any One. **[5]**

a) Luminous and Fluorescent pigment.

b) Prussian Blue modified electrode.

c) Use of Polymers in electroplating.

SECTION - II

(Environment)

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

a) What is primary and secondary treatment of waste water?

b) Give schematic presentation of muncipal waste water treatment.

c) Define active and passive solar heating system.

d) Describe how to do a BOD test on a water sample.

e) How is biogas produced?

Q5) Answer the following.(any two) **[10]**

a) Define P^E. What is the range of P^E in natural water? A sample from lake gave a $P^E = 10.5$, does the lake favours oxidation?

b) Name the instrumental method for the determination of metals such as Hg, Cd, As and Pb. Explain cold vapour atomic absorption method for the determination of Hg from polluted water.

c) Explain in detail the construction and working of - Phosphoric Acid Fuel cell.

d) Will geothermal energy ever be a major source of energy world wide? Explain.

Q6) Write a note on any one. **[5]**

a) Reverse Osmosis.

b) Biorefractory organic pollutants.

c) Primary and secondary sludge.

SECTION - III

(Applications of Metal ions in Medicine)

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

a) Name the ligands with Au(I) forms stable complexes.

b) What is the role of metal ion-DNA binding in biology?

c) What is the effect of binding of Cis-platin to DNA with respect to structure of DNA?

d) Draw the structures of -

i) Myochrisin. ii) Aurinofin.

e) Name two gold complexes used for treating HIV and draw their structures.

Q8) Answer any two. **[10]**

a) Explain the role of lithium isotopes in precise localization of lithium on cells.

b) Explain with the help of suitable diagrams the nuclease activity of Cu-$(Phen)_z$ complex.

c) Discuss the binding of Bismuth with thiolate ligands.

Q9) Write note on (any one) **[5]**

a) Platinum based anti-cancor drugs.

b) Vanadium and insulin modification.

ζ ζ ζ

Total No. of Questions :6]

SEAT No. :

P2020

[Total No. of Pages :3

[4923]-410
M.Sc. - II
ORGANIC CHEMISTRY
CHO -450: Chemistry of Natural Products
(2013 Pattern) (Semester - IV)

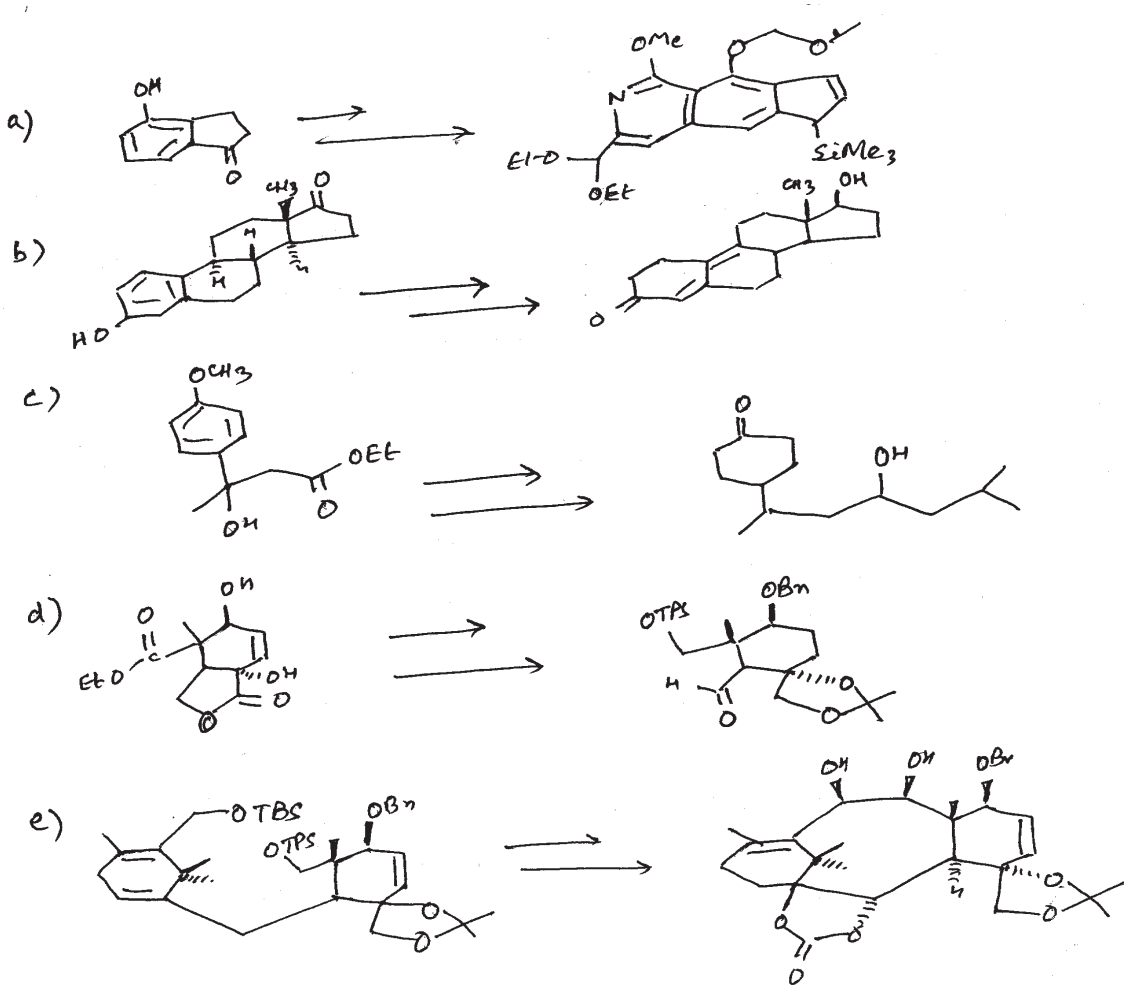
Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

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

SECTION - I

Q1) Outline the steps involved in the following synthetic sequence. Indicate the reagent used and discuss the mechanism and stereochemistry. **[10]**



P.T.O.

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

a) Give evidences to prove the presence of following in camptothecin.

i) Quinoline ring conjugated to pyridone ring.

ii) Lactone ring.

b) How is the presence of

i) Mono substitutes furan ring.

ii) α,β - unsaturated acid proved in Hardwickiic acid.

c) Give evidences in support of

i) Presence and nature of -OH group.

ii) 3,4,5- trimethoxy benzene and benzene nucleus in podophyllotoxin.

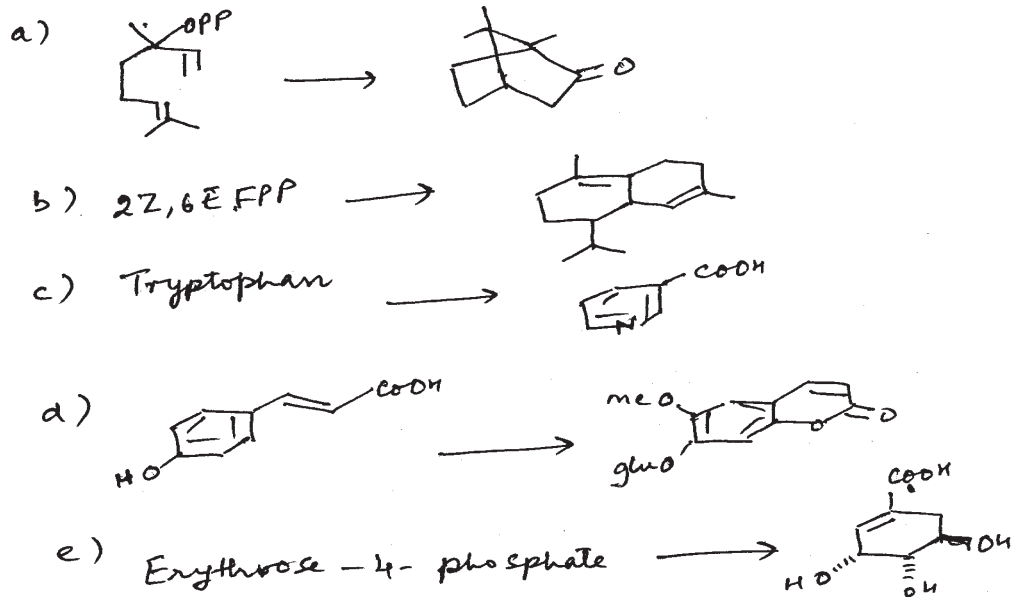
Q3) Attempt any one of the following. **[5]**

a) Write a note on Birch reduction.

b) How will you establish the configuration at C_5 methyl in Hardwickiic acid.

SECTION - II

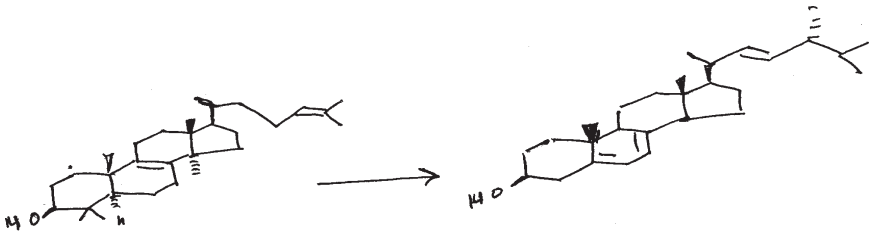
Q4) Suggest biogenetic scheme for the following. **[10]**



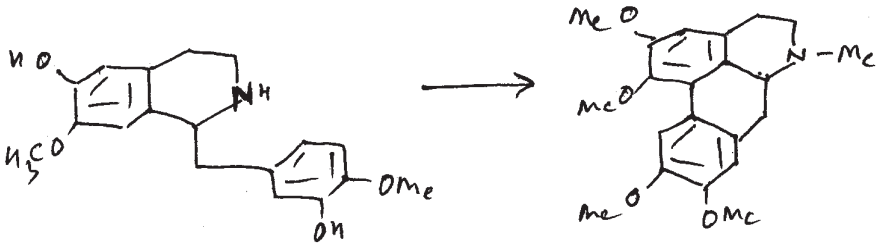
Q5) Attempt any two of the following. **[10]**

a) Outline the steps involved in the following conversion

b) Give the steps involved in the following biogenetic conversion



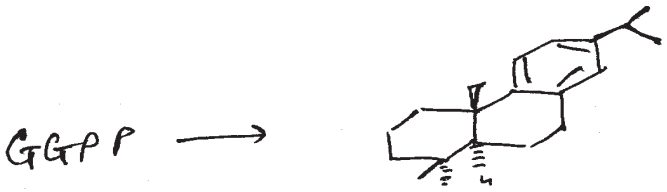
c) Complete the following conversion



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

a) Write a note on SAM and explain its importance in the biogenesis.

b) Suggest the biogenetic step for the following scheme:



X X X

Total No. of Questions :6]

SEAT No. :

P2021

[Total No. of Pages :4

[4923]-411
M.Sc. - II
ORGANIC CHEMISTRY
CHO -451: Advanced Synthetic Organic Chemistry
(2013 Pattern) (Semester - IV)

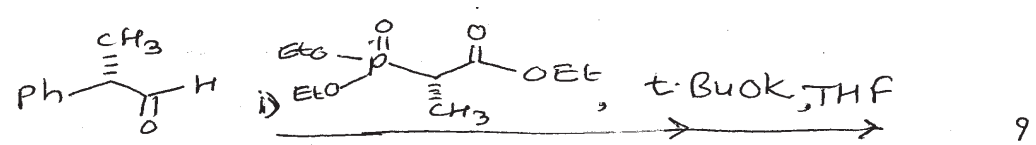
Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

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

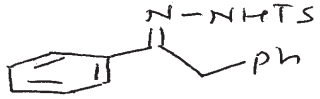
SECTION - I

Q1) Predict the major product/s of the following. **[10]**

a) 

9

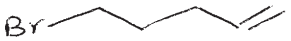
b) 
$Co_2(CO)_8$, H_2, CO, Pressure
$NH_2OH \cdot HCl$. Pyridine
9

c) 

i) But-Li, THF, 0°C
ii) F-N(SO_2Ph)$_2$, −78°C − rt
?

d) 

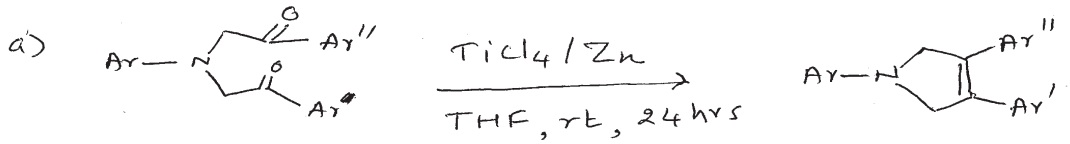
+ H−≡−CH_3
i) $Pd(PPh_3)_2Cl_2$, CuI, R_3N
ii) H_3O^+
9

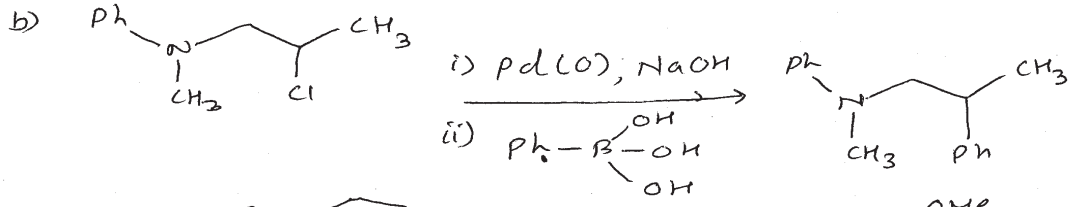
e) 

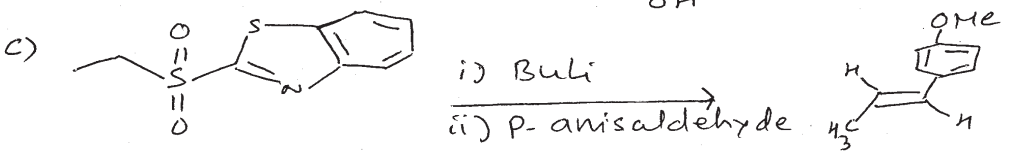
i) $Na_2(Fe(CO)_4)$, CO, PPh_3, H^+
ii) $TiCl_2$, Zn Cu, THF
9

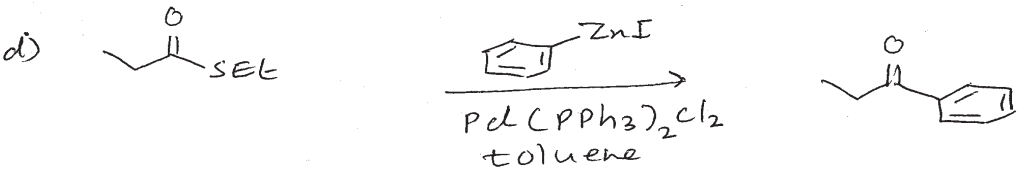
P.T.O.

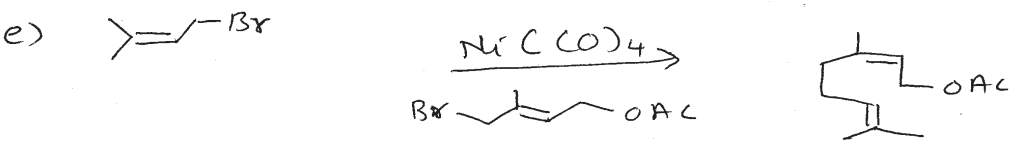
Q2) Suggest the mechanism in any four of the following. **[10]**

a) 

b) 

c) 

d) 

e) 

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

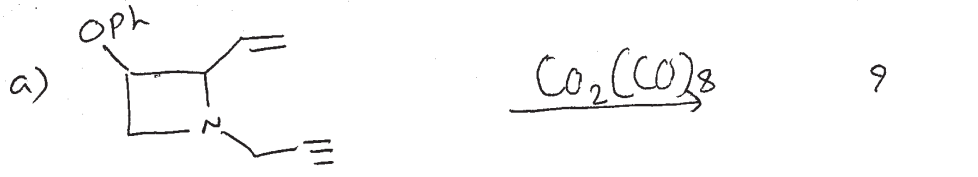
a) Advantages of Tebbe olefination over wittig olefination.

b) Write a note on Heck reaction.

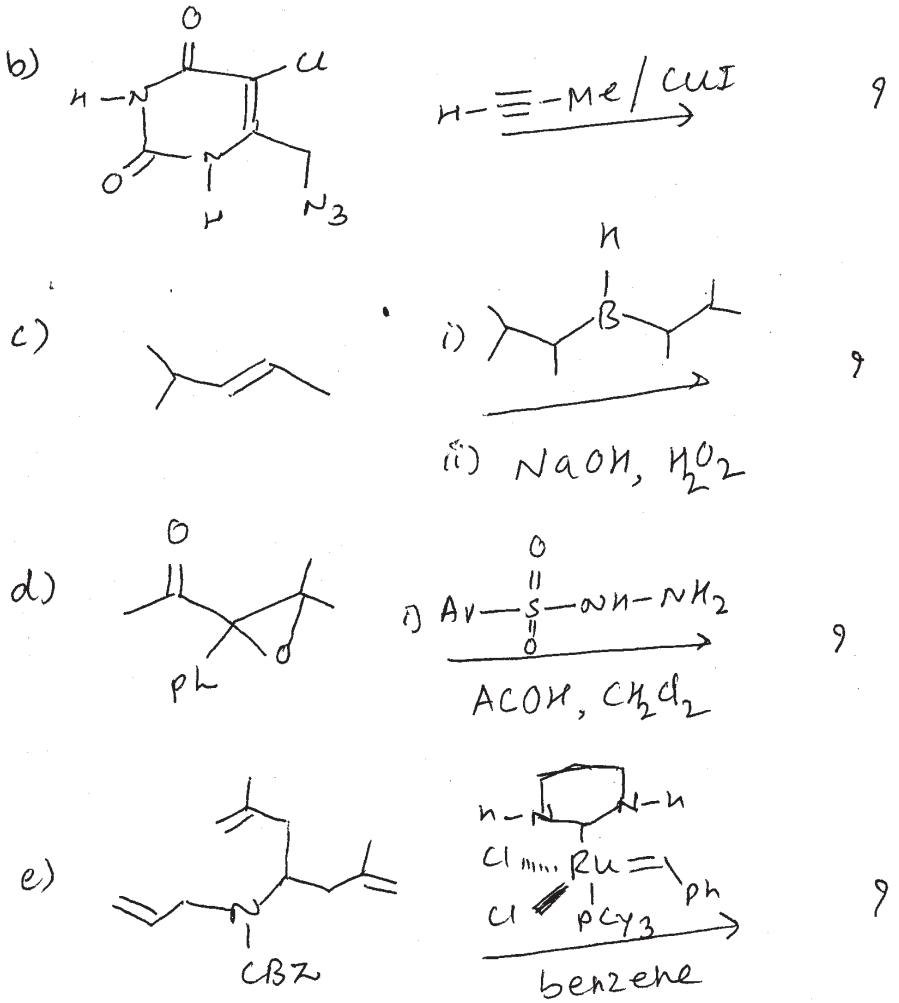
c) Noyori asymmetric hydrogenation of ketones.

SECTION - II

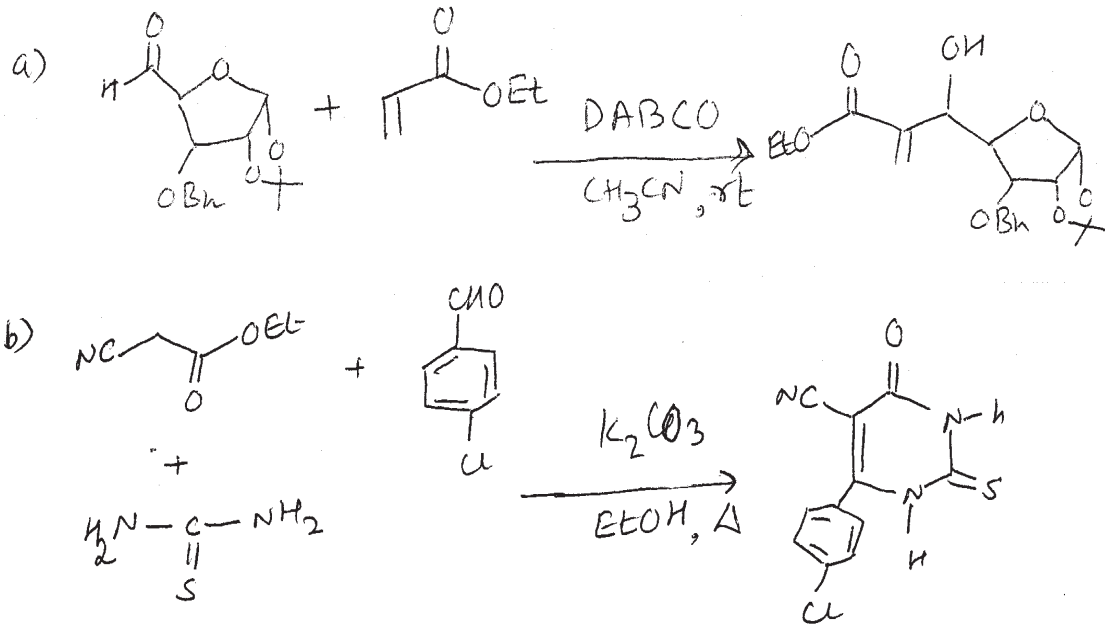
Q4) Predict the major product/s of the following. **[10]**

a) 

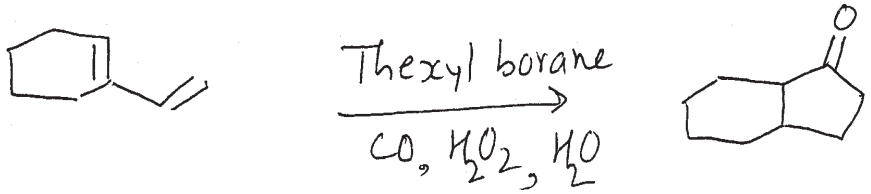
9



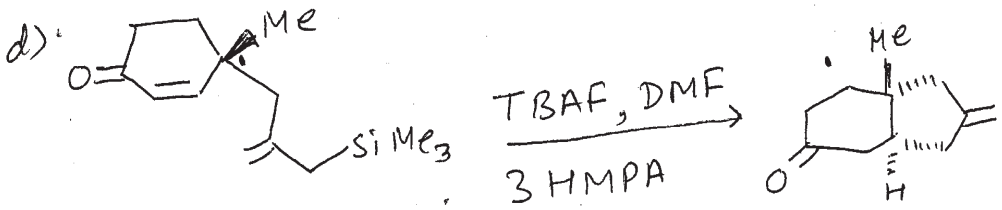
Q5) Suggest the mechanism in any four of the following. **[10]**



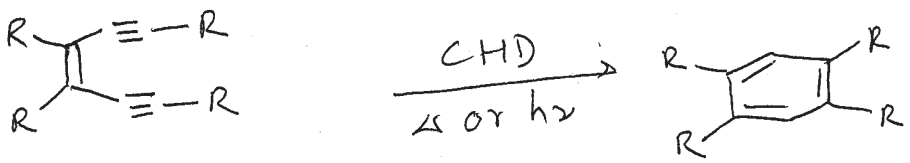
c)



d)



e)



Q6) Answer in any two of the following. **[5]**

a) Discuss chiral boranes in organic synthesis.

b) Silicon in organic synthesis.

c) Ring opening and cross metathesis.

x x x

Total No. of Questions :6]

SEAT No. :

P2022

[Total No. of Pages :3

[4923]-412
M.Sc.
ORGANIC CHEMISTRY
CHO -452: Carbohydrate, Chiron Approach, Chiral Drugs & Medicinal Chemistry
(2013 Pattern) (Semester - IV)

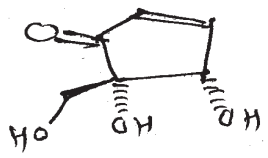
Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

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

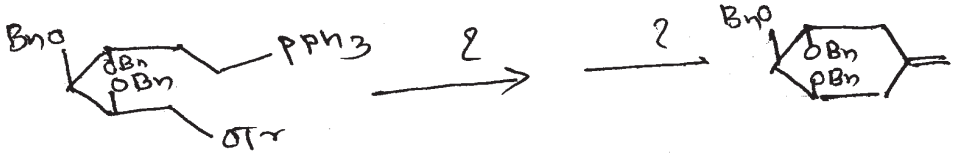
SECTION - I

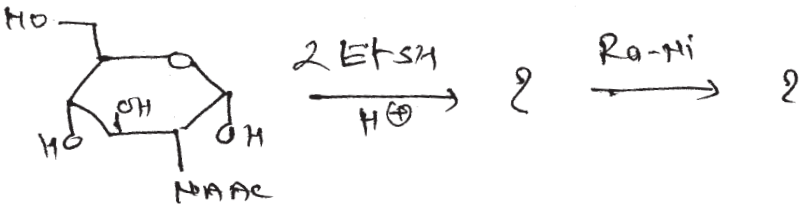
Q1) a) Give the retrosynthesis of (–) pentanomycin. **[3]**



Explain how will you determine the stereochemistry of two adjacent –OH groups.

b) Complete the following conversions. Give the mechanism in each step. (Any Three) **[6]**

i) 

ii) 

P.T.O.

iii) Write the complete synthesis of R-Epichlorohydrin from D-manitol.

iv) D - manitol $\xrightarrow[H\oplus]{\text{Acetone}}$? $\xrightarrow[\text{Benzene}]{Pb(OAc)_4}$?

c) Write $^1C_4$ conformation of D-Glucose. **[1]**

Q2) Answer the following (Any Five) **[10]**

a) What is chiral drugs? What drugs in an daily life are chiral?

b) Give the structure of R- and S- Ibuprofen. State which isomer of Ibuprofen is eutomer.

c) Give the synthesis of Ephidrine.

d) Explain the pharmacological activities of (±) metoprolol.

e) Give the site effects and structure of detropropoxyphene.

f) Give the stereospecific synthesis of Griseofulvin.

Q3) Solve the following (Any two) **[5]**

a) What are the products of

$HOCH_2(CHOH)_4CHO$ & $HOCH_2(CHOH)_3 - \overset{O}{\overset{\|}{C}} - CH_2OH$ with

i) $Br_2.H_2O$ ii) HIO_4

b) Write short note on mutarotation.

c) How will you convert Aldopentose to Aldohexose - give reactions.

SECTION - II

Q4) Solve Any -5 **[10]**

a) Discuss the mechanism of action of tetracyclins.

b) Explain SAR of cephalosporins.

c) What are macrolides?

d) What do you mean by selective toxicity? Explain with an example.

e) How do peptide antibiotics disrupt cell membrane functions.

f) Explain the term broad spectrum antibiotics with an example.

Q5) Solve any -2 **[10]**

a) i) Explain the term QSAR.

ii) Draw the structure of chlorimphenicol and discuss its SAR.

b) i) Discuss use of sulphonamides as antibacterial agents.

ii) Give classification of antibiotics on the basis of their mode of action with an example.

c) i) Describe in short Antiviral Agents.

ii) Define and explain the term pharmacodynamics.

Q6) Solve Any -1 **[5]**

a) Draw the structure of penicillin-g. Why it is unstable to acids? How were acid stable penicillins were developed? Discuss the mode of action of penicillins.

b) Define:- Pharmacokinetics. Discuss the 'ADME' of Drug transport mechanism. How pharmacokinetics helps in Drug designing.

x x x

Total No. of Questions :6]

SEAT No. :

P2023

[Total No. of Pages :4

[4923]-413
M.Sc. - II
ORGANIC CHEMISTRY
CHO -453: Designing Organic Synthesis and Asymmetric Synthesis
(2013 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

SECTION - I

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

a) Enamine approach is preferred over the conventional method for effecting the monoalkylation of cyclic ketones. Justify.

b) Explain the role of 1,3-propane dithiol in umpolung of reactivity.

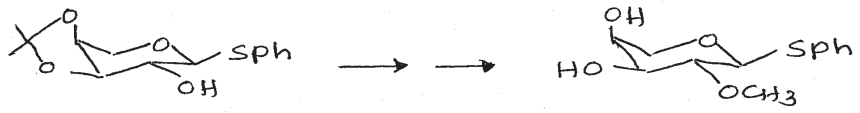
c) Give the synthetic equivalents to the following synthons.

d) Explain the benzylidine protection for 1,3 diol with a suitable example.

e) Why convergent method is more useful than the linear method for the synthesis of a target molecule?

Q2) a) How will you effect the following conversions? (any two) **[5]**

i)

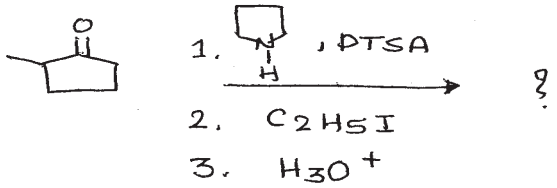


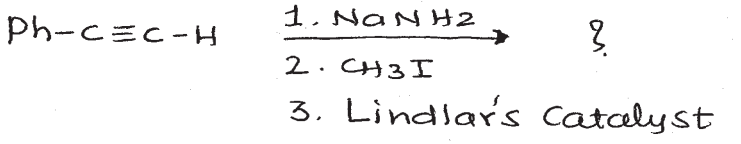
ii)

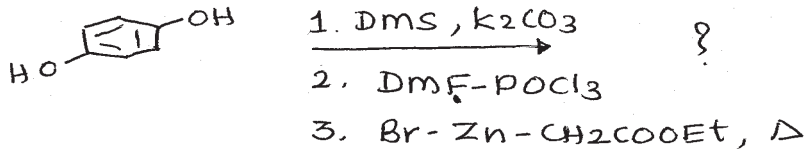
iii)

P.T.O.

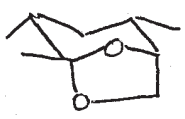
b) Predict the products in any two of the following. **[5]**

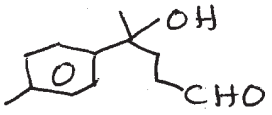
i) 

ii) 

iii) 

Q3) a) Using retrosynthetic analysis, suggest suitable method to synthesise <u>any one</u> of the following. **[3]**

i) 

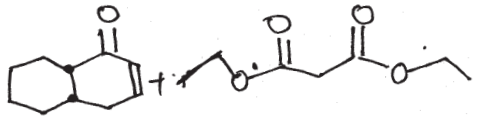
ii) 

b) Arrange the given reagents in proper order to accomplish the following conversion. Write the structures of the intermediates. **[2]**

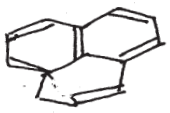
ACOH, H_2O; RCHO; MeOH, TsOH; KOtBu

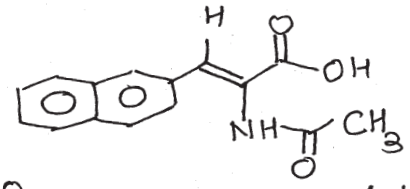
SECTION - II

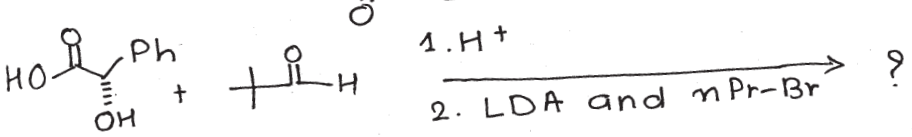
Q4) Complete the following conversions and suggest the correct stereochemistry of the product/s with the help of mechanism. (All sub-questions are compulsory). **[10]**

a) 

b) 

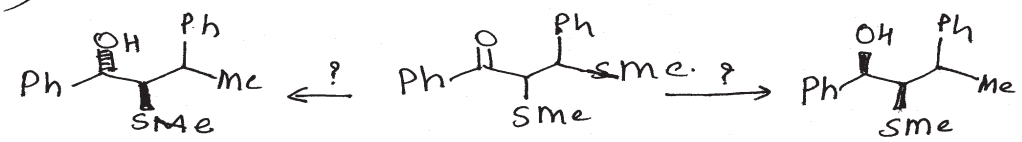
c) 

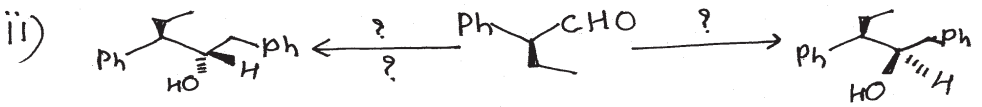
d) 

e) 

Q5) Answer any two of the followings. **[10]**

a) Justify the following observations with suitable reagents and stereochemical model.

i) 

ii) 

b) Define following terms with suitable examples.

i) Houk model

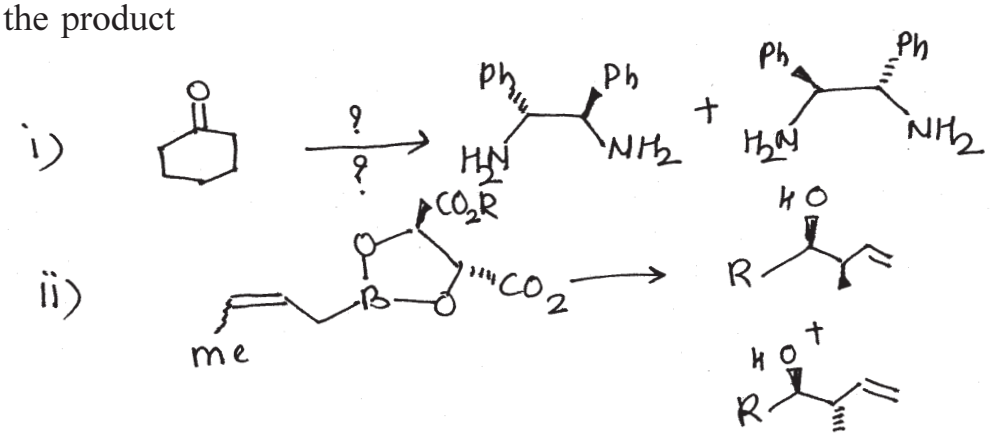
ii) Evan's cato

c) Comment on the following statements. Justify it with an appropriate example:

i) "Trans-2,5-disubstituted pyrrolidine moiety at the amine component has proved to be an excellent substrate in asymmetric alkylation."

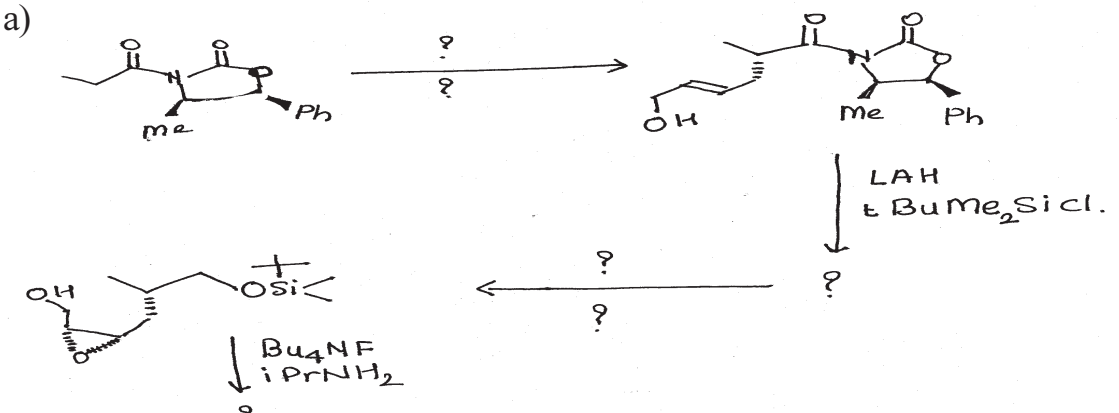
ii) 'α- silyl ketones have widely been used in aldol reactions to get high ee."

d) Complete the following conversions and comment on optical purity of the product

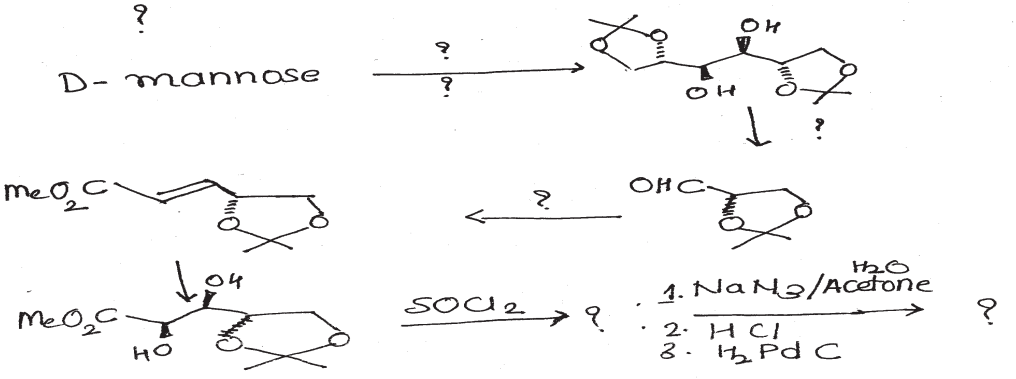


Q6) Complete the following multistep synthesis using appropriate reagents or intermediates. (Any one) **[5]**

a)



b)



X X X

Total No. of Questions :6]

SEAT No. :

P2024

[Total No. of Pages :3

[4923]-414
M.Sc. - II
ANALYTICAL CHEMISTRY
CHA -481: Analytical Toxicology and Food Analysis
(2013 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

SECTION - I

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

a) What is protective agents?

b) Give the principle of isolation and identification of amphetamine and methamphetamines Type B procedure.

c) Define the terms:

i) Opium ii) Coca derivatives

d) Give the principle of isolation and identification at caffeine Type-B procedure.

e) Explain "Depresemts".

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

a) How heroin is isolated from urine sample? Give detailed procedure for its adsorption and elution.

b) Explain the procedure type-A for isolation and identification of amphetamine.

c) Outline the procedure for determination of benzodiazapines.

d) State the principle and give the procedure 'B' for determination of barbiturates.

P.T.O.

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

a) Define the terms:-

i) Dutaible goods ii) Alcohol

iii) Opium poppy iv) Cannabis

b) A sample containing barbiturate was analyzed by gas chromatography method. It gaves following observations. Calculate the conc. of barbiturate in given sample.

i) Concentration of known barbiturate = 3.4µg/ml

ii) Peak area of drug in sample = 6.4 min

iii) Peak area of internal standard = 4.7 min

iv) Peak area of known drug sample = 3.4 min

v) Peak area of internal standard in reference barbiturate sol^n = 7.6 min.

SECTION - II

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

a) What are carbohydrates? Give their classification.

b) What is protein efficiency and net protein ratio?

c) Give the principle of Tanner method?

d) Define saponification value.

e) What are pectic substances?

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

a) Give the principle for estimation of protein. Describe Lowry's method in detail.

b) State the principle and outline the analytical method for estimation of free fatty acids.

c) How is benzoic acid estimated from food sample?

d) Outline the analytical method for estimation of carbohydrates by Nelson Somyogi method.

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

a) Calculate percentage of lactic acid in ll.00 ml sample of milk, if it was required 2.2 ml of 0.01 M NaOH solution.

b) A sample of oil Weighing 0.310 gm was treated with Wij's solution. After 30 minutes it was treated with 10% KI and the iodine liberated was titrated with 0.1 M thiosulphate solution and it required 8.7 ml of titrant. If blank titre value of Wij's solution was 25 ml, calculate iodine value of oil. (At.wt.of iodine = 126.9)

x x x

Total No. of Questions : 6]

SEAT No. :

P2025

[Total No. of Pages : 3

[4923] - 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) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table/Non - programmable calculator is allowed.***

SECTION - I

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

a) Explain the term electron shakeup and electron shakeoff.

b) Give the application of ESCA.

c) Draw the schematic diagram of X-ray tube.

d) Distinguish between flat crystal monochromator and curved crystal monochromator.

e) What are the limitation of human eyes? How it overcome by X-ray microscopy?

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

a) What is Bremsstrahlung? Draw and explain the typical X-ray absorption spectrum.

b) Draw the schematic diagram showing the essential components of ESCA. How the beam of electron is analysed with the help of magnetic field?

P.T.O.

c) What is TEM? Discuss the construction and working of TEM.

d) The time was recorded for the copper analyte and the Standard to yield a detector count of 7500 by X-ray fluorescence. The 100 ppm standard reached 7500 counts in 29.3 s and the analyte reached the count in 15.8 s. Determine the concentration of copper in the analyte.

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

a) Explain with schematic diagram the difference between the wavelength dispersive and Energy dispersive X-ray fluorescence.

b) The 1 ‘s’ electron of Na ion has binding energy of 1072.0 eV. Estimate the work function of electron spectrometer if incident radiation is the K_α line of magnesium and kinetic energy of measured electron is 176.7eV.

[Given : Plancks constant = 6.625×10^{-34}Js. λ for MgK_α = 1.89 $\mathring{A}$].

SECTION - II

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

a) What is luminescences? Enlist the different type of luminescences.

b) Define and explain luminescences efficiency.

c) Explain the term-E-type delayed fluorescence and p-type delayed fluorescence.

d) Enlist the various solvent used in NMR.

e) Why TMS is used as reference in NMR?

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

a) What is chemiluminescence? Explain the phenomenon of electrochemiluminescence.

b) Discuss the qualitative and quantitative analysis of NMR spectroscopy.

c) Draw labled diagram of a instrument used to measure photoluminescences and discuss its major components.

d) The ^{1}H NMR of a compound with empirical formula $C_5H_{10}O_2$ shows doublet at δ 1.2, singlet at δ 2.0, and multiplet at δ 5.0. The integration of each peak shows 6 : 3 : 1 ratio respectively. Identify the compound.

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

a) What is 2-D NMR? Explain in brief HETCOR and COSY.

b) The standard addition technique was used for the fluorometric assay of a Al^{3+} sample. From the data listed in the table, calculate the concentration of Al^{3+} in the sample.

Added Conc^{n} (mM) of Al^{3+}	Fluorescence Intensity
0	3.8
1.20	5.5
2.50	7.2
4.04	9.5
6.00	12.2
7.50	14.3

Total No. of Questions : 6]

SEAT No. :

P2026

[Total No. of Pages : 3

[4923] - 416
M.Sc. - II
ANALYTICAL CHEMISTRY
CHA - 491 : Analytical Methods for Analysis of Fertilizers, Detergents, Water and Polymer, Paint and Pigment
(2013 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

SECTION - I

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

a) Define titer test.

b) What is available phosphorus in mixed fertilizer?

c) Give general scheme for detergent analysis.

d) List standard test methods used for acidity and alkalinity.

e) Give a test used for dissolved oxygen in water analysis.

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

a) Describe a method for estimation of total Nitrogen from mixed fertilizer by Kjeldahl method.

b) Write a short note on bio-degradability of detergents.

c) Give a method for determination of residual chlorine and chlorine demand in water.

P.T.O.

d) 0.50g detergent containing phosphate was ignited to red hot to destroy organic matter. The residue was then dissolved in hot HCl which gave H_3PO_4, the phosphate was precipitated as $MgNH_4PO_4.6H_2O$ by addition of Mg^{2+} ions followed by ammonia. After filtration, washing, drying and ignition weight of residue $Mg_2p_2O_7$ was 0.407g. Calculate percentage of phosphorus in given sample.

[Given : At.wt. P = 30.97, Mg = 24.31, O = 15.99].

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

a) Discuss aerobic treatment process for waste water.

b) Nitrogen containing fertilizer weighing 0.60 g was kjeldahlized and NH_3 produced was absorbed in 50ml N/10 H_2SO_4. The excess of acid required 15ml N/10 NaOH solution for neutralization. Find the percentage of Nitrogen in the fertilizer.

[Given at.wt. N = 14].

SECTION - II

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

a) Define pigment and binder.

b) Enlist the colligative properties used for molecular weight measurement.

c) How organic pigments are analysed?

d) Explain gloss and haze.

e) Define degree of polymerisation.

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

a) Write a short note on IGA used for thermal analysis of polymer.

b) Outline the general procedure for total lead and titanium dioxide from pigments.

c) Outline general procedure for estimation of white and tinted pigments with flow sheet.

d) Equal masses of polymer molecules with $M_1 = 5000$ and $M_2 = 50,000$ are mixed. Calculate $\overline{Mn}$ and $\overline{Mw}$ of given polymer sample.

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

a) Explain mechanical properties of polymer with respect to stress-strain curve.

b) A 0.700 g sample containing zinc is dissolved in 100 ml of acid. An aliquot of 25ml needed 12.9 ml of 0.0125 m EDTA. Calculate the percentage of zinc in sample.

[At.wt : Zn = 65.33].

Total No. of Questions : 9]

SEAT No. :

P2027

[Total No. of Pages : 3

[4923] - 417
M.Sc. - II
ANALYTICAL CHEMISTRY
CHA - 492 : Methods of Analysis and Applications
Pollution Monitoring and Control
Analysis of Body Fluid
Carbon Nanostructures and Applications of Nanotechnology
(2013 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

SECTION - I

Pollution Monitoring and Control

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

a) Give the principle of chemical precipitation method for removal of heavy metals from waste water.

b) Mention in brief classification of particulate matter on basis of size.

c) Explain hazards occuring due to SO_2.

d) Give the composition of effluents from nitro aromatic industries.

e) Which analytical techniques are used for determination of small amounts of metal pollutants.

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

a) Describe in detail any one method used for determination of chromium from waste water.

b) Give a detailed account of Gravity setting chambers.

c) Write a short note on estimation of urea and nitrogenous compounds in effluents.

d) Discuss safety measures for workers analyzing particulate matter.

P.T.O.

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

a) Write short note on "Photochemical Smog".

b) Explain sources of Arsenic Contamination.

SECTION - II

Analysis of Body Fluid

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

a) What are anticoagulants? Explain with examples.

b) Write a note on glucose tolerance test.

c) Discuss the chemistry of vitamin A with respect to structure, sources and biological functions.

d) What is ELISA? Give it's different types.

e) A patient has blood urea of 75mg% and urinary urea of 1200 mg%. Rate of urine flow is 3ml/min. Calculate the urea clearance and comment on results.

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

a) Explain Benedict's quantitative method for the estimation of glucose from urine.

b) How serum bilirubin is estimated by van der Bergh method?

c) Outline an analytical method for the estimation of thiamine.

d) Give instrumentation and practical applications of radioimmunoassay.

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

a) Explain how retinol and serum carotene is determined by TFA.

b) Discuss DAM method for the estimation of urea from serum.

SECTION - III

Carbon Nanostructure and Applications of Nanotechnology

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

a) Explain the structure of C_{60}.

b) Define photodynamic therapy in targeted drug administration.

c) Give the major routes of entry for engineered nanomaterials in the body.

d) Define Biosensors & give any two examples of it.

e) Define: i) Carbon Nanotubes.

ii) Nanowires.

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

a) Explain the role of bacteria in nanoparticle synthesis.

b) How carbon nanotubes are fabricated?

c) Write a short note on nanoparticle as drug carriers.

d) Explain diagnostic imaging techniques in detail.

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

a) Describe risk assessment of nanoparticles.

b) Explain the application of carbon nanotubes in

i) Fuel cells

ii) as chemical sensors.