[5530]-1001
M.Sc.
PHYSICAL CHEMISTRY
CHP-110: Fundamentals of Physical Chemistry-I
(2014 Pattern) (Semester - I) (New) (4-Credits)

Time : 3Hours]   *[Max. Marks : 50*
Instructions to the candidates:
   1)   *Answers to the two sections should be written in separate answer books.*
   2)   *All questions are compulsory.*
   3)   *Figures to the right side indicate full marks.*
   4)   *Use of logarithmic table/calculator is allowed.*
   5)   *Neat diagrams must be drawn wherever necessary.*

Physico - Chemical Constants

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

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

    a)   Write a note on exact and inexact differentials.

    b)   How clausius inequality can be used to show that ΔG is negative for a spontaneous process?

    c)   Show that dG=Vdp-sdT where G is Gibb's free energy.

    d)   Draw a neat graph showing molar specific heats (Cv,m) plotted aginst temperature as obtained by dwang-petit, Einstein and debye.

    e)   Define Raoult's law and Henrys's law with suitable diagram.

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

    a)   Explain Gibb's free energy change during mixing of ideal gases.

    b)   Discuss the effect of addition of non-volatile solute on the freezing point of liquids.

    c)   Show that 'diffraction of particles' lead to uncertainty principle.

    d)   Derive clausius - clapeyron equation.

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

    a)   Calculate $\Delta S, \Delta G$ and ΔH when 20g of methane is mixed with 30g of ethane considering both of them to be ideal at 30°c. comment on your answer.

    b)   When a particle of mass 9.1×10^{-28}g in one dimensional box goes from A=5 to n=2 level, it emits a photon of frequency of 6×10^{14} Hz. Find the length of the box.

SECTION-II

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

    a)   Define half life time. Explain its variation with initial concentration of reactant in second order reactions.

    b)   Explain the term 'quantum yield' with suitable example.

    c)   Give the expression for thermodynamic probability and meaning of each terms involved in it.

    d)   Define collision frequency. How it explains the rates of gas phase reactions.

    e)   Define relaxation time and enlist any two methods to study kinetics of fast reaction.

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

a)   What are inhibitors? Explain competitive and non-competitive inhibition in detail.

b)   Explain pre-equilibrium approximation show that $\dfrac{d[p]}{dt} = kp.[A]^2.[B]$ for the following reaction $A+B \rightleftharpoons I$; $I+B \xrightarrow{\;kp\;} p$ .where I is an intermediate.

c)   What is partition function? Derive the expression for rotational partition function.

d)   What are fast reactions? Distinguish between continuous and stopped flow method. With neat diagrams.

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

a)   The preexponential factor and activation energy for a unimolecular reaction are $4.0 \times 10^{13}\,s^{-1}$ and $272 kJ\, mole^{-1}$ respectively calculate the value of ΔH^*, ΔS^* and ΔG^* at 300k.

b)   Calculate the rate constant in $dm^3.mol^{-1}s^{-1}$. for the recombination of iodine atoms in hexane at 293K, when the viscosity of solvent is 0.236cP. $(1cP = 10^{-3}\, kg.m^{-1}.s^{-1})$.

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M.Sc. - I

INORGANIC CHEMISTRY

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

(Semester - I) (4 - Credit System)

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

Instructions to the candidates:

1) All questions are compulsory.

2) Answers to the two sections should be written in separate answer books.

3) Figures to the right indicate full marks.

4) Use of log tables/character tables and calculator is allowed.

SECTION - I

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

a) What is the point group symmetry of BF_3 and PCl_5?

b) When *n* is even, $S_n^n \equiv E$, prove this.

c) Define and explain σ_n and σ_v using suitable example.

d) Find out the product of $\sigma_{v2}.\sigma_{v3}$ *in* NH_3 molecule and also find whether the two operations are commutative or not?

e) Mention the symmetry elements order and classes of D_2h point group.

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

a) Explain all the symmetry elements present in $[Ni(CN)_4]^{2-}$ and assign the correct point group to it.

b) Define abelian group. Explain an abelian group with suitable example.

c) Derive the character table for C_2v point group and assign mulliken symbols to the irreducible representations.

d) Using matrix multiplication method, find

i) $C_2^z \times \sigma^{xy} = ?$

ii) $C_2^x \times C_2^y = ?$

iii) $\sigma^{xy} \times \sigma^{xy} = ?$

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

a) Find the reducible representation for ABs molecule with D_3h point group considering σ bond as a basis of representation and thus find out the orbitals offered for sigma bond formation in the molecule.

b) Find out the normalized SALC using projection operator of Eu irreducible representation which operates on σ_1 orbital of the $[B_rF_4]^{2-}$ ion.

D_4h	E	$2C_4$	C_2	$2C'_2$	$2C''_2$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$
Eu	2	0	-2	0	0	-2	0	2	0	0

SECTION-II

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

a) Explain the principle of isolation of alkali metals using crown ethers.

b) Give the synthesis of borazine.

c) What are saline hydrides? Give their properties.

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

e) What are interhalogens? Give different types of interhalogen compounds with examples.

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

a) What are Boron hydrides? Explain different types of Boron hydrides with suitable example.

b) What are Silicones? How they are prepared? Give important properties and uses of Silicones.

c) Write a note on molecular sieves.

d) What are oxyacids? Explain oxyacids of sulphur.

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

    a)   Explain structure and bonding in

        i)   Diborane

        ii)   SN compounds

    b)   Draw the structures of following :

        i) BrF_5 ii) $[B_6H_6]^{-2}$

        iii) Benzo 18-crown-6   iv) $Fe(Co)_3\ B_4H_8$

        v) SbH_3

Character table for D_3h :

D_3h	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$		
$A_1^{'}$	1	1	1	1	1	1		$x^2 + y^2, z^2$
$A_2^{'}$	1	1	−1	1	1	−1	Rz	
E'	2	−1	0	2	−1	0	(x, y)	$(x^2 − y^2, xy)$
$A_1^{''}$	1	1	1	−1	−1	−1		
$A_2^{''}$	1	1	−1	−1	−1	1	z	
E''	2	−1	0	−2	1	0	(Rx, Ry)	(xz, yz)

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M.Sc. - I

ORGANIC CHEMISTRY

CHO-150 : Basic Organic Chemistry

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

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 separate answer books.*

SECTION-I

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

   a)   Explain with suitable example resonance effect.

   b)   Define Huckel's rule.

   c)   Discuss in brief stereospecific reactions.

   d)   Explain enantiomeric relationship.

   e)   Annulenes are aromatic. Why?

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

   a)   Comment on the aromaticity of the following.
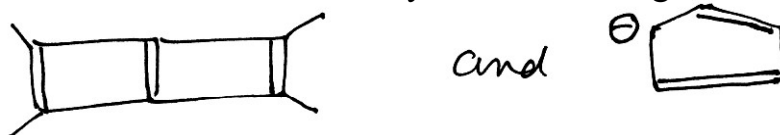
   b)   Explain structure and stability of carbocations.

   c)   Write short note on optical activity in spiranes.

   d)   Discuss structural effects on basicity of organic compounds.

   e)   Comment on the optical activity of the following with justification.
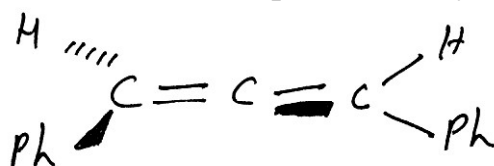
   f)   Assign Pro-R and Pro-S labels to HA and HB.
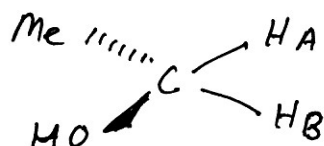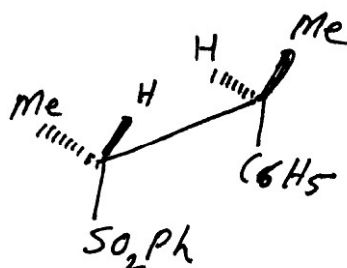
Q3) Attempt any five of the following: [10]

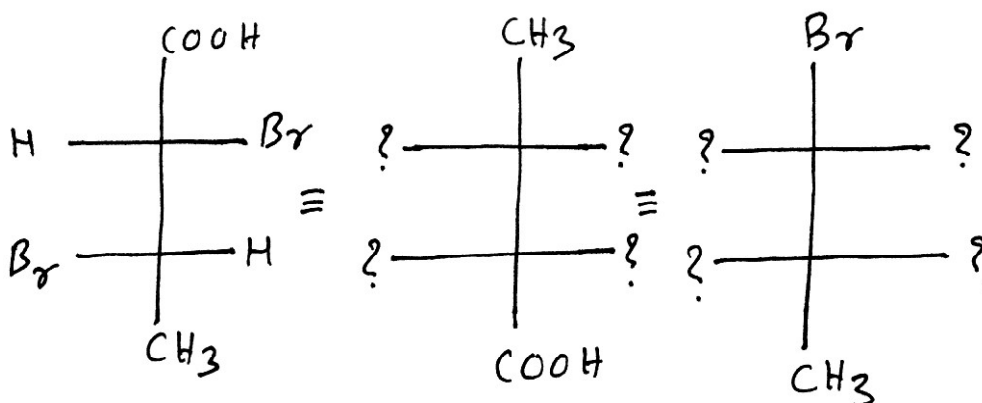a) What is the stereochemical relationship between the following compounds.

b) Salicyclic acid is a stronger acid as compared to m-hydroxybenzoic acid. Explain.

c) Assign E/Z designation to the following.

d) Assign R/S label to the chiral carbons and justify.

e) Write equivalent structures.

f) Write short note on Inductive effect affecting acidity of organic molecules.
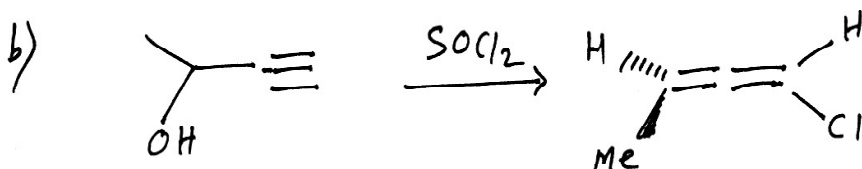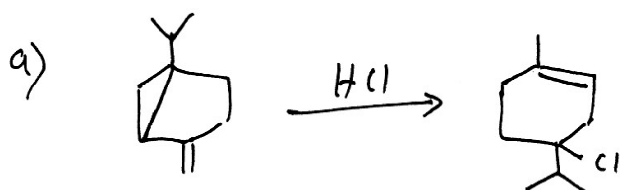
SECTION-II

Q4) Answer the following: [5]

    a) Explain stereochemical aspects of addition to c-c multiple bonds.

    b) Discuss reactivity in aromatic nucleophilic substitutions.

    c) What is EICB mechanism.

    d) Give suitable examples of ambident nucleophiles.
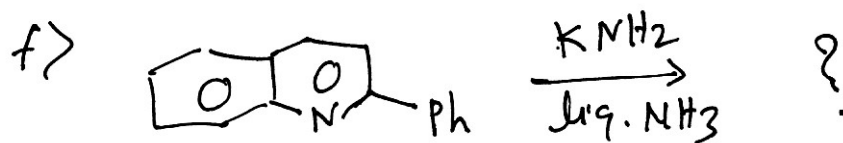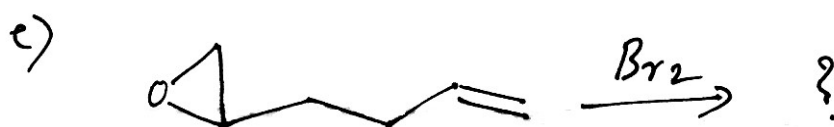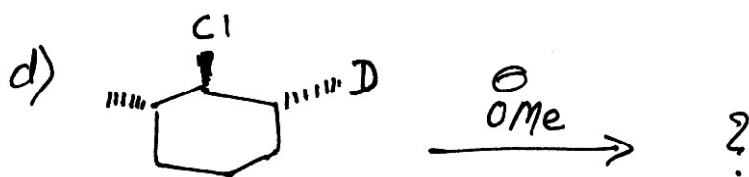
    e) Comments on Arenium ion mechanism.

Q5) Suggest the mechanism (any five): [10]
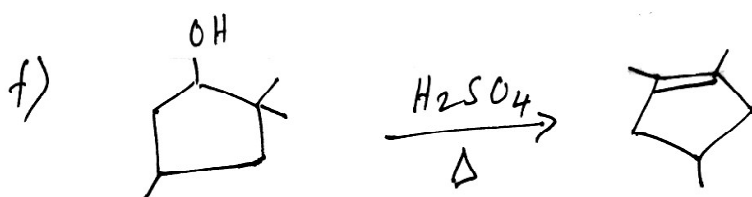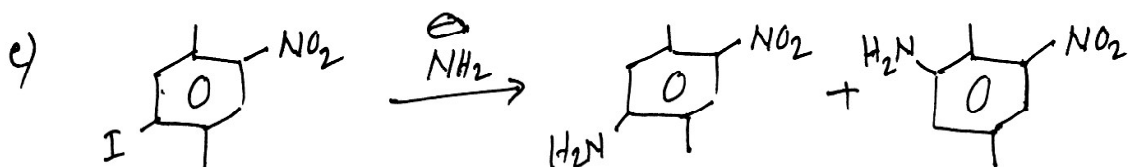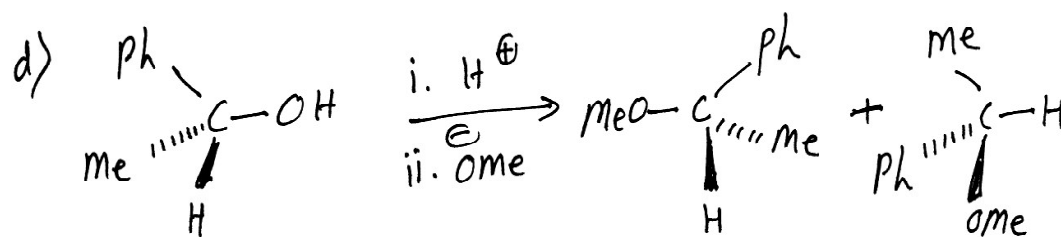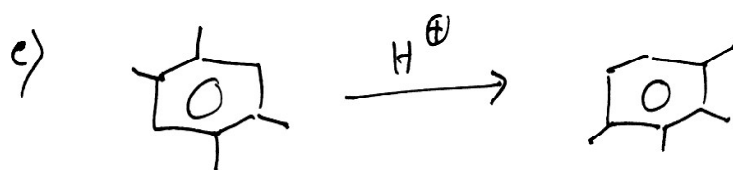
Q6) Predict the products (Any five): [10]

a)

$\underset{\text{NO}_2}{\overset{\oplus}{\longrightarrow}}$?

b)

$\underset{\text{alkali}}{\overset{DMS}{\longrightarrow}}$?

c)

 + C_6H_6 $\underset{\Delta}{\overset{AlCl_3}{\longrightarrow}}$?

d)

$\overset{\ominus}{OMe}$ $\longrightarrow$?

e)

$\overset{Br_2}{\longrightarrow}$?

f)

$\underset{liq.\,NH_3}{\overset{KNH_2}{\longrightarrow}}$?

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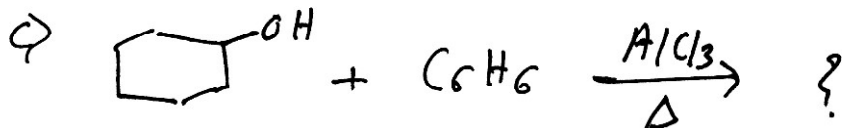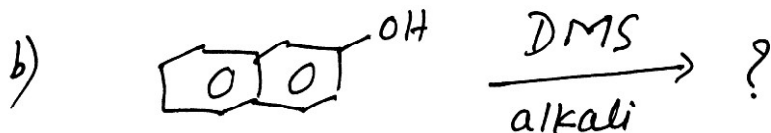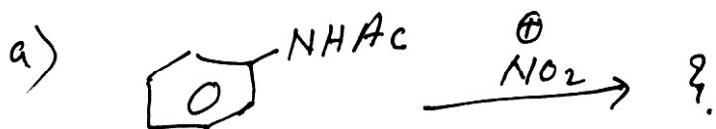
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M.Sc. - I

CHEMISTRY

Analytical Chemistry

CHA-190 Safety in Chemical Laboratory and Good Laboratory Practices

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

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

Instructions to the candidates:

 1) Answer to the two sections should be written in seperate answer books.

 2) All questions are compulsory

 3) Neat diagram must be drawn wherever necesarry

 4) Use of logarithimic table, non-progammable calculator is allowed.

SECTION-I

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

 a)   Define flammable and toxic chemicals.

 b)   What is function of respirator?

 c)   Give the first aid for contact of different chemicals on skin.

 d)   What is green chemistry approach?

 e)   What are different types of hazards in chemical laboratory?

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

 a)   Explain in brief assesment of physical hazards.

 b)   Write a short note on use of personal protective equipment

 c)   Give a brief account for assesing risk with acute toxicology.

 d)   Explain ten steps for creating effective safety and security in chemical laboratory.

Q3) Answer <u>any one</u> of the following [05]

    a) Explain the responsibilities of safety manager, students and workers.

    b) Give a brief account of inventory management.

SECTION-II

Q4) Answer the following [10]

    a) What are four fundamental principles of working with chemicals.

    b) Define fire and give its types.

    c) What do you mean by hazardous chemicals and biohazard material?

    d) What is mixed waste?

    e) Define

        i) Toxicants

        ii) Acid spills

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

    a) Explain the guidelines for storage of chemicals.

    b) Write a note on sop system overview

    c) Give the injuries and emergencies while working with compressed gas

    d) Explain the treatment for disposal of hazardous material

Q6) Answer <u>any one</u> of the following [05]

    a) Explain in brief "Fundamentals of GLP".

    b) Write a note on " General procedure for working with flammable and explosive chemicals".

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M.Sc.
PHYSICAL CHEMISTRY
CHP-110 : Fundamentals of Physical Chemistry - I
(2013 Pattern) (Semester - I) (Credit System) (5 Credits)

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

Instructions to the candidates:

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

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23}\, mol^{-1}$
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}\, erg\, K^{-1}\, molecule^{-1}$
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3.	Planck Constant	h	$= 6.626 \times 10^{-27}\, erg\, s$
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4.	Electronic Charge	e	$= 4.803 \times 10^{-10}\, esu$
			$= 1.602 \times 10^{-19}\, C$
5.	1 eV		$= 23.06\, k\, cal\, mol^{-1}$
			$= 1.602 \times 10^{-12}\, erg$
			$= 1.602 \times 10^{-19}\, J$
			$= 8065.5\, cm^{-1}$
6.	Gas Constant	R	$= 8.314 \times 10^{7}\, erg\, K^{-1}\, mol^{-1}$
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			$= 1.987\, cal\, K^{-1}\, mol^{-1}$
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	$= 9.11 \times 10^{-31}\, kg$

SECTION - I

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

    a)   State and explain the third law of thermodynamics.

    b)   Differentiate between exact and inexact differentials.

    c)   State Rayleigh - Jeans law and explain the terms involved.

    d)   Give the expression for Boltzman distribution law and give its significance.

    e)   Give any two statements of the second law of thermodynamics.

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

    a)   What are partial molar quantities? Describe a method to determine partial molar volume.

    b)   What is Bohr's correspondance principle? Explain it with reference to energy of a particle in one diamensional box.

    c)   Explain Fermi - Dirac statistics.

    d)   Derive Clausius - Clapeyron equation.

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

    a)   Energy of a particle in three diamensional box is $50\ h^2/8\ mL^2$, calculate the degeneracy of the energy level.

    b)   Determine the entropy of mixing when 6g of N_2 is added to 5g of O_2 at 20ºC spontaneously. Consider N_2 and O_2 are ideal gases.

        [Given : At. wts. N = 14, O = 16]

SECTION - II

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

    a)   Define order of reaction. Enlist any two methods to determine order of reaction.

    b)   Give postulates of activated complex theory.

    c)   Explain parallel reactions with suitable examples.

    d)   How does steric factor (p) is related to entropy of activation?

    e)   Draw double reciprocal plots for competitive and non-competitive enzyme in hibition.

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

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

b) For a given reaction, $A \rightarrow B \rightarrow C$, determine $\dfrac{d[B]}{dt}$.

c) Derive the expression for Michaells - Menten equation for an enzyme catalyzed reaction.

d) Define energy of activation. Explain its variation with temperature.

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

a) The rate constants for decomposition reaction at 350 and 700 K are 0.246 and 0.423 dm^3 $mol^{-1}S^{-1}$ respectively. Calculate the energy of activation for the reaction.

b) For the gaseous reaction, $A + B \rightarrow$ Products, the reactive cross section has the value 9.2×10^{-22} m^2. The collision cross section of A and B estimated from transport properties are 0.95 and 0.65 nm^2 respectively. Find the p-factor of the reaction.

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M.Sc. - I

INORGANIC CHEMISTRY

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

(2013 Pattern) (Semester - I) (5 Credits)

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

Instructions to the candidates:
1) *All questions are compulsory.*
2) *Answers to the two sections should be written in separate answer books.*
3) *Figures to the right side indicates full marks.*
4) *Use of log tables, character tables and calculator is allowed.*

SECTION - I

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

a) Define proper axis of rotation using suitable example.

b) Define centre of inversion using suitable example.

c) Symmetry elements of a molecule are E, C_3, C_3^{-1}, $3C_2$, $3\sigma_V$, i, S_6, S_6^{-1}. Find its point group.

d) List out the symmetry elements of point group 'oh'.

e) Find out planes of symmetry in H_2O molecule.

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

a) Predict the product of symmetry operations

   i) $C_3 \times \sigma_{V_1}$.   ii) $\sigma_{V_2} \times \sigma_{V_3}$.

b) Prepare a group multiplication table for H_2O_2 molecule.

c) Derive the character table for C_2V point group.

d) Prove that $S_2 = i$ using matrices.

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

a) Find the reducible representations for which σ bond forms a basis. Find out which orbitals offered for σ bonding in SO_3 molecule.

   (Given : Character table for D_3h point group)

b) Explain the symmetry operations & symmetry elements in NH_3 molecule.

Q4) Answer the following : [10]

   a) What is activation of nitrogen?

   b) Explain separation of alkali metals using crown ethers.

   c) Why fluorine shows most oxidizing behaviour? Explain the trend.

   d) Why solutions of alkali metals are good conductors?

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

   a) What are boron-nitrides? How are they synthesized?

   b) What are allotropes of carbon? Add a note on fullerenes.

   c) Write note on Inter halogen compounds.

   d) What are boranes? How are they classified?

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

   a) Explain the structure and bonding in Al_2Br_6 and B_2H_6.

   b) Draw the structure of :

   i) IF_5 ii) N_2O_4

   iii) IF_7 iv) SO_3

   v) H_2SO_4.

   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
A'_2	1	1	–1	1	1	–1
E'	2	–1	0	2	–1	0
A''_1	1	1	1	–1	–1	–1
A''_2	1	1	–1	–1	–1	1
E''	2	–1	0	–2	1	0

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M.Sc. - I

ORGANIC CHEMISTRY

CHO-150 : Organic Reaction Mechanism and Stereochemistry

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

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

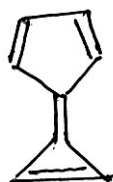*Instructions to the candidates:*

    1)   *All questions are compulsory.*

    2)   *Figures to the right indicate full marks.*

    3)   *Answers to the two sections should be written in separate answer books.*

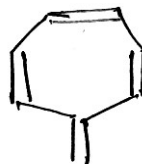## SECTION-I

Q1) Attempt any three of the following: **[9]**
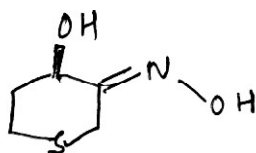
    a)   Write the different factors affecting acidity of organic compounds.

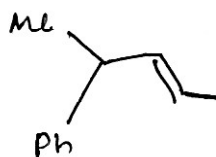   b)   Explain aromaticity in the following compounds.

    c)   Describe the reactivities of carbene and nitrene intermediates with suitable examples.

    d)   P-hydoxybenzoic acid is about 40 times weaker than salicylic acid. Explain.

    e)   Assign E/Z configurational labels to the following compounds.
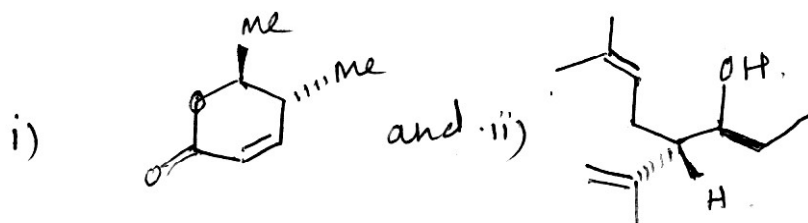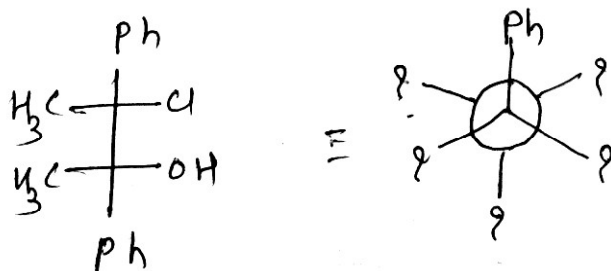
Q2) a) Write short notes on (any two): [4]

    i) Stereospecific reactions.

    ii) Non-classical carbonium ion

    iii) Syn elimination.

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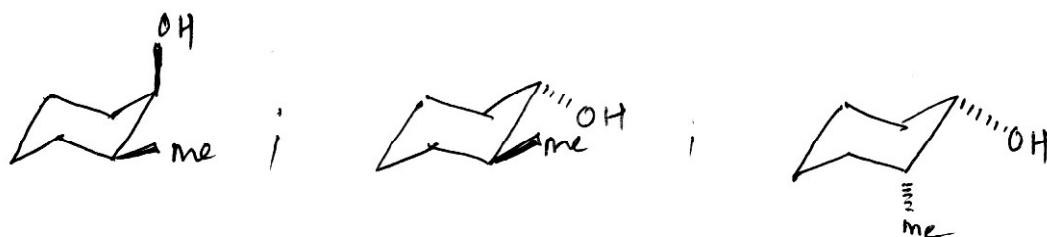

    i)   and ·ii)

Q3) Attempt any four of the following: [8]

a) Convert Fischer projection to Newmann projection for the following structure.
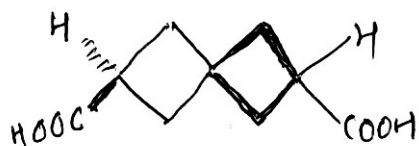

b) Give the stereochemical relationship between the following compounds.

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

    i)   ii)

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

e) Comment on the stability of the following.

SECTION-II

Q4) Attempt any three of the following: [9]

a) Cycloheptatrienyl cation is aromatic. Explain .

b) Discuss the evidences for SN^1 reaction.

c) What are Pyrolytic elimination reaction? Explain with suitable example.

d) What is SNAr mechanism? Explain with suitable example.

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

a)

b)

c)

d)

$\xrightarrow[\text{Al Br}_3]{\text{Br}_2}$

 + $Me_2C=CH_2$

e)

$\cdot \overset{\ominus}{O}Et$ →

Q6) a) Predict the products: [4]

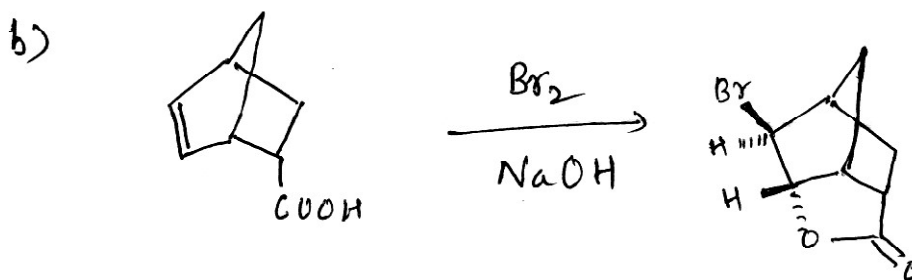i) $\xrightarrow[\text{b) NaBH}_4]{\text{a) Hg(OAc)}_2}$?

ii) $\xrightarrow{CH_2N_2}$?
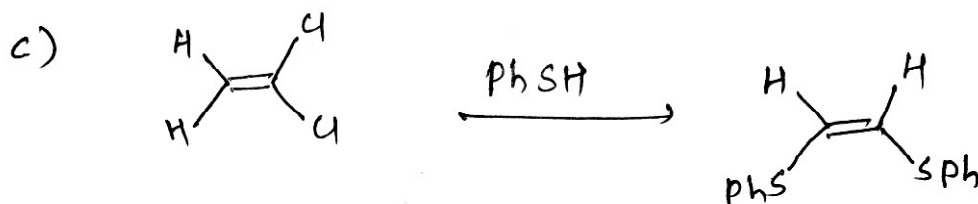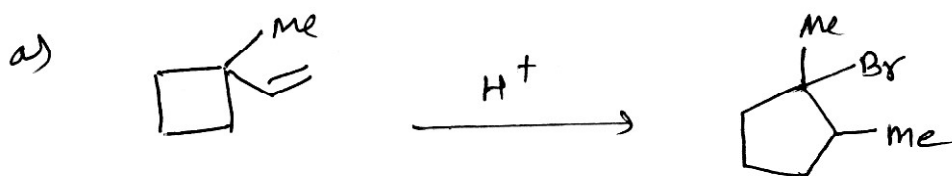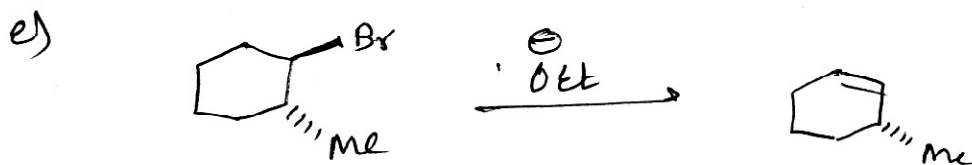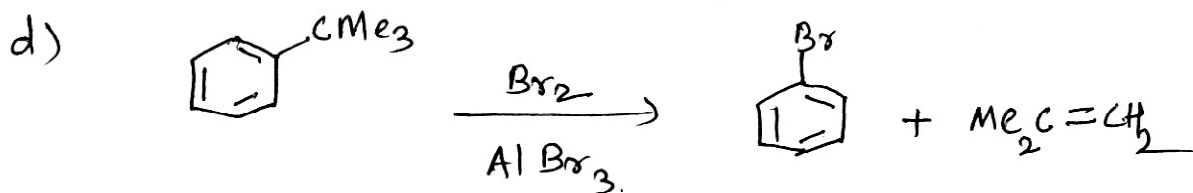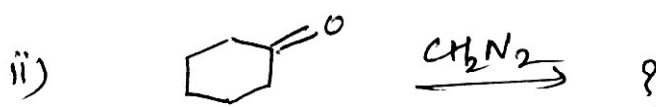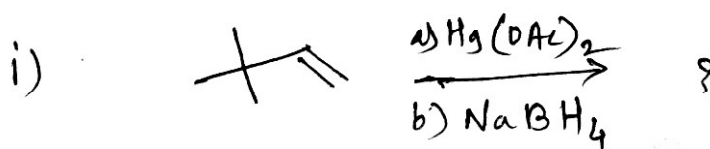
b) Attempt any two of the following: [4]

i) Discuss the SN^2 reaction in 4-t-butyl-cyclo-hexyl bromide.

ii) What is SET mechanism?

iii) Discuss the rate of solvolysis for following.

 and.

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[5530]-2003

M.Sc. - I

ORGANIC CHEMISTRY

CHO-250 : Synthetic Organic Chemistry and Spectroscopy

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

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

Instructions to the candidates:

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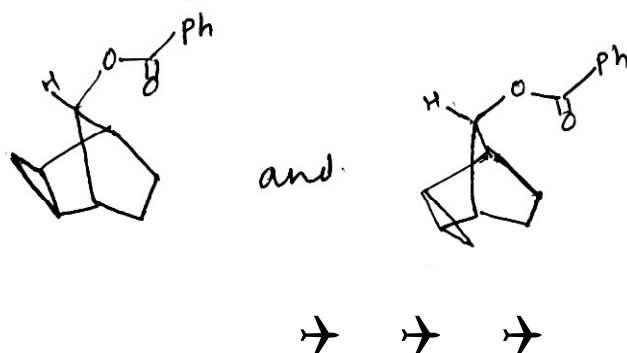2) *All questions are compulsory.*
3) *Figures to the right indicate full marks.*

SECTION - I

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

a) At high temperature, phenylacetate on reaction with $AlCl_3$ gives ortho-acyl phenol as a major product. Explain.

b) Reaction of ketone with phosphorous ylide gives alkene whereas with sulphur ylide, it gives epoxide. Explain.

c) α, β - unsaturated carbonyl compounds can be epoxidised using H_2O_2/NaOH as a reagent. Explain.

d) Explain catalytic hydrogenation with suitable example.

e) Give the applications of organozinc reagents in organic synthesis.

f) In Bayer Villiger oxidation t-Butyl group migrates in preference to methyl group. Explain.
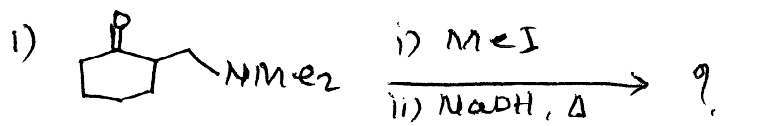
Q2) Explain any five of the following :   **[10]**
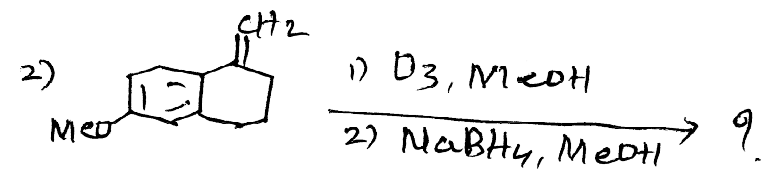
a) Birch reduction.

b) Use of $NaIO_4$ and HID_4.

c) Beckmann rearrangement.

d) Nitrogen ylides.

e) Use of organolithium compounds in organic synthesis.

f) Various methods of reduction of $C=O$ to CH_2.
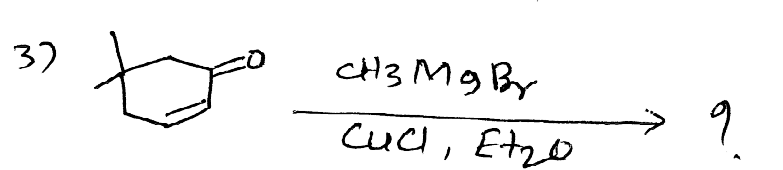
Q3) Predict the product suggest the mechanism any two :   **[5]**

1)

$$\text{i) } MeI$$
$$\xrightarrow{\text{ii) } NaOH, \Delta} \quad ?$$

2)

$$\text{i) } O_3, MeOH$$
$$\xrightarrow{\text{2) } NaBH_4, MeOH} \quad ?$$

3)

$$\xrightarrow[CuCl, Et_2O]{CH_3MgBr} \quad ?$$

4) $Ph-C\equiv C-CH_3$ $\xrightarrow[\text{ii) } AcOH]{\text{i) } 9\text{-}BBN} \quad ?$

SECTION - II

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

a) How will you follow the following sequence of reactions using IR Spectroscopy?
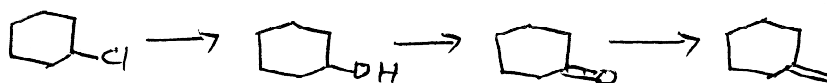
b) Phenol in alkaline medium shows red shift while in acidic medium shows blue shift. Explain.

c) Calculate λ_{max} for the following compound. Clearly show your calculations.

and
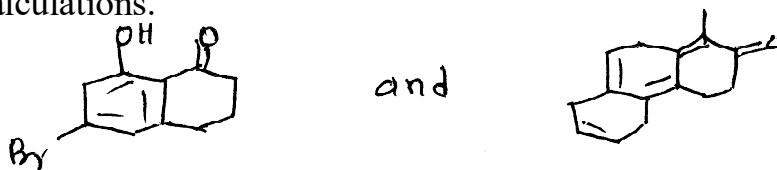
d) Distinguish the following compounds by IR.

and
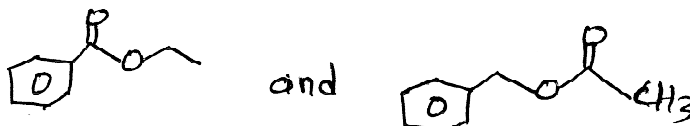
e) Distinguish the following compounds by UV.

and
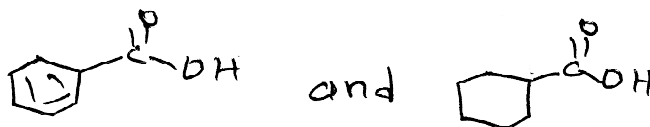
f) Explain the α-halo rule in IR with suitable example.

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

a) M.F. : $C_5H_{11}Br$

UV : Featureless above 210 nm.

IR : Nothing significant.

PMR : δ : 1.02 (d, J = 6 Hz, 24 mm)

1.65 (m, 4 mm), 1.85 (m, 8.3 mm), 3.4 (t, J = 6 Hz, 8.2 mm)

b) M.F. : $C_6H_{10}O$

IR : 1700, 1620 cm^{-1}

PMR : δ = 1.90, (S, 3H); 2.10 (S, 6H); 6.00 (S, 1H)

c) M.F. : $C_9H_{12}O$

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

PMR : δ = 1.15 (t, J = 7.5 Hz, 3H)

3.5 (g, J = 7.5 Hz, 2H)

4.4 (S, 2H)

7.2 (S, 5H)

d) M.F. : $C_7H_4O_3NCl$

UV : 255 (∈ = 1200)

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

PMR : δ = 8.03 (d, J = 8 Hz, 2H)

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

e) M.F. : $C_7H_{12}O_4$

IR : 1742 cm^{-1}

δ = PMR : 2.6 (S, 2H)

1.3 (t, J = 6.5 Hz, 6H)

4.16 (q, J = 66.5 Hz, 4H)

f) M.F. : $C_8H_{10}O$

UV : λ_{max} : 250, 260, 265 nm.

IR : 3360 (broad), 1610, 1550 cm^{-1}

PMR : δ = 1.6 (br, S, 3.8 mm),

2.8 (t, J = 7 Hz, 8 mm)

3.9 (t, J = 7 Hz, 7.9 mm)

7.2 (S, 20 mm)

Q6) Attempt any two of the following : [5]

a) Explain the factors affecting chemical shifts?
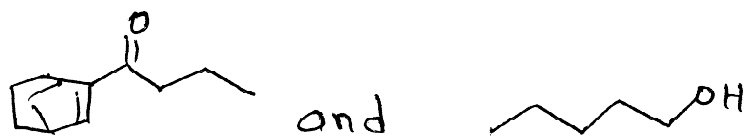
b) Give the genesis of the following compounds.

 and

c) Distinguish the following compounds by CMR.
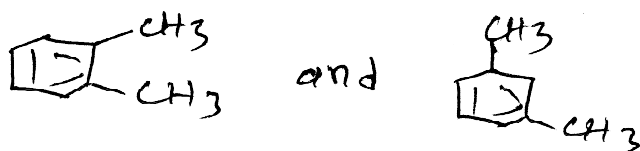
 and

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[5530] - 2004
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
(2014 Pattern) (Semester - II) (New 4 Credits)
New Course Based on Credit & Semester System

PART - A	:	Modern Separation Methods and Hyphenated Techniques (2.0 Credit / 25 Marks)
PART - B	:	Basic Biochemistry (4.0 Credit / 50 Marks)
PART - C	:	Concept of Analytical Chemistry (2.0 Credit / 25 Marks)
PART - D	:	Industrial Methods of Analysis (2.0 Credit / 25 Marks)
PART - E	:	Organometallic and Inorganic Reaction Mechanism (2.0 Credit / 25 Marks)
PART - F	:	Mathematics for Chemists (2.0 Credit /25 Marks)
PART - G	:	Pericyclic, Photochemistry and Free Radical Reactions (2.0 Credit / 25 Marks)

Time : 3 Hours]   *[Max. Marks : 50*
Instructions to the candidates:
1) *All questions of the respectively section/part are compulsory.*
2) *Figures to right hand side indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*
4) *Use of logarithmic table/non-programmable calculator is allowed.*
5) *Students should attempt any two parts from Part-A, C, D, E, F and G or full paper of Basic Biochemistry (Part-B).*
6) *Write the answers of two parts in separate answer books.*

PART - A
Modern Separation Methods and Hyphenated Techniques

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

a) State and explain the 'Nitrogen rate' in MS.

b) Give any two applications of HPLC.

c) Why compounds like aminoacids, lipids and high molecular weight polymers cannot be directly separated by GC?

P.T.O.

d) State and explain ion-pair chromatography.

e) Give the fragmentation pattern of

   i) m-anisidine

   ii) chloropropane

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

a) Enlist the mass analyzers and explain any one of it in detail.

b) Explain sample injection system in gas chromatography.

c) Write a short note on 'ICPMS'.

d) Explain the principle of separation mechanism in HPLC.

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

a) Give the principle of GC and explain its essential components.

b) For a given 200 cm column it required 4.80 min to emerge sample and 0.5 min for air bubble. The time required for the sample to pass the detector was 0.40 min. Calculate plate count N and height equivalent to theoretical plate (HETP).

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P2808

[5530]-2004

M.Sc. - I

DRUG CHEMISTRY

CHA - 290 : PART-B : Basic Biochemistry

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

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

Instructions to the candidates:

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

SECTION - I

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

     a)   What is Edman's reagent? How is it used in the study of proteins?

     b)   Discuss the mechanism and action of $Na^+ K^+$ pump.

     c)   Explain the following in brief:

             i) α-keratins

             ii)   protein denaturation

     d)   Name the acidic and basic aminoacids and give their structures.

     e)   What are homopolysaccharides? Explain structure and function of Glycogen.

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

     a)   What is glycolysis? Discuss reactions producing ATP in glycolytic pathway.

     b)   Give details of forces involved in stabilizing tertiary structure of protein.

     c)   Describe the structure and function of ribosomes and Endoplasmic reticulum.

Q3) Explain the following terms (any five): **[5]**
   a) Non essential aminoacids.
   b) pI and pKa.
   c) Glycogenesis.
   d) Aminoacid therapy.
   e) Peptide bond.
   f) Sugar acids.
   g) Mitochondria.

SECTION-II

Q4) Answer any four of the following: **[12]**
   a) Describe in detail different forms of DNA.
   b) Explain the flow of genetic information.
   c) What is competitive inhibition? Discuss with suitable example.
   d) What are enzymes? Discuss their general properties.
   e) Discuss the structure and function of Vitamin B_{12}.

Q5) Attempt any two of the following: **[8]**
   a) What is DNA Repair? Describe U.V. repair system in E.coli.
   b) Give an account of characteristics of Genetic Code. Add a note on Wobble hypothesis.
   c) Explain elongation and termination stage of transcription process.

Q6) Explain the following terms (any five): **[5]**
   a) Initiation codon.
   b) Pellagra.
   c) K_m.
   d) Enzyme immobilization.
   e) DNA polymerases.
   f) Introns.
   g) Gene.

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[5530]-2004
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
(2014 Pattern) (Semester-II)

PART - C
Concept of Analytical Chemistry

Q1) Answer the following: **[10]**
    a)   What is gross sample?
    b)   How laboratory samples are prepared?
    c)   What is student T-test?
    d)   Explain the term precision with suitable example.
    e)   What is separation by precipitation?

Q2) Attempt any two of the following: **[10]**
    a)   Describe the determinate or systematic error with suitable example.
    b)   What is the interpretation of least squares results?
    c)   Give the relationship between migration rate and distribution constant.
    d)   Write note on automated sample handling.

Q3) Attempt any one of the following: **[5]**
    a)   Explain the term propagation of error with suitable example.
    b)   A new gravimetric method is developed for determination of Iron (III) in which the iron is precipitated in crystalline form with an organoboron 'cage' compound. The accuracy of the method is checked by analyzing the iron in an ore sample and comparing with the results using the standard precipitation with ammonia and weighing of Fe_2O_3. The results, reported as %Fe for each analysis, were as follows.

Test Method	Reference method
20.10%	18.89%
20.50%	19.20%
18.65%	19.00%
19.25%	19.70%
19.40%	19.40%
19.99%	

        Is there a significant difference between the two methods?

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[5530]-2004
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
(2014 Pattern) (Semester-II) (2.0 Credit)
PART - D
Industrial Methods of Analysis

Q1) Answer the following: [10]

a) What is instability constant?

b) Describe preparation of 1000 ml of 100 ppm solution of sodium from A.R. grade sodium chloride. (Atomic weight : Na = 23.0, Cl = 35.5)

c) Differentiate betwen theoretical yield and practical yield.

d) Why NH_4OH is employed in presence of NH_4Cl in qualitative analysis of III-A group metal ions?

e) What is solubility product? Give its application in qualitative analysis.

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

a) How many moles and millimoles of benzoic acid are contained in 20.0 grams of A.R. grade benzoic acid?
   (Atomic weight : C = 12.0, H = 1.0, O = 16.0)

b) What is common ion effect? Explain any two applications of common ion effect in qualitative analysis.

c) Write a short note on 'automatic cheminal analyzer'?

d) Describe quality system in chemical laboratories.

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

a) The solubility product of lead bromide in its saturated aqueous solution is 8.0×10^{-5} at 25°C. Find its solubility in grams per litre at this temperature. (Atomic weight : Pb = 207.0, Br = 80.0).

b) What is buffer solution and buffer capacity? Explain the buffer action of acidic and basic buffer solutions with suitable examples.

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[5530]-2004

M.Sc. - I

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry

(2014 Pattern) (Semester-II)

PART - E

Organometallic and Inorganic Reaction Mechanism

Q1) Answer the following: [10]

    a)   i) $\left[PtCl_4\right]^{2-} \xrightarrow{+NH_3} A \xrightarrow{+Py} B$

           Trans effect : $Cl^- > Py > NH_3$

       ii) $\left[Pt\left(NH_3\right)_4\right]^{2+} \xrightarrow{+Cl^-} A \xrightarrow{+Py} B$
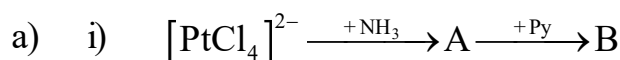
           Trans effect : $Cl^- > Py > NH_3$

    b)   Write a note on insertion reaction.

    c)   Write down the difference between S_N1 and S_N2 reactions.

    d)   Give the valence electron counts for the following complexes.

       i) $\left[Co_2\left(\mu CO\right)_2\left(CO\right)_6\right]$ ii) $\left[H\,Rh\left(CO\right)_5\right]$

    e)   Write down the difference between associative, dissociative and interchange mechanism.

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

    a)   What is conjugate base dissociation mechanism? Explain it with one example.

    b)   Explain in detail bonding in metal carbonyl complexes.

    c)   Describe briefly the Monsanto acetic acid process.

    d)   Explain in detail role of solvent in substitution reactions of square planar complexes.

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

    a)   Explain why $Cr(CO)_6$ shows higher CO stretching absorption than $V(CO)_6$?

    b)   Explain with an example inner sphere mechanism.

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[5530]-2004

M.Sc. - I

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry

(2014 Pattern) (Semester-II)

PART - F

Mathematics for Chemists

Q1) Answer the following: [10]

a) If $A = \begin{bmatrix} 2 & 3 \\ 4 & -5 \end{bmatrix}$ $B = \begin{bmatrix} 8 & 9 \\ 6 & 7 \end{bmatrix}$ then find:

   i) $2A + 3B$

   ii) $5A - 3B$

b) Define transpose of a matrix. Give suitable examples.

c) Define maxima and minima.

d) Give the Cramer's rule for linear equations.

e) Find the adjoint of the following matrix:

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

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

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

   i) $y = \dfrac{\log x}{x}$

   ii) $y = \dfrac{x^2 + x + 1}{x^2 - x + 1}$

b) Enlist rules for partial differentiation.

c) With suitable diagrams explain the following:

    i) Concave and Convex curves.

    ii) Node.

d) Evaluate the following:

    i) $\int \left(x^2 - 3\right)^2 dx$

    ii) $\int \tan^2 x \; dx$

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

a) Write a short note on method of least squares for curve fitting.

b) What are the rules for tracing a curve of Cartesian form of equations.

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[5530]-2004

M.Sc. - I

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry
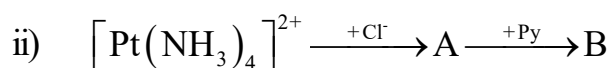
(2014 Pattern) (Semester-II)

PART - G

Pericyclic, Photochemistry and Free Radical Reactions

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

    a) With the help of FM0, show that (2 + 2) cyclo-addition reaction of two ethylenes will be thermally or photochemically allowed.

    b) Explain the decomposition of diacyl peroxides.

    c) Discuss the mechanism of Lumiketone rearrangement reaction.

    d) Write a short note on photodimerisation of α, β - unsaturated ketones.

Q2) a) Predict the product/s and Explain (any two): [4]

    i)

    ii)

    iii) $CCl_4 + CH_2N_2$ (excess) $\xrightarrow{h\nu}$
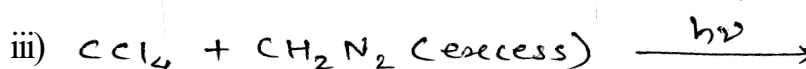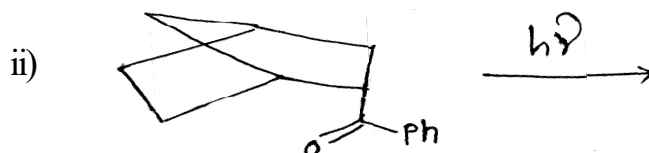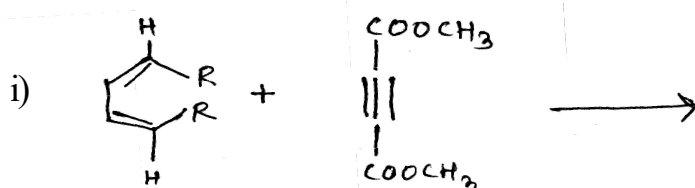
b) Explain any two of the following: **[4]**

   i)   When 2, 4 - dinitro tritiobenzene is arylated with benzoyl peroxide, two products are formed in equal quantities.

   ii) Cis - 3, 4 dimethylcyclobutene on heating gives (2Z, 4E) - 2, 4 hexadine.

   iii) Cyclobutanone undergoes three types of photo reaction.

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

i)

ii)

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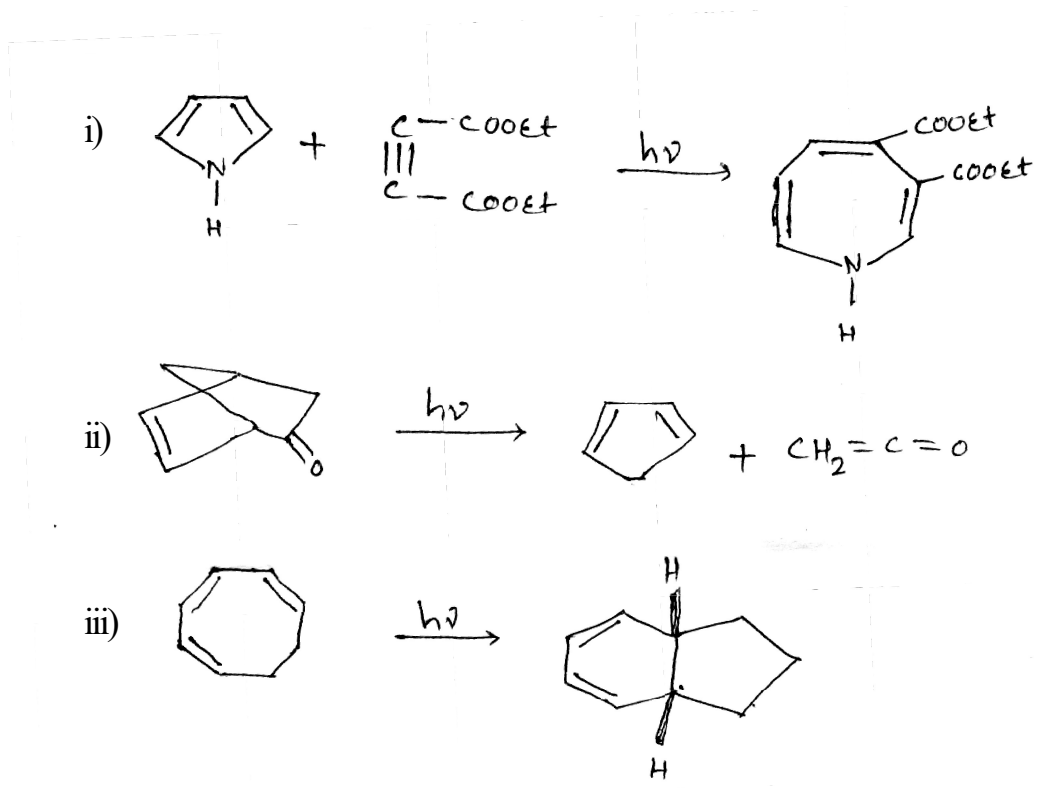
b) Write a short note on any two of the following: **[4]**

   i)   The fate of excited molecule.

   ii) Claisen rearrangement.

   iii) 1, 3 photo addition of benzene.

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[5530]-201

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

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

Instructions to the candidates:

1) *Answers to the two sections should be written in separate answer books.*
2) *All questions are compulsory.*
3) *Figures to the right side indicates 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	$= 8.314 \times 10^{7} \, erg \, K^{-1} \, mol^{-1}$
			$= 8.314 \, J \, K^{-1} \, mol^{-1}$
			$= 1.987 \, cal \, K^{-1} \, mol^{-1}$
7.	Faraday Constant	F	$= 96487 \, C \, equiv^{-1}$
8.	Speed of light	c	$= 2.997 \times 10^{10} \, cm \, s^{-1}$
			$= 2.997 \times 10^{8} \, m \, s^{-1}$
9.	1 cal		$= 4.184 \times 10^{7} \, erg$
			$= 4.184 \, J$
10.	1 amu		$= 1.673 \times 10^{-27} \, kg$
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24} \, J \, T^{-1}$
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27} \, J \, T^{-1}$
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31} \, kg$

P.T.O.

Q1) Attempt the following : [10]

    a)   Enlist the factors governing the intensity of spectral lines.

    b)   Define :

        i)   Hot bands.

        ii)   Fermi resonance.

    c)   Explain the principle of ESR.

    d)   State the rule of mutual exclusion.

    e)   Classify the following molecules on the basis of moment of inertia, CH_3F, C_2H_2, OSO_4, $CH_2 = CHCl$.

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

    a)   Discuss the pure rotational Raman spectra of Linear molecules.

    b)   What do you mean by non-rigid rotator? Discuss its spectrum.

    c)   Write a note on energy of a vibrating diatomic molecule. Give the expressions of oscillation frequency and vibrational energies in cm^{-1}. Define zero point energy.

    d)   State Franck-Condon principle and explain the intensity of vibrational electronic spectra.

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

    a)   The first rotational line of $^{12}C\ ^{16}O$ is observed at $3.84235\ cm^{-1}$, and that of $^{13}C\ ^{16}O$ is observed at $3.6737\ cm^{-1}$. Calculate the exact atomic weight of ^{13}C assuming that of oxygen to be 15.9949.

    b)   Calculate the population of first excited level of the ground state has 1000 molecules at 298K. Given $\Delta E = 4.005 \times 10^{-23}$ J molecule^{-1}.

SECTION - II

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

    a)   What is dead time of G.M. counter?

    b)   Sketch the plane (111) in simple cubic cell.

    c)   State Fick's laws of diffusion.

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

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

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

    a)   What is radiotracer technique? How it is used to determine surface area of precipitate?

    b)   Explain the Huckel theory of Cyclobutadiene.

    c)   Derive Bragg's equation for the interplaner distance in a crystal face. How is it used for the determination of a crystal structure?

    d)   Discuss zone diffusion technique to calculate diffusion coefficient.

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

    a)   The element chromium exists as body centered cubic lattice. The unit cell edge is 2.88 $\overset{\circ}{A}$. The density of chromium is 7.2 gm cm^{-3}. How many atoms does 52 gram of chromium contain?

    b)   The half life period of ^{226}Ra is 1600 years. How many gram of it will be left undisintigrated from 1.0 gram of the isotope after 4750 years?

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[5530]-203

M.Sc. - I

ORGANIC CHEMISTRY

CHO - 250 : Synthetic Organic Chemistry & Spectroscopy

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

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

Instructions to the candidates:

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

SECTION - I

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

a) Benzaldehyde oxime on reaction with pcl_5 gives benzonitrile as a major product.

b) How does the isotope labelling technique helps in deducing the reaction mechanism of Favoraskii rearrangement.

c) On reaction with $\alpha-\beta$ unsaturated carbonyl compound, dimethyl sulphonium methylide yields an epoxide, whereas dimethyl sulphoxonium methylide gives cyclopropane formation.

d) CIS-2 butene on reaction with OSO_4 gives meso compound.

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

a) Comment on migratory aptitude of p-chlorophenyl, phenyl and p-anisyl group in pinacol-pinacolone rearrangement.

b) Give the applications of organo copper compounds.

c) Write a note on Homogeneous Hydrogenation.

d) Regioselectivity and stereochemistry in hydroboration reaction.

e) Selective reduction of triple bond into cis&trans olefins.

P.T.O.

Q3) a) Predict the product. (any two) **[4]**

i) i) ⌇∿MgBr/THF
ii) $H_3O^{\oplus}$
iii) 220°C ?.

ii) NH_2-NH_2 , H_2O
$\underset{\substack{CH_2-OH \\ CH_2-OH}}{\longrightarrow}$, KOH ?.

iii) OHC⌇∿COOEt i) Br-CH_2COOEt/Zn
ii) MnO_2 ?.

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

i) i) TsCl, Py
ii) KO^tBu
^tBuOH →

ii) SeO_2/H_2O_2
^tBuOH →

iii) i) HNO_2
ii) $H_3O^{\oplus}$ →
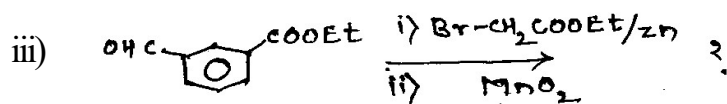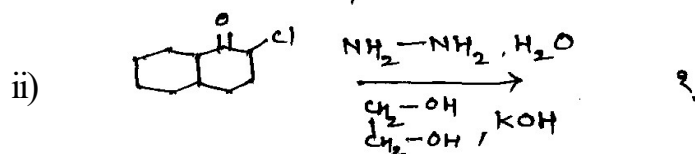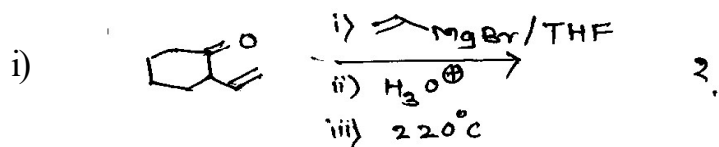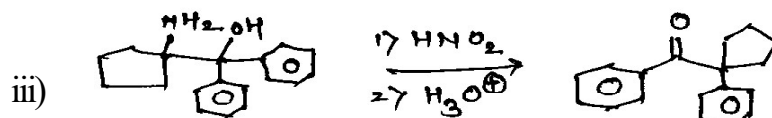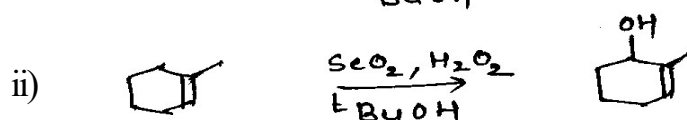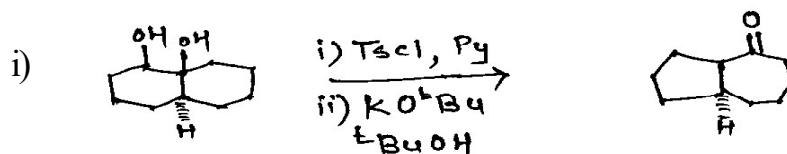
SECTION - II

Q4) Attempt the following. (any four) **[8]**

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

b) How will you monitor the following reaction sequence by I.R., suggest the reagents.
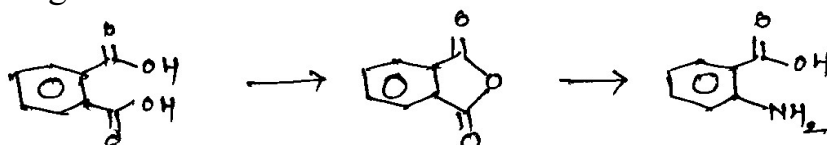
c) Distinguish the following compounds by ^{1}H-NMR.

d) Substitution of nitro group in acetophenone shifts the $-\overset{||}{\underset{O}{C}}-$ stretching frequency from about 1685 cm^{-1} to 1695 cm^{-1} explain.

e) Arrange the following compounds according to increasing carbonyl stretching frequency.
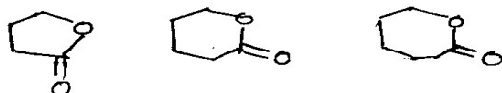
Q5) Answer any four of the following. **[8]**

a) The U.V. spectrum of acetone shows a absorption maxima at 189nm and 279nm. What type of transitions are responsible for each of these bands.

b) Explain molecular ion and base peak with suitable example.

c) Explain effect of solvents on IR stretching frequency.

d) Assign the chemical shifts for the following

CMR : δ 17

δ 33

δ 58

δ 172

e) Give the genesis of the following compound.

  m/z : 43, 58
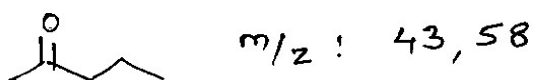
Q6) Deduce the structure of any three of the following compounds using spectral data and justify your answer. **[9]**

a) MF : $C_8 H_8 O_2$

IR : 1685, 1600, 1170 cm^{-1}

PMR : 3.77, (s), 30mm

6.90, (d), J = 8.5Hz, 20mm

7.75 (d) J = 8.5 5Hz, 20mm

9.78, (s) 10mm

b) MF : $C_7 H_{12} O_4$

IR : 1742 cm^{-1}

PMR : 2.6 (s) 2H

1.3 (t) 6H, J = 6.5Hz

4.16 (q) 4H, J = 6.5Hz

c) MF : $C_5 H_{12} O$

IR : 3600 cm^{-1}

PMR : 0.8 (t), 3H, J = 7.5Hz

1.1 (s), 64

1.4 (q), 24, J = 7.5Hz

2.4 (bs), 1H

d) MF : $C_3 H_6 O$

IR : No significant peak above 1100 cm^{-1}

PMR : 1.32 (3H, d, J = 6Hz)

IR : 2.42 (1H, dd, J = 3.5Hz & 2.5Hz)

2.72 (1H, dd, J = 3.5Hz & 3Hz)

2.98 (1H, ddq, J = 2.5Hz & 6Hz)

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[5530] - 204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
(2013 Pattern) (Semester - II) (Old 5 Credits)

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

PART - A

Modern Separation Methods and Hyphenated Techniques

Q1) Answer the following.   [10]
   a) Give the principle of mass spectrometry.
   b) Differentiate between partition and adsorption chromatography.
   c) State the different types of colums used in gas chromatography.
   d) Give any two applications of size enclusion chromatography.
   e) Define the terms -
      i) Retention time   ii) Dead time

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

a) Explain the different types of ionization in mass spectrometry.

b) Give the principle and applications of ion exchange chromatography.

c) With the help of neat labelled diagrams explain the different types of pumps and sample injection system used in HPLC.

d) Explain the working of a Gas chromatograph with the help of a neat labelled diagram.

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

a) Substances A and B have retention times of 16:40 and 17:63 min respectively on a 30.0 cm long column. An unretained species passes through the column in 1.30min. The peak widths at base for A and B are 1.11 and 1.21 min respectively.

Calculate:-

1) Column Resolution.

2) Average number of plates in the column.

3) Plate height.

b) Enlist the detectors used in HPLC and explain any one of them in detail.

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M.Sc. - I

CHEMISTRY

CH-290 (B) : Basic Biochemistry

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

PART - B

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

Instructions to the candidates:

   1) *All questions are compulsory.*

   2) *Answer to both the sections should be solved in separate answer sheets.*

   3) *Figures to right side indicate full marks.*

SECTION - I

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

   a)   Differentiate between prokaryotic cell and eukaryotic cell.

   b)   Elaborate on essential and non essential amino acids.

   c)   Give one example of tertiary protein, quaternary protein and globular protein.

   d)   How will you explain active and passive transport?

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

   a)   Give the classification of lipids with example.

   b)   Explain the structure and metabolism of chitin and starch.

   c)   What is the general mechanism of transport of drugs across cell membrane?

Q2) Write short notes on any four of the following: **[8]**

   a)   Structure and function of plasma membrane.

   b)   Mitochondria as a power house.

   c) Na^+ - K^+ pump.

   d)   Titration curve of amino acid.

   e)   Peptide bond formation.

   f)   Glycolytic pathway.

SECTION - II

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

    a)   Describe the major difference between A, B and Z form of DNA.

    b)   What is enzyme inhibition? Discuss irreversible inhibition.

    c)   Give the structure of fat soluble vitamins.

    d)   Elaborate on the role of nutrients in our daily life.

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

    a)   Describe translation process in eukaryotes.

    b)   Derive Michaelis Menten equation.

    c)   What are co-enzymes? Name the co-enzymes derived from B complex vitamins. Discuss their biological role.

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

    a)   Nutrition disorders (any two).

    b)   Gene theraphy

    c)   Function of Vitamin K

    d)   Enzymes as a therapeutic agent.

    e)   Introns

    f)   Nucleotides and nucleosides.

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[5530]-204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA-290 : General Chemistry
(2013 Pattern) (Semester - II)

PART - C

Concept of Analytical Chemistry

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

    a)   Define sampling. What is meant by a gross sample?

    b)   Give the answer of the following problem to the maximum number of significant figures $50.00 \times 27.8 \times 0.1167$.

    c)   Differentiate between accuracy and precision.

    d)   Explain the term salting out of proteins used in precipitation of proteins.

    e)   Give any two applications of ion exchange chromatography.

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

    a)   Explain the different types of errors in an analysis.

    b)   Define the following terms used in chromatography.

        1)   Elution

        2)   Mobile phase

        3)   Stationary phase

        4)   Retention time

        5)   Resolution

c) Derive the relation

$$[A]_i = \left[\frac{V_{aq}}{V_{arg} K + V_{aq}} \right]^{i^\circ} [A]_\circ \text{ used in separation by extraction.}$$

d) Explain the various steps involved in sampling operations.

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

a) The following replicate calcium determinations on a blood sample using atomic absorption spectrophotometry and a new colorimetric method were reported. Is there a significant difference in the precision of the two methods?

AAS	Colorimetric
mg/dL	mg/dL
	9.2
10.9	10.5
10.1	9.7
10.6	11.5
11.2	11.6
9.7	9.3
10.0	10.1
	11.2

Given : F tabulated   =   4.88

b) What are nanomaterials? Describe the synthesis of nano-materials by sol - gel method.

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[5530]-204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA-290 : General Chemistry
(2013 Pattern) (Semester - II)

PART - D
Industrial Methods of Analysis

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

    a)   Give any two types of quality standard for laboratory.

    b)   Define microsensor. Give it's two types.

    c)   Define the terms:

        i)   Normality

        ii) Molarity

    d)   Explain continuous flow method.

    e)   How will you prepare 10 ppm Na^+ from NaOH
        (Given : Molecular Wt. of NaOH = 40 gm)

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

    a)   Explain what is automatic chemical analyser. Explain any one automatic chemical analyser in detail.

    b)   Describe stability and instability constant with suitable examples.

    c)   What is a buffer? Explain the composition of different types of buffers with examples.

    d)   Explain the concept of total quality management in detail.

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

    a)   Write a note on continuous online process control.

    b) $CuSO_4.5H_2O$ is converted into $\left[Cu(NH_3)_4\right]SO_4$. Calculate the theoretical percentage of copper in the complex.
        [Given : At. wt. Cu = 63.5, N = 14, S = 32, O = 16, H = 1]

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[5530]-204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA-290 : General Chemistry
(2013 Pattern) (Semester - II)

PART - E

Organometallic and Inorganic Reaction Mechanism

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

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

        i) $Mn_2(CO)_{10}$

        ii) $(\eta^5 - C_5H_5)_2 Fe$
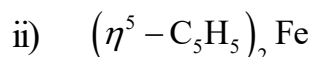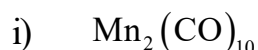
    b) Define and give one example of carbonyl insertion reaction.

    c) Give the rate law for interchange reaction mechanism.

    d) State $\left[Cr(CO)_6\right]$ complex obey's $18e^{\ominus}$ rule or not.

    e) Predict the type of reaction.

$$Fe(CO)_5 + P(CH_3)_3 \xrightarrow{\Delta} Fe(CO)_4\left[P(CH_3)_3\right] + CO$$
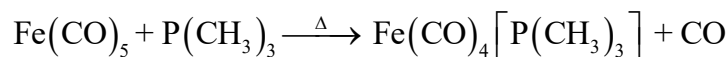
Q2) Attempt <u>any two</u> of the following: **[10]**

    a) Write a note on - Wacker process.

    b) Write a note on - outer sphere reactions.

    c) Explain the methods of synthesis of metal Carbonyls.

    d) Write a note on Kinetic Chelate effect.

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

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

    b) Draw the following structures.
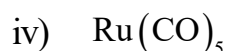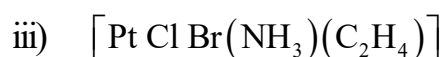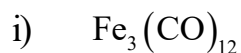
        i) $Fe_3(CO)_{12}$

        ii) $\left[Ti(CP)_2(CO)_2\right]$

        iii) $\left[Pt\,Cl\,Br(NH_3)(C_2H_4)\right]$

        iv) $Ru(CO)_5$

        v) Uranocene

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[5530]-204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA-290 : General Chemistry
(2013 Pattern) (Semester - II)

PART - F

Mathematics for Chemists

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

a) i) If $A = \begin{bmatrix} 2 & 3 & 4 \\ 1 & 8 & 6 \end{bmatrix}$ GA = ?

ii) Add the following matrices

$\begin{bmatrix} 1 & 2 \\ 4 & 8 \end{bmatrix}$ $\begin{bmatrix} 2 & 6 \\ 4 & 9 \end{bmatrix}$

b) Give the quotient rule for differentiation.

c) Define :

i) Conjugate point

ii) Cusp

d) Define :

i) Square matrix

ii) Diagonal matrix

e) If $y = \dfrac{x^4}{y}$, $\dfrac{dy}{dx} = ?$

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

    a)   Differentiate with respect to x

        i) $y = x^3\left(x^2 - 2\right)$

        ii) $y = \dfrac{3 + x}{3 - x}$

    b)   Give two applications of Taylor's theorem.

    c)   Find maximum and minimum values of $2x^3 - 15x^2 + 36x + 10$

    d)   Evaluate the following integrals:

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

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

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

    a)   Explain types of double points in curves.

    b)   If $A = \begin{bmatrix} 2 & 6 \\ 8 & 9 \end{bmatrix}$ $B = \begin{bmatrix} 1 & 1 \\ 2 & 3 \end{bmatrix}$

       find

        i)   6A

        ii)   2A + 3B

        iii) 2B

■   ■   ■

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[5530]-204
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA-290 : General Chemistry
(2013 Pattern) (Semester - II) (5 Credit)

PART - G

Pericyclic, Photochemistry and Free Radical Reactions

Q1) Answer <u>any three</u> of the following. **[9]**

a) Free radical addition reaction of HBr to Propylene.

b) Write a note on photo rearrangements of β, γ -unsaturated ketone.

c) What is Norrish type - I reaction? Explain with suitable example.

d) With the help of co-relation diagram, explain $\pi^4S + \pi^2S$ cyclo addition reactions are thermally allowed process.

Q2) a) Predict the product/s and explain the mechanism. **[4]**
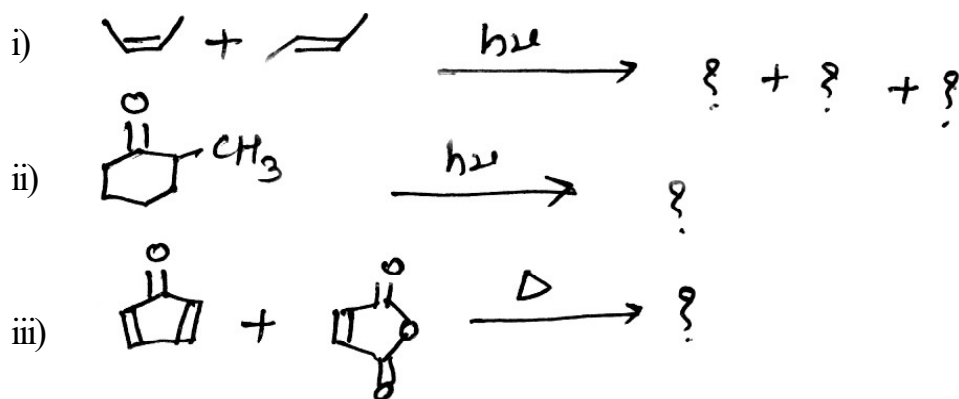
b) Answer any two of the following. **[4]**

i) Draw the corelation diagram for thermal cyclization of 1, 3, 5 hexatriene to 1, 3 cyclohexadiene.

ii) Explain Jablonski diagram.

iii) Draw the π molecular orbitals of $H_2e = CH – CH = CH_2$. Identify HOMO and LUMO.

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

i)

ii)

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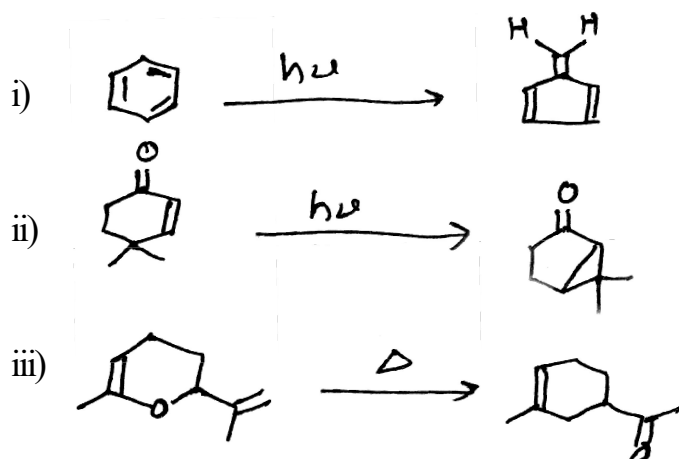
b) Attempt any two of the following. **[4]**

i) With the help of FMO approach, explain the stereochemistry of $[1,5]$ sigmatropic rearrangement under thermal condition.

ii) Formation and stability of free radical.

iii) Use of tributyl tin hydride in Free radical cyclization.

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[5530]-3002
M.Sc.
PHYSICAL CHEMISTRY
CHP-311 : Nuclear, Radiation and Photo-Chemistry
(2013 Pattern) (New) (Semester - III)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

SECTION-I

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

    a) Discuss the origin of delayed neutrons with an example.

    b) Explain the role of moderator & coolant in a reactor.

    c) Discuss the principle of RBS technique.

    d) What the role of 'Tl' in NaI(Tl) Scintillator?

    e) What is RBE & REM?

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

    a) Discuss the principle & working of breeder reactor.

    b) Explain the discontinuties in nuclear properties with reference to magic numbers, With typical example.

    c) Discuss the construction & working of surface barrier detector.

    d) Explain projectile acceleration & target preparation in PIXE.

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

    a) If the number of uranium atoms fissioning per two seconds are $6.24. \times 10^{17}$, find the power generated in MW,

        Given: Energy released per uraniumnuclear fission is 200 MeV.

    b) Calculate the thickness of Zn (Z=30&A=64) plate required to reduced the level of radiation from 1.2Gy/min to 1.2 MGy/hr.

        Given : $\mu_{e^-} = 0.211 b e^{\ominus}$,Density of Zn = 7.1 g/cm³.

SECTION-II

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

    a) State Grotthnuss-Draper's law.

    b) Define the terms oscillator strength and the natural radiative lifetime of the atom or molecule.

    c) Define the term 'Effective light of photochemical change'.

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

    e) Explain 'Population inversion'

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

   a)   Discuss nanosecond laser flash photolysis.

   b)   Discuss the Einstein's treatment of absorption and emission phenomena.

   c)   Derive stern - volmer equation for the kinetics of collisional quenching.

   d)   Define Actinometry. Name different types of chemical actinometers. Explain Uranyl oxalate actinometer.

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

   a)   Calculate the energy in calories per mole for radiation of wavelength 1500Å.

   b)   A certain system absorbs 2×10^{16} quanta of light per second. At the end of 20 minutes it is observed that 0.002 mole of the irradiated substance has reacted, What is quantum yield of the process?

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M.Sc.

PHYSICAL CHEMISTRY

CHP-312 : Physico - Chemical Methods of Analysis

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

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

Instructions to the candidates:

1) Answers to the 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	$= 5.051 \times 10^{-27}$ J T^{-1}
13)	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

SECTION-I

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

    a) What is Bremsstrahlung?

    b) What is the basis for qualitative and quantitative analysis in ESCA technique.

    c) Define the terms Fermi energy and binding energy.

    d) How are X-rays produced? Which is the most useful portion of the X-ray region for chemical analysis.

    e) What is meant by thermal analysis? Enlist the various methods of thermal analysis.

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

    a) Discuss the applications of TGA technique.

    b) Enlist the analyzers used in ESCA. Explain any one of them with a neat labelled diagram.

    c) Draw a neat labelled diagram of an X-ray absorption apparatus. What are the advantages of X-ray radioactive source?

    d) Give a brief account on electron microprobe that is used to map the surface of a sample.

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

    a) The mass absorption coefficient for nickel is 49.2 cm^2/g (Cu, Kα line). Calculate the thickness of a nickel foil that was found to transmit 32.7% of the incident radiation. Density of nickel is 8.9 g/cm^3.

    b) Calculate the mass absorption coefficient for the solution prepared by mixing 11.00 g of KI with 89.00 g of water. The mass absorption coefficients for K, I, H, O are 16.7, 39.2, 0.00 and 1.50 cm^2/g respectively.

SECTION-II

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

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

b) Define luminescent efficiency.

c) State the principle of coulometry.

d) Draw a neat labelled diagram of typical ICP source.

e) Enlist the essential components of the apparatus used to measure photoluminescence.

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

a) Discuss current-voltage relationship in coulometric technique.

b) Write a note on cyclic voltammetry.

c) Explain S route and T route mechanism for electrochemiluminescence.

d) State the principle of ICP atomic emission spectroscopy. Discuss its applications.

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

a) A sample of nickel ore weighing 3.18 g is dissolved in acid and the nickel is electrolysed using constant current of 2.5 µA for 10 minutes. Calculate the percentage of nickel in the ore.

b) During the forward scan of triangular wave voltammogram at a disk electrode, a peak current of 25 A 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.

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[5530]-3004

M.Sc. - II

PHYSICAL CHEMISTRY

CHP-313 : Polymer chemistry

(2013 Pattern) (Semester-III)

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

Instructions to the candidates:

1) *Answer to the two sections should be written in separate answer books.*
2) *All questions are compulsory.*
3) *Figures to the right side indicate full marks.*
4) *Use of logarithmics 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) Answer precisely the following: **[10]**

    a)   State and explain the Mark-Houwink equation.

    b)   Compare Tg and Tm.

    c)   Define flory temperature.

    d)   Define ideal and non-ideal solutions.

    e)   State assumptions of krigbuum theory.

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

    a)   Explain the classification of polymers.

    b)   Give examples of synthetic, natural and blended polymers.

    c)   Sketch and explain stress-strain curves for polymers.

    d)   Discuss creep phenomenon.

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

    a)   Explain the terms:

        i)   atactic

        ii)   syndiotactic and

        iii)   isotactic configuration

    b)   Explain the WFF equation and its applications.

SECTION-II

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

a) Define the term degree of polymerization.

b) Distinguish between condensation polymerization and addition polymerization.

c) Give two applications of conducting polymers.

d) Define the term chain depolymerization.

e) State the principle of ultracentrifugation process.

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

a) Define the term copolymerization. Explain in brief alternating copolymerization process.

b) Describe the process of vulcanization with a suitable example.

c) Write a note on determination of molecular weight of a polymer by viscosity technique.

d) Explain in brief the types of polymer degradation.

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

a) 250 g of vinyl chloride and 86 g of methyl acrylate copolymerize. Find the polymer composition.

(Monomer reactivity ratios : 0.23 and 1.68 respectively At. Wts: $C = 12$, $H = 1$, $Cl = 35.5$, $O = 16$)

b) Give an account of the steps involved in polymerization process.
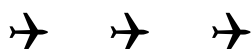
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[5530]-3005

M.Sc. - II

PHYSICAL CHEMISTRY

CHP-314 : Modern Trends in Physical Chemistry

(2013 Pattern) (Semester-III) (New) (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 and 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}
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3)	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
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4)	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
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5)	1 eV		$= 23.06$ k cal mol^{-1}
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9)	1 cal		$= 4.184 \times 10^{7}$ erg
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10)	1 amu		$= 1.673 \times 10^{-27}$ kg
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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) Answer precisely the following: **[10]**

a) Explain the term lower critical solution temperature. Give its example.

b) Explain the term-constituent of a system with examples.

c) Write the proton condition for H_2S.

d) Write the charge balance for 0.1 M H_3AsO_3.

e) Write the proton condition for $NaHCO_3$.

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

a) Explain the temperature-composition diagram for distillation of an ideal mixture with one component more volatile than the other.

b) Explain zone refining technique to get ultrapure material.

c) Calculate pH and concentration of all the species for 0.1 M acetic acid solution. (Given : ka = 1.8×10^{-5})

d) State and explain the lever rule.

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

a) Draw a logarithmic concentration diagram for 0.1 M sodium acetate. (Given : ka = 1.8×10^{-5}).

b) The pH of 0.1 M solution of a salt succinic acid is 6.78. Find the fractions of $C_6H_6O_4$, $C_6H_5O_4^-$ and $C_6H_4O_4^{2-}$. (Given : pka_1 = 4.19, pka_2 = 5.48).

SECTION-II

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

    a) Give the principle of electron microscopy.

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

    c) Write various types of interaction between specimen and electron beam in SEM.

    d) Define Magnetorehological & Electrorehelogical Fluids.

    e) What is meant by biomineralisation?

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

    a) How are rubber like ceramics prepared? Discuss their applications.

    b) Discuss the metal nano particles and their properties.

    c) Describe the secondary electron detector used in SEM.

    d) Write a note on Smart Gel.

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

    a) Describe briefly electron beam lithography.

    b) Write the applications of nanomaterials in various fields.

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[5530]-3006

M.Sc-II

INORGANIC CHEMISTRY

CHI-326 : Organometallic Chemistry and Homogeneous Catalysis

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

Time : 3Hours]   *[Max. Marks : 50*
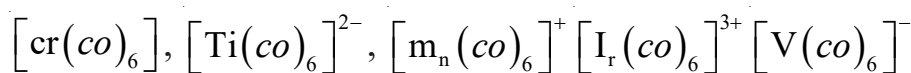
Instructions to the candidates:

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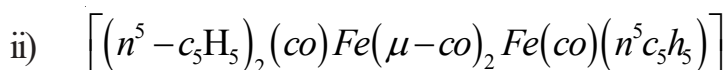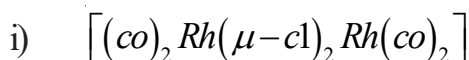3) *Figures to the right indicate full marks.*

SECTION-I

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

   a) Arrange the following metal carbonyls in the decreasing order of back donation.

$$\left[cr(co)_6 \right], \left[Ti(co)_6 \right]^{2-}, \left[m_n(co)_6 \right]^{+} \left[I_r(co)_6 \right]^{3+} \left[V(co)_6 \right]^{-}$$

   b) Determine the number of metal–metal bonds in the following complexes which obey 18 $e^{\ominus}$ rule.

     i) $\left[(co)_2 Rh(\mu-cl)_2 Rh(co)_2 \right]$

     ii) $\left[(n^5 - c_5H_5)_2 (co) Fe(\mu-co)_2 Fe(co)(n^5 c_5 h_5) \right]$

   c) Give two reactions for the synthesis of metal carbene complexes.

   d) Draw the structures of ferrocence & osmocene and give reasons for the difference between them.

   e) Define heptacity? What is the possible heptacity for the following ligands.

     i) $C_6 h_6$ ii)   butadiene

   f) What are the advantages of homogeneous catalyst over heterogeneous catalysts.

   g) What is biphasic catalysis? List out various biphasic systems.

   h) Draw the structures of grubbs first & second generation catalyst for olefin metatnesis.

   i) What are the advantages of Cativa process over the Monsanto process?

   j) What is Fenton reagent? Mention it's advantages.

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

   a) What is the DCD model? How does it explains the bonding of alkenes to metal in the organometallic compounds?

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

   c) What do you mean by c-c bond formation reaction? Discuss the mechanism of Heck reaction.

   d) Discuss the mechanism of olefin epoxidation reaction.

Q3) Answer the following. (Any two) **[10]**

   a) Discuss the Fluxional behaviour of organometallic compounds.

   b) Give an account of organometallic compounds as a protecting and activating agents.

   c) Discuss different types of selectivities with suitable examples.

   d) Give an account of metallocene based catalysts for polymerisation of progylene.

Q4) Write a note on. (Any two) **[10]**

   a) Asymmetric catalysis

   b) Insertion and migration reactions

   c) Metal clusters

   d) Schrock and Fischer carbene

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[5530]-3007

M.Sc.-II

INORGANIC CHEMISTRY

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

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

Time : 3Hours]   *[Max. Marks : 50*
Instructions to the candidates:
   1)   *All questions are compulsory.*
   2)   *Neat diagrams must be drawn wherever necessary.*
   3)   *Use of calculator is allowed.*

Q1) Attempt the following.   **[20]**
   a)   What do you mean by inert and Labile complexes?
   b)   Explain the mechanism of the following reaction.
       $Cis[Co(en)_2 cl_2]^+ \rightarrow$ Trans $[Co(en)_2 cl_2]^+$
   c)   Describe the phenomenon of Fluorescence.
   d)   What is trans effect? Explain with suitable example.
   e)   Arrange the following complexes according to their increasing order of rate aquation. justify your answer. trans $[Co(en)_2Cl_2]^+$, trans $[Co(en)(NH_3)_4 Cl_2]^+$, trans $[Co(NH_3) Cl_2]^+$
   f)   What do you mean by anation reaction? Give example.
   g)   Find out R.S. term symbol for Ni^{2+} and Ti^{3+}.
   h)   Describe the mechanism for alkylation of coordinated sulphur or nitrogen atom.
   i)   Define the terms:
       i)   Paramagnetism
       ii)   Curie temperature
   j)   Give the main type of inorganic reactions.

Q2) Answer the following.(Any Two)   **[10]**
   a)   What do you mean by acid hydrolysis? Explain with suitable example.
   b)   Compare SN^1 and SN^2 mechanism in octahedral substitution reactions.
   c)   Write a note on methyl migration and Co insertion reactions.
   d)   What are mixed valence compounds? How they are classified, comment on their magnetic behaviour?

P.T.O.

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

    a)   Explain the mechanism of inner sphere electron.

    b)   Discuss photochemical reactions of Co (III) complexes.

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

    d)   Nucleophilic substitution in square planar complexes takes place with retention of configuration. Explain.

Q4) Write a note on. (Any two) **[10]**

    a)   Two electron transfer reactions.

    b)   Solute-solvent interactions.

    c)   Isomerisation in trischelate complexes.

    d)   Magnetically dilute and concentrated system.

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[5530]-3008

M.Sc. - II

INORGANIC CHEMISTRY

CHI-331 : Physical Methods in Inorganic Chemistry

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

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

Instructions to the candidates:

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

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

a) Draw the Mössbauer spectra for $Fe(CO)_5$ complex.

b) Give the application of XPS.

c) Explain the ESR spectra for $^{13}CF_3$ radical.

d) Why dropping mercury electrode used in cyclic voltammetry measurement?

e) Which changes can be detected by DYA?

f) Write the parameter's for rhombohedral crystal system.

g) Define Kramer's degeneracy.

h) Write the Nernst equation used in cyclic voltammetry.

i) Define hyper fine splitting.

j) What is TGA?

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

a) Derive the Bragg's equation.

b) Draw the ^{127}I - Mössbauer spectra for I_2Cl_6 and explain the possible structure.

c) Sodium chloride (Molecular weight = 58.43 and density 2.166 gl^{-1}) exists in FCC lattice with unit cell edge 5.64 Å. The unit cell contains '4' molecules. Calculate Avogadro number.

d) Explain the cyclic voltammetry for nucleophilic substitution reaction with suitable example.

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

a) Explain the instrumentation and working of DSC.

b) Explain the ESR spectra for bis (salicylaldiminato) Copper (II) complex.

c) Explain the applications of XPS to surface analysis of materials.

d) Explain the exotherm and endotherm DTA curve with suitable example.

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

a) Calculate the 'g' value for a electron and explain the 'g' value of squar planar complex of copper (II).

b) Explain the experimental procedure with neat labelled diagram with suitable example of one electron transfer reaction.

c) Explain factors affecting on chemical shift of Mössbauer spectroscopy.

d) Explain the application of single crystal X-ray spectroscopy to structure determination.

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[5530]-3009

M.Sc. - II

INORGANIC CHEMISTRY

CHI-332 : Bioinorganic and Inorganic Medicinal Chemistry

(2013 Pattern) (Semester-III) (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) *Draw neat diagrams wherever necessary.*

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

a) Enlist the functions of blue-copper proteins.

b) Define P-cluster and give its role.

c) Explain the structurally important components of Mo containing enzymes.

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

e) Draw the active site of carbonic anhydrase. Which is the metal present in it?

f) Give the biological functions of four inorganic elements.

g) Which element is present at the active center of carboanhydrase? What is the function of carboanhydrase?

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

i) Draw the structure of Vit B-12.

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

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

    a)   How does nitrogen fixation take place by molybdenum?

    b)   Write an account of zinc containing enzymes.

    c)   Describe the model compounds of Fe/S proteins. How do, they help in understanding the structures of proteins?

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

Q3) Answer <u>any TWO</u> of the following: **[10]**

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

    b)   Why is Tc considered as best nucleus in radio pharmaceuticals?

    c)   Explain the role of Mn in peroxidase.

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

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

    a)   Bone imaging agents.

    b)   Gamma scintigraphy and its applications.

    c)   Enzyme tyrosinase.

    d)   Purple acid phosphotase.

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[5530]-3010

M.Sc.-II

ORGANIC CHEMISTRY

CHO-350 : Organic Reaction Mechanism

(2013 Pattern) (Semester - III)

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

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *Figures to the right indicate full marks.*

    3)   *Answer to the two sections should be written in separate answer books.*

SECTION-I
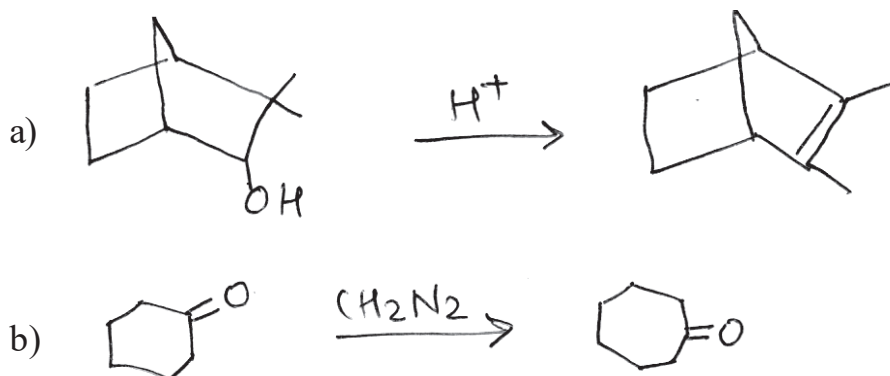
Q1) Answer the following.   **[10]**

    a)   Trans - 2-thio substituted chlorocyclohexane undergoes reaction with aqueous solution of ethand 70000 times faster than the unsubstituted compound Explain.

    b)   Give a brief account of factors stabilizing the carbanions.

    c)   State the advantages of enamine approach over classical approach for α-alkylation of cyclic ketones.

    d)   List various synthetic applications of carbenes.

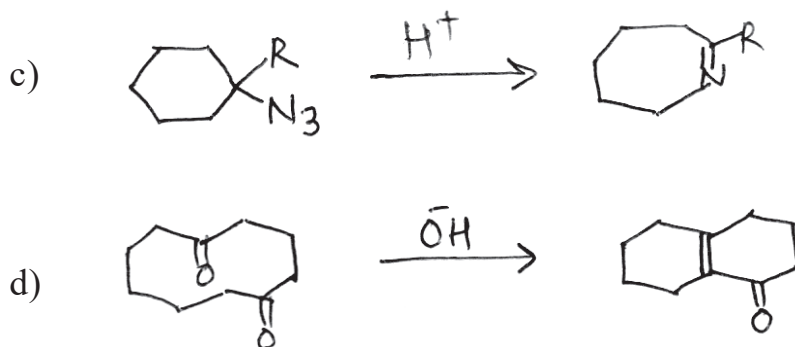   e)   Explain claisen-schmidt condensations reaction with suitable example.

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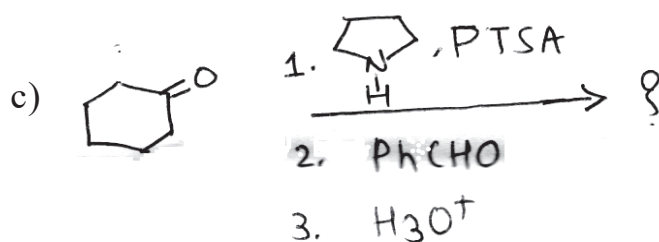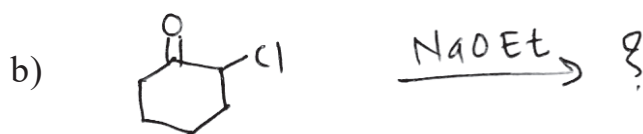
a)

b)

c)

d)

B) Write short notes on any two. [4]
   a) Neighbouring group participation by sulphur atom.
   b) Benzoin condensation.
   c) Role of pyridoxal phosphate in nature.

Q3) Predict the products in any two of the following. [5]

a)

b)

c)
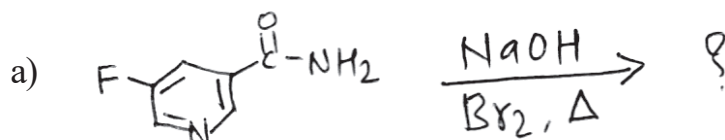
SECTION-II

Q4) Answer the following. [10]
   a) Write a note on phenolic oxidation coupling reactions.
   b) Explain free radical substitution reaction with a suitable example.
   c) Explain in brief Nature's reducing agents.
   d) Illustrate the role of AIBN-Bu$_3$S$_n$H in making cyclic ring with an example.
   e) Explain nature's end equivalent with an example.

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

a)

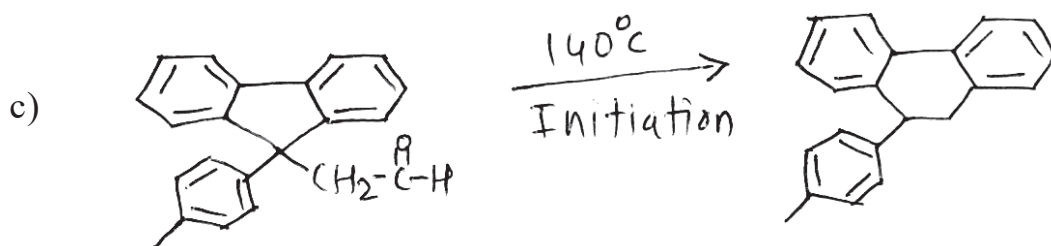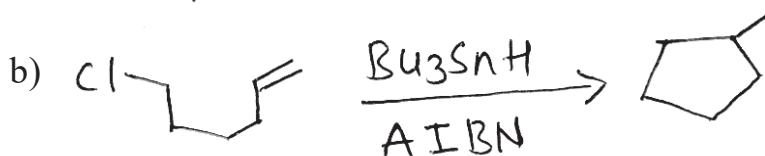(cyclohexene with t-Bu) + NBS / hν → (bromo cyclohexene with t-Bu)

b) Cl–CH₂CH₂–CH=CH₂ $\xrightarrow[\text{AIBN}]{\text{Bu}_3\text{SnH}}$ (methylcyclopentane)

c)

(fluorene derivative with CH₂–C̈–H) $\xrightarrow[\text{Initiation}]{140°C}$ (product)

d)

(cyclohexanone N–NH–Ts) $\xrightarrow{\text{Base}}$ (cyclohexene)
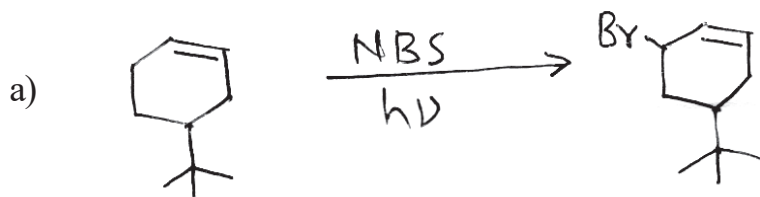
B) Write short notes on any two. [4]
a) Oxidative coupling
b) Sandmeyer reaction
c) Synthetic methods for cyclopropane ring

Q6) Predict the products in any two. [5]

a)

(bicyclic peroxide) $\xrightarrow{\Delta}$?

b) Ph–CH₂CH₂CH₂–CH=CH₂ $\xrightarrow[140°C]{\text{ROOR}}$?

c)

(β-keto ester, OEt) $\xrightarrow[\text{Glucose}]{\text{Baker's Yeast}}$?

○ ○ ○ ○

[5530]-3011

M.Sc. - II

ORGANIC CHEMISTRY

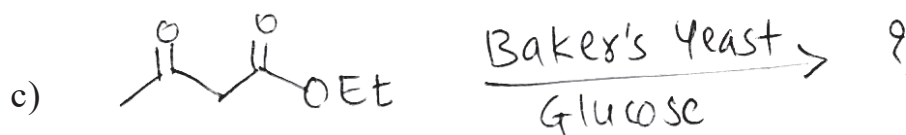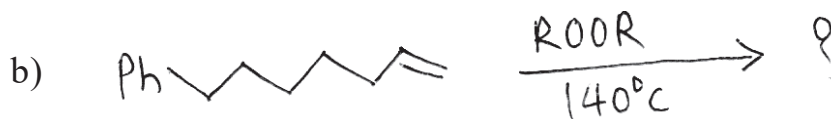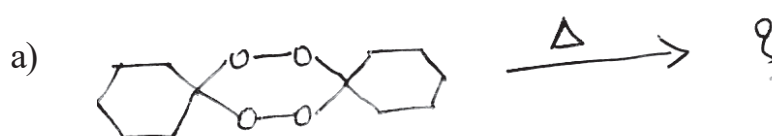**CHO-351 : Spectroscopic Methods in Structure Determinations**

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

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

Instructions to the candidates:

   1)   *All questions are compulsory.*

   2)   *Answers to the two sections to be written on two separate answer books.*

   3)   *Figures to the right indicate full marks.*

SECTION - I

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

   a)   Explain the observed chemical shifts in ^{13}CNMR for the following compounds.
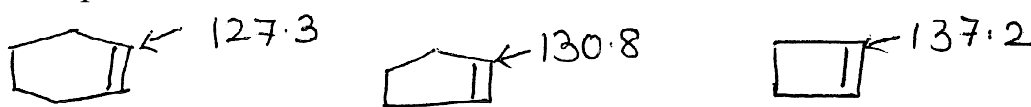
   b)   Distinguish between the following pairs by indicated spectral method.
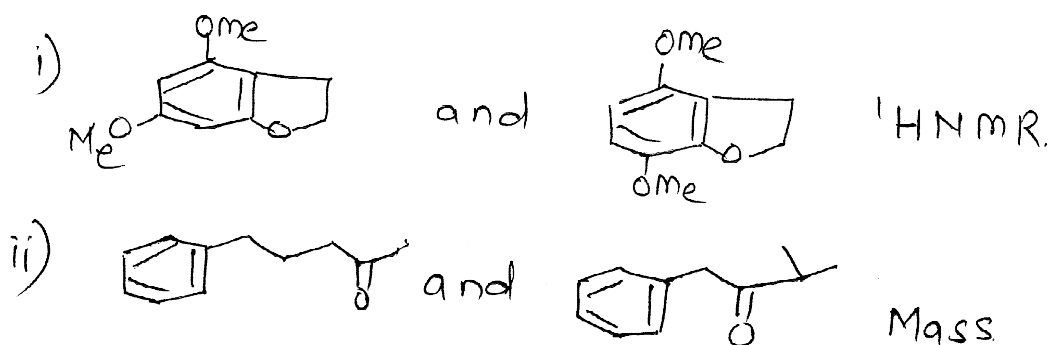
   c)   Three isomeric compounds A, B and C with molecular formula C_3H_6O show the following mass spectra. The underlined peaks are the base peaks. Assign structure to the isomers.

$$\frac{m}{2} \quad A : 58, \underline{43} \quad B : 58, \underline{29}, 28, 27 \quad C : 58, \underline{57}, 29, 28$$

   d)   Describe the role of shift reagents in NMR spectroscopy.

e) A neutral compound with molecular formula $C_6H_{10}O_2$ shows the following signals in ^{13}CNMR. Suggest probable structure for the compound. Justify.

^{13}CNMR δ : 6.3 (q), 15.3 (q), 71.1 (t), 119.9 (s), 168.4 (d), 191.8 (d).

Q2) Answer any three of the following :   **[12]**

a) A substituted r-pyrone with molecular formula $C_{12}H_{10}O_5$ shows following signals in the ^{1}HNMR. Suggest the probable structure for the same.

^{1}H NMR : δ : 3.98 (S, 3H), 4.0 (S, 3H),

7.07 (d, J = 9 Hz, 1H),

7.97 (d, J = 9 Hz, 1H),

8.50 (S, 1H), 10.32 (S, 1H)

b) Assign the structures to compound <u>M</u> and <u>N</u> on the basis of the data given below :

Compound M	i) PCl₃	Compound N
Mol. Formula $C_{11}H_{14}O_2$	ii) AlCl₃/CS₂ iii) Zn/Hg–HCl. →	Mol. formula $C_{11}H_{14}$

^{1}H NMR δ : 1.22 (S, 6H)   1.21 (S, 6H)

2.0 (S, 2H)   1.85 (t, J = 6Hz, 2H)

7.0 (S, 5H)   2.83 (t, J = 6Hz, 2H)

10.10 (S, 1H, ex.)   7.02 (m, 4H)

c) A compound with molecular weight 73 (M^+ 73) shows the spectral data as follows. Analyze and write the probable structure for the compound.

IR : 3360, 3280, 2960, 1603, 1465 cm^{-1}.

^{1}H NMR : δ : 0.65 (t, J = 7 Hz, 30 mm)

0.8 (S, 20 mm)

1.2 (m, 40 mm)

2.5 (t, J = 7 Hz, 20 mm)

^{13}C NMR : δ : 13.9, 20.2, 36.3, 42

DEPT I :   13.9 up

20.2, 36.3, 42 down

Mass $\dfrac{m}{2}$ = 73, 41, 39, 30 (base peak)

d)   Suggest probable structure for the compound X on the basis of spectral data as below :

Molecular formula : $C8H8O_2$

U.V. – 316 ($\in$, 22,000)

I.R. – 1695, 1675, 1615, 1555, 1480, 970 cm^{-1}.

^{1}H NMR : δ :   2.29 (S, 3H)

6.46 (dd, J = 1.5 & 3.5 Hz, 1H)

6.56 (d, 16 Hz, 1H)

6.66 (d, J = 3.5 Hz, 1H)

7.20 (d, J = 16 Hz, 1H)

7.48 (d, J = 1.5 Hz, 1H)

^{13}C NMR : δ - 28.3 (q), 110.2 (d), 114.4 (d), 124.2 (d), 128 (d), 143 (d), 150.3 (S), 198.6 (S).

Q3) Assign the signals to various protons in compound Y. Use the data, Justify. Based on the data draw the stereostructure for the same.   [5]

compound Y.
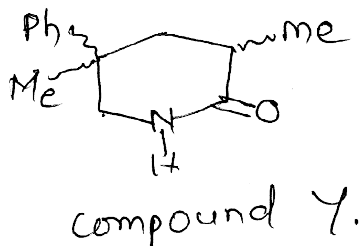
^{1}H NMR : δ :   3.5 (1 H, d, J = 12 Hz)

3.3 (1 H, dd, J = 12 & 2 Hz)

2.6 (1 H, ddq, J = 12, 6 & 7 Hz)

2.1 (1 H, ddd, J = 13, 6 & 7 Hz)

1.8 (1 H, dd, J = 13 & 12 Hz)

1.4 (3 H, S)

1.3 (3 H, d, J = 7 Hz)

Irradiation of 1.3 changes signal at 2.6 into dd, J = 12 & 6 Hz.

Irradiation of 2.1 gives a small enhancement at 1.4.

SECTION - II

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

a) Explain the genesis of ions in the following compound.

 $\dfrac{m}{2} = 149, 134, 106, 77.$
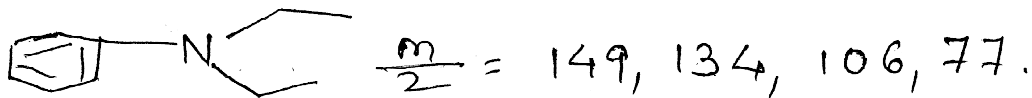
b) 1-Chloro-3-methylbutane shows M^+ 106/108 with 3 : 1 intensity while 1 - Bromo - 3 - methyelbutane shows M^+ 150/152 with 1 : 1 intensity. Explain.

c) 2-Heptanone shows a base peak at $\dfrac{m}{2} = 43$ while 3 - Heptanone at $\dfrac{m}{2} = 57$. Justify predict the products obtained from each of them by Mc Lafferty rearrangement.

d) Distinguish between the isomeric esters G and H by mass spectrometry.

G   H
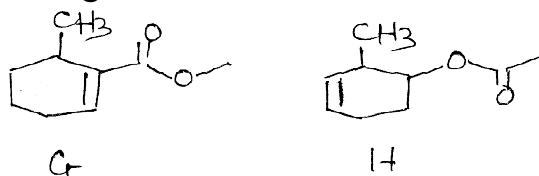
e) A compound with molecular wt 162 (M^+ 162, 18%) shows the formation of following ions in mass. Predict probable structure for the same.

$\dfrac{m}{2} = $ 162 (18%),   91 (40%)

    71 (100%),   43 (90%)

Q5) Write short notes on any three of the following : **[9]**

a) Role of methane in chemical ionization method.

b) Proton coupled spectra as compared to off resonance spectra in ^{13}CNMR.

c) Factors affecting geminal coupling constants in NMR.

d) Advantages of HETCOR Over COSY spectra.

Q6) Spectra of an unknown compound are shown on the adjacent page. Analyse the data and arrive at a correct structure for the unknown compound. Justify your assignments. **[8]**

MASS
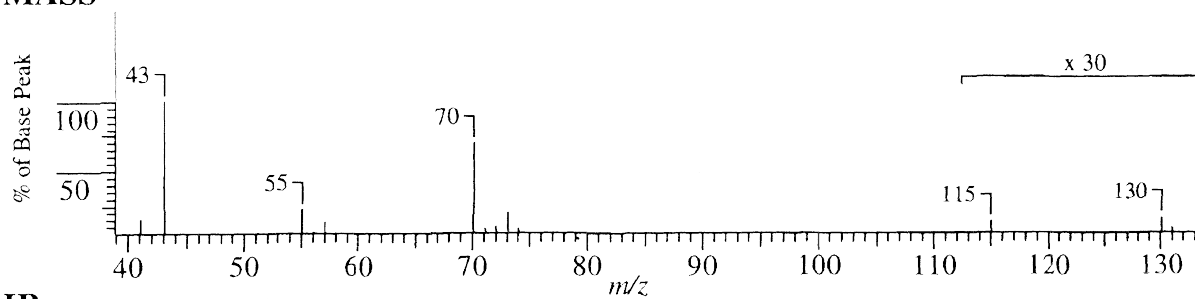
IR
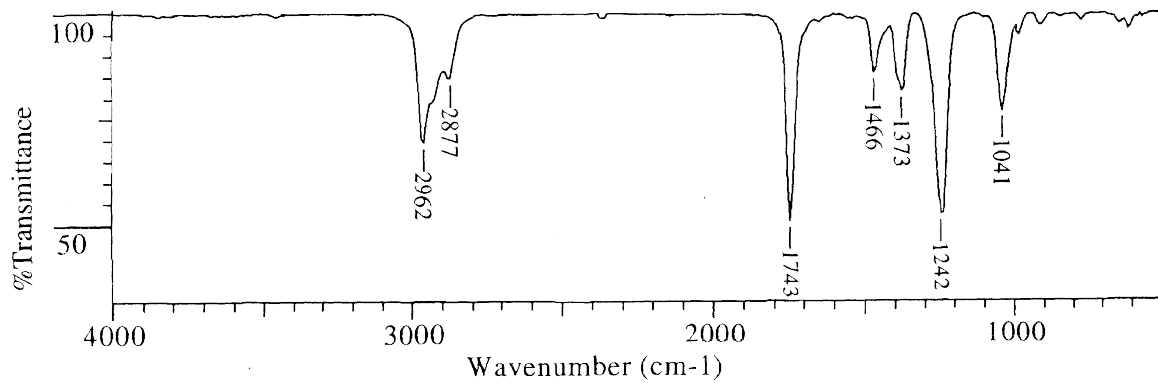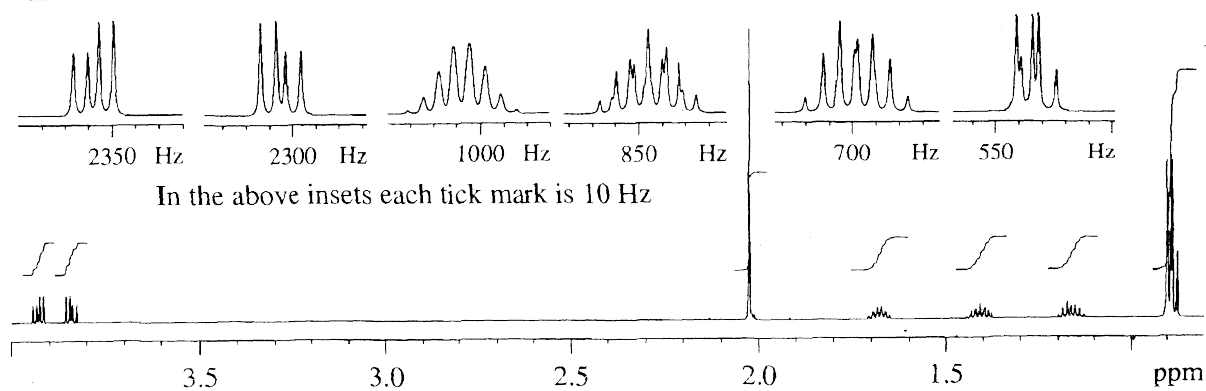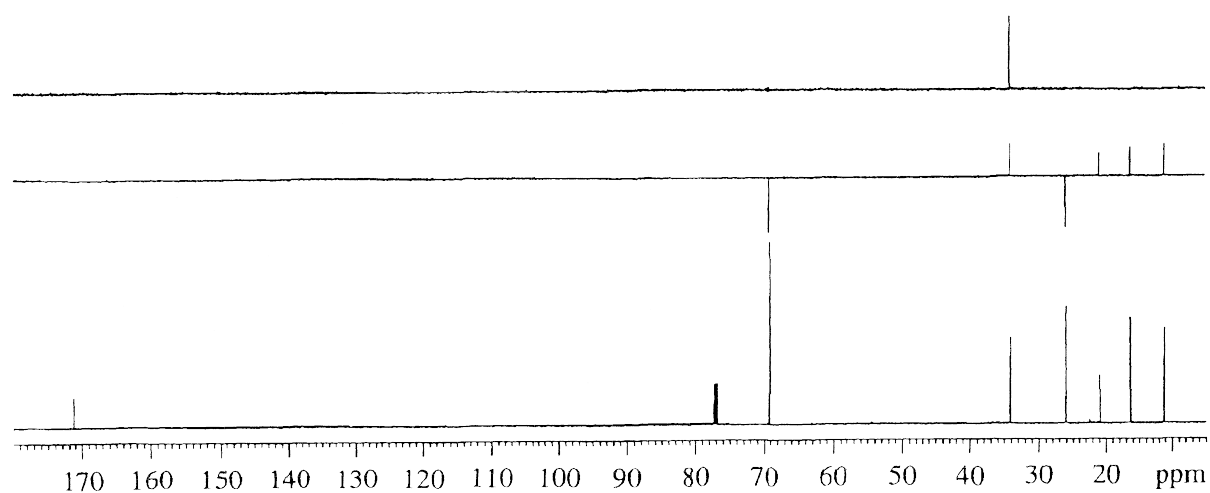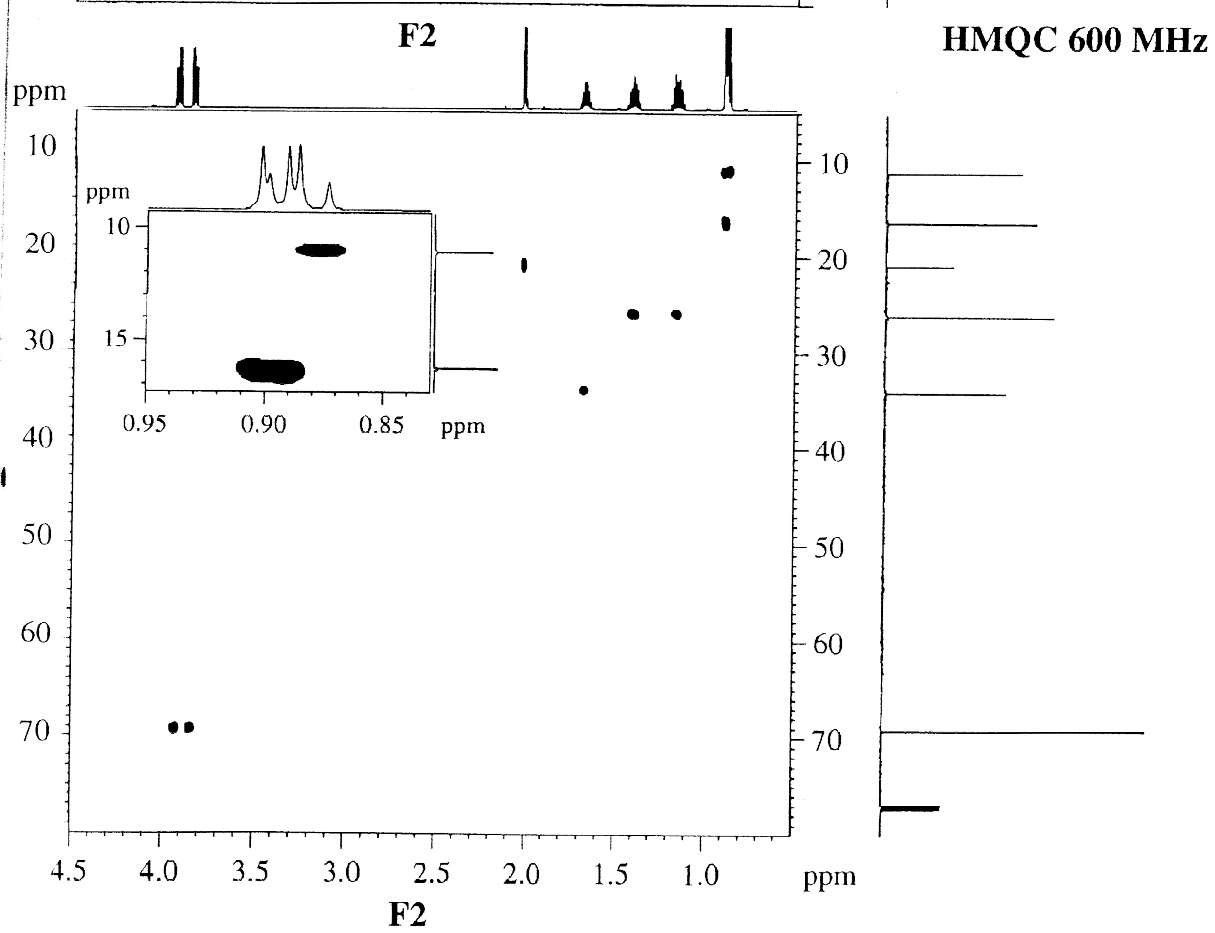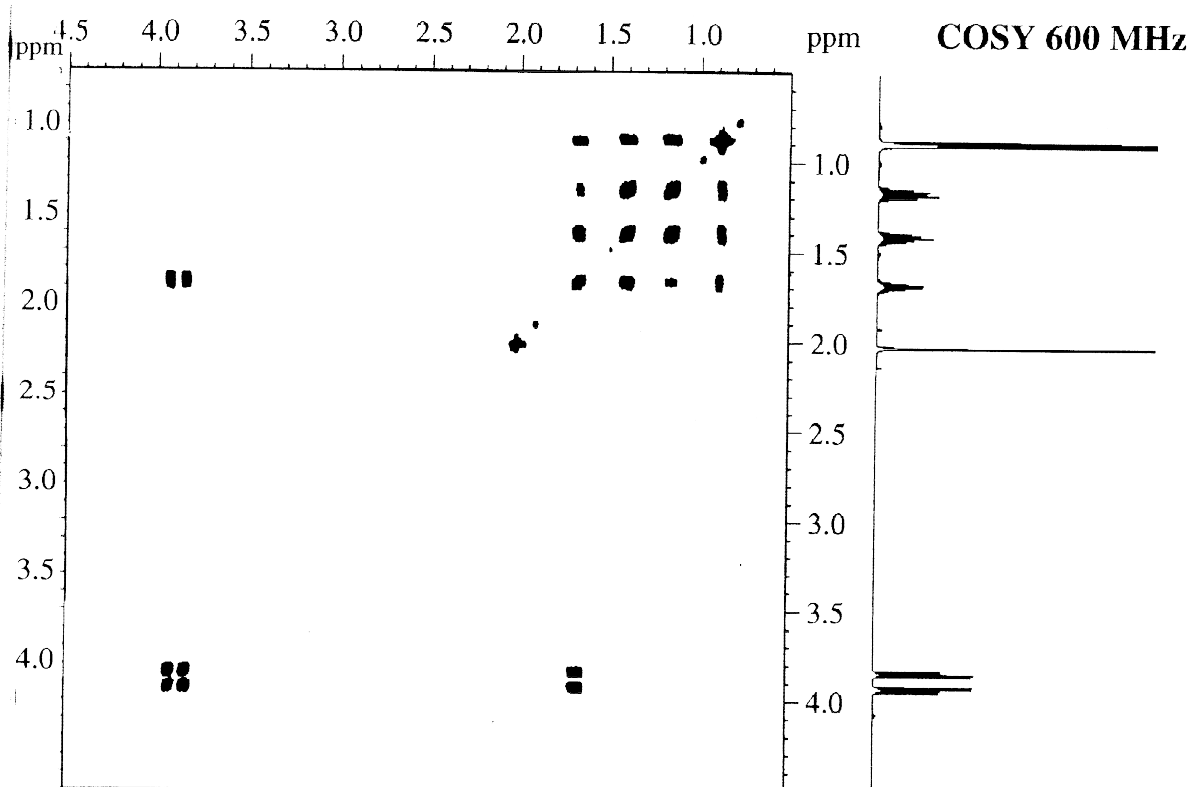
Wavenumber (cm-1)

^{1}H NMR 600 MHz

2350 Hz   2300 Hz   1000 Hz   850 Hz   700 Hz   550 Hz

In the above insets each tick mark is 10 Hz

^{13}C/DEPT NMR 150.9 MHz

COSY 600 MHz

HMQC 600 MHz

[5530]-3012

M.Sc. - II

ORGANIC CHEMISTRY

CHO-352 : Organic Stereochemistry

(2013 Pattern) (Semester-III) (New 4 Credits)

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

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *Figures to the right indicate full marks.*

    3)   *Answers to the two sections should be written in separate answer book.*

<u>**SECTION-I**</u>

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

    a)   Draw the stable conformation of cyclohexene indicating different type of bonds.

    b)   Which is the most favoured conformation of following compound and why?
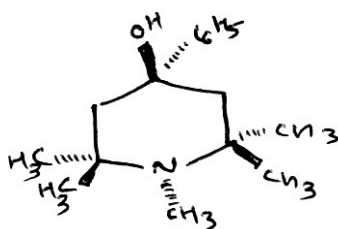
    c)   Discuss the difference in energy of cis and trans 9-methyl decaline.

    d)   Why solvent sensitive UV absorption band is observed in trans-5-cyclodecenone and not in cis?

    e)   Explain the reactivity of 2α, 3β - chlorocholesterol in comparison with 2β, 3α isomer to give epoxide.

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

a) Draw the conformations of cis-syn-trans and cis-anti-trans perhydro phenanthrenes and comment on their stabilities and optical activity.

b) With the help of energy profile diagram, explain the difference in rates of reaction of compound A and compound B undergoing unsymmetrical substitution via S_N2 mechanism.

where R = t-butyl
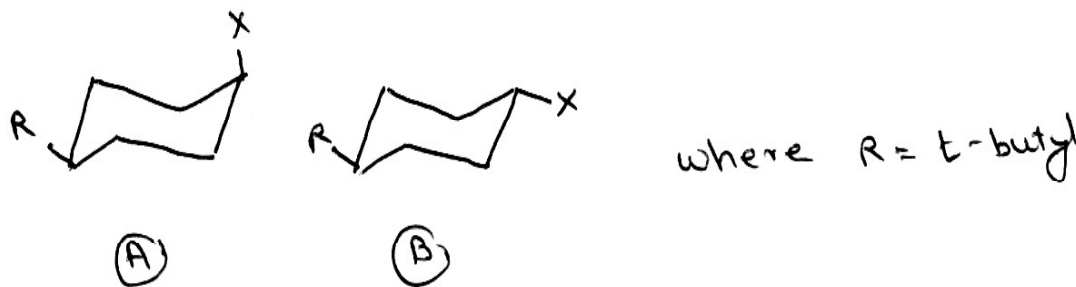
c) Write the products formed during pyrrolysis of cis and trans-2-phenyl cyclohexyl acetate. Explain the reactivity with suitable example and mechanism.

d) Explain the product formation giving mechanism in following reactions. Justify your answer.

i)

ii)
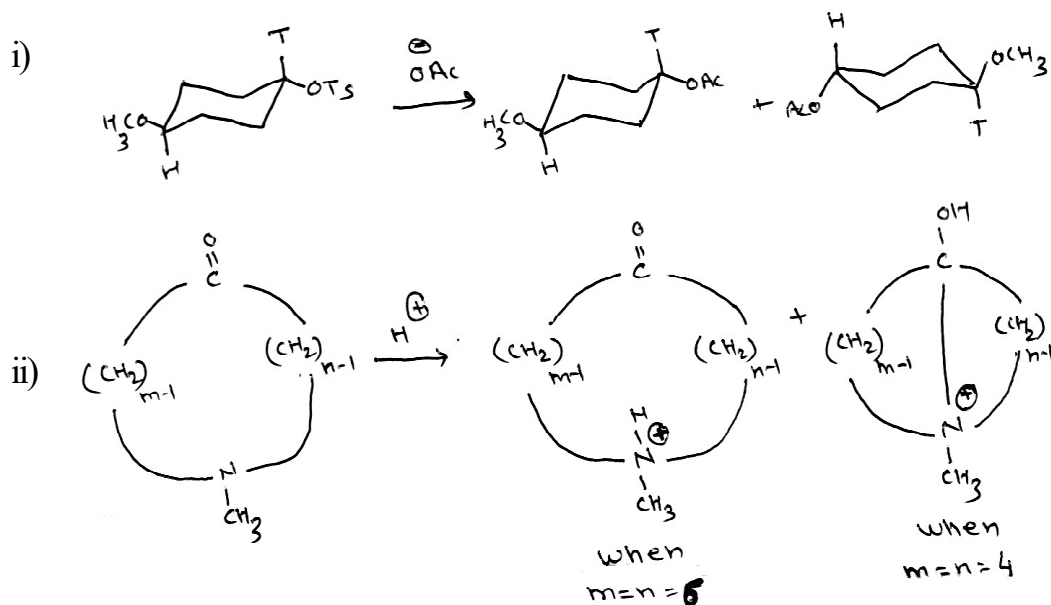
Q3) Anwer the following (any one): **[5]**

a) Write short notes on:

i) Bredt's Rule.

ii) I-strain.

b) Discuss the following:

i) The orientation of hydroxyl group during MPV reduction of cyclohexanone.

ii) The difference in acidity of cis and trans cyclohexane -1, 2-dicarboxylic acid in its first and second ionization.

SECTION-II

Q4) Answer <u>Any Three</u> of the following: **[9]**

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

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

c) Describe the Mutarotation and asymmetric transformation.

d) Explain the methods of determination of configuration of Geometrical Isomers.

Q5) Answer <u>Any Four</u> of the following: **[8]**

a) Cis-Cinnamic acid pKa = 3.96 and trans-Cinnamic acid pKa = 4.44. Explain Acid strength.

b) Explain the role of Ultraviolet spectroscopic technique for characterization of Geometrical Isomers.

c) Cis isomer of 1,2 cyclopentanediol reacts 3000 times as fast as that of trans isomer with lead tetra acetate. Explain.

d) Describe use of chiral solvating agents.

e) Addition of hydrogen bromide to 2-butyne gives exclusively trans - 2-bromo - 2 butene. Explain with mechanism.

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

(i) $\xrightarrow[Pd]{H_2}$?

(ii) $\xrightarrow[\text{② Hydrolysis}]{\text{① HCOOH}}$?

(iii) $\xrightarrow[\text{② } H_2O_2 / \bar{O}H]{\text{① } B_2H_6 / ether}$?
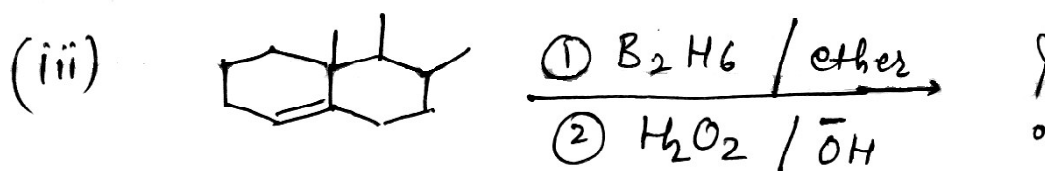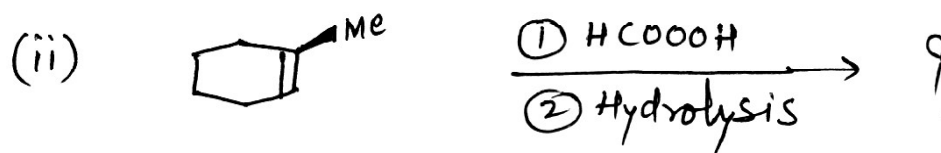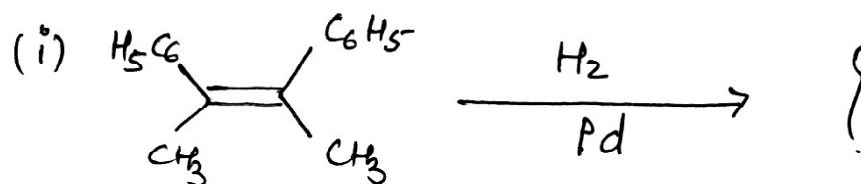
b) Draw the correct stereostructure of a compound Z with the help of ¹H-NMR data given below and justify your assignment. **[4]**
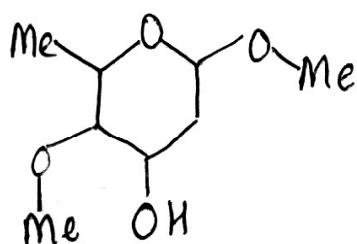
¹H-NMR (δ, ppm)
1.33 (d, J = 6 Hz, 3 H); 1.61 (bs, D₂O exch. 1 H); 1.87 (ddd, J = 14, 3, 5.5 Hz, 1 H); 2.21 (ddd, J = 14, 3, 1.5 Hz, 1 H); 2.87 (dd, J = 10, 3 Hz, 1 H); 3.40 (s, 3H); 3.47 (s, 3H), 3.99 (dq, J =10, 6 Hz, 1 H); 1.33 (d, J = 6 Hz, 3 H); 4.24 (ddd, J = 3, 3, 3.5 Hz, 1 H); 4.79 (dd, J = 3.5, 1.5 Hz, 1H)

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[5530]-3013

M.Sc. - II

ORGANIC CHEMISTRY

CHO-353 : Photochemistry, Pericyclic Reactions and Heterocyclic Chemistry

(Semester-III) (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)   *Answers to the two sections should be written in separate answer book.*

SECTION-I

Q1) Explain the following (all subquestions are compulsory). **[10]**

   a)   What is Paterno-Buchi reaction? Explain the mechanism with suitable example.

   b)   Di-π-methane rearrangement.

   c)   What is Alder's endo rule? Explain with suitable example.

   d)   Draw the π molecular orbitals of $H_2C = CH - CH = CH_2$. Identify HOMO and LUMO and find out their symmetry elements.

   e)   [3, 3] sigmatropic rearrangements.

Q2) Predict the product/s and suggest the mechanism Any Five: **[10]**

a)

b)

c)

d)

e)

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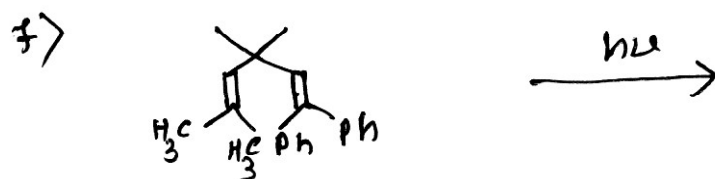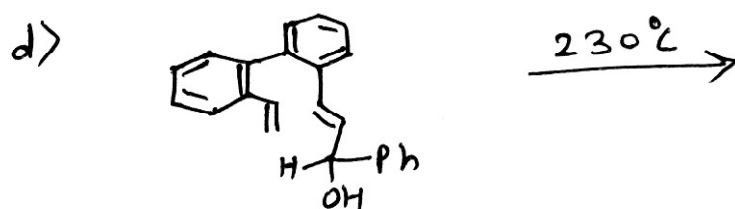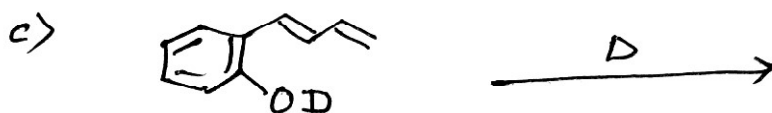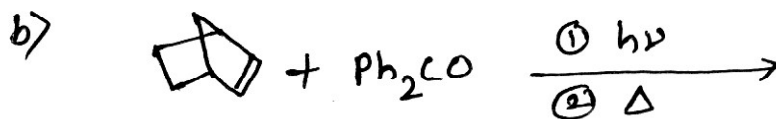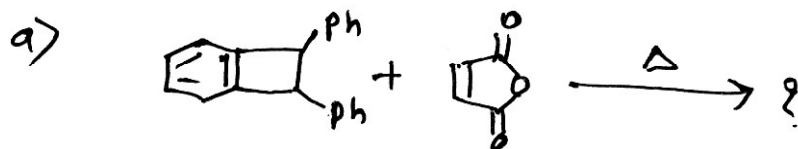
Q3) Answer any Two of the following: **[5]**

a) With the help of co-relation diagram show that the Diels-Alder reaction is thermally allowed process.

b) Draw correlation diagram for following reaction.

c) Complete the following synthetic sequence indicating all intermediates and reagents required.
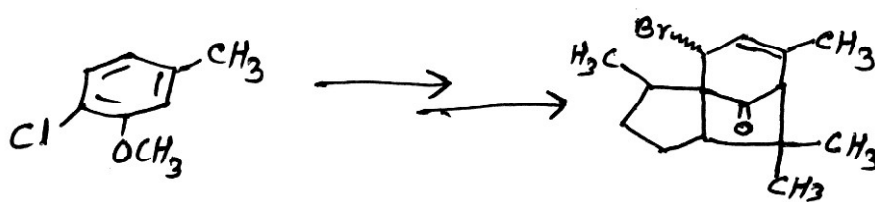
SECTION-II

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

    a)   Furan is less aromatic than purrole and thiophene.

    b)   4-chloro-3-nitropuridine hydrolyses readily under milder conditions.

    c)   Benzofuran undergoes metallation at 2-position.

    d)   Pka value of imidazole is 7 and that of pyrazole is 2.5.

    e)   1, 2, 3 triazole is less basic than 1, 2 and 1, 3 azoles.

Q5) Predict the product/s suggesting suitable mechanism for <u>Any Two</u> of the following: **[10]**

a) HO—(ring)—OH + $CH_3-\overset{O}{\overset{||}{C}}-CH_2-\overset{O}{\overset{||}{C}}-OCH_2-CH_3 \xrightarrow[R.T.]{H_2SO_4}$?

b) (benzene ring)—$\overset{N}{\underset{H}{N}}-N$(cyclohexane ring) $\xrightarrow{H^+}$?

c) Br—(thiophene ring with N)—CH_3 $\xrightarrow[\text{ii) } C_6H_5CHO, H_3O^+]{\text{i) } n\text{-}BuLi, ether}}$?

d) (furan ring)—CH_3 $\xrightarrow[THF, 15°C]{BuLi}$? $\downarrow$ $\overset{H}{\underset{H}{}}C=C\overset{H}{\underset{CH_2-CH_2-Br}{}}$

? $\xleftarrow{HBr}$?
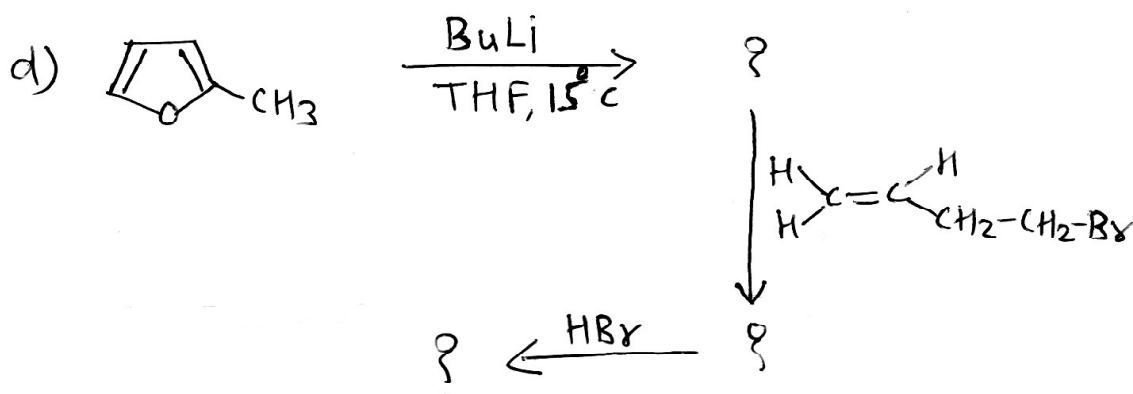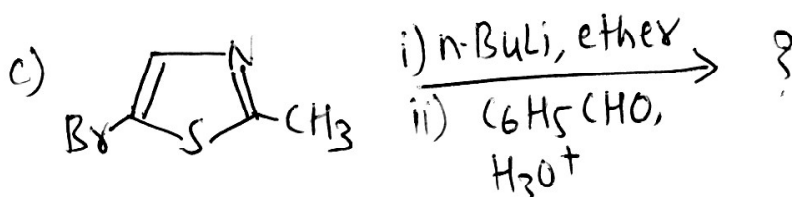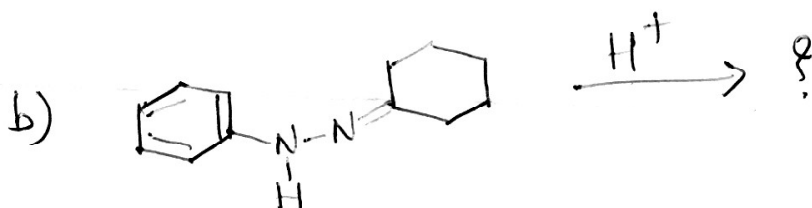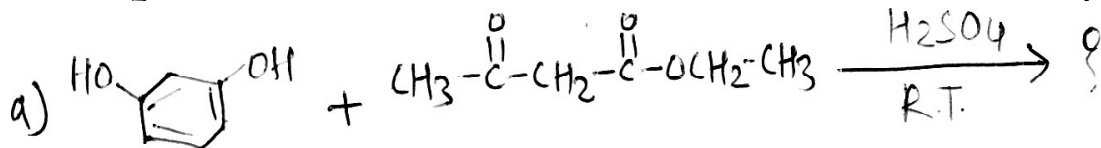
Q6) Write short note on <u>Any Two</u> of the following: **[5]**

    a)   Chichibabin reaction.

    b)   Pictet-Spengler synthesis.

    c)   Fiest-Benary furan synthesis.

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[5530]-3014

M.Sc. II
ANALYTICAL CHEMISTRY
CHA-390 Electroanalytical and Radioanalytical Methods of Analysis
(2013 Pattern) (Credit System) (Semester - III) (4 Credit)

Time : 3Hours]   *[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)   State principle of coulometry. Give two advantages of coulometric titrations.
   b)   Distuingsh between chronopotentiometry and chronoamperometry.
   c)   State koutecky equation and give meaning of each term involved in it.
   d)   Sketch and label oxygen sensor.
   e)   What is pulse polarography? Enlist different types of signals used in it.

Q2) Attempt any two of the following.   **[10]**
   a)   Give brief account of cyclic voltammetry.
   b)   Describe the applications of voltammetric detectors used in chromatography.
   c)   Write a note on amperometry.
   d)   In a coulometric titration of 20.0 ml of $k_2cr_2o_7$ with fe(11) it tooks 26.7 min to reduces when 197 MA of current was used. Calculate the normality of $k_2cv_2o_7$ solution.

Q3) Attempt any one of the following.   **[5]**
   a)   Explain the instrumentation and applications of constant current and constant voltage coulometry.
   b)   If the diffusion current constant for zn is 7.94, when in is 32.5 mg/sec. and flow time of mercury is 3.6 sec. If diffusion current for unknown solution of zn is 3.5 µA what is the concentration of Zn?

                                                     P.T.O.

SECTION-II

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

    a) State and explain principle of neutron activation analysis.

    b) State the principle of isotope dilution analysis. Give its advantages.

    c) What is radiometric titrations? Give its limitations.

    d) Explain the differential scanning calorimetric curve for polyethylene terphthalate.

    e) Explain the principle of thermogravimetric analysis technique.

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

    a) Describe the abosolute method and comparator method used in NAA.

    b) Explain in detail isotope dirution analysis technique.

    c) What is the principle of differential thermal analysis. Describe the DTA technique for the analysis of mixture of polymer.

    d) In thermometric analysis of 0.250 gm of $ca(OH)_2$ the loss in weight at different temperature was

        i) 0.018 gm at 100-150°c (loss of hygroscopic water)

        ii) 0.038 gm at 500-560°c (dehydration)

        iii) 0.022 gm at 900-950°c (dissociation)

Determine the composition of calcium hydroxide.

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

    a) Explain the TG and DT curve for $Mn(PH_2O_2)_2 . H_2O$.

    b) A pure radiochemical preparation was found to disintegrate at the rates of 4280 cpm at 9.00 AM and 870 cpm at 10.30 AM of the same day. As the disintegration rate is proportional to the number of atoms in the sample, what is the half life of material.

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[5530]-3015

M.Sc.-II
ANALYTICAL CHEMISTRY
CHA-391 Pharmaceutical Analysis
(2013 Pattern) (Credit System) (Semester - III)

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

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

SECTION-I

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

    a) Define drug.

    b) What is karl fischer reagent?

    c) What is sterilization by ionizing radiation?

    d) Define shelf life and Expiry date of a drug.

    e) What is assay design?

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

    a) Give the limit test for Arsenic and Iron.

    b) Write a short note on "Role of FDA in pharmaceutical industries."

    c) Discuss in detail the cylinder or cup plate method for microbial assay.

    d) Explain in detail - "Undue toxicity"

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

    a) Discuss the following.

       i) Sterilization by heating with bacteriacides.

       ii) Dry heat sterilization

    b) Write a note on stability study for pharmaceutical product.

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

    a)   What are parenterals?

    b)   What are gel and magma.

    c)   Define ointment and give its classification.

    d)   Give advantages of emulsions.

    e)   Explain in brief, 'Atmospheric contamination'.

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

    a)   Give an assay of mannitol.

    b)   Explain in brief the manufacturing hazards.

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

    d)   1.5 g of ferrous fumurate table ($C_4H_2FeO_4$) was dissolved in 15ml dil. H_2SO_4 by gentle warm heating and diluted to 100ml. 10 ml of this solution was titrated against 0.25N cetric ammonium sulphate, It gave a burette reading 2.2ml. calculate the percentage of ferrous fumarate in given tablet.

       [At. wt. C=12, H=1, O=16, Fe=55.85]

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

    a)   Write a note on "Blood products and reporting protocols".

    b)   0.6g of Isonizid ($C_6H_7N_3O$) sample was dissolved in 40ml water and diluted upto 100ml. 10ml of the dilute solution was taken in a stoppered bottle. To it, 10 ml 0.1N bromine solution 5ml conc. HCL solution and 10 ml 10% KI were added. the liberated Iodine was titrated with 0.1N sodium thiosulphate solution using starch as an indicator. The burette reading was 2.1ml. The blank titration reading was 10.2ml calculate the percentage of Isoniazid present in the sample.

       [At.wt. C=12, N=14, H=1, O=16]

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[5530]-3016

M.Sc. - II
ANALYTICAL CHEMISTRY
CHA-392 : Advanced Analytical Techniques
(2013 Pattern) (Semester - III) (Credit System) (4 Credit)

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

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

SECTION-I

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

     a) Enlist factors affecting SPE.

     b) Give two functions of SPME holder.

     c) How can emulsion formed in LLE be broken up?

     d) Give the typical operating conditions for pressurized and atmospheric MAE.

     e) What is end-capping?

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

     a) Discuss the stages of SPE in detail.

     b) Explain continuous and discontinuous LLE.

     c) Explain selection of SFE operating parameters.

     d) Outline the analysis of abietic acid and dehydroabietic acid in food samples by SPME-LC-MS system.

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

     a) Explain the process of isolation of amino acids from liquid samples by ion-exchange SPE.

     b) What is MAE? Explain heating effect of microwaves in MAE.

SECTION-II

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

    a) Explain interferences observed in AFS.

    b) Give any two applications of AAS.

    c) Describe the phenomenon of stimulated emission.

    d) Distinguish between ICP and DCP.

    e) Enlist different types of mass analyzers.

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

    a) Explain Resonant Ionization spectroscopy with suitable diagram.

    b) Differentiate between micro and macro nutrients and explain a suitable process for estimation of Boron from soil sample.

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

    d) Write a short note on electrothermal atomiser.

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

    a) A time-of-flight mass spectrometer has a flight path of 1.250 m and an accelerating potential of 2875 V. Calculate the time required for ions with m/z 200 and 250 to strike the detector after emission from the source.

    b) The soil samples were analysed for the determination of 'Mn' at 280 nm in air acetylene by AAS. The observations are as follows:

Mn in ppm	Absorbance
0.1	0.02830
0.2	0.0565
0.3	0.08475
0.4	0.11375
0.5	0.14140
Sample	0.0617

Calculate the concentration of Mn in ppm for soil sample.
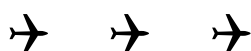
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[5530]-3017

M.Sc. - II

ANALYTICAL CHEMISTRY

CHA-380 : Analytical Method Development and Validation, Geochemical and Alloy Analysis and Laboratory Automation and Sensor Based Techniques

(2013 Pattern) (Semester-III)

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

Instructions to the candidates:

   1)   *Attempt any two sections.*

   2)   *Answer to the two sections should be written in separate answer books.*

   3)   *All questions from respective sections are compulsory.*

   4)   *Neat diagrams must be drawn wherever necessary.*

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

SECTION-I

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

   a)   Enlist the various dissolution characteristics.

   b)   What is limit of detection?

   c)   Draw a neat labelled diagram for USP type II apparatus.

   d)   Define:

       i)   Linearity

       ii)   Precision

   e)   Describe the term - Method validation.

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

a) Write a note on interlaboratory qualification process.

b) Explain the role of documentation and communication in method transfer.

c) Explain in brief single point test versus dissolution profile.

d) The % of iron in ore was reported by different analyst as 34.04, 34.14, 34.54 and 34.61. Calculate mean, standard deriation and relative mean deviation.

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

a) Describe the five step process for finallization and issuance of ICH guidelines.

b) In the determination of radioactive element in river water sample, following data is obtained. Find out the equation for best filted line.

Concentration of element (ppm)	0.0	10	15	20	25	30
Intensity	2.3	4.4	5.3	6.1	7.5	8.7

SECTION-II

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

a) What is an ore? Give any two examples.

b) What is cation exchanger capacity of soil?

c) Name the constituent present in the Bauxite and Hematite ore.

d) How the sampling of soil is carried out?

e) Give the principle for determination of tin in solder alloy.

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

a) Discuss method for determination of iron from steel.

b) Describe a method to estimate magnesium from Dolomite ore.

c) Outline the analytical procedure for estimation of combined oxides in soil.

d) A sample weighing 3 g containing calcium was dissolved in acid and calcium was precipitated as calcium oxalate. The precipitate was dissolved in dilute sulphuric acid and solution was diluted to 1000 ml. An aliquot of 10 ml was titrated with 0.025 N $kMnO_4$. Gave Burette reading 7.5 ml. Calculate percentage of calcium in the given sample.

(Given : At. Wt. Ca = 40.08, O = 15.99, Mn = 54.93, K = 39]

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

a) Outline analytical procedure for estimation of manganese in pyralusite ore.

b) 1.5 g of brass sample was analysed for estimation of tin and zinc. It gave 0.035 g of SnO_2 and 0.520 g of $Zn_2P_2O_7$. Calculate the percentage of each metal in the sample.

(Given : At. Wt. Sn = 118.7, O = 16, Zn = 65.38, P = 30.97)

SECTION-III

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

a) Give the different types of mass analyser.

b) State any four achievments of biotransduction.

c) What is silicone and glass micro matching?

d) Give the types of calorimetric and mass sensors.

e) Describe the advantages of automation.

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

    a)   Explain serial and parallel integration.

    b)   Discuss in detail chemical sensors.

    c)   Give an account of flow injection analyser.

    d)   Write a note on potentiometric sensors.

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

    a)   Write a short note on voltometric chemical sensors.

    b)   What are different types of analyser? Explain any one in detail.

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[5530]-4001

M.Sc. - I

PHYSICAL CHEMISTRY

CHP-410 : Molecular Structure and Spectroscopy

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

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

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

Physico - Chemical Constants

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

SECTION - I

Q1) Attempt the following : [10]

a) Define the term 'Coupling constant' in NMR.

b) Explain the theory of spin-spin interaction for an A_2 type case.

c) Write NMR equation and explain the terms involved in it.

d) Why are microwave radiations used to observe ESR signals?

e) What is quadrapole moment?

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

a) State the essential characteristics of the instrumentation for high resolution NMR.

b) Describe the working of magic T in the instrumentation of ESR.

c) Explain the concept of electric field gradient and quadrapole coupling constant.

d) Discuss the advantages of FT-NMR.

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

a) Predict the nature of ESR spectra of $^{14}NH_3$ and $^{15}NH_3$.

Given : ^{14}N, I = 1, A = 20 G (For $^{14}N - H$)

^{15}N, I = $\frac{1}{2}$, A = 6 G (For $^{15}N - H$)

^{1}H, I = $\frac{1}{2}$.

b) Calculate the frequency, required to excite proton from $m_1 = \frac{1}{2}$ to $m_1 = -\frac{1}{2}$.

Given : g_N = 5.585, H = 1.4 T.

SECTION - II

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

   a)   State and explain Bragg's diffraction law.

   b)   How are X-rays detected?

   c)   Define 'diamagnetism' and 'paramagnetism'.

   d)   Write Wierl equation and explain the terms involved in it.

   e)   What is magnetically ordered unit cell?

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

   a)   Derive Langevin equation.

   b)   Write a note on indexing in X-ray diffraction.

   c)   Explain how electron diffraction technique is more advantages than XRD.

   d)   Draw and explain with a neat labelled diagram of the experimental arrangement for the study of neutron diffraction technique.

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

   a)   Calculate the spin only moment for a metal complex with 3 unpaired electrons.

   b)   The gram susceptability of $Ni(en)_3 \, S_2O_3$ is 11.03×10^{-6} CGS units at 290 K. Find the susceptibility at 500 K.

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[5530]-4003
M.Sc.
PHYSICAL CHEMISTRY
CHP - 412 : Materials Chemistry and Catalysis
(2013 Pattern) (Semester - IV) (New)

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

Instructions to the candidates:

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

SECTION - I

Q1) Answer the following. [10]

    a) What is capacitor? Give its two applications.

    b) What is Poissons ratio?

    c) What is transistor? Give its three modes of operation.

    d) Draw the paining modes in hitech materials.

    e) What is Perovskite?

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

    a) What is rectifier? Explain full-wave rectifier.

    b) Explain ᴍᴀᴄᴠᴅ with reaction mechanism.

    c) What is sputtering? Explain RF sputtering.

    d) Explain preparation method of 1.2.3 material.

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

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

    b) Explain sol-gel method for preparation of thin film.

SECTION - II

Q4) Attempt the following. [10]

    a) Define 'catalyst deactivation'.

    b) What are zeolites? Give an example.

    c) Write the principles of green chemistry.

    d) Define the term 'calcination'.

    e) Give the mechanism of decomposition of ozone

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

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

    b) How is the characterization of a catalyst done by using XPS technique?

    c) Describe the sol-gel method for preparing catalysts.

    d) How are organic pollutants degraded using photocatalyst?

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

a) Derive the expression for kinetics of unimolecular surface reaction.

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

P/kPa	13.3	26.7	40.0	53.3	66.7	80.0	93.3
V/cm³	10.3	19.3	27.3	34.1	40.0	45.5	48.0

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[5530]-4004

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	$= 6.022 \times 10^{23}$ 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}
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5)	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
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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) Answer the following: [10]

    a)   Distinguish between animal cell and plant cell.

    b)   Differentiate among types of proteins.

    c)   Define proteolysis.

    d)   Give functions of Chaperones.

    e)   Differentiate between gene and genome.

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

    a)   Discuss the role of ATP in biological systems.

    b)   Write a note on protein finger printing.

    c)   Explain gel electrophoresis.

    d)   Write a note on flickering clusters.

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

    a)   Discuss the role of carbonic acid in thermoregulation.

    b)   Explain the use of Henderson equation to determine pH.

SECTION-II

Q4) Attempt the following: [10]

    a)   Distinguish between osmosis and diffusion.

    b)   Distinguish between isotonic and isomeric contraction.

    c)   Write a note on protein folding.

    d)   State Bragg's equation.

    e)   Give the principle of circular dichroism.

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

a) Discuss the role of calcium in muscle contraction.

b) Write a note on Michaelis Menten kinetics.

c) Discuss the Monod-Whyman Changeux Mechanism.

d) Write a note on Donnan Membrane Equilibrium.

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

a) Discuss the mechanism of the Na^+-K^+ pump.

b) Discuss the methods for determining shapes of macromolecules.

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[5530]-4005

M.Sc.

PHYSICAL CHEMISTRY

CHP-414 : Special Topics in Nuclear and Radiation Chemistry

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

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

Instructions to the candidates:

1) *Answers to the two sections should be written in separate answer books.*

2) *All questions are compulsory.*

3) *Figures to the right side indicate full marks.*

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

a)   Describe Szilard-Chalmer's reaction with a suitable example.

b)   Give an acccount of elastic scattering.

c)   Draw the schematic diagram of Van-de Graff electrostatic generator.

d)   Define the term radiopharmaceutical & give it's different methods for preparation.

e)   Complete the following reactions by writing equation.

   i) ^{197}Au (n,V) ....

   ii) ^{63}Cu (p, p3n9α) ....

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

a)   What do you understand by the terms in-vivo & in-vitro techniques? Explain in vivo diagnostic procedure.

b)   Explain the construction & working of linear accelerator.

c)   What were the reasons for Chernobyl accident? Write after effect's of this accident.

d)   Derive Breit-Wigner formula.

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

a)   Write a note on Radioimmunoassay.

b)   Evaluate Q-value for the reaction ^{7}Li(P, N)^{7}Be reaction

   Given:

   ^{7}Li = 7.01822 amu

   $^1_1$H = 1.00814 amu

   $^1_0$H = 1.008665 amu

   ^{7}Be = 7.019465 amu

SECTION-II

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

a) What is the condition for choosing a radioactive nuclide as indicator for radio metric titrations?

b) Explain the term protostar.

c) What are the advantages of radiometric titrations based on interaction of β-particles?

d) Write the uses of pulse radiolysis technique.

e) Write products formed in radiolysis of a alcohol.

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

a) What is radiolysis? Describe in detail radiolysis of aromatic hydrocarbons.

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

c) Write a note on types of radioactive wastes.

d) Give a brief account on stellar evolution.

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

a) 25 cm³ of K*I was titrated with 0.1 M AgNO₃ solution. Addtion of 2 cm³ AgNO₃ followed by removal of Ag*I percipitate showed a loss in activity from 5000 counts for 2 minutes to 4000 counts for 2 minutes. Find the concentration of KI taken for titration if background counts are 100 per 5 min. (Given : Atomic weight : K-39.1, I-127, Ag-108, N-14 and O-16)

b) Explain in brief the radiometric titration curve based on the interaction of β-particles with the substance.

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[5530]-4006

M.Sc. - II

INORGANIC CHEMISTRY

CHI-430 : Inorganic Polymers and Heterogeneous Catalysis

(2013 Pattern) (Semester - IV) (4 Credits)

Time : 3 Hours]

[Max. Marks : 50

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

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

a)   Describe in short the concept of active site in heterogeneous catalysts.

b)   What are zeolites? Give their classification.

c)   What do you mean by extra framework species in zeolites? Comment on its position.

d)   Discuss in short the effect of physical parameters on zeolite synthesis.

e)   How Raney metal catalysts are prepared? Explain their advantages.

f)   What do you mean by intercalated and pillered clays?

g)   Draw the structure of Perovskite oxides. Where do they find application as a catalyst.

h)   Draw the structure of tetrameric phosphazene.

i)   How promoters affects the performance of catalyst? Explain with suitable example.

j)   Describe the structure of HPA in short.

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

a)   What is chemical reactor? Explain construction, working, merits and demerits of fixed bed reactors.

b)   Discuss the use of zeolite as a hydrocracking catalysts.

c)   What is meant by supported metal catalysts? How support plays an important role in heterogeneous catalysts.

d)   What are inorganic polymers? Discuss the synthesis, structure and properties of S-N compounds.

P.T.O.

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

   a)   Discuss the characteristics of zeolite framework structure.

   b)   Give an account of spectroscopic and microscopic techniques.

   c)   How semiconducting oxides acts as a photocatalysts? Explain with suitable example.

   d)   Draw the Scheelite structure for $BiMoO_4$. Discuss its use as a oxidation and ammoxidation catalyst.

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

   a)   Immobilisation of transition metal complexes.

   b)   Catalytic converter.

   c)   LTA and FAV type zeolites.

   d)   Use of phosphotungstic acid (PTA) in organic synthesis.

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[5530]-4008

M.Sc. - II
INORGANIC CHEMISTRY
CHI - 432 : Material Science - II (Nanomaterials)
(2013 Pattern) (Semester - IV) (4 Credits)

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

Instructions to the candidates:
    1)   *All questions are compulsory.*
    2)   *All questions carry equal marks.*
    3)   *Use of calculators is allowed.*

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

    a)   What are nanocomposites? Give one example.

    b)   What are surfactants? Give any two example.

    c)   Give the two reducing agents used in synthesis of zero valent nanoparticle.

    d)   What is the porous size of mesoporous nanomaterials.

    e)   Define Rayleigh line.

    f)   What is a quantum dot? Give its aspects.

    g)   Define Piezoelectricity. Give one example.

    h)   Enlist the methods for synthesis of oxide nanoparticles.

    i)   Define fermilevel equilibrium.

    j)   What are colloids?

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

    a)   What is sonochemistry? Give sonochemical fabrication of nanomaterials.

    b)   What are nanoparticles? Discuss the advantages and disadvantages of mechanical method for synthesis of nanoparticle.

    c)   Explain the synthesis of nanomaterials using chemical vapour deposition (CVD) method with neat and labelled diagram.

    d)   Describe co-precipitation method for the synthesis of nanoparticles with suitable example? State its limitation and applications.

P.T.O.

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

a) Give the important criteria for choosing the synthetic route for preparation of nanoparticles.

b) How will you differentiate between SEM and TEM.

c) What do you mean by elastic and inelastic scattering of electrons?

d) Explain XRD-technique used for characterization of nanomaterials with suitable example.

Q4) Answer the following. (any two) **[10]**

a) What are nanosensors? Explain the any two types of nanosensors.

b) What are inorganic nanotube? Write the properties and synthesis of WS_2 nanotube.

c) Explain the surface area/volume ratio and magnetic properties of nanoparticle with suitable example.

d) Write a note on nanomaterial used in longer-lasting medical implants.

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[5530]-4009
M.Sc. - II
INORGANIC CHEMISTRY
CHI : 445 : Inorganic Chemistry : Applications In Industry, Environment and Medicine
(2013 Pattern) (Semester - IV) (4-Credit)

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 indicates full marks.*
    5)   *Neat diagrams must be drawn wherever necessary.*

SECTION : I

(Applications in Industry)

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

    a)   What is Pigment? Give the classification of Pigments on the basis of its origin.

    b)   Write the composition of tetrachromate electrolytic bath.

    c)   Give the methods for electroplating of precious metals.

    d)   Give the names of two essential natural Pigments.

    e)   Why animal Pigment like melanin in light shows dark colour?

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

    a)   Describe giving chemical reactions process of manufacture of Red Iron oxide by synthetic route.

    b)   Discuss the use of polymers in electroplating.

P.T.O.

c) Give two examples and draw structures of

    i)   Metallized dyes   ii)   Medially metallized azodyes

d) Give an account of preparation of copper dyes from O-hydroxy diazyl azo compounds and O-halogeno-o-hydroxy diazyl azo compounds.

Q3) Write note on any one   **[5]**

a) Electrodeposition of chromium.

b) Brightening agents.

c) Mordant dyeing.

SECTION : II

(Environment)

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

a) List the provisions of clean water act.

b) Explain oil and grease removal from waste water.

c) What are pollutants? Name two water pollutants.

d) List the different methods of removal of Nitrogen from waste water.

e) How powerball is manufactured?

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

a) List the trace element pollution in natural water with sources, effect and significance.

b) Name the instrumental method for the determination of Hg, Cd, As, and Pb. Explain X-ray Fluorescence (XRF) method for the determination of lead from polluted water.

c) Compare aerobic treatment process with an anaerobic treatment process.

d) What are the oxygen consuming waste? Name typical sources. Describe how to do BOD test on a water sample.

Q6) Write a note on any one: **[5]**

    a) Energy sources for the 21ˢᵗ century.

    b) Activated sludge process.

    c) Reverse osmosis

SECTION : III

(Medicine)

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

    a) Name the ligand with Au(I) from stable complexes.

    b) Give the names of any four radionuclides which are used as diagnostic agent.

    c) Name any two gold complexes that are used to treat HIV.

    d) Define "Prodrug" and give suitable example.

    e) What is meant by chelation therapy? What is it used for?

Q8) Answer the following any two: **[10]**

    a) Discuss the mechanism of action of cis-platin based anticancer drugs.

    b) Explain the coordination interaction of metal complexes with nucleic acid.

    c) Explain with the help of suitable diagram the nuclease activity of Cu(phen)$_2$ complex.

    d) Discuss the binding of Bismuth with thionate ligand.

Q9) Write a note on <u>any one</u> **[5]**

    a) Vanadium and insulin modification.

    b) Crysotherapy.

    c) Metals in medicine.

■ ■ ■

[5530]-4012

M.Sc. - II

ORGANIC CHEMISTRY

CHO-452 : Carbohydrates, Chiron Approach, Chiral Drugs and Medicinal Chemistry

(2013 Pattern) (Semester-IV)

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

Instructions to the candidates:

1) All questions are compulsory.

2) Figures to the right indicate full marks.

3) Answers to the two sections should be written in separate answer books.

SECTION-I

Q1) Answer any five of the following: **[10]**

a) Explain the term distomer with an example.

b) Give key steps in the synthesis of L(+) alanine.

c) Draw the stereo structure of Dextropropoxyphene and explain its applications as chiral drug.

d) Explain mechanism of action of S-Metaprolol.

e) Complete the following conversion with mechanism.
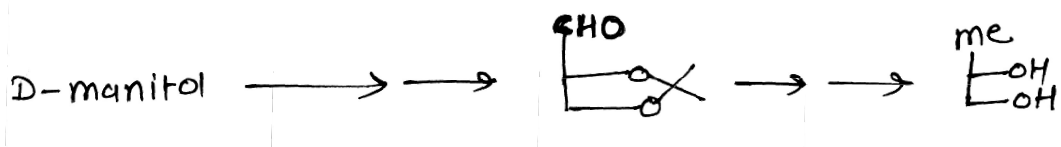
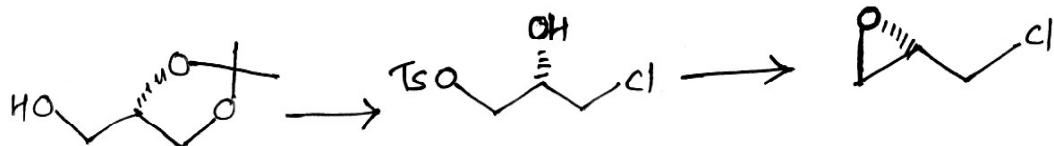f) Explain the adverse effect of Indinavir.

Q2) Explain any five: **[10]**

a) Explain with an example how R-isomer of a chiral drug is converted into its S-isomer in vivo.

b) Complete the following sequence with correct reagents.

c) Write retrosynthesis of α(–) multistriatin leading to D-Glusose.

d) Explain the term: Eudysmic Ratio

e) Explain the advantage of using the single enantiomer as drug than racemate.

f) Explain pharmacology and side effects of captopril.

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

Explain importance of carbohydrates as a starting material in chiron approach. How will you convert a pentose sugar into Aldohexose sugar? Discuss various reactions that confirm the cyclic form of D-glucose.

SECTION-II

Q4) Answer any 5: **[10]**

a) Explain with an example : Narrow Spectrum Antibiotics.

b) Discuss mode of action of macrolides.

c) What are antimetabolites? Explain with an example.

d) Give an account of history of antibiotics.

e) Discuss SAR of tetracyclins.

f) What are β-lactam antibiotics? Give their mode of action.

Q5) Solve any 2: **[10]**

a) Discuss various types of bondings involved in Drug-Receptor interactions? What is partition coefficient (P)?

b) What is selective toxicity? Explain it with respect to antifungal and antiviral agents.

c) Define: Pharmacokinetics. What is Lipinski rule of five? Explain the observation: Quinine is absorbed more effectively from the intestines than from the stomach.

Q6) Explain any - 1: **[5]**

a) What are sulphonamides? Discuss SAR and mode of action of sulphonamides. Explain uses of sulphonamides.

b) How penicillin –G gets deactivated in stomach? Discuss acid resistant penicillins and Beta lactamase resistant penicillins.

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[5530]-4013

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 indicates full marks.*

    3)   *Answers to the two sections should be written in separate answer books.*

SECTION-I

Q1) Answer the following: **[10]**
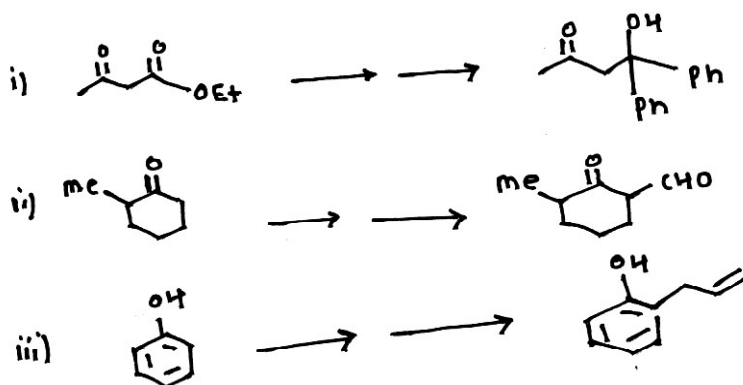
    a)   Write a short note on linear method for the synthesis of target molecule.

    b)   Explain why enamine approach is better than the base catalysed alkylation of ketone.

    c)   Use of Fmoc group in organic synthesis with suitable examples.

    d)   Robinson Annulation.

    e)   Give the synthetic equivalent to the following synthons.

$$^{\ominus}CH_2-COOEt \qquad \overset{\overset{O}{\parallel}}{CH_3-C}{}^{\oplus}$$

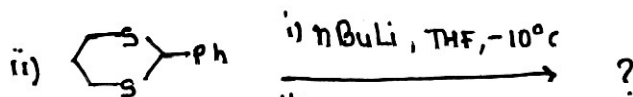**Q2)** a)   How will you bring about following transformations. (Any two):   **[5]**
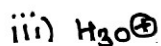
b) Predict the products in <u>any two</u> of the following: [5]

i)

 , me i) [pyrrolidine] , PTSA, C_6H_6 Δ ?

ii) $\diagup\!\!\diagdown\!\!\diagup$ Br

iii) $H_3O^\oplus$

ii) [1,3-dithiane]—Ph   i) nBuLi , THF, $-10°C$

→ ?

ii) Ph$\diagup\!\!\diagdown$Br

iii) $H_3O^\oplus$, Hg^{2+}

iii)

HO$\diagup\!\!\diagdown\!\!\diagup\!\!\diagdown$OH   [epoxide] , $H^\oplus$, PhH
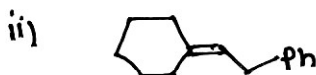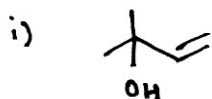   1 eq.   ? $\xrightarrow{PCC}$?
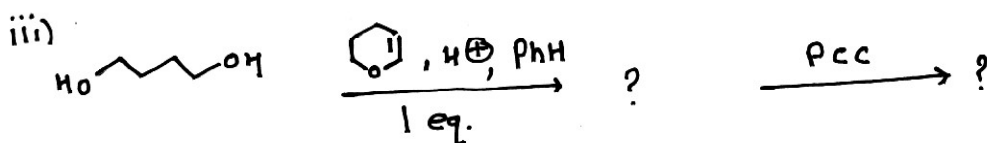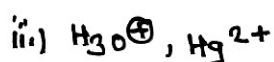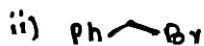
Q3) a) Using reterosynthetic analysis, suggest suitable method to synthesis
        (Any One).   [3]

i) $\diagup\!\!\diagdown\!\!\diagup$
        OH   ii) [cyclohexane]$=\diagup\!\!\diagdown$Ph

b) Arrange the given reagents in proper order to accomplish the following
    conversion. Write the structures of intermediates.   [2]

H—C—H $\longrightarrow$ $\longrightarrow$ $\longrightarrow$ me—C(=O)—C(=O)—Me

nBuLi , me-I , THF ; HS$\diagup\!\!\diagdown\!\!\diagup$SH, $H^\oplus$; $H_3O^\oplus$, $HgCl_2$; nBuLi , me-C(=O)-cl
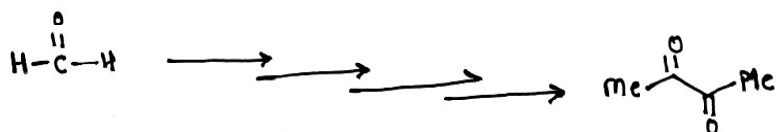
Q4) a) Explain the following transformations with respect to stereochemical outcome of the reaction (<u>Any two</u>): **[6]**

i)
95%   5%

ii)

iii)
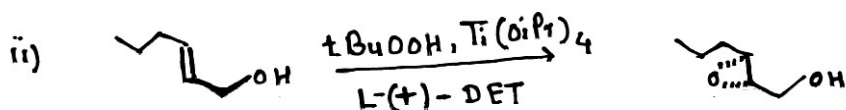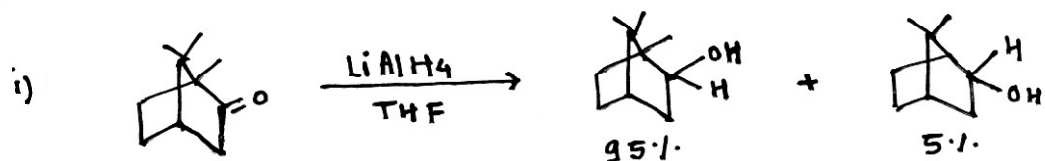
b) Name the suitable reagent for the following transformations and comment on the formation of product (<u>Any two</u>): **[4]**

i)

ii)
(Major)

iii)
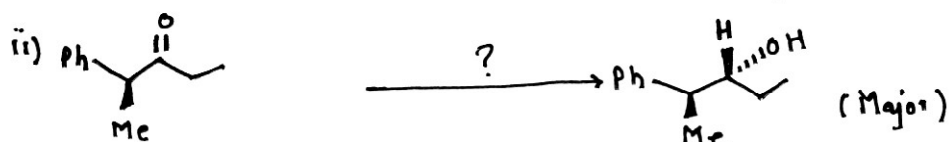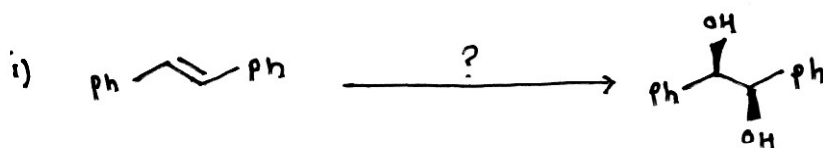
Q5) a) Write a short note on <u>any two</u>: **[6]**

i) Burgi-Dunitz angle.

ii) CBS Reduction.

iii) Chiral Auxiliaries.

b) Predict the products and comment on the following transformations (Any two): **[4]**
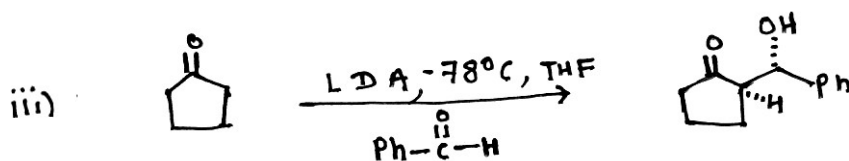

i) [structure with Me and CHO]   i) ZnCl₂ ii) H₂/Pt   → ?

ii) R—[cyclohexenone]   Me₂CuLi → ?

iii) Ph—[SMe ketone]   Li⁺ R₃BH⁻ → ?
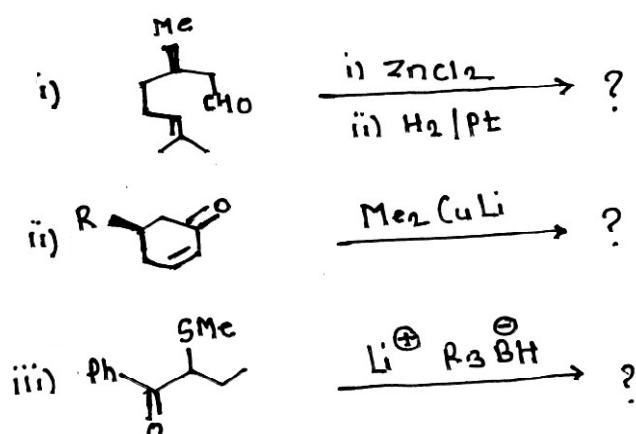
Q6) a) Define the following terms (Any one): **[2]**

     i) Stereospecific Reactions.

     ii) Amino acids as a Chiral Pool.

b) Complete the following multistep synthesis using appropriate reagents or intermediates. **[3]**
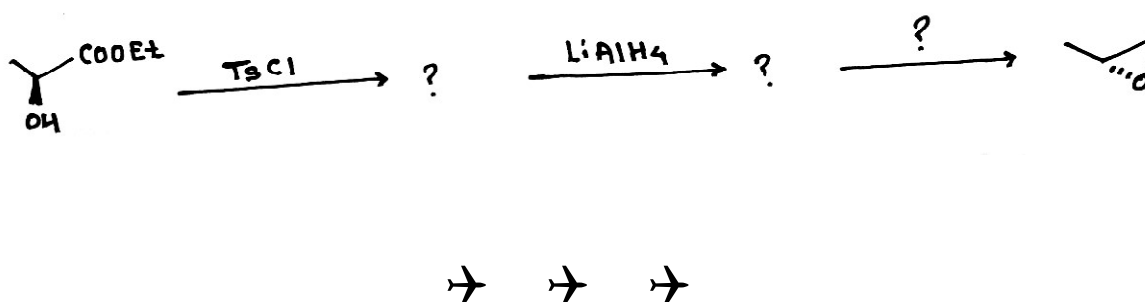
[structure COOEt / OH]   TsCl → ?   LiAlH₄ → ?   ? → [epoxide]

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[5530]-4014

M.Sc. - II
ANALYTICAL CHEMISTRY
CHA-481 : Analytical Toxicology and Food Analysis
(2013 Pattern) (Semester - IV)

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

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

SECTION - I

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

a) Give the steps underlying an analytical toxicological investigation.

b) Give the principle of isolation and identification of amphetamine and methamphetamine type A procedure.

c) Define the terms :

   i) Narcotic drugs.

   ii) Cannabis.

d) Give the principle of isolation and identification of Caffeine from urine procedure type B.

e) Explain 'Stimulants'.

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

a) Give detail procedure for absorption and elution of cocaine.

b) Give the principle of isolation, identification and determination of amphetamine and methamphetamine type C procedure.

c) Give the rules related to narcotic and psychotropic substances related to import and export.

d) State the principle for determination of barbiturates by procedure type A. Explain its procedure in detail.

P.T.O.

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

a) Explain in short pre-treatment of biological fluid.

b) Blood sample was analysed for metamphetamine content using gas chromatographic method.

It gave following observations :

i) Internal standard concentration = 2.85 µg/ml.

ii) Peak height for metamphetamine = 9.87.

iii) Peak height for metamphetamine in standard reference solution = 5.20.

iv) Peak height for internal standard in specimen = 3.71.

v) Peak height for internal standard in reference solution = 1.89.

vi) Volume correction factor = 0.67.

Calculate metamphetamine concentration in blood sample.

SECTION - II

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

a) Write a note on food additive.

b) Give an analytical procedure for determination of saccharin sweetner.

c) Discuss the method used for the estimation of sap value of oil.

d) How sterilization of milk is verified?

e) Give legislation and regulation for food preservatives.

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

a) Describe the Tanner method used for estimation of SO_2 from food sample.

b) Give Folin-Wu method for determination of Carbohydrate.

c) Write a note on determination of Methionine content in food grain.

d) Describe method for determination of boric acid in preservatives.

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

a) If nitrogen retained, nitrogen absorbed, nitrogen taken from protein by rat was 1.85 mg, 1.25 mg and 9.37 mg respectively. Calculate NPV, D, BV.

b) Sample of buffer weighing 5g was dissolved in chloroform and treated with potassium iodide solution. It was titrated aganist 0.01M sodium thiosulphate gave burette reading 8.2 ml. Calculate peroxide value.

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[5530]-4016

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) *Draw neat diagrams wherever necessary.*
4) *Use of logarithmic tables, non-programmable calculators is allowed.*

SECTION - I

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

   a) What is total hardness? How is it estimated?

   b) Enlist the methods used for determination of phosphorus from fertilizers.

   c) Enlist general methods for analysis of soaps and detergents.

   d) Define:

      i) Total Nitrogen

      ii) Urea Nitrogen

   e) Mention the parameters used to ensure the water quality.

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

   a) Give a method for determination of residual chlorine and chlorine demand in water.

   b) Enlist methods for estimation of potassium from mixed fertilizers. How is potassium estimated from mixed fertilizer by flame photometric method.

   c) How is free glycerol estimated from soap?

   d) Nitrogen containing fertilizer weighing 0.56g was treated in a Kjeldahl flask 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]

Q3) Answer any one of the following. **[5]**
    a)   Give suitable methods for estimation of :
        i)   Unsulfonated or unsulfated matter.
        ii)   Combined alcohols from synthetic detergents.
    b)   Estimate the amount of potassium as K_2O in 45.0kg of NPK fertilizer having the proportion (18:8:8).
        [Given : Atomic weight of K = 39.0, Atomic weight of O = 15.99]

SECTION - II

Q4) Answer the following. **[10]**
    a)   What is polydispersivity index?
    b)   Define pigment and binder.
    c)   Explain what is haze and gloss.
    d)   Give a brief account of electrical properties of polymer.
    e)   What are the tests carried out on total coating? Explain briefly.

Q5) Attempt any two of the following. **[10]**
    a)   Explain the role of thermal methods used in structure elucidation of polymeric material.
    b)   Outline the general procedures for estimation of white and tinted pigments with flow sheets.
    c)   Describe Ebuliometric method for determination of number average molecular weight of polymeric sample.
    d)   0.250 g of yellow chrome pigment was disintegrated and soluble chromate was extracted with sulphuric acid and diluted to 250 ml. The 25 ml solution was used for estimation of chromate iodometrically which required 12.8 ml of 0.05N $Na_2S_2O_3$ solution. Calculate the percentage of chromium in a given sample.
        [Given : Atomic weight of Cr = 51.999]

Q6) Answer any one of the following: **[5]**
    a)   What are volatile and non-volatile components of paints? How are they estimated?
    b)   The intrinsic viscosity of myosine is 317 cm³/g. Calculate approximate concentration of myosine in water which could have a relative viscosity 1.5.

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[5530]-4017

M.Sc. - II

ANALYTICAL CHEMISTRY

CHA-492 : Methods of Analysis and Applications

(2013 Pattern) (Semester-IV)

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

Instructions to the candidates:

1) *Students should attempt any two sections from section I, II and III.*
2) *All questions of respective sections are compulsory.*
3) *Figure to right hand side indicates full marks.*
4) *Neat labelled diagrams must be drawn wherever necessary.*
5) *Use of log table/non-programmable calculator is allowed.*
6) *Write the answers of two sections on seperate answer book.*

SECTION-I
(Pollution Monitoring and Control)

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

     a)   What are pollutants?

     b)   Give the types of dust collectors.

     c)   Mention the sources of SO_2 in environment.

     d)   Give the principle for determination of arsenic.

     e)   What is industrial effluent?

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

     a)   Write a short note on copper recovery.

     b)   Explain in brief desulphurization of fuel.

     c)   What is liquid scrubbing. How it is use for seperation of particulate matter.

     d)   Explain the determination of urea and other nitrogen compound in the effluent.

P.T.O.

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

    a)   Discuss the hazardous effect of particulate matters.

    b)   Explain the importance of removal of heavy metals from waste.

SECTION-II

(Analysis of Body Fluid)

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

    a)   What are the physical characteristics of urea?

    b)   Define anticoagulants. Give its examples.

    c)   Give the principle of Radioimmunoassay.

    d)   What are the defficiancy diseases of Vitamin A and Vitamin B?

    e)   What are ketone bodies?

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

    a)   Explain the method used for determination of serum cholesterol.

    b)   Write a short note on ELISA.

    c)   Describe the flurometric method for estimation of Vitamin B_1.

    d)   Write a note on collection of blood sample with respect to its storage and preservation.

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

    a)   Write a note on glucose tolerance test.

    b)   How serum bilrubin is estimated by Van der Bergh Method.

SECTION-III

(Carbon Nanostructure and Applications of Nanotechnology)

Q7) Answer the following: [10]

    a) What is scooter mechanism?

    b) What are carbon nanotubes and nanowires?

    c) Give the name of any four microorganisms used for synthesis of gold nanoparticles.

    d) Enlist the different types of sensors.

    e) What are quantum dots?

Q8) Attempt <u>any two</u> of the following: [10]

    a) Explain the mechanical properties of CNT's.

    b) Describe any two relevant parameters in nanoparticle toxicology.

    c) Write a note on photodynamic therapy in targeted drug administration.

    d) Explain the term:

        i) Biomembrane based sensors.

        ii) Intercalation.

Q9) Attempt <u>any one</u> of the following: [5]

    a) How carbon nanotubes are fabricated?

    b) Explain the role of yeast in the synthesis of nanoparticles.

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