Total No. of Questions : 6] **[Total No. of Pages : 2**

P1229

[3623]-104
M.Sc.
BIOCHEMISTRY
BCH-170 : Biomolecules
(New and Old Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions :

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.***

SECTION - I

Q1) Answer any four of the following : **[10]**

a) Explain acid base titration curve.

b) Explain furan ring structure with reference to glucose.

c) What is deoxysugar? Give its importance.

d) Give the significance of bilayer in membrane organization.

e) Discuss the structure of water molecule.

Q2) Attempt any three of the following : **[15]**

a) What are fat soluble vitamins? Give their role with suitable example.

b) Explain the cyclic structure of monosaccharide.

c) Give the structure, importance of co-enzyme form of vit. B_6.

d) Explain the structure of prokaryotic cell.

Q3) Answer any three of the following : **[15]**

a) Explain in detail physiological buffer system.

b) Write a note on composition of living matter.

c) Discuss the role of phospholipids.

d) Give principle and working of pH meter.

P.T.O.

SECTION - II

Q4) Answer any five of the following : **[15]**

a) What is isoelectric point? Give its significance.

b) Give the structure of following tripeptide.

Gly – Arg – Ala

c) Give Edman's reaction for terminal determination.

d) What are rare amino acids?

e) Explain the role of carboxypeptidase in terminal determination.

f) Amino acids are optically active. Explain.

Q5) Attempt any three of the following : **[15]**

a) Describe the folding and unfolding of protein.

b) Write a note on helixcoil transition.

c) Explain amino acid titration curve with suitable example.

d) Give the separation techniques of amino acids.

Q6) Answer any two of the following : **[10]**

a) Write a note on role of forceses in stability of protein structure.

b) Describe α helical and β pleated structure of protein.

c) Discuss the role and importance of protein.

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Total No. of Questions : 6] **[Total No. of Pages : 2**

P1228

[3623]-52
M.Sc.
BIOCHEMISTRY
BCH-375 : Nutrition and Clinical Nutrition
(New Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions :

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

SECTION - I

Q1) Answer any two of the following : **[10]**

a) Discuss how the data generated from clinical examination is useful for assessment of nutrition.

b) Give the classification of dietary lipids, sources and their physiological role.

c) Describe the effects of radioactive fall out, food additives, agricultural chemicals and fungi on food.

Q2) Answer any three of the following : **[15]**

a) How will you diagnose the different types of nutritional anaemias?

b) Justify the statement and scientific finding, "doctors advice their patients to control calary intake for living healthy life.

c) Describe the disorders due to protein deficiency in diet.

d) Write a short note on allergy.

Q3) Write short notes on any three : **[15]**

a) Factors affecting nitrogen balance.

b) Thermogenic effect of food.

c) Role of minerals in the body.

d) Deficiency disorders due to vitamin B complex.

P.T.O.

SECTION - II

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

a) What are the effects of cooking and refining on food quality?

b) Write a short note on amino acid therapy and its clinical significance.

c) What is alcoholism? Explain the adverse effects of it.

Q5) Answer any three of the following : **[15]**

a) Explain the effect of hallucinogens.

b) Describe the chemistry of dietary fibers and their beneficial and harmful effects.

c) Write a short note on food toxins.

d) What are neutral transquilizers? Give the physiological action of any two.

Q6) Write short notes on (any three) : **[15]**

a) Long term effects of tobacco.

b) Inborn errors of metabolism.

c) Geriatric nutrition.

d) Food quality.

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Total No. of Questions : 4] **[Total No. of Pages : 2**

P838

[3623]-305

M.Sc. - II

INORGANIC CHEMISTRY

CH-326 : Organometallic Compounds of Transition Metals and Homogeneous Catalysis (New Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates :

1) ***All questions are compulsory and carry equal marks.***
2) ***Figures to the right indicates full marks.***
3) ***Use of log. table and calculator are allowed.***
4) ***At. No : Mn = 25, Fe = 26, Co = 27, Mo = 42, W = 74.***

Q1) Attempt any FOUR of the following : **[20]**

a) Give the systematic classification of σ-bonded T.M. hydrocarbyls.

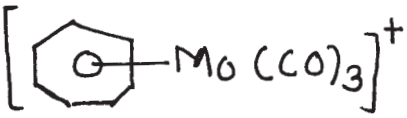
b) What are the structural features of simple metal-carbonyls.

c) Give the typical reactions of zeise's salt.

d) What are the alkyne complexes? Discuss bonding in such complexes.

e) What is EAN rule? Which of the following obey EAN rule?

i) $Fe_2(CO)_9$ ii) $[Mn(CO)_4NO]^-$

iii) $[Co(\eta^5\text{- } C_5H_5)_2]$ iv) 

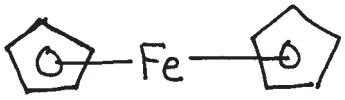
v) $Cpd(NO)_2W^-H$

Q2) Attempt any FOUR of the following : **[20]**

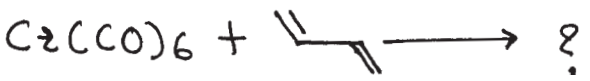
a) Complete the following reactions.

i) $(\eta^5 - C_5H_5)_2\ HRe + H^+ \longrightarrow ?$

ii) $Co_2(CO)_8 + NO \qquad ?$

iii)  $? \xrightarrow{N_2O_4} ?$

iv) $Mo(CO)_6 \xrightarrow{RCOOH} ?$

v) 

P.T.O.

b) Discuss the ^{1}HNMR of $Fe(CO)_3$ ($\eta^4 - C_8H_8$) at room temp. and –145°C.

c) What do you understand by

i) Sandwich compounds.

ii) Bent metallocenes. Describe the methods of synthesis of metallocene.

d) Explain the effect of organometallic compounds on environment.

e) Write the factors favourable for the oxidative addition reactions.

Q3) Attempt <u>any FOUR</u> of the following: **[20]**

a) Comment on the statement NMR-spectroscopy is an eminently suitable technique to study fluxional behaviour of organometallic compounds.

b) Explain with the help of suitable examples, the role of organometallic compounds as 'Protecting & activating agents'.

c) Explain the role of Rh(III) complex in monsanto acetic acid process.

d) The ν(CO) in the IR spectrum of $[Fe(CO)_4]^-$ is seen at about 1790 cm^{-1}, whereas for $Ni(CO)_4$ it is seen at about 2060 cm^{-1}. Explain.

e) Give steps involved in Tolman's catalytic cycle.

Q4) Attempt <u>any FOUR</u> of the following: **[20]**

a) Write a short note on – Suzuki Coupling.

b) Giving the catalytic cycles for hydroformylation of olefin. What are advantages of rhodium catalyst over cobalt catalyst.

c) Explain the role of alkyne molybdate in the epoxidation of propylene.

d) Draw the structures –

i) $Os_6(CO)_{18}$ ii) $Rh_4(CO)_{12}$

iii) Dimenc $Mn_2(CO)_{10}$ iv) $Fe_2Ru(CO)_{12}$

v) $[Mn(CO)_4Br]_2$

e) Discuss briefly group V organometallic compounds in medicine.

Total No. of Questions : 4] **[Total No. of Pages : 2**

P839

[3623]-306

M.Sc. - II

INORGANIC CHEMISTRY

CH-330 : Coordination Chemistry, Magnetism and Inorganic Reaction Mechanism

(Sem. - III) (New Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates :

1) ***All questions are compulsory and carry equal marks.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Use of logarithmic tables and calculator is allowed.***

Q1) Attempt any four of the following : **[20]**

a) What are magnetically diluted and concentrated systems.

b) Discuss the factors that affect the crystal field stabilization energy in transition metal complexes.

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

Ti^{3+} μ B.m. expt = 1.7 to 1.8 B.m.

Co^{2+} μ B.m. expt = 4.1 to 5.2 B.m.

Given :- atomic no. of Ti = 22 and that of Co = 27.

d) Write about super exchange model for an antiferromagnetic interaction.

e) $Mn_2(CO)_{10}$ is diamagnetic. Explain.

Q2) Answer any four of the following : **[20]**

a) Draw the structures of following molecules and state whether they are paramagnetic or diamagnetic.

i) $[Pt(NH_3)_3Cl_3]Cl$ Atomic No. : Pt = 78

ii) $[Cr(NH_3)_5Cl]Cl_2$ Atomic No. : Cr = 24

iii) $K_3[Fe(OX)_3]$ Atomic No. : Fe = 26

iv) $Mo_2(CO)_8$ Atomic No. : Mo = 42

v) $[Rh(PPh_3)_2Cl_2]$ Atomic No. : Rh = 45

b) What are mixed valence compounds? How they are classified? Why many of them are intensely coloured.

P.T.O.

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) Explain why certain Ni(II) complexes shows anomalous magnetic moments.

e) Draw the crystal field splitting of d orbitals of a central metal ion in symmetric tetrahedral, square planar and trigonal bipyramidal complexes.

Q3) Attempt <u>any four</u> of the following : **[20]**

a) Explain the main reaction types with suitable examples.

b) What is conjugate base dissociation mechanism? Explain it with reference to octahedral cobalt (III) complexes.

c) What is trans effect? Explain it with suitable examples.

d) Write a note on insertion reactions.

e) Discuss the mechanism of electron transfer reaction, with reference to inner sphere reactions.

Q4) Answer <u>any four</u> of the following : **[20]**

a) Explain the mechanism of Photographic Process.

b) Explain isomerism in $[Co(en)_2Cl_2]^+$.

c) Write a note on oxidative addition reactions.

d) Complete the following chemical equations.

i) $IrH(CO)(PPh_3)_3 + Cl_2 \longrightarrow \square + \square$

ii) $TiCl_4 + Cl^- \quad \square + \square$

iii) $Cr(CO)_6 + Py \quad \square + \square$

iv) $[Cr(H_2O)_6]^{2+} + CHCl_3 \quad \square + \square + H_2O$

v) $[Fe(CN)_6]^{4-} + [Fe(Phen)_3]^{3+} \quad \square + \square$

e) Discuss in brief reductive elimination reactions.

Total No. of Questions : 4] **[Total No. of Pages : 2**

P840

[3623]-307

M.Sc. - II

INORGANIC CHEMISTRY

CH-331 : Structural Methods in Inorganic Chemistry

(New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***

Q1) Answer the following (any four) : **[20]**

a) What is DTA? Draw the DTA curves for decomposition of $CaC_2O_4 \cdot H_2O$ in air and CO_2. Explain the difference in the two curves.

b) Explain Kramer degeneracy theorem.

c) Explain the cyclic voltamogram of $K_3[Fe(CN)_6]$ in 1N KNO_3 scanned between +0.80 to – 0.15V.

d) Explain the principle and limitations of NQR techniques.

e) Discuss the factors affecting "Chemical Shift" in NMR.

Q2) Attempt any four : **[20]**

a) Discuss the ESR spectrum of $CuCl_2 \cdot 2H_2O$.

b) Give the criteria for reversible electron transfer reaction.

c) How can the structures of phosphorus and hypo phosphorus acids be determined by NMR technique?

d) Predict the number of lines and transition expected in the ESR spectrum of $C_6H_6^-$ anion.

e) What are Miller indices? Compute the Miller indices for faces having Intercepts as

i) $\frac{1}{3}, 1, \frac{1}{2}$.

ii) 2, 5, 3.

iii) $\frac{1}{2}, \frac{2}{3}, \infty$.

P.T.O.

Q3) Solve any four : **[20]**

a) From the following data determine the 'g' value of a given compound. H = 3250 guass, $\nu = 9.144 \times 10^{9}$ cycles/sec. h = 6.625×10^{-27} erg/sec.

b) Calculate the interplanar spacing of a set of planes if the angle for the first order reflection is $23°6^{l}$. Wave - length of X-rays used is 1.84 $\mathring{A}$.

c) In the thermogravimetric analysis containing $Ca(OH)_2$ the loss in weight at different stages of heating was as follows.

i) 0.018g between 100 – 150°C

ii) 0.038g between 500 – 560°C

iii) 0.022g between 900 – 950°C

Predict the changes and determine the composition of $Ca(OH)_2$ in the sample.

d) $NiSO_4 \cdot 7H_2O$ dehydrates in three stages. Draw the thermogram and write equations indicating the changes taking place.

e) What is the amount of KO_3 in the sample if in TGA analysis of potassium compound shows the following transformation

$$KO_{3(S)} \xrightarrow{\Delta} KO_{2(S)} + \frac{1}{2}O_{2(g)}$$

The 0.2546g of sample when heated at 70°C for 60 min. weighed 0.213g.

Q4) Write short notes on (any four) : **[20]**

a) Asymmetry parameter.

b) Quadrupole splitting in Mössbauer spectro-scopy.

c) Cathodic and Anodic current.

d) DSC.

e) Applications of ESR.

Total No. of Questions : 4] **[Total No. of Pages : 2**

P841

[3623]-308

M.Sc. - II

INORGANIC CHEMISTRY

CH-332 : Bioinorganic Chemistry : Inorganic Elements in the Chemistry of Life

(Sem. - III) (New Revised)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***

Q1) Attempt the following (any four) : **[20]**

a) Explain the role of Dopamine β-mono oxygenase in the biological oxidation of phenylalanine. Which is the hormone obtained in this process?

b) Explain the catalytic cycle for the transformation of catechol derivatives to light absorbing quinones by copper containing enzymes.

c) Explain the mechanism for carboxypeptidase catalysed hydrolysis.

d) Which are the enzymes that contain Vit. B-12. Comment on their functions.

e) Give an account of the various oxidation states of Manganese and discuss the kinetic and thermodynamic aspects with reference to biology.

Q2) Answer any two : **[20]**

a) Explain in detail the mode of action and Binding interaction of cis plastin with DNA.

b) Comment on the chemical aspects of Gallium and Indium as Radiopharmaceuticals.

c) How does nature make use of the different interactions of metals with nucleic acids.

Q3) Attempt the following (any four) : **[20]**

a) Name the techniques used to study the binding interactions between DNA and metal complexes. Explain any one technique with a suitable experiment.

P.T.O.

b) Give an account of metal complexes of Technitium used for imaging kidney structure and kidney function.

c) Explain how tissue iron concentration in the brain acts as an Endogenous agent in High Field MRI.

d) What is molecular imaging? Which are the different modalities employed in molecular imaging and their means of detection?

e) Comment on the Fundamental Reactions of Transition metal complexes with poly nucleotides.

Q4) a) Write short notes on : (any 2) **[10]**

i) Regulatory role of zinc in biological systems.

ii) Cytochrome oxidase.

iii) Manganese cluster chemistry.

b) Draw the structures and mention one important feature of each one of them. **[10]**

i) Cytochrome C.

ii) Spirogermanium.

iii) GdDTPA.

iv) Carboplatin.

v) Auranofin.

Total No. of Questions : 6] **[Total No. of Pages : 3**

P408

[3623] - 21
M.Sc.
DRUG CHEMISTRY
CH - 211 : Physical Chemistry - II
(Sem. - II) (Old)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt Any Three of the following: **[15]**

a) Derive the expression for vibrational energy of simple harmonic oscillator. Draw a neat diagram showing vibrational energy levels and transitions for this oscillator.

b) Give the principle used in Fourier transform spectroscopy. Mention the advantages of F.T. spectroscopy.

c) Discuss the pure rotational Raman Spectra for linear molecules.

d) Explain the origine for appearance of pre-dissociation in fine structure of electronic spectra of the molecules.

e) Describe with suitable example, the determination of internuclear distance by microwave/spectroscopy.

Q2) Attempt Any Three of the following: **[15]**

a) Explain stark effect giving its applications.

b) Describe the analytical applications of Infrared spectroscopy

c) Discuss the general rules governing the number of lines observed in the ESR spectrum.

d) Why are lasers prefered as source of radiations in Raman spectra? What are the disadvantages of coloured samples in Raman spectroscopy?

e) Describe the application of Born-Oppenheimer Approximation for electronic spectra of diatomic molecules.

Q3) Solve Any Two of the following: **[10]**

a) Calculate the moment of inertia for CO molecule if the internuclear distance is 1.121 A°. Also find the value of $\upsilon_{0\to1}$ in the microwave spectra of CO molecule.

b) The frequency of the fundamental, frist and second overtone absorption bands of HCl are known to be 2885.9, 5668.0 and 8346.9 cm^{-1} respectively. Estimate the oscillating frequency force constant and dissociation energy of HCl molecule (H = 1, Cl = 35.5)

c) When CS_2 is irradiated with the 435.8 nm Hg line, a Raman line is observed at 17652 cm^{-1} . Calculate the fundamental vibrational frequency of CS_2.

SECTION - II

Q4) Attempt Any Three of the following: **[15]**

a) List the ionic, radical and molecular products of radiolysis of water. How are the molecular products formed? What is the effect of LET of the radiation on the yield of molecular products?

b) Write equations for Ficks first and second law of diffusion explaining the terms involved. How is the diffusion coefficient calculated using a radioisotope?

c) Describe construction and working of GM counter explaining the terms plataue voltage, quenching process and resolving time of the counter.

d) What is dose? Describe the various units of a dose.

e) Explain the working of Fricke dosimeter. What precautions should be taken while using it?

Q5) Attempt Any Three of the following: **[15]**

a) Discuss the primary effects due to passage of charged particles through matter. Explain the terms, spur, track and δ rays.

b) What are scavangers? How are they used in the radiolysis of water?

c) Discuss the principle of neutron activation analysis. What is saturation activity? Explain the comparator method of NAA.

d) Discuss the evidences in favour of the existence of hydrated electron. Draw its neat structure and give the physical and chemical properties.

e) Explain the use of lebelled chlorine in the study of mechanism of Friedel Crafts reaction.

Q6) Solve Any Two of the following: **[10]**

a) Calculate the thickness of lead required to reduce the level of radiation due to a gamma source at a point from 1.5 Gy to 6 mGy. If $e^{\mu} = 0.211$ barn electron^{-1} and density of lead is 11.35 gm cm^{-3}.

b) Calculate the mass absorption coefficient for 1MeV γ - gamma radiation for i) $Ca(PO_3)_2$ ii) $NaIO_3$.

c) Calculate the dose absorbed in 3 hours by CH_3COOH at a position where dose absorbed by Fricke dosimeter is 3.5Gymn^{-1}. $\left(\overline{Z/A}\right)$ of Fricke solution is 0.553 (Atomic wt : H =1, C = 12, O = 16).

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Total No. of Questions : 4] **[Total No. of Pages : 5**

P409

[3623] - 22
M.Sc. - I
DRUG CHEMISTRY
CH - 231 : Inorganic and Analytical Chemistry
(Sem. - II) (Old Course)

Time : 3 Hours] ***[Max. Marks :80***

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.***
4) ***Use of log table and calculator is allowed.***
5) ***Atomic numbers: Cr = 24, Ni = 28, Co = 27.***

SECTION - I

Q1) Attempt any Four of the following: **[20]**

a) Give the Splitting ^4F state in weak octahedral field using character table for pure rotational point group 'O'.

b) Determine the ground state term in the following complexes:

i) $[Cr(H_2O)_6]^{3+}$

ii) $[Ni(Cl)_4]^{2-}$

c) Construct microstate table for nitrogen atom in the ground state and derive allowed R·S terms for the same.

d) Calculate the degeneracy of following states/configurations.

p^2d^2 , $3.^4A_{2g}$, $t_{2g}^{\ 2}$, eg^2, ^6G, d^8.

e) Interprete the spin allowed transitions in terms of Racah parameter and crystal field splitting parameter in the following complexes:

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

Q2) Attempt any Four of the following: **[20]**

a) Explain the mechanism of oxygen transfer in hemerythrin.

b) Explain, how ferritin store iron atom?

c) What are kinetic aspects of binding of metal in biological system?

d) What are physical effects of binding of cis-platin with DNA.

e) What are the functions of hemoglobine?

P.T.O.

SECTION - II

Q3) Answer any Four of the following: **[20]**

a) How polyacrylamide gel is made? What is PAGE? Discuss the simple form of PAGE.

b) What are the different interferences that may occur during AAS procedure? What is remedy for them?

c) What is spectrophotometric titration? Explain the various titration curves in spectrophotometric titrations.

d) Explain with suitable examples the different nuclear emissions given by a radionuclide.

e) Discuss the principle and applications of FES.

Q4) Attempt any Four of the following: **[20]**

a) Discuss the principle and instrumentation of HPLC.

b) Write brief note on

i) Graphite tubular furnace and

ii) Hollow cathode lamp.

c) On a given 140 cm column the sample required 9.2 minutes to emerge, an air bubble required 0.58 minutes and time required for the sample to pass the detector was 0.83 minutes. Calculate the number of theoretical plates and the plate height.

d) The transmittance of 1.5×10^{-3} M solution of a substance was found to be 85% at 375 nm when placed in a cell of 1cm inner diameter. Calculate molar absorptivity and absorbance of the solution. What would be transmittance of this solution if placed in a cell of 1.5 cm inner diameter.

e) Show by calculation which is more effective extraction of 25.0 ml aqueous solution

i) With 25.0 ml of organic solvent.

ii) With 15 ml of organic solvent or

iii) Extractions with 3 separate 8.0 ml portions of organic solvents. (Given D = 20).

Character Table for O (rotational group)

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

Correlation Table for the Group O_h

O_h	O	T_d	D_{4h}	D_{3d}	C_4^v	C_3^v	D_{2d}	D_3	C_{2v}
A_{1g}	A_1	A_1	A_{1g}	A_1	A_1	A_1	A_{1g}	A_1	A_g
A_{2g}	A_2	A_2	B_{1g}	B_1	B_1	A_2	A_{2g}	A_2	B_g
E_g	E	E	$A_{1g}+B_{1g}$	A_1+B_1	A_1+B_1	A_2+A_2	E_g	E	A_g+B_g
T_{1g}	T_1	T_2	$A_{2g}+E_g$	A_2+E	A_2+E	A_1+A_2+E	$A_{2g}+E_g$	A_2+E	A_g+2B_g
T_{2g}	T_2	T_1	$B_{2g}+E_g$	B_2+E	B_2+E	A_1+A_2+E	$A_{1g}+E_g$	A_1+E	$2A_g+B_g$
A_{1u}	A_1	A_2	A_{2u}	B_2	A_2	A_2	A_{2u}	A_2	A_u
A_{2u}	A_2	A_1	B_{2u}	A_2	B_2	A_2	A_{2u}	A_2	B_u
E_u	E	E	$A_{2u}+B_{2u}$	A_2+B_2	A_2+B_2	A_2+A_2	E_u	E	A_u+B_u
T_{1u}	T_1	T_2	$A_{2u}+E_u$	B_2+E	A_2+E	$A_2+B_2+B_2$	$A_{2u}+E_u$	A_2+E	A_u+2B_u
T_{2u}	T_2	T_1	$B_{2u}+E_u$	A_2+E	B_2+E	$A_2+B_2+B_2$	$A_{2u}+E_u$	A_2+E	$2A_u+B_u$

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

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

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

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

For all groups :

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

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

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

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

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

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

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

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

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

(c) For D_{4d} :

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

irrespective of the suffix on B.

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

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

irrespective of the suffix on B.

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

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

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

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

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

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

(c) For D_{4d} :

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

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

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

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

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

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

(*d*) D_{5d}, D_{5h}, D_5, C_{5v}, C_{5h}, C_5 :

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

$E_1 \times E_2 = E_1 + E_2$.

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

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

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

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

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

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

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

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

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

6. The complete results for O are :

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

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Total No. of Questions : 6] **[Total No. of Pages : 5**

P410

[3623] - 23

M.Sc.

DRUG CHEMISTRY

CH - 251 : Synthetic Organic Chemistry & Spectroscopy

(Sem. - II) (Old Course)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

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

SECTION - I

Q1) Answer the following (Any Four): **[16]**

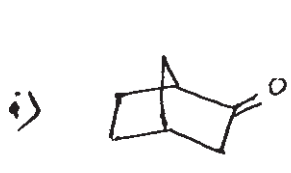
a) O.Hydroxy acetophenone can be obtained by fries rearrangement of phenyl acetate and not by direct acylation of phenol.

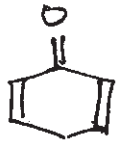
b) Acid chlorides can not be used for the synthesis of ketones using organolithium compounds.

c) In 2 - bromo cyclohexanone, the isomer having equatorial bromine exhibits $\nu_{c=0}$ at 1745 cm^{-1} while the other isomer exhibits $\nu_{c=0}$ at 1725 cm^{-1}.

d) Lindlar catalyst and sodium in liquid ammonia are used for selective reduction of triple bonds. Explain.

e) Predict which member in each of the following pair is more extensively enolized.

i)  or 

ii)  or 

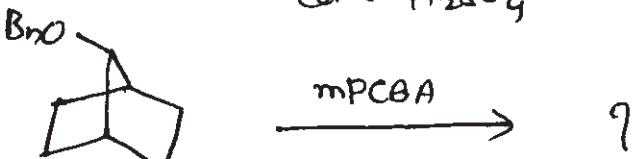
Q2) Predict the product and explain mechanism [Any Four]: **[12]**

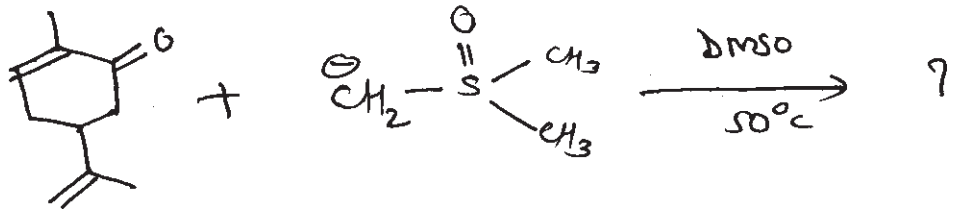
P.T.O.

i) 

ii) 

iii) 

iv) 

v) 

Q3) Explain the following (Any Three): **[12]**

a) With proper illustration, discuss how the following factors inflyevees the mechanism in elimination reaction?

i) Strength of base

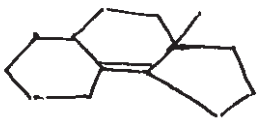
ii) Nature of leaving group

iii) Solvent polarity

b) What are ylids? Explain selectivity, stereochemistry and applications of phosphorus ylids with proper illustration.

c) Use of PMR in structure determination of E and Z isomer.

d) The ozonolysis product of compound A exhibited $\nu_{c=0}$ at 1705 and 1735 cm^{-1}. Explain.

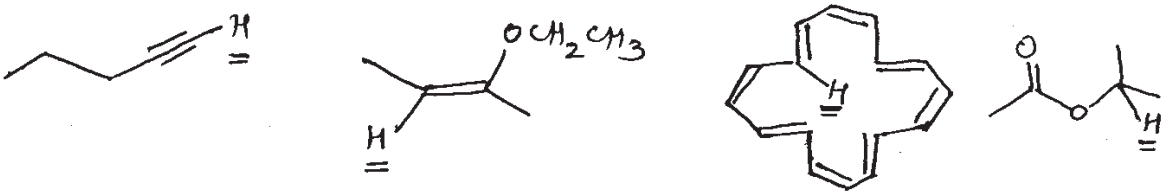


A

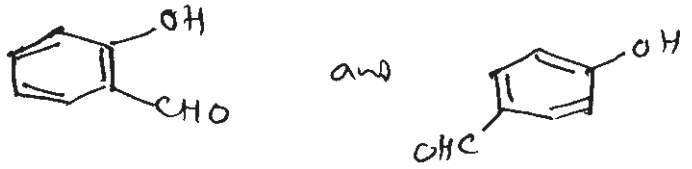
SECTION - II

Q4) Answer the following (Any Four): **[16]**

a) Predict the approximate chemical shifts of the underlined protons. Justify your chemical shift values.

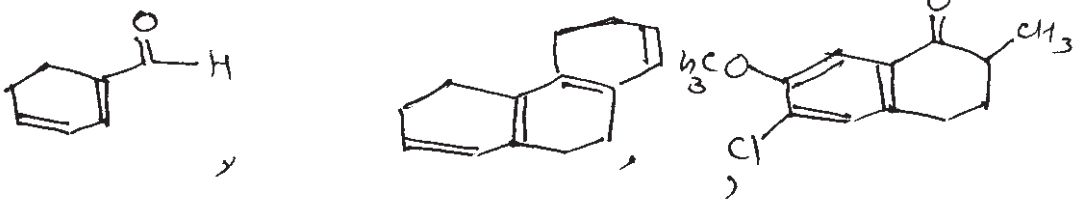


b) Distinguish the following pairs by IR spectroscopy.



c) A compound having molecular formula $C_6H_{10}O$ Shows –Ve lodoform test. It shows λ_{max} at 240 nm in UV and bands at 1700 and 1620 cm^{-1} is IR. Suggest the structure and Justify.

d) Calculate λ_{max} for the following, show your calculations (Any Two).



e) Write short note on 'Red and Blue shift'.

Q5) Deduce the structure of <u>any three</u> of the following using spectral data and justify your answer. **[12]**

a) M. F. : $C_7H_7NO_3$
IR. : 3250, 1590, 1530, 1490 cm^{-1}.
PMR : 2.31 δ (s, 21 mm)
7.02 δ (d J = 7.5 Hz 7 mm)
7.35 δ (dd J = 2, 7.5 Hz 7mm)
7.85 δ (d J = 2 Hz 7 mm)
11.2 δ (7 mm, exchangeable with D_2O)

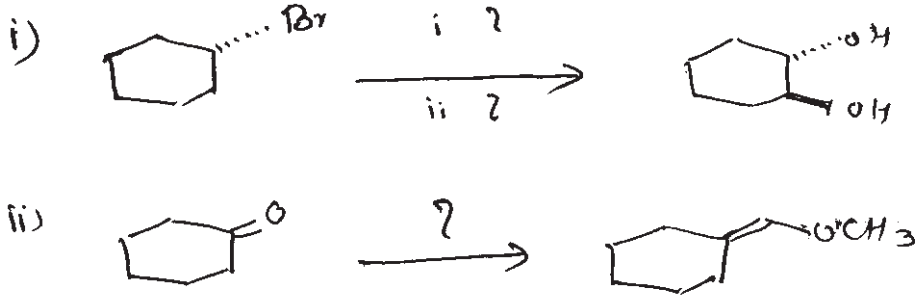
b) M. F. : C_3H_7ON
UV : Featureless above 210 mm
IR : 3500, 3400, 3370, 3170, 1670, 1600 cm^{-1}.
NMR : 1.2 δ (t J = 6 Hz 15 mm)
2.25 δ (q J = 6 Hz 10 mm)
6.40 δ (broad signal 10 mm)

c) M. F. : $C_7H_4O_3NCL$
UV : 255 nm (∈ = 12000)
IR : 1770, 1530, 1350, 850 cm^{-1}.
PMR : 8.03 (d J = 8 Hz 12 mm)
8.13 (d J = 8 Hz 12 mm)

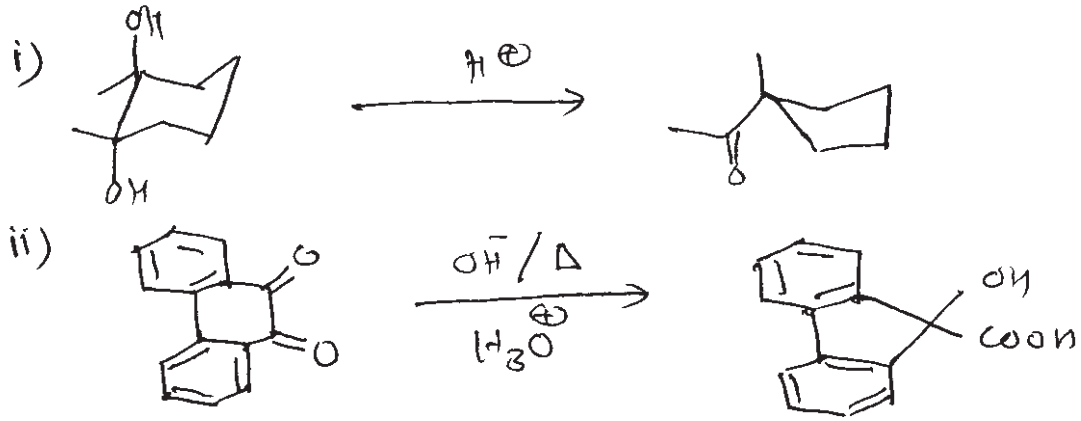
d) M. F. : C_9H_9N
UV : 253 (∈ – 200)
IR : 2240, 1600, 1500 cm^{-1}
PMR : 2.30 (t 7 Hz 6 mm)
2.51 (t 7 Hz 6 mm)
7.20 (m 15 mm).

Q6) Answer the following (Any Four): **[12]**

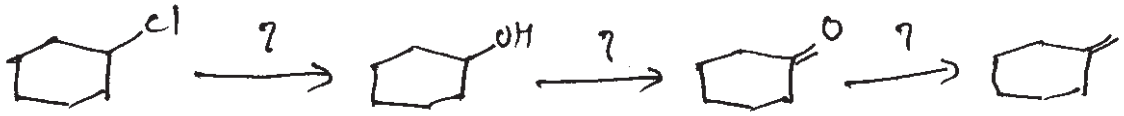
a) Suggest the reagents for the following conversions and justify your choice.



b) Give the mechanism for the following conversion.

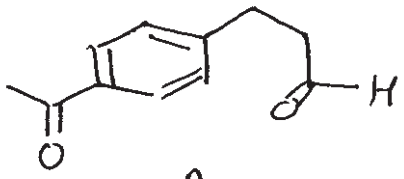


c) How will you follow the following sequence of reactions using IR spectroscopy.



d) Explain electronic transitions in UV spectroscopy.

e) Compound A on $NaBH_4$ reduction yield three products. Write their structures and give simple chemical test to distinguish them.



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Total No. of Questions : 6] **[Total No. of Pages : 4**

P434

[3623] - 203

M.Sc. - I (Sem. - II)

ORGANIC CHEMISTRY

CH - 250 : Synthetic Organic Chemistry & Spectroscopy

(2008 Pattern)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

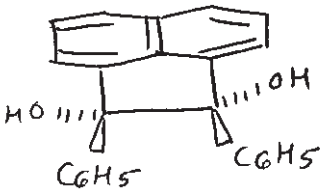
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) Explain any Four of the following: **[16]**

a) Cis-4-hydroxycyclohexane carboxylic acid undergo lactonisation on heating whereas the trans isomer does not lactonise.

b) Which of the following will rearrange faster on treatment with conc. H_2SO_4?



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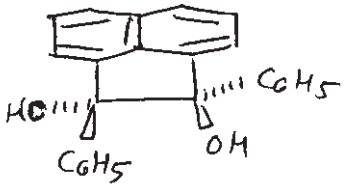
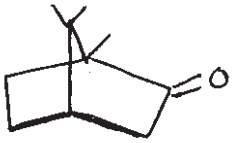


B

c) β-Hydroxyester can not be prepared by using Grignard reagent but can be prepared by organozinc compounds.

d) In most of the reactions wittig Horner reaction is preferred over wittig reaction.

e) Reduction of cyclic ketone A with $LiA1H_4$ gives exo alcohol as a major product.



A

P.T.O.

Q2) Attempt any Four of the following: **[12]**

a) Trans 1,3 dimethyl cyclohexane is a resolvable molecule. Explain.

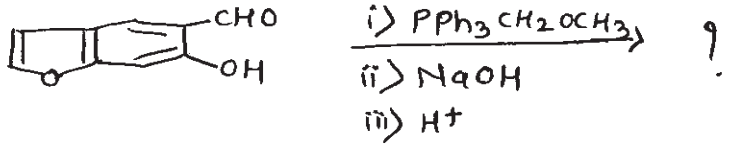
b) In the sommelet rearrangement the product is formed from the less stable ylide. Explain.

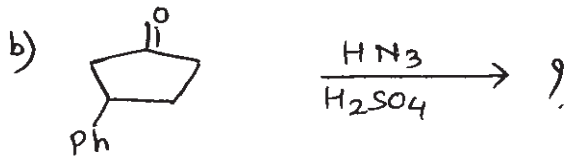
c) Give the use of lithium dialkyl copper in organic synthesis.

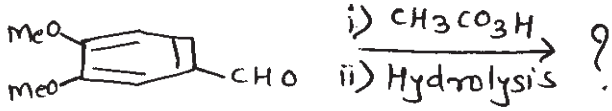
d) Write short note on Curtius rearrangement.

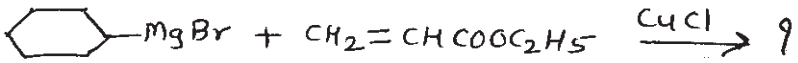
e) What is the use of selenium dioxide?

Q3) Predict the product and suggest the mechanism in any four of the following: **[12]**

a) 

b) 

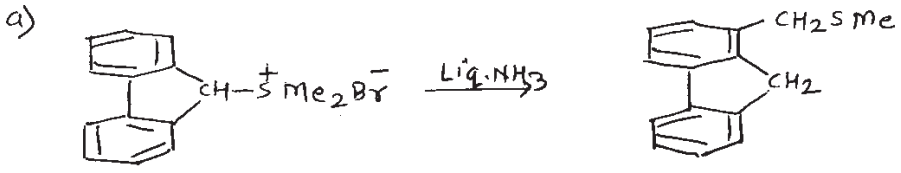
c) 

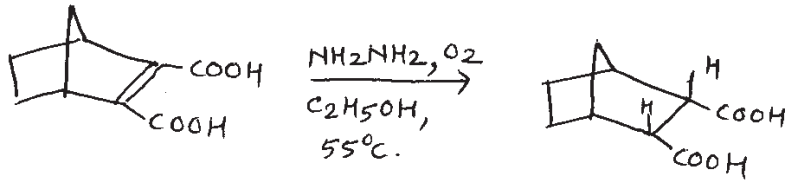
d) 

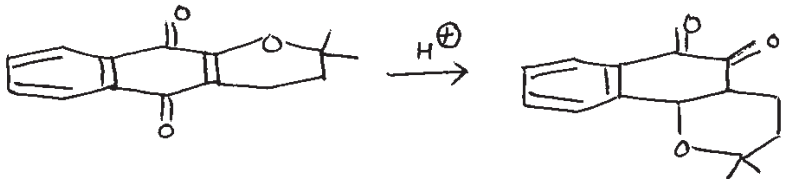
e) 

SECTION - II

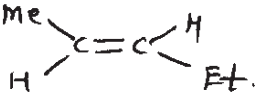
Q4) A) Suggest the mechanism for any two of the following : **[6]**

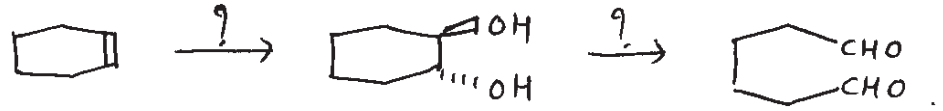
a) 

b) 

c) 

B) Suggest the reagents in following conversions. (any three): **[6]**

a) $CH_3-C\equiv C-H \xrightarrow{?} Me-C\equiv C-Et \xrightarrow{?}$ 

b) 

c) $R-\overset{O}{\overset{\|}{C}}-Cl \xrightarrow{?} R-CH_2-\overset{O}{\overset{\|}{C}}-OH$.

d) 

Q5) Attempt any <u>four</u> of the following: **[16]**

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

b) 4–Carboethoxy cyclohexanone shows IR bands at 1736 and 1718 cm^{-1} while 2–carboethoxy cyclohexanone shows IR bands at 3300, 1740, 1718, 1656 and 1618 cm^{-1}. Explain.

c) Write a note on spin spin coupling.

d) How will you complete following sequence of reactions? How will you follow this sequence using IR spectroscopy?

$$Ph-CHO \longrightarrow Ph-CH_2OH \longrightarrow Ph-CH_2Cl \longrightarrow Ph-CH_2CN.$$

e) Arrange the following compounds according to increasing order of their carbonyl frequency.

Q6) Deduce the structure of any <u>three</u> of the following. Using given spectral data and justify your answer. **[12]**

a) M.F. : C_3H_6O

IR. : No Significant Peak above 1100 cm^{-1}.

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

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

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

2.98 (1H, ddq, J = 2.5 & 3 & 6 Hz)

b) M. F. : $C_5H_6O_3$

IR : 1820, 1770 cm^{-1}.

PMR : 1.95 (10 mm, quin., J = 6.5 Hz)

2.7 (20 mm, t , J = 6.5 Hz)

c) M. F. : C_4H_9ON

IR : 3500, 3400, 1680 cm^{-1}.

PMR : 1.0 (18 mm, d , J = 6Hz)

2.2 (3mm, septet , J = 6 Hz)

7.08 (6 mm, bs , D_2O exchange.)

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

IR : 1742 cm^{-1}

PMR : 2.6 (2H, s)

(δ) 1.3 (6H, t , 6.5 Hz)

4.16 (4H, q , 6.5 Hz).

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Total No. of Questions : 6] **[Total No. of Pages : 5**

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[3623] - 203

M.Sc. (Sem. - II)

ORGANIC CHEMISTRY

CH - 250 : Synthetic Organic Chemistry & Spectroscopy

(2005 Pattern)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

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

SECTION - I

Q1) Explain any four of the following: **[16]**

a) N - methyl benzamide does not give N - methyl aniline in presence of NaOH solution.

b) Orthohydroxyacetophenone can be obtained by Fries - rearrangement of phenylacetate and not by direct acylation of phenol.

c) Explain the advantages of organolithium compounds over organo magnesium compounds.

d) 2 - butene on treatment with osmium tetroxide give cisdiol, whereas reaction with peracid followed by hydrolysis gives trans .diol.

e) Sulphur ylids could be used for synthesis of epoxide.

Q2) Write short notes on any four of the following: **[12]**

a) Birch reduction.

b) Synthetic applications of organoboranes.

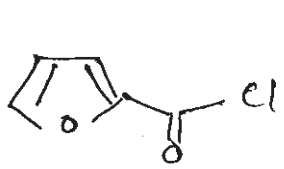
c) Michael addition reaction.

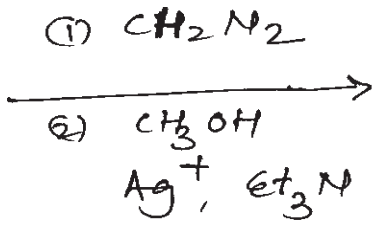
d) E_1CB reaction.

e) Use of phosphoranes in organic synthesis.

P.T.O.

Q3) Predict the product and suggest the mechanism for <u>any four</u> of the following: **[12]**

(i) 



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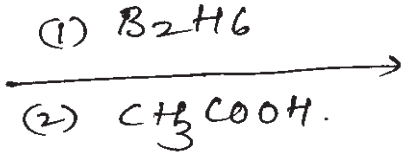
(ii) 



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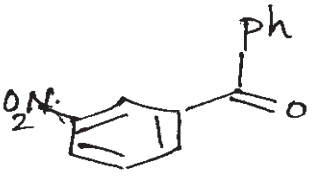
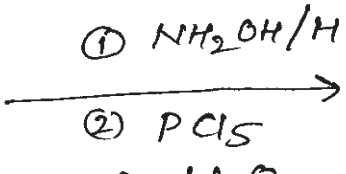
(iii) 



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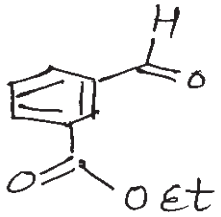
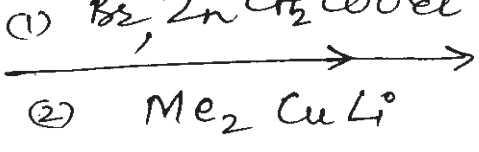
(iv) 



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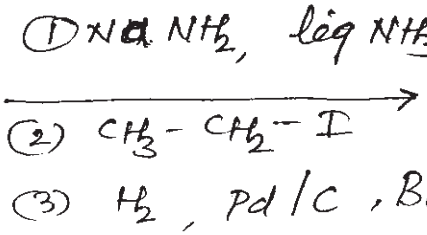
(v) $Ph-C\equiv C-H$


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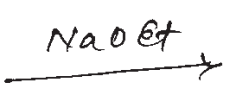
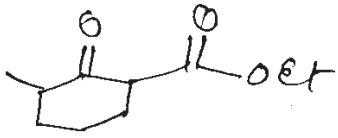
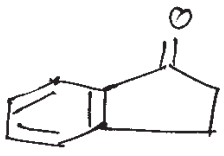
SECTION - II

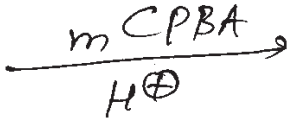
Q4) a) Suggest mechanism for the following conversion (any two): **[6]**

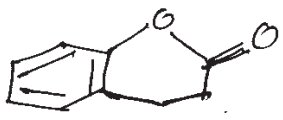
(i) 

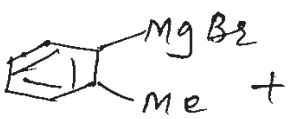




(ii) 





(iii) 

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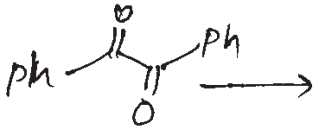
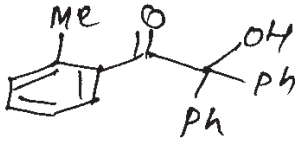
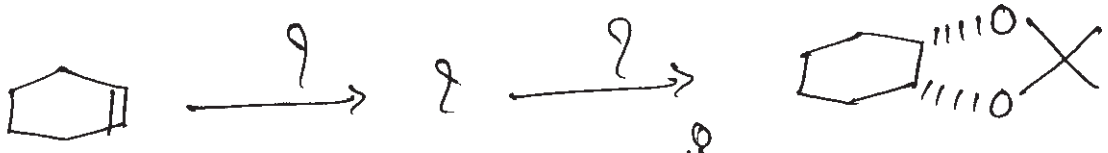
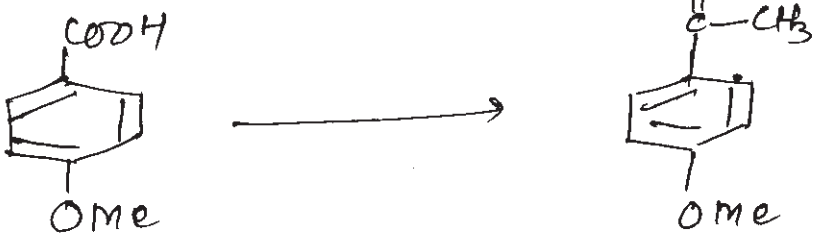
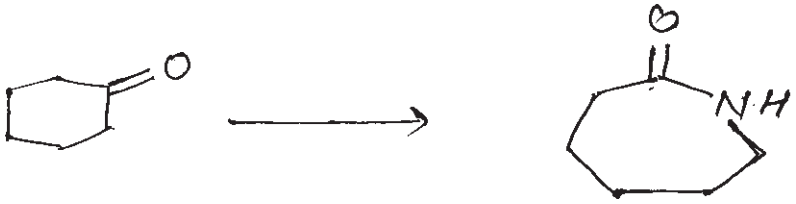




b) Suggest the reagents for the following conversion and justify your choice (any two): **[6]**

(i) 

(ii) 

(iii) 

Q5) Answer <u>any four</u> of the following: **[16]**

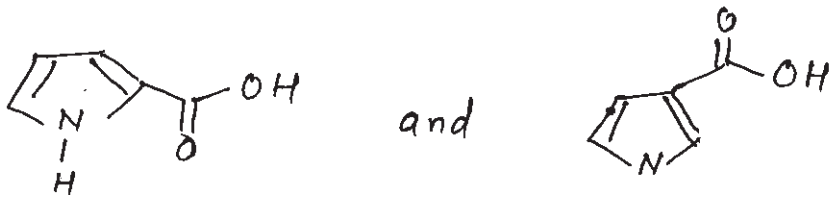
a) Calculate the λ_{max} for the following, show your calculations.

b) Distinguish the following pair of compound by spectroscopic method.

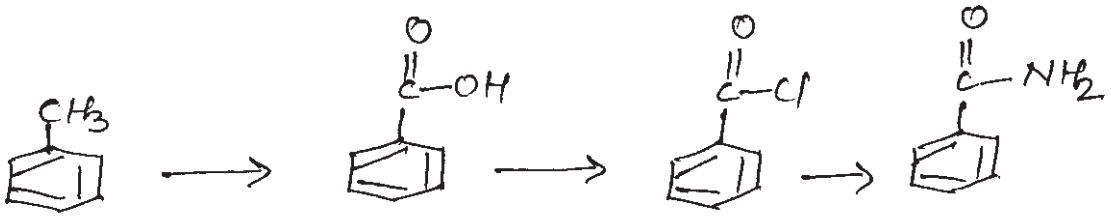
(i) 

(ii) $CH_3 - CH = CH - COOCH_3$ and $CH_3 - CH = CH_2$

(iii) 

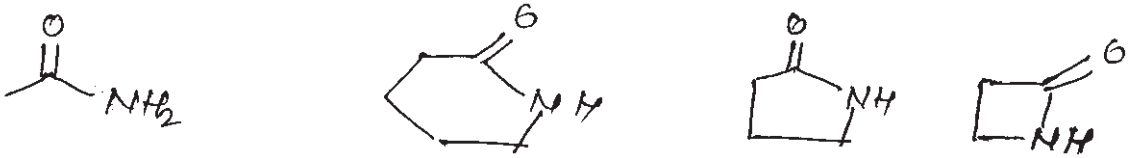
(iv) 

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



d) Explain : (i) Spin - Spin Coupling.
(ii) Bathochromic shift.

e) Arrange the following compounds according to increasing order of their carbonyl stretching frequencies and Justify.



Q6) Analyse the spectral data and deduce the structure of the compounds for <u>any three</u> of the following. Justify. **[12]**

a) $C_9 H_6 O_2$

UV = 260 , 250 nm.

IR = 3300 – 2600, 2200, 1680, 1600, 1480 cm^{-1}.

'H NMR = 7.4 δ (3 H, m)

7.7 δ (2 H, dd 2 and 8 Hz)

11.2 δ (1H, broad singlet, D_2O exchangeable)

b) $C_4 H_9 ON$

IR = 3500, 3400, 1680 cm^{-1}

'H NMR = 1.0 δ (d 6 Hz, 18 mm)

2.2 δ (sept. 6 Hz, 3 mm)

7.0 δ (. broad Singlet, 6mm)

D_2O exchangeable

c) $C_9 H_{12} O$

IR : No bands above 3100 cm^{-1}

No bands in 2000 – 1650 cm^{-1}.

'H NMR = 1.15 (t, 3H, 7Hz)

3.5 (q, 2 H, 7 Hz)

4.4 (s, 2 H,)

7.2 (s, 5H)

d) C_4H_8O

IR : 1720 cm^{-1}

UV : 290 nm (E 200)

'H NMR = 1.05 δ (t, 15 mm, J = 6 Hz)

2.05 δ (s, 15 mm)

2.04 δ (q, 10 mm J = 6Hz).

❄❄❄

Total No. of Questions : 6] **[Total No. of Pages : 2**

P1230

[3623]- 105
M.Sc.
BIOCHEMISTRY
BCH - 171 : Enzymology and Physiological Biochemistry
(Old & New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I
(Enzymology)

Q1) Answer any five of the following : **[15]**

a) What are the applications of purified enzymes? How purity of an enzyme is judged?

b) Which simple experiment is designed to prove that an enzyme exhibits an allosteric kinetics.

c) Give the therapeutic applications of enzymes.

d) How enzymes are separated on the basis of their size?

e) How it is confirmed that the enzyme catalyzed reaction goes via ping-pong mechanism?

f) Why is the side chain ser-195 of chymotrypsin especially super reactive?

g) How activation of trypsin from trypsinogen takes place?

Q2) Attempt any three of the following : **[15]**

a) Discuss the various conditions by which enzyme-substrate complex is stabilized to determine the mechanism of catalysis by x-ray crystallography.

b) How substrate cycle and interconvertible enzyme cycle controls the activity of an enzyme?

c) While determining the rate of degradation of enzyme how reutilization of precursor amino acids is prevented?

d) What are the effects of proximity and orientation an enzyme catalysis?

e) Give the clinical significance of acid and alkaline phosphatases.

P.T.O.

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

a) Explain the mechanism of action of tryptophan synthase multienzyme complex.

b) Binding of substrate to one active site of sub-unit of regulatory enzyme increases the affinity of other active sites. Which allosteric model best accounts for this cooperativity? Give the important features of this model.

c) Modify Michealis-Menten equation in to liveweaver-Burk equation. Show the effect of competitive and uncompetitive inhibitors on liveweaver-Burk plot.

SECTION - II

(Physiological Biochemistry)

Q4) Attempt any three of the following : **[15]**

a) What is differential blood count? Comment on its significance.

b) Describe blood cloting cascade.

c) Give different systems involved to maintain the pH of blood to 7.4.

d) Distinguish metabolic and respiratory acidosis.

Q5) Attempt any three of the following : **[15]**

a) What is composition of urine? Give renal function test.

b) What are diuretics? Explain.

c) Give function, sources, absorption and metabolism of Ca and P.

d) Discuss the role of liver in protein metabolism.

Q6) Write note on any two of the following : **[10]**

a) Hormones of kidney.

b) Albumin.

c) Anion gap.

Total No. of Questions : 6] **[Total No. of Pages : 2**

P1231

[3623]- 106
M.Sc.
BIOCHEMISTRY
BCH - 172 : Cell Biochemistry (Microbiology and Cell Biology)
(New & Old)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

(Cell Biochemistry/Microbiology)

Q1) Answer the following (any three) : **[15]**

a) What are the general methods of classifying bacteria? Add a note on its nomenclature.

b) What is meant by differential staining? Add a note on Gram staining.

c) Discuss the oxygen and temperature requirement for growth of bacteria.

d) Why moist heat is more effective than dry heat during sterilization?

e) What are characteristics of antibiotic? Give the action of penicillin.

Q2) Explain any three of the following : **[15]**

a) Structure and arrangement of flagella.

b) Replication of bacterial viruses.

c) Characteristics of an ideal antimicrobial agent.

d) Difference between procaryotic and eukaryotic cell.

e) Industrial production of lactate.

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

a) Enlist the methods of isolation of pure culture. Add a note on streak plate method.

b) What are different chemical agents for control of microorganisms. Add a note on action of alcohol.

c) What are exotoxins? Explain with suitable examples.

P.T.O.

SECTION - II

(Cell Biochemistry/Cell Biology)

Q4) Attempt any three of the following : **[15]**

a) Describe in detail the structure of prokaryotic cell.

b) Give the structure and function of golgicomplex.

c) Distinguish the process of mitosis from meiosis.

d) What are marker enzymes? Give their role in cell Biochemistry study.

Q5) Attempt any three of the following : **[15]**

a) Discuss the structure and function of plant cell wall.

b) What is cell communication? Give the process of cell communication in plants.

c) What is cell junction? Comment on its different types.

d) Distinguish sexual and asexual reproduction. Why highly evolved organisms prefer sexual mode of reproduction.

Q6) Write note on any two of the following : **[10]**

a) Stem cells.

b) Cell adhesion.

c) Plasmamembrane.

☒☒☒☒

Total No. of Questions : 6] **[Total No. of Pages : 5**

P1232

[3623] - 61

M.Sc.

DRUG CHEMISTRY

CH - 361 : Chemistry of Heterocycles & Biologically Active Compounds

(2005 Pattern) (Old)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:-

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

SECTION - I

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

a) Imidazole can be used as an effective catalyst in ester hydrolysis.

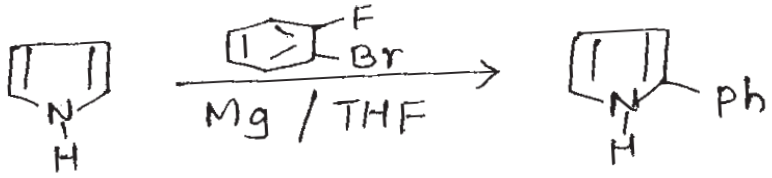
b) The ^1H NMR spectrum of 2-aminopyrrole in acetic acid shows no coupling between the H-5 and those at H-4 or H-3.

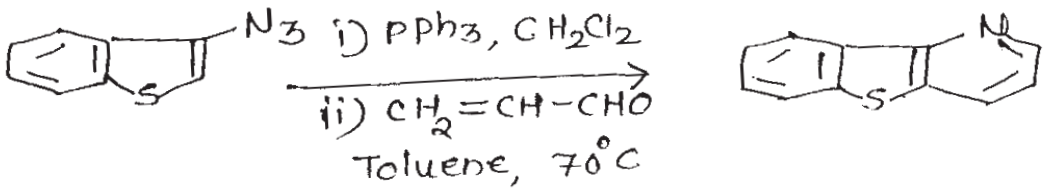
c) Furan undergoes Diels. Alder reaction with maleic anhydride but pyrrole undergoes substitution reaction.

d) Coumarin is easily attacked by electrophilic as well as nucleophilic reagents.

e) Predict the principle site of deprotonation on treatment of 2-and 3-methoxythiophene with BuLi/ether. Justify your prediction.

Q2) Suggest the suitable mechanism for any four of the following conversions. **[12]**

a) 

b) 

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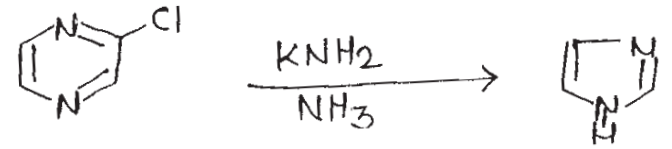
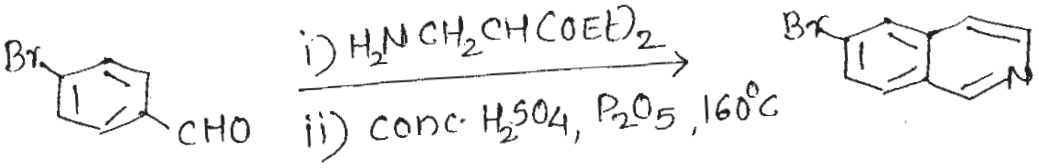
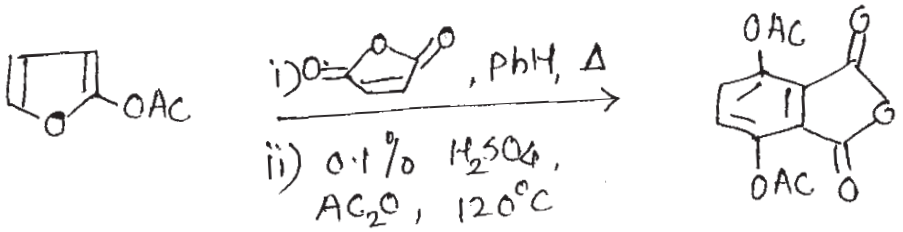
c) 

d) 

e) 

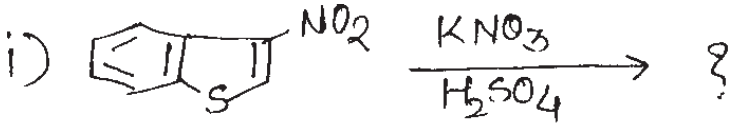
Q3) a) Give synthesis of any two of the following : **[7]**

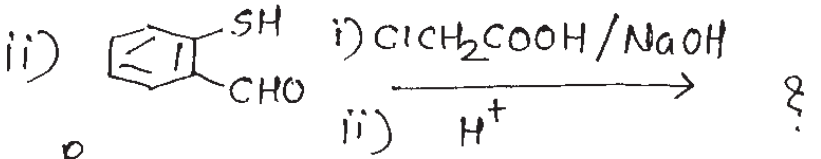
i) Fischer Indole synthesis.

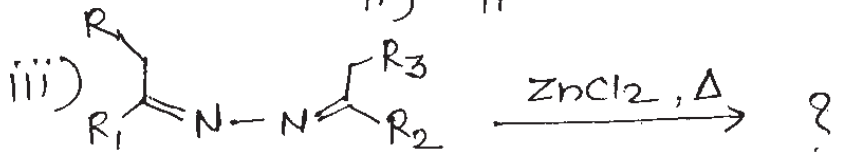
ii) Hinsberg Thiophene synthesis.

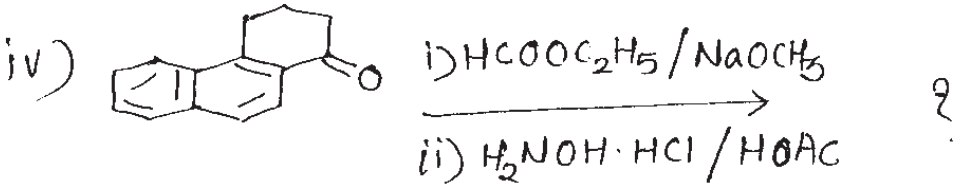
iii) Perkin synthesis of coumarins.

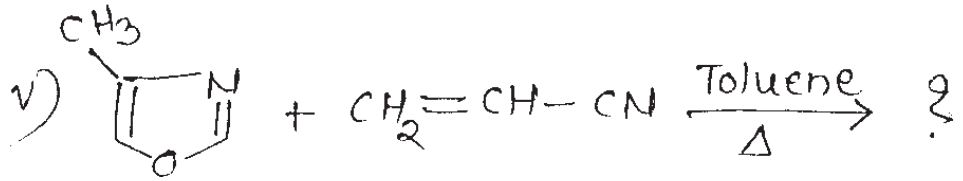
b) Predict the products with mechanism (any three) : **[9]**

i) 

ii) 

iii) 

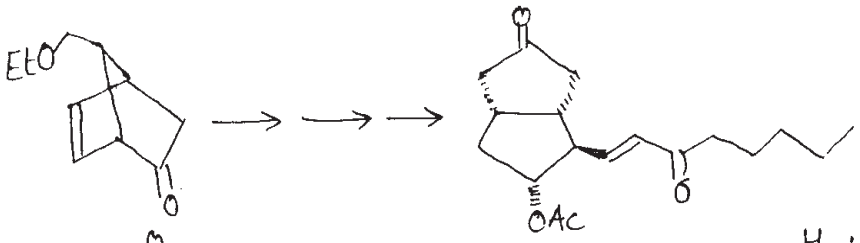
iv) 

v) 

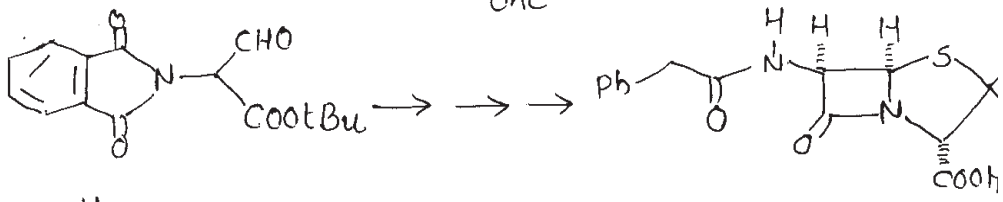
SECTION - II

Q4) Discuss the steps involved in the synthesis of the following molecules. Explain the stereochemistry and mechanism involved in all steps. (any three) : **[15]**

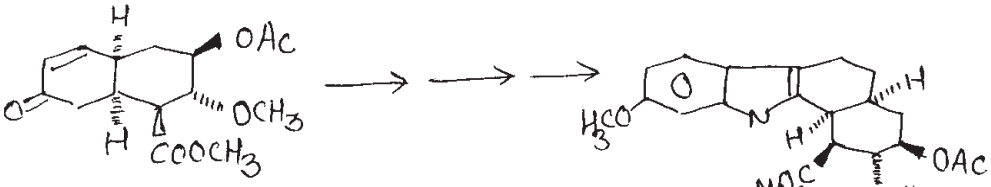
a)



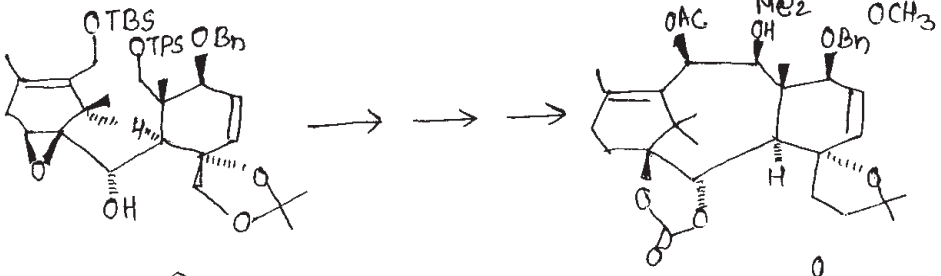
b)



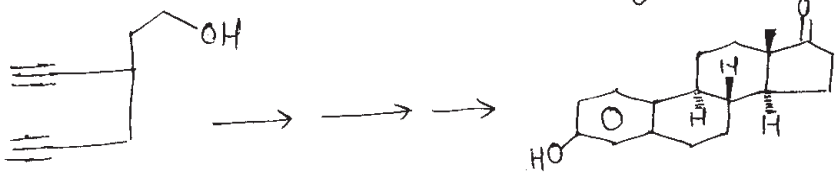
c)



d)

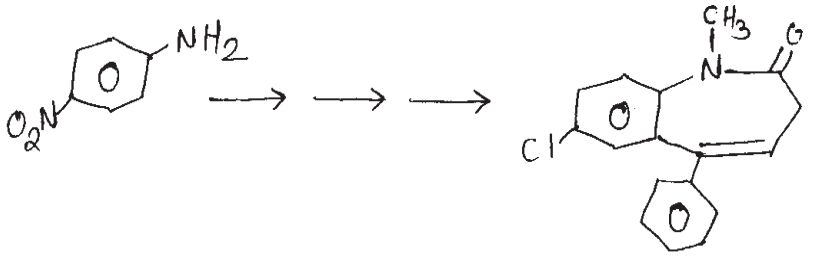


e)

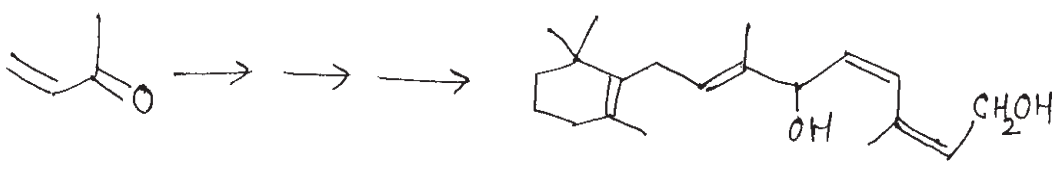


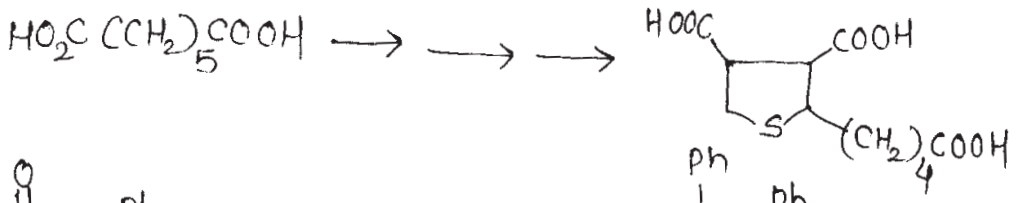
Q5) Describe the steps involved in the synthesis of following drug molecules. Explain the mechanism involved (any four) : **[16]**

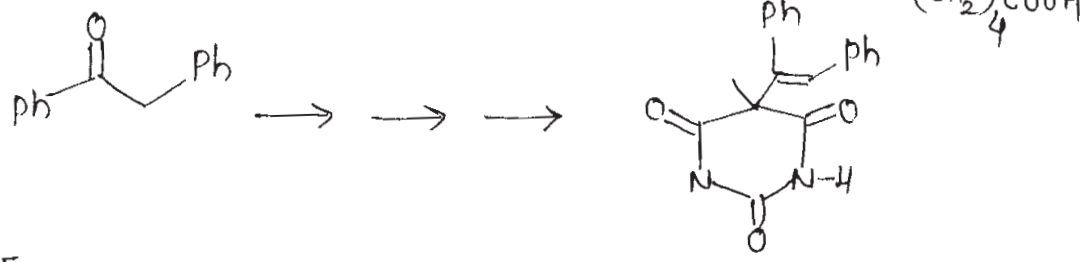
a)

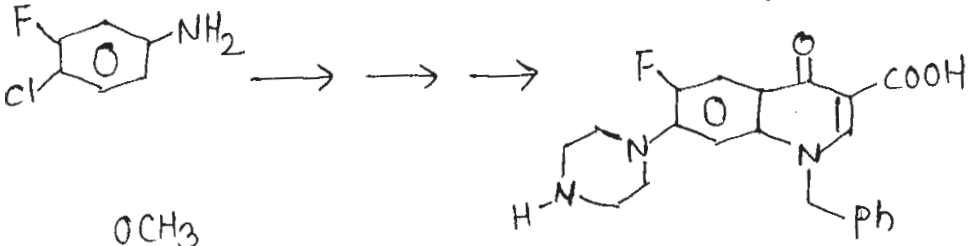


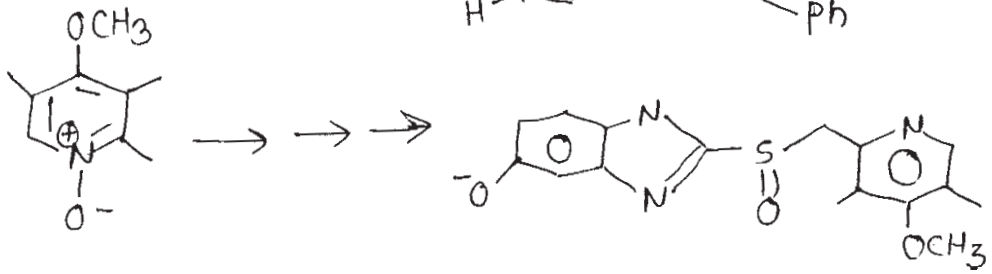
b)



c) 

d) 

e) 

f) 

Q6) Answer any two of the following : **[9]**

a) Explain the following :

i) Use of Wittig Horner Emmons reaction in prostaglandin synthesis.

ii) Shapiro reaction.

b) The reagents involved in the following transformations are :

i) HCl, H_2O.

ii) P-TsOH.

iii) $BrMg(CH_2)_3 - \underset{|}{C} = CH_2$.

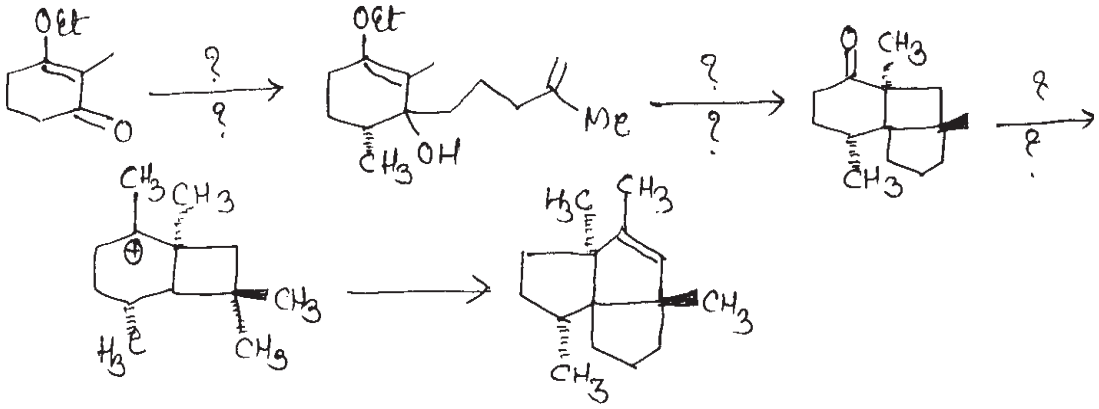
iv) $Ph_3P = CH_2$,DMSO.

v) hν, 350 nm, hexane.

vi) Bond migration.

vii) LDA, THF, MeI.

Arrange them in correct order and explain different steps.



c) Describe at least two strategies employed for Ibuprofen synthesis.

❖❖❖❖

Total No. of Questions : 6] **[Total No. of Pages : 5**

P1233

[3623] - 62

M.Sc.

DRUG CHEMISTRY

CH - 362 : Advanced Analytical Methods

(2005 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

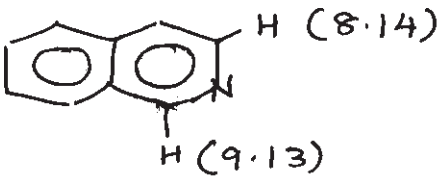
Instructions to the candidates:-

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

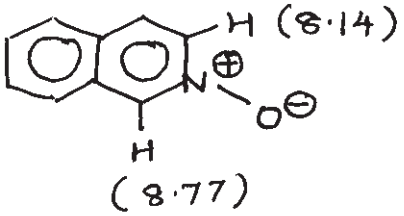
SECTION - I

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

a) The chemical shifts in compound A & B are as shown below :



A



B

b) While scanning CMR spectrum ~6000 times magnification is required.

c) Z, Z, E, Z, E - cyclodecapentene show eight proton signal between 6-8 δ, while two proton signal appear upfield to TMS signal.

d) N-butylbenzene shows a peak at m/z 92 in its MS, while this peak is absent for t-butyl benzene.

e) FT-NMR is required to record ^{13}C NMR spectrum.

P.T.O.

Q2) Deduce the structures from the given spectral data (any four) : **[16]**

a) M.F. : $C_8H_{11}N$
PMR : 7.2 (s, 5H), 3.87(q, 6.6 Hz, 1H)
1.83(bs, 2H), 1.2(d, 6.6 Hz, 3H)
CMR : 148, 128 (str.), 126, 125(str.), 51, 26
IR : 3354, 1596, 1020, 761, 703 cm^{-1}

b) C = 64% H = 8.8%
IR : 1195, 1670, 1720 cm^{-1}
Mass : 114, 99, 86, 69, 41
PMR : 1.3(t, 7Hz, 3H), 2.0(d, 7Hz, 3H), 4.2(q, 7Hz, 2H)
5.8(d, 16Hz, 1H), 6.9(dq, 7 & 16 Hz, 1H)

c) M.F. : $C_{11}H_{13}NO$
Mass : 175, 174, 145, 120
CMR : 40(q, str.) 112(d, str.) 122(s) 124(d)
130(d, str.) 152(s) 156(d) 202(d)
PMR : 3.1(s,6H), 6.5(dd, 7 & 16Hz, 1H) 6.8(d, 8Hz, 2H)
7.2(d, 16Hz, 1H), 7.5(d, 8Hz, 2H) 9.6(d, 7Hz, 1H)

d) M.F. : $C_5H_8O_2$
IR : 1775, 1175 cm^{-1}
Mass : 100, 85, 56
PMR : 1.35(d, 6.5 Hz, 18 mm) 1.5 – 2.2 (m, 12 mm)
2.4(m, 12 mm), 4.5(sextet, 6.5Hz, 6 mm)

e) M.F. : $C_7H_7O_3N$
UV(λ_{max}) : 265 nm (ϵ = 15,000)
IR : 3600, 1600, 1530, 1495, 1360 cm^{-1}.
PMR : 2.9(s, 6mm, exch.) 5.0(s,12mm)
7.6(m, 18 mm) 8.15(dd, 2 & 7 Hz, 6 mm)

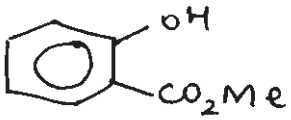
Q3) Write short notes on <u>any three</u> of the following : **[12]**

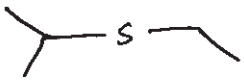
a) Difference between CW and FT NMR.
b) Distortionless Enhancement by polarization Transfer.
c) Various ionization methods in mass spectrometery.
d) Factors affecting geminal coupling constants.

SECTION - II

Q4) a) Explain the genesis of the following ions (any three) : **[9]**

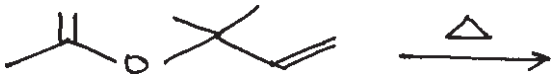
i)  102, 73, 59, 56, 41, 31

ii)  152, 121, 120

iii)  104, 89, 61, 47

iv) Cyclohexanone 98, 83, 70, 55, 42

b) How could the progress of the claisen rearrangement of the ether show below be followed by mass spectral fragmentation pattern? **[3]**



Q5) a) Answer <u>any two</u> of the following : **[6]**

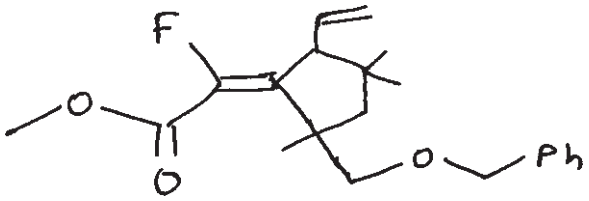
i) What are the various detectors used in HPLC? Write their applications.

ii) Discuss the various parts of the GCMS.

iii) Discuss the applications of the chiral column.

b) Assign the chemical shifts and comment on the observed coupling constants and spin decoupling experiment. **[6]**

[Note : C-CH_3 and aromatic signals are not given]



1.47 (d, 13Hz, 1H) 1.82 (d, 13Hz, 1H) 2.88(dd, 9 & 2Hz, 1H)

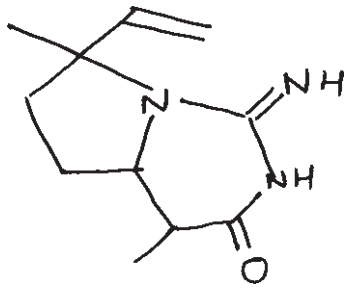
3.46 (d, 8Hz, 1H) 3.63 (s, 3H) 3.94 (d, 8Hz, 1H) 4.51(s, 2H)

5.07 (dd, 17 & 2Hz, 1H) 5.27 (dd, 10 & 2Hz, 1H)

5.56 (ddd, 17, 10 & 9Hz, 1H)

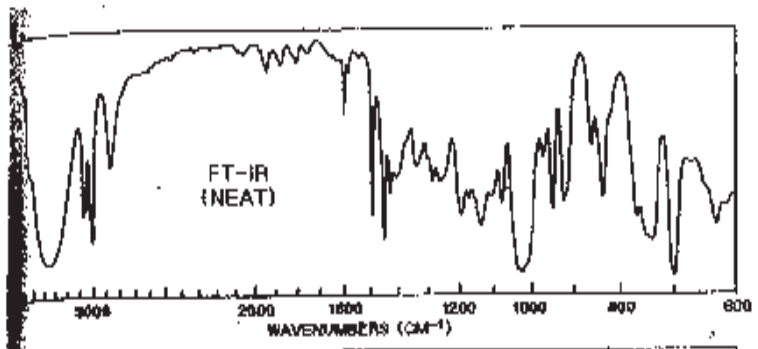
spin decoupling	:	irradiate at 2.88δ	change at 5.56 into dd(17 & 10Hz)
NOE	:	1.82 δ	7% increase at 2.88δ.

c) Assign the chemical shifts to various carbon atoms. **[4]**



11.5(q)	20.6(q)	29.9(t)
40.7(t)	42.3(d)	63.1(d)
65.1(s)	116.1(t)	142.5(d)
158.5(s)	179.8(s)	

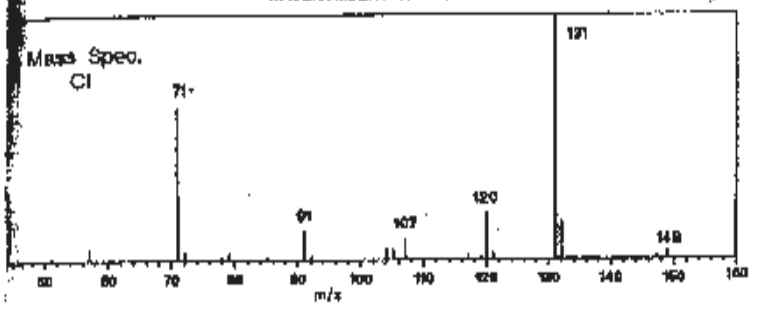
Q6) A compound exhibits the spectral properties shown on the attached sheet. Suggest the structure and explain the spectral data. **[12]**

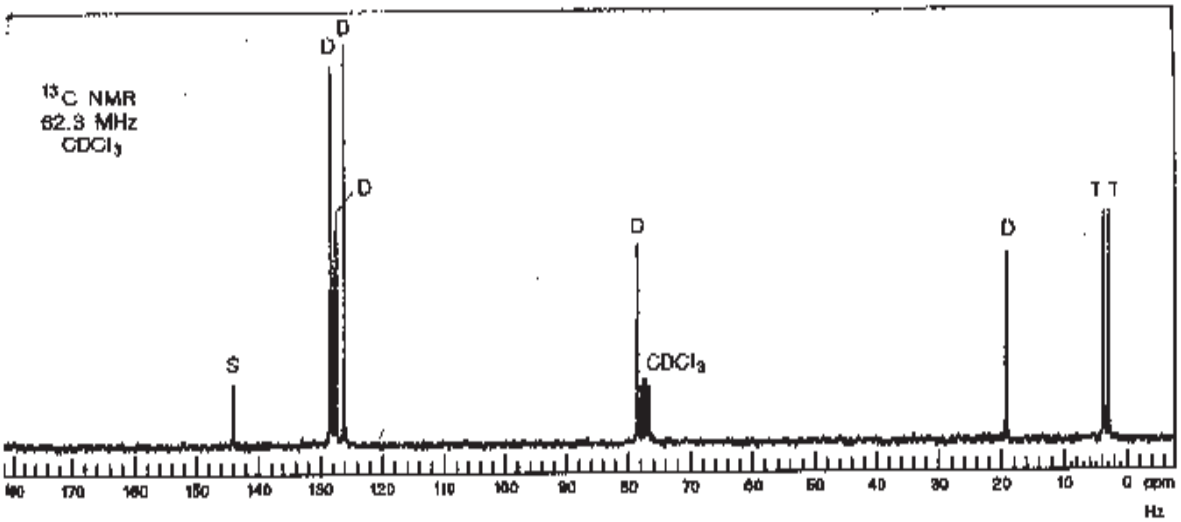


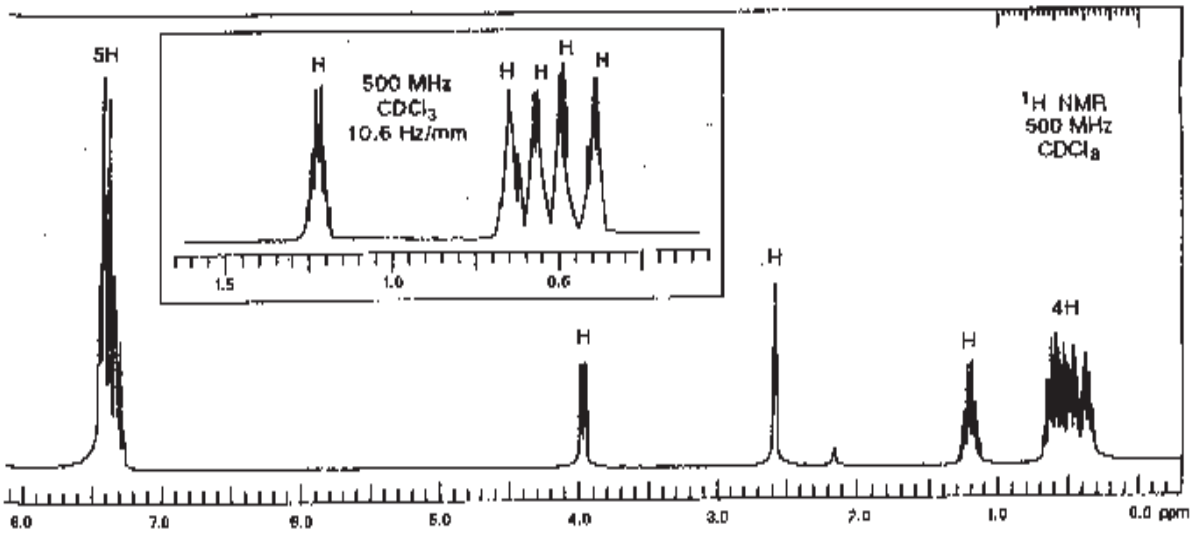
Exact M.S. (CI) = 149.0966

$UV\lambda_{max}$ = 208 (ε = 64,000)
= 296 (ε = 600)

M.F. $C_{10}H_{12}O$







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Total No. of Questions : 6] **[Total No. of Pages : 2**

P1234

[3623]- 63
M.Sc.
DRUG CHEMISTRY
CH - 363 : Drug Development
(2005 Pattern) (Old)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

Q1) Answer any three of the following : **[15]**

a) What are actinomycetes? Why are they favourist of pharma industry?
b) Which factors are important in upstream and downstream processing and why they are important?
c) Explain in short the recombinant DNA technique and site directed mutagenesis in strain improvement.
d) Why biological treatment is important in sewage treatment?
e) How are bacteria classified on the basis energy, carbon and electron source they use for growth?

Q2) Answer any three of the following : **[15]**

a) Define autoimmunity and immunodeficiency and give the etiology of their development.
b) Explain radioimmunoassay and rocket immuno electrophorosis and give the significance of both techniques.
c) Define B and T cell and their functions adaptive immune response.
d) What are vaccines? Why vaccination is important w.r.t. individuals health?
e) Give the function of macrophage, natural killer cells, and memory cells.

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

a) Castor is known in Ayurvedic literature to be effective in controlling breast cancer. How will you approach towards discovery and development of new drug from castor? Justify your approach.
b) Discuss how different dosage forms and it route of administration are related with pharmacokinetics of drug and helps in exhibiting its biological activity.

P.T.O.

c) Give a brief overview of the drug targets and the mechanism of drug action. Discuss the factors involved in pharmacodynamics of drug action.

SECTION - II

Q4) Answer any three of the following : **[18]**

a) Explain the following

i) Active and passive transport.
ii) Bioavailability and Bioequivalence.
iii) Pharmacognosy and pharmaceutics.

b) Discuss the following tests

i) Acute toxicity.
ii) Subacute toxicity and their significance.
iii) Carcinogenicity.
iv) Teratogenicity.

c) Give a short account of Bioassays - Explain how antimicrobial and pharmacological assays are carried out. Discuss the process.

d) Describe in brief how lead discovery and lead development of NCE's is carried out? Explain the processes.

Q5) Answer any two of the following : **[14]**

a) Explain the salient features of each phase of clinical trials. Discuss how the subjects are selected and the GO and NO GO criteria. What is the need for phase IV. Explain.

b) What is intellectual property? What are the conditions for getting a patent? What is the need of a patent? Explain the terms involved in a patent specification.

c) Discuss the role and functions of the following departments. Explain the strategies employed in scale up of a process and in process development.

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

a) The need for various dosage forms and their benefits. Discuss.

b) Benefits of rational approach over Random Screening with examples.

c) Preclinical drug development. A brief overview.

Total No. of Questions : 6] **[Total No. of Pages : 4**

P1235

[3623]-64
M.Sc.
DRUG CHEMISTRY
CH - 364 : Stereochemical Principles and Applications
(2005 Pattern) (Old)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

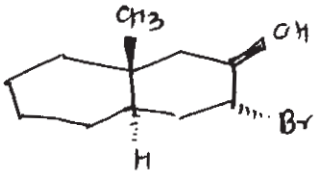
Q1) Answer any four of the following : **[16]**

a) 2, 5 - Dimethylcyclopentane 1,1-dicarboxylic acid exists in two isomeric forms. What are those and how will you differentiate them.

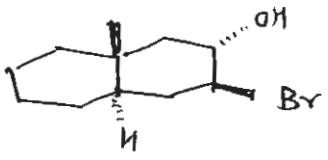
b) Chair-boat interconversion is more facile in cyclohexanone than in cyclohexane. Explain.

c) One of the isomer of 2-hydrindone on reduction gives two meso alcohols. While other gives only one isomer. Explain.

d) Which of the conformation will form epoxite on treatment with base.



I

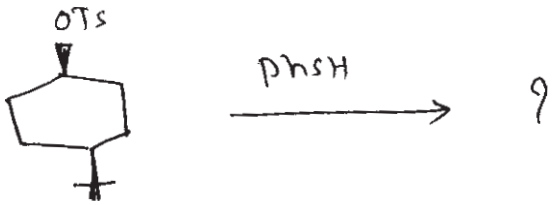


II

e) Trans-4-t-butyl cyclohexanol is more strongly absorbed on alumina than cis isomer.

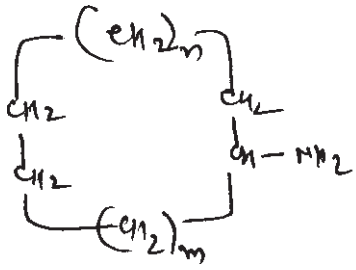
Q2) Predict the product/s in any four of the following and explain the stereochemical principles involved. **[12]**

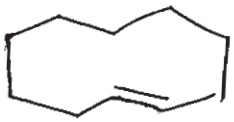
a)

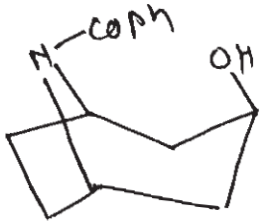


P.T.O.

b) cis-anti-cis hexahydrodiphenic acid → ? (i) 2 mole CH_2N_2 (ii) NaOMe excess (iii) $H_3O^{\oplus}$

c)  HNO_2 → A + B

d)  $HCOOH$ → ?

e)  HCl → ?

Q3) Discuss <u>any three</u> of the following : **[12]**

a) Stereostructures and stabilities of perhydrophenanthrocene.

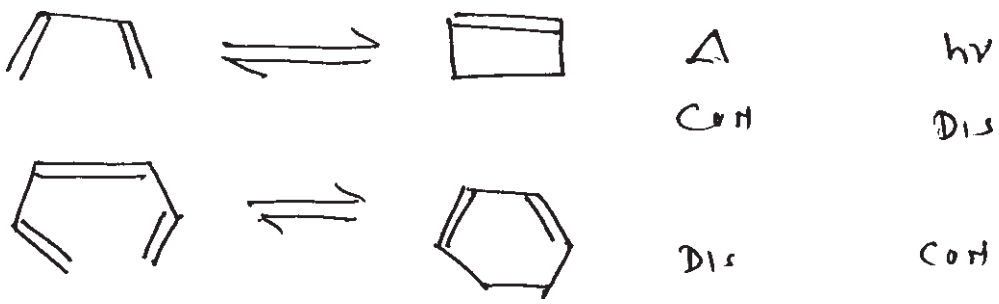
b) Bredt's rule with two examples.

c) Axial haloketone rule.

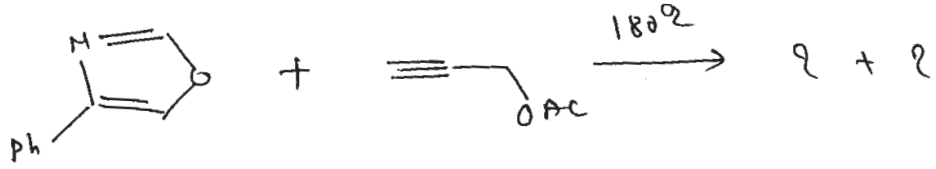
d) I-strain.

SECTION - II

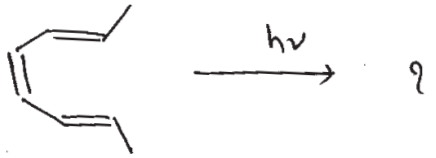
Q4) a) Use PMO method and prove the following selection rules. **[5]**

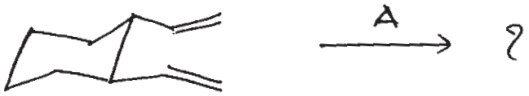


b) Suggest mechanism and predict the product/s for <u>any three</u> of the following : **[9]**

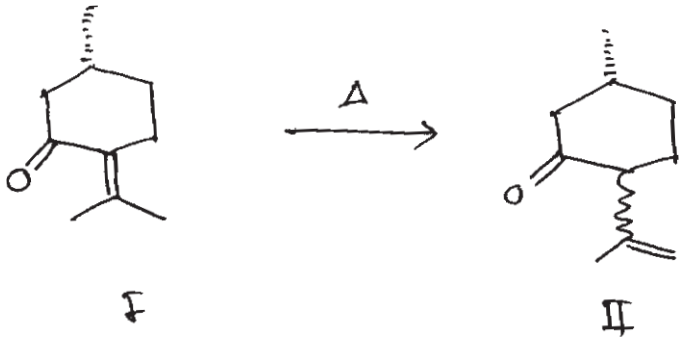
i) 

ii) 

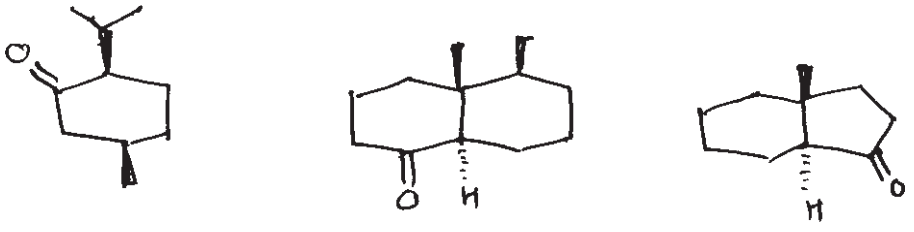
iii) 

iv) 

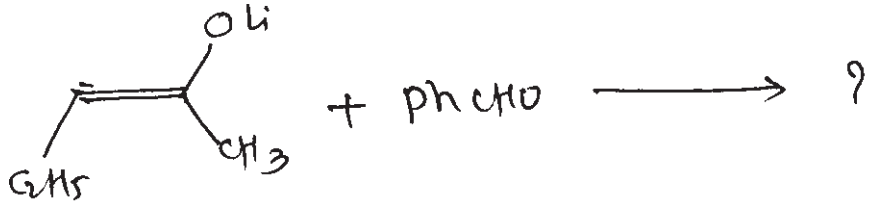
Q5) a) (+) pulegone (I) (whose absolute configuration is shown) on heating gives (–) pulegone (II), which shows + ve (strong) cotton effect. Use this information to deduce the stereochemistry of isopropyl group. Suggest the possible mechanism for the conversion of I to II. **[4]**

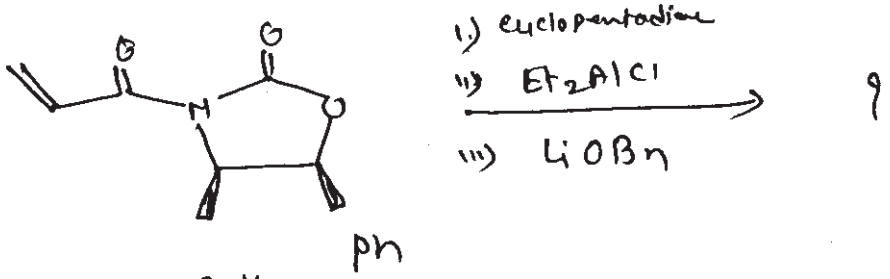


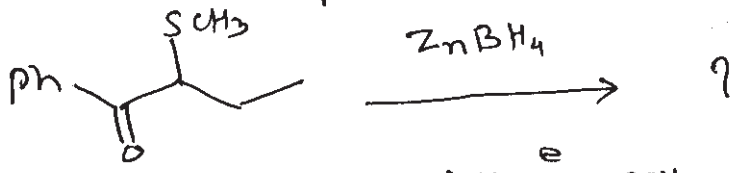
b) Using Octant rule predict the sign of cotton effect for <u>any two</u> of the following : **[8]**

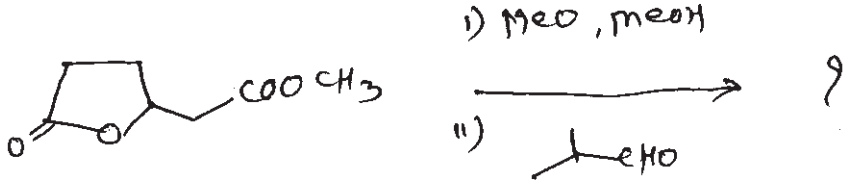


Q6) a) Predict the product/s and suggest the stereochemical principle involved (any three) : **[9]**

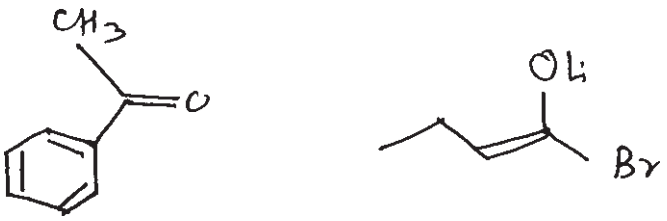
i) 

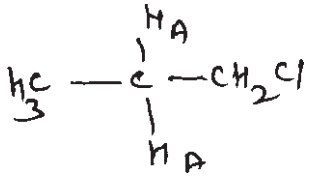
ii) 

iii) 

iv) 

b) Identify Re and Si faces from the following : **[3]**



c) Write Pro-R or Pro-S for  **[2]**

☒☒☒☒

Total No. of Questions : 6] **[Total No. of Pages : 4**

P1236

[3623]-321
M.Sc.
DRUG CHEMISTRY
CH - 361 : Chemistry of Heterocycles and Biologically Active Compounds
(2008 Pattern) (New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

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

a) Acetyl nitrate is used at low temperature for nitration of pyrrole instead of nitrating mixture.

b) Activated thiazoles undergo electrophilic substitution at C-5 rather than at C-4 position.

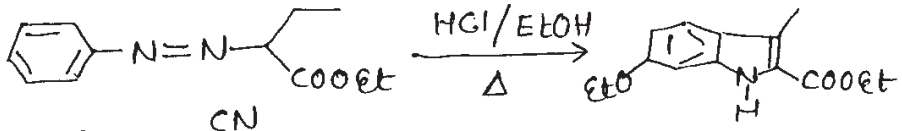
c) 2-chloro pyridine can be converted easily into 2-methoxy pyridine using NaOMe/MeOH, but under similar conditions 3-chloro pyridine is unreactive.

d) Sulphonation of quinoline occurs in homocyclic ring while sulphonation of indole occurs in heterocyclic ring.

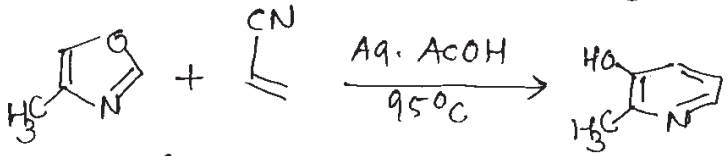
e) N-Alkylation of purines under neutral condition occurs at five member ring nitrogen.

Q2) Suggest the suitable mechanism for any four of the following conversions. **[12]**

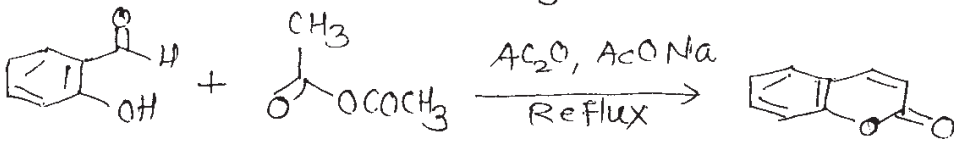
a)



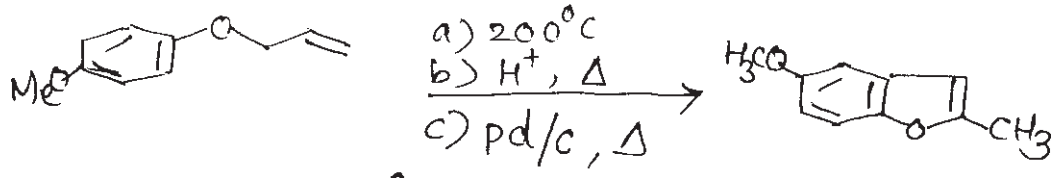
b)

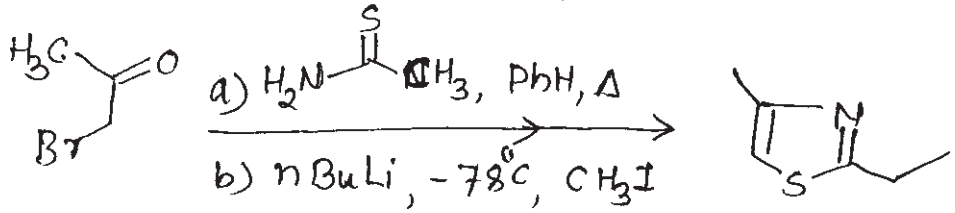


c)



P.T.O.

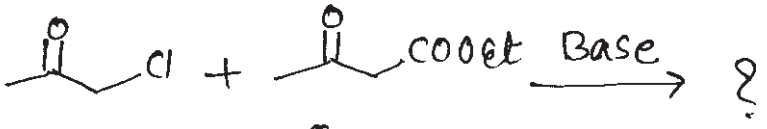
d) 

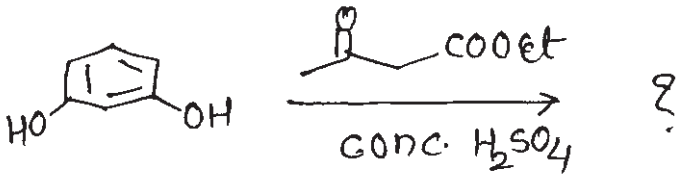
e) 

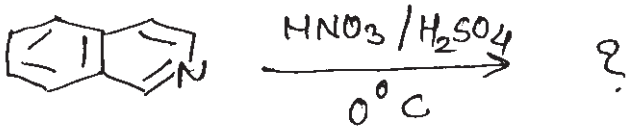
Q3) a) Give <u>any two</u> of the following synthesis : **[7]**

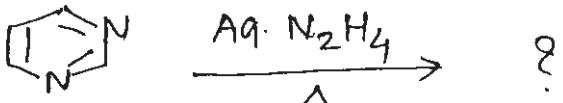
i) Pictet-spengler synthesis.
ii) Reissert synthesis.
iii) Bischler-Napieralski Synthesis.

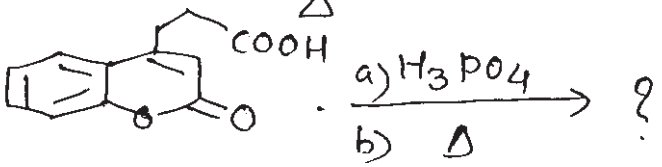
b) Predict the products with mechanism (any three) : **[9]**

i) 

ii) 

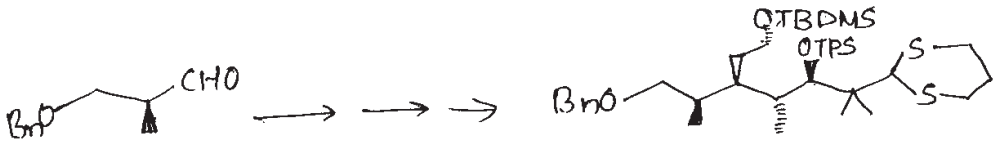
iii) 

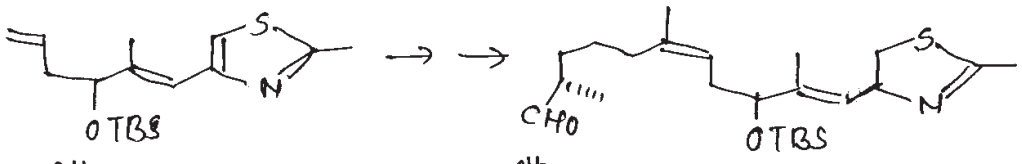
iv) 

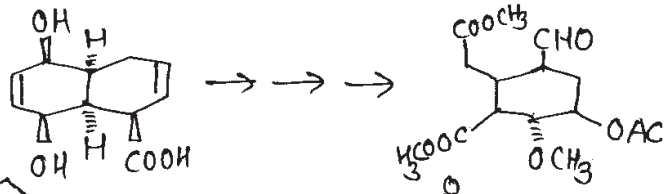
v) 

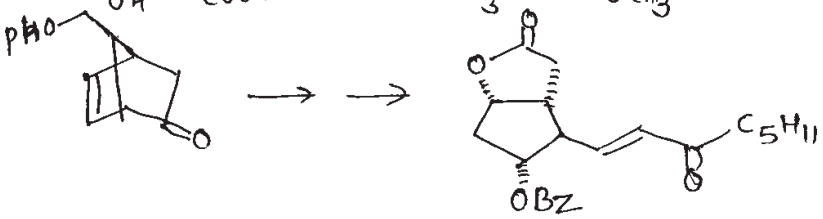
SECTION - II

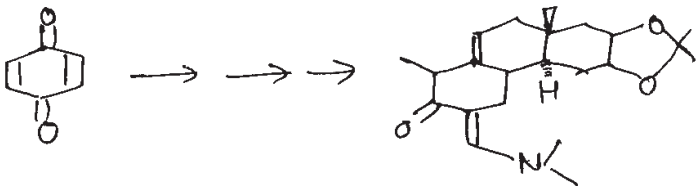
Q4) Discuss the steps involved in the synthesis of following naturally occuring drug molecules or intermediates. Explain the mechanism (any three) : **[15]**

a) 

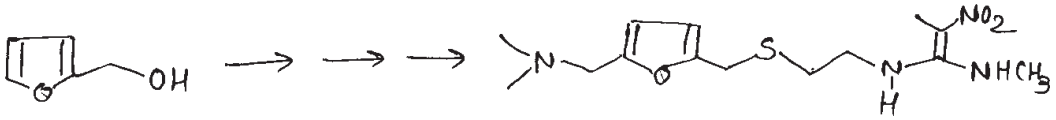
b) 

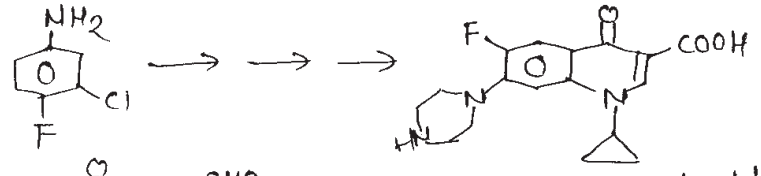
c) 

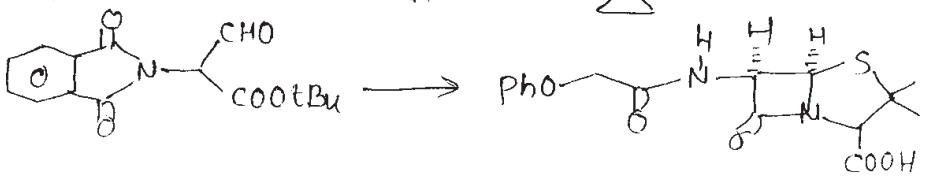
d) 

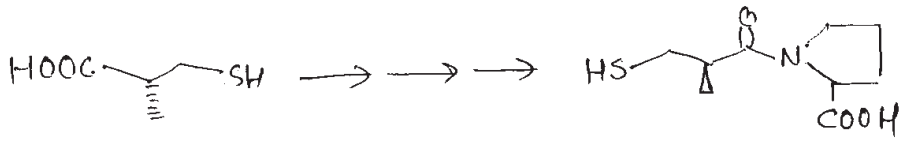
e) 

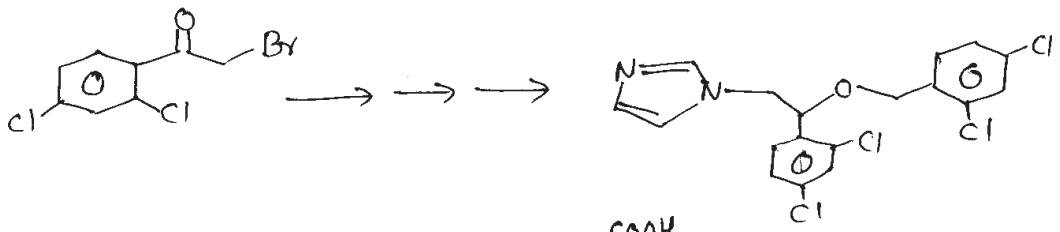
Q5) Discuss the steps involved in the synthesis of the following drug molecules from the precursors shown (any four) : **[16]**

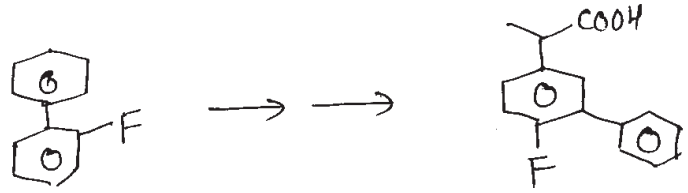
a) 

b) 

c) 

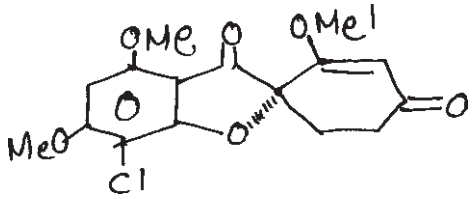
d) 

e) 

f) 

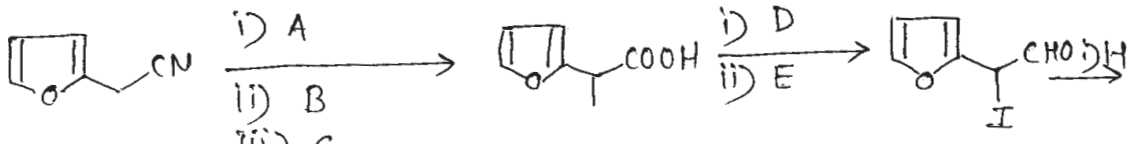
Q6) Answer any two of the following : **[9]**

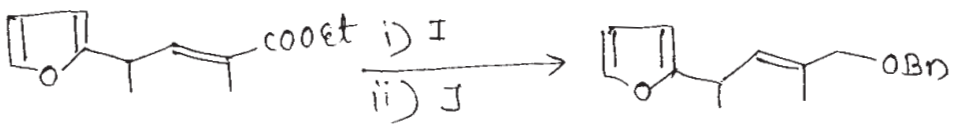
a) Do the reterosynthetic analysis of Griseofulvin and discuss the important reactions involved.



b) Explain olefin metathesis approach and macroaldolisation approach for epithiolone synthesis.

c) Identify the missing reagents in the following conversion. Explain the steps.





Total No. of Questions : 6] **[Total No. of Pages : 3**

P1238

[3623] - 323

M.Sc.

DRUG CHEMISTRY

CH - 363 : Drug Development

(2008 Pattern) (New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:-

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

SECTION - I

Q1) Answer any three of the following : **[15]**

a) What is the difference between inhibitory and exhibitory assays? Why microbial assays are carried out though quick and simple chemical assays are available for antibiotics and growth factors?

b) What role is played by chemicals and microorganisms in waste water treatment?

c) With a neat graph show different stages of microbial growth and name the phase of growth that is used to obtain secondary metabolites during fermentation stating reason behind it.

d) What is industrial fermentation? List the different ways which can improve the final yield of product during fermentation and explain any one of them.

e) Define any three :

i) Autotrophs.

ii) Chemotrophs.

iii) Phototrophs.

iv) Organotrophs.

P.T.O.

Q2) a) Answer any two : **[7]**

i) What is artificially acquired active immunity? What is its significance.

ii) Name the different types of hypersensitivities and explain type II hypersensitivity.

iii) What are monoclonal antibodies? Give the possible applications of monoclonal antibodies.

b) Answer any two : **[8]**

i) What are cytokines? Which cell are the first to release cytokines in response to injury? What role cytokines play in response to injury?

ii) Draw a neat diagram of a typical antibody structure and give the function of each domain on it.

iii) What is immunosuppression? Name the drugs with possible action in immunosuppression.

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

a) What is a drug? Why do some drugs exhibit side effects? What are the strategies to improve Therapeutic Index of drugs?

b) Discuss in brief the role of natural products as drugs. Explain how the active ingredients are extracted from natural products.

c) Give a commentary on how combinational chemistry, HTS, & computers have aided the process of drug discovery.

SECTION - II

Q4) Answer any three of the following : **[18]**

a) Explain the following terms with respect to a patent : Novelty, prior art, invention, priority date, provisional specification.

b) Explain bioavailability. How does the bioavailability change with different dosage forms & routes of administration, discuss.

c) Discuss in brief with examples the various strategies employed for Lead discovery & Lead development.

d) Explain the term 'Rational drug discovery'. With relevant illustrations discuss how would you approach toward discovery of a novel therapeutic - Justify your approach.

Q5) Answer any two of the following : **[14]**

a) What is the need for toxicological evaluation of NCE's. Discuss the tests performed & their outcome. Why many NCE's fail in there tests?

b) Give a brief account of the design of clinical trials. Discuss in brief the intention of each phase & the made of conduct of there phases. What is the role of FDA & IRB in clinical trials.

c) Discuss in brief the functions of the following departments in a pharmaceutical Industry. How do they achieve their abjective.

i) R & D

ii) Process development.

Q6) Explain in brief any four of the following : **[8]**

a) Bioassay.

b) Competitive & Non competitive Inhibitors.

c) Pharmacaepia.

d) Phase I metabolism.

e) Quality Assurance.

f) Orphan drug.

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Total No. of Questions : 6] **[Total No. of Pages : 5**

P1239

[3623] - 324

M.Sc.

DRUG CHEMISTRY

CH - 364 : Stereochemical Principles and Applications

(New 2008 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

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.***

SECTION - I

Q1) Answer any four of the following : **[16]**

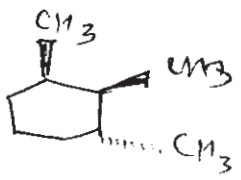
a) Cyclopropanone, Cyclobutanone and Cyclopentanone undergoes foster addition reaction, whereas their products give slow oxidation reaction. Explain.

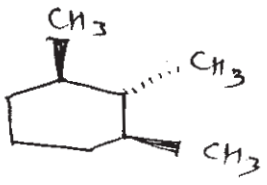
b) Draw different conformations of cyclohexane. Explain the relative stability of these conformations with respect to potential energy.

c) Which of the following conformational isomer is more stable? Give their nomenclature.

d) Bromocampbor fails to undergo dehydrobromination on treatment with base.

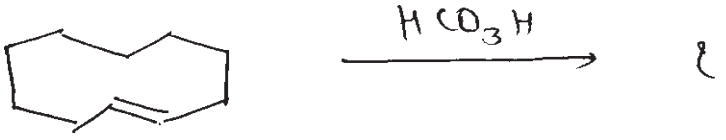
e) Draw chair conformations of (I) & (II). Evaluate the enthalpy difference for each.

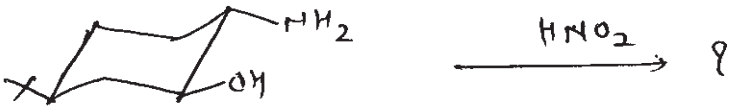




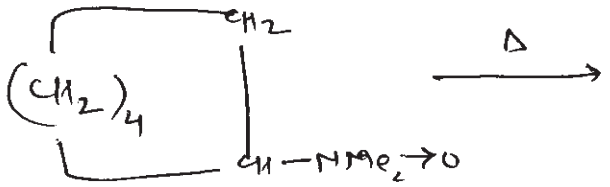
P.T.O.

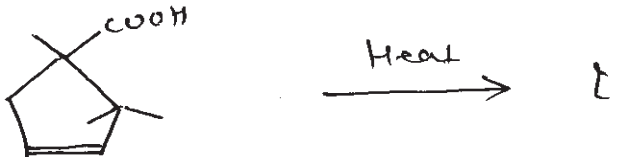
Q2) Predict the product/s in <u>any four</u> of the following and explain the stereochemical principles involved. **[12]**

a) 

b) 

c) 

d) 

e) 

Q3) Solve <u>any three</u> of the following : **[12]**

a) Rearrangement of (A) to (B) was first believed to occur via classical carbocation (SN^1). The second accepted mechanism involved simultaneous migration of bridge with rear attack at $Cl^{\ominus}$ on migration origin. How both mechanisms are ruled out? What is accepted mechanism?

b) Explain the following observations

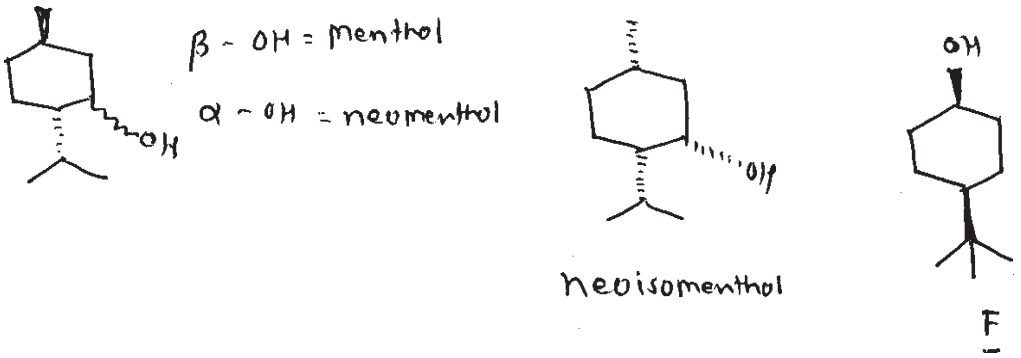
2-phenyl cyclohexylxanthate $\xrightarrow{\Delta}$ 3-phenyl cyclohexene + 1-phenyl cyclohexene

Cis	96%	4%
trans	12%	88%

c) Explain the concept of I-strain.

d) The rates of ocylation decreases in the series

menthol > neoisomenthol > neomenthol > cis-4tert butylcyclohexanol(F)



SECTION - II

Q4) a) Use PMO method to prove wheather the following sigmatropic shifts are thermally allowed or photo chemically allowed. **[4]**

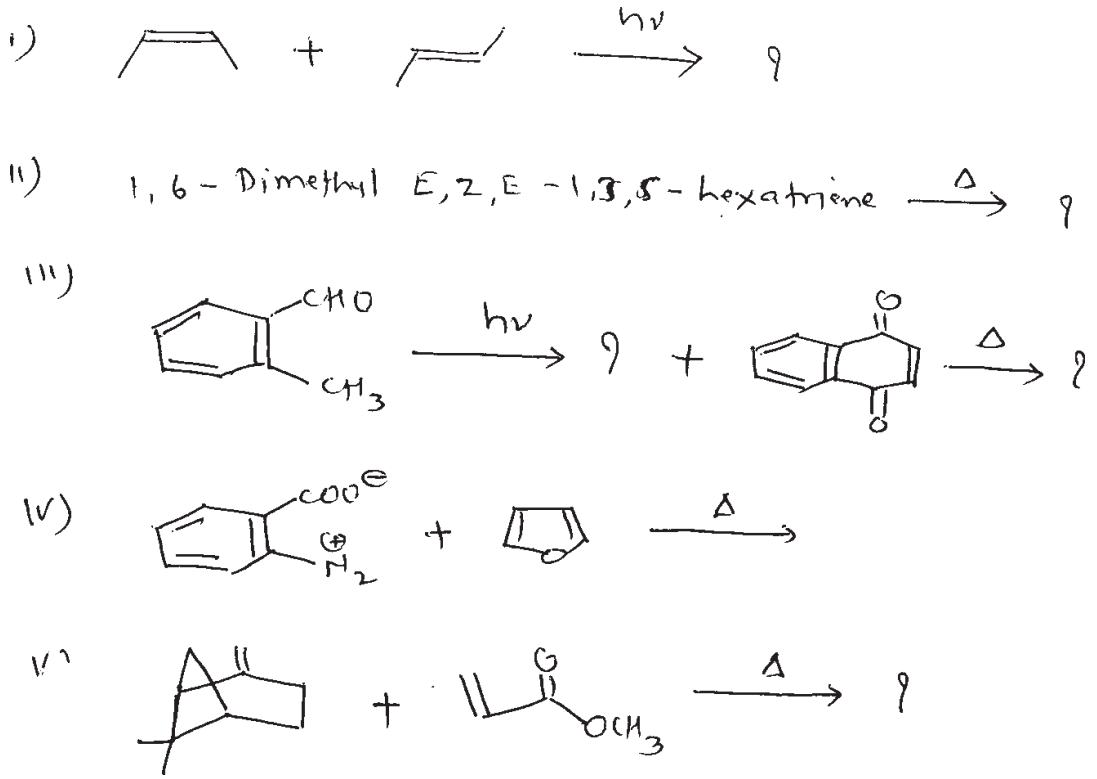
i) [1, 3] suprafacial H shift.

ii) [1,3] suprafacial carbon shift with inversion.

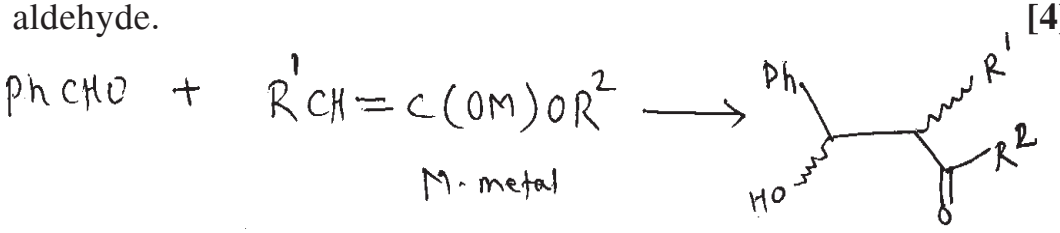
iii) [1, 5] suprafacial H-shift.

iv) [1, 5] suprafacial carbon shift with retention.

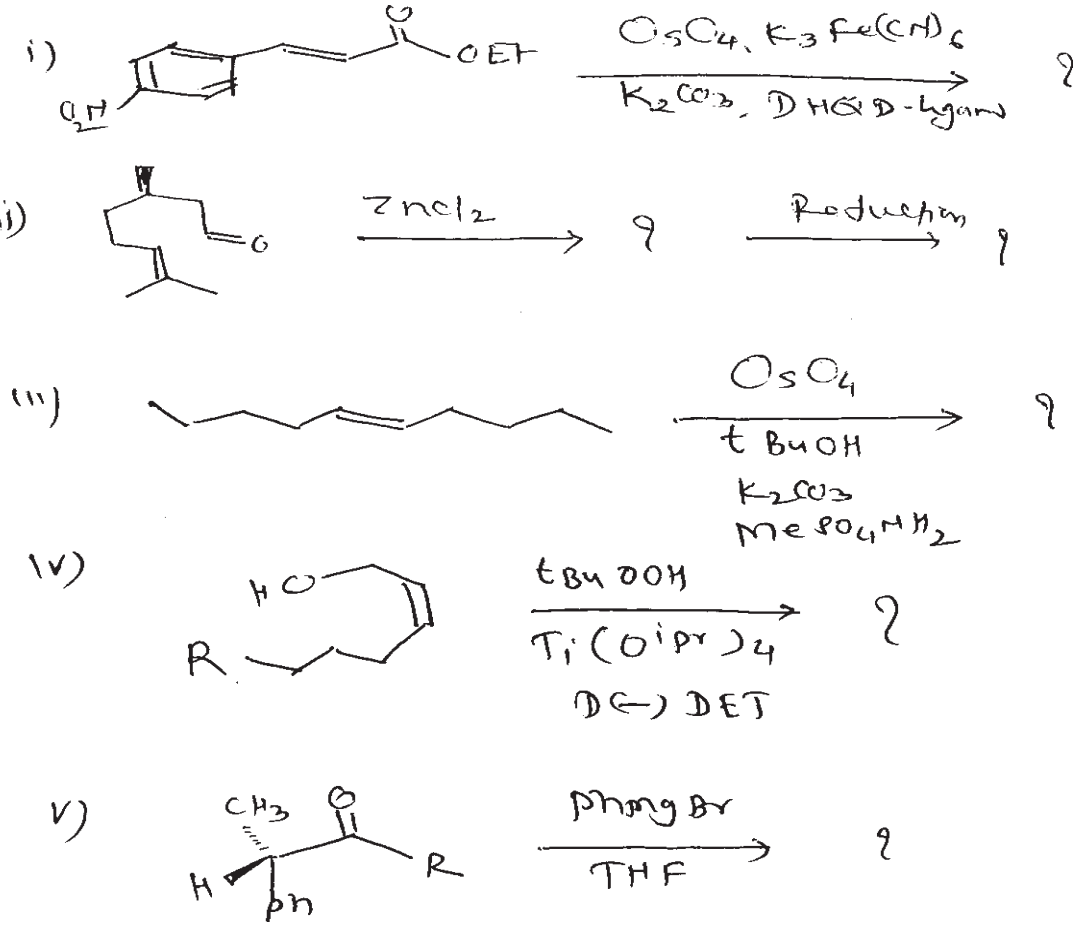
b) Predict the product/(s) and explain the stereochemistry, Justify your answer [any four] : **[8]**



Q5) a) Explain the stereochemistry of major product and draw transition state in the following aldol condensation between z-enolate at an ester and aldehyde. **[4]**



b) Predict the product / (s) and explain the stereochemistry at the following reaction [any four] : **[8]**

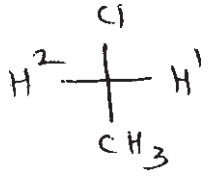


c) Write Re and Si faces for the compound '<u>A</u>'. **[2]**

$PhCH_2COPh$

A

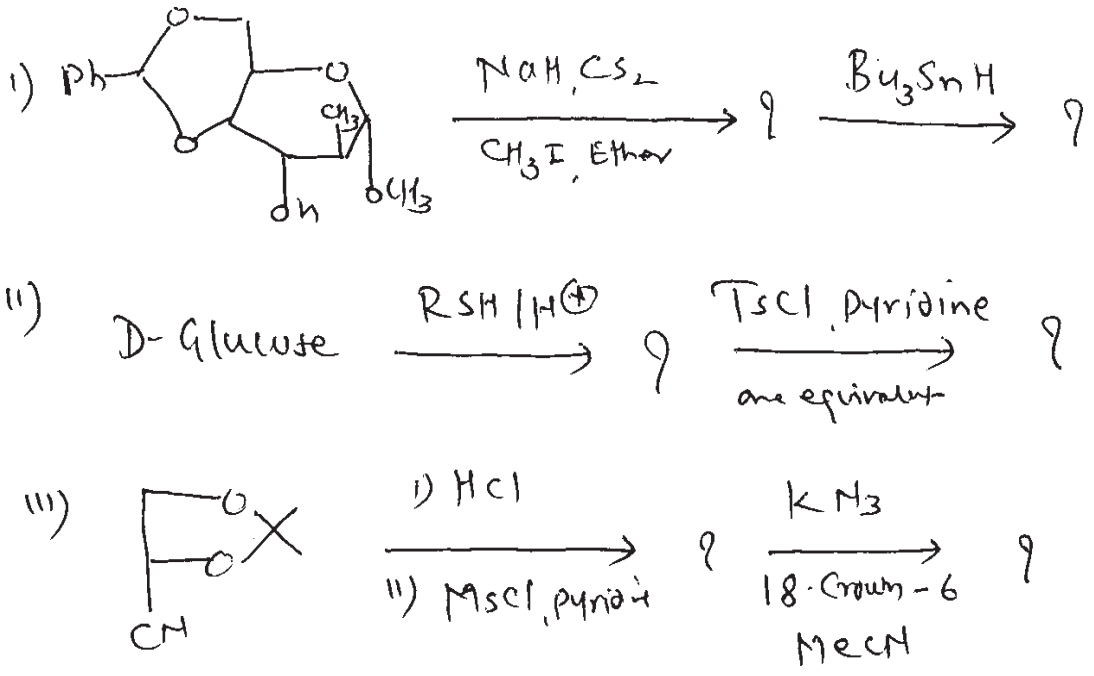
d) Identify pro-R or pro-S in compound '<u>B</u>' **[2]**



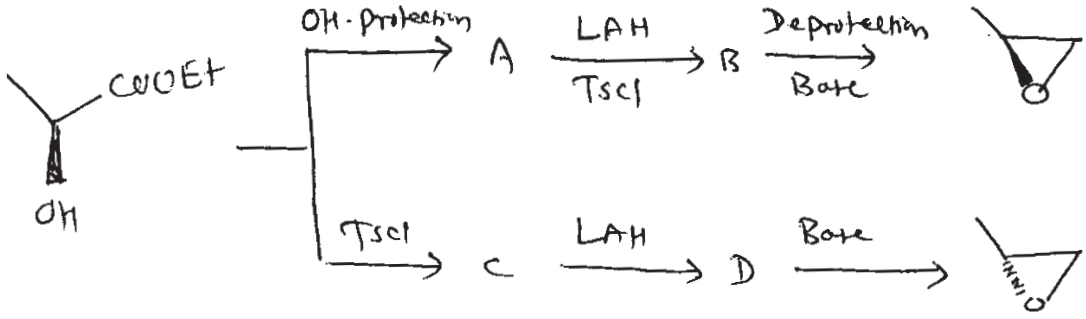
B

Q6) a) Give the experimental evidence for the ring structure of glucose. Write $^4C_1$ and $^1C_4$ conformations for D-glucose. **[4]**

b) Predict the products in <u>any two</u> of the following : **[5]**



c) Complete the following reaction sequence. **[3]**



Write structures of A, B, C & D.

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Total No. of Questions : 6] **[Total No. of Pages : 4**

P411

[3623] - 421
M.Sc. (Sem. - IV)
DRUG CHEMISTRY
CH - 461 : Synthetic Methods in Organic Chemistry

Time : 3 Hours] ***[Max. Marks : 80***

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.***

SECTION - I

Q1) a) Explain any three of the following with an example: **[9]**

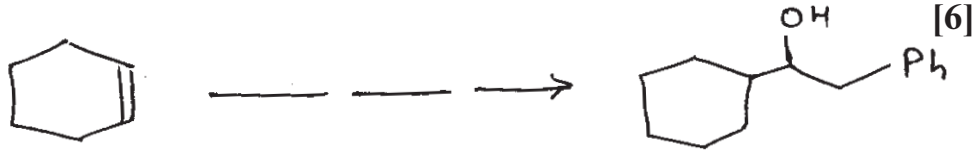
i) Carene derived organoboranes can be used to prepare optically active alcohols.

ii) 9-Fluorenylmethoxy carbonyl group is used in protecting amino function in peptide synthesis.

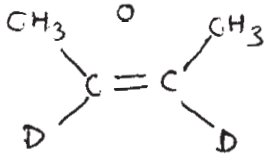
iii) Organo nickel compounds are used in synthesis of macrocyclic ring compounds.

iv) Ethyl ethylthiomethyl sulphoxide is used for synthesising 1, 4-dicarbonyl compounds.

b) Complete the following transformation and justify your answer (any two): **[6]**

i) 

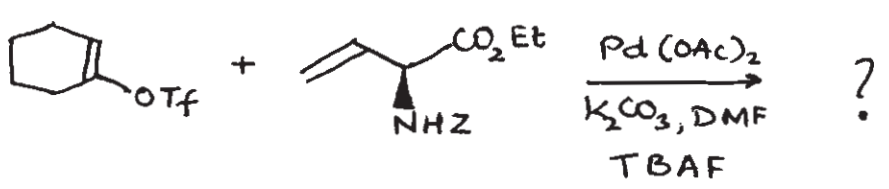
ii) 

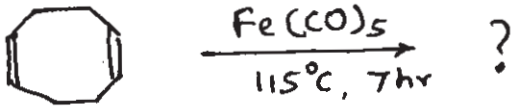
iii) $CH_3-C\equiv C-CH_3$ ⟶ 

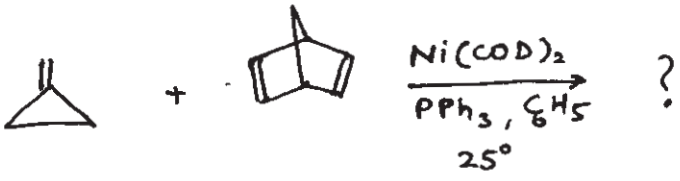
iv) $Ph-CH=CH_2$ ⟶ $Ph-CH_2-CH_2-CH=CH-COOEt$

P.T.O.

Q2) a) Predict the product explaining the mechanism of transition metal complex (any three): **[9]**

i) 

ii) 

iii) 

iv) 

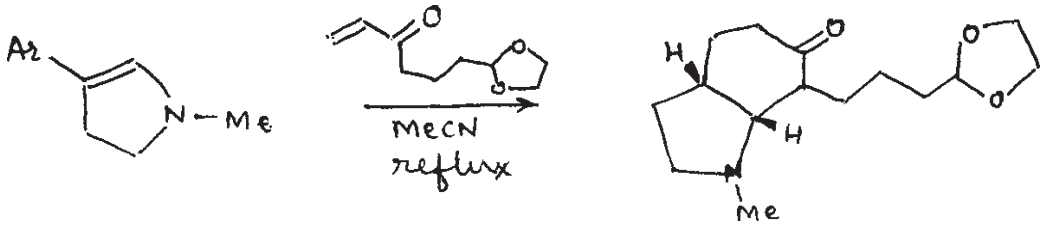
b) Discuss <u>any two</u> of the following: **[6]**

i) Use of Pd(O) in suzuki coupling.

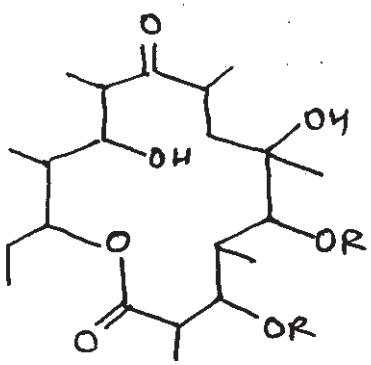
ii) Use of umpolung reaction in synthesis of 1,2-di-carbonyl compounds.

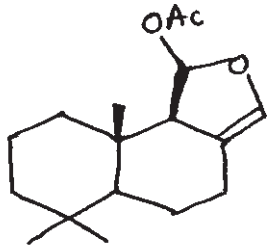
iii) Enamines are monoalkylated at α-position preferentially than di-alkylated.

Q3) a) Explain how Domino reaction is preferred over multistep organic synthesis. Explain the following Domino reaction. **[5]**



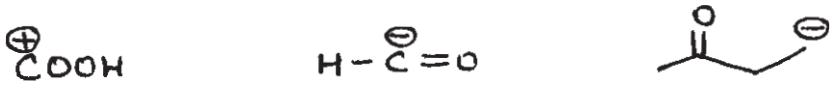
b) Explain the biomimetic approach to reterosynthesis. Explain how this approach is used to obtain <u>any one</u> of the following compounds. **[5]**

i) 

ii) 

SECTION - II

Q4) a) Give one reaction with reagent for each synthon given below. **[6]**



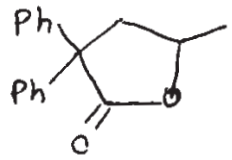
b) Using the method of umpolung carryout conversion of any two of the following. **[6]**

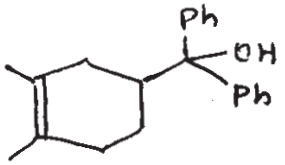
i) $CH_3CHO \longrightarrow CH_3-\overset{\overset{O}{\|}}{C}-\underset{\underset{OH}{|}}{CH}-CH_3$

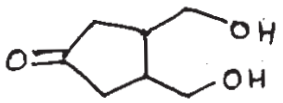
ii) $CH_3CH_2NO_2 \longrightarrow CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-COOEt$

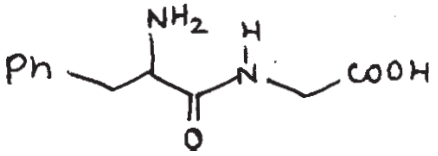
iii) 

Q5) Using reterosynthetic analysis, suggest a suitable method to synthesize any three of the following. **[12]**

i) 

ii) 

iii) 

iv) 

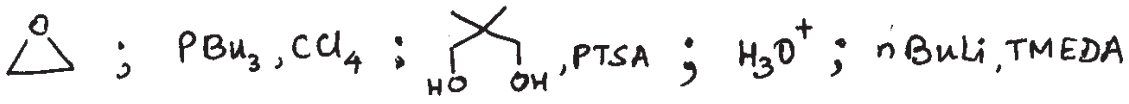
Q6) a) Give brief account of <u>any one</u> of the following : **[4]**

i) Advantages of green chemistry in organic chemistry with one suitable example.

ii) Advantages of Domino reactions.

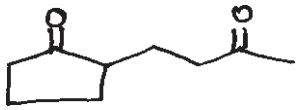
b) Answer <u>any four</u> of the following: **[12]**

i)

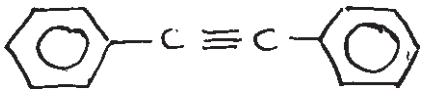


ii) How the follow conversion can be achieved?

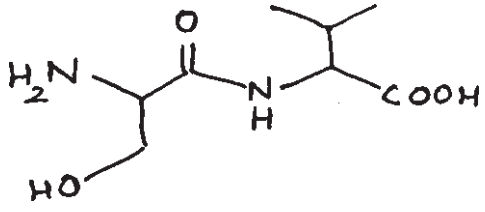
iii) How the following compound can be prepared by enamine approach?



iv) Give two methods for the synthesis of the following compound.



v) Discuss the steps involved in the synthesis of the following dipeptide.



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Total No. of Questions : 6] **[Total No. of Pages : 3**

P412

[3623]-422
M.Sc. - II
DRUG CHEMISTRY
CH - 462 : Chemotherapy (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

Q1) Answer any three of the following : **[18]**

a) Discuss the concept of selective toxicity? Explain why most of the antibiotics/antibacterials exhibit selective toxicity with illustrations.

b) Explain the benefits exhibited in the following modifications of Cephalosporins.

Cephalosporin C $\longrightarrow$ Cephalothin

Cephalothin $\longrightarrow$ Cephloridine

Cephalosporin C $\longrightarrow$ Cephaloxin

Cephaloxin $\longrightarrow$ Cefadroxil

Cephalothin $\longrightarrow$ Cefuroxime

Cephalothin $\longrightarrow$ Cefoloxine

c) Outline the steps towards the synthesis of the following (any 2)

i) Penicillin G $\longrightarrow$ 6 - APA

ii) Penicillin G $\longrightarrow$ 7 - ADCA

iii) Cephalosporin C $\longrightarrow$ 7α Methoxy, 7-aminocephalosporanic acid.

d) Give a brief account of any two :

i) Antibiotic Resistance.
ii) Tuberculosis.
iii) Malaria.

P.T.O.

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

a) Discuss the steps in protein biosynthesis - which are the steps/targets inhibited by streptomycin, chloramphenicol, erythromycin & tetracycline.

b) Explain in brief the mechanism by which nerve impulse is transmitted from one neuron to another, how the impulses regulated? What happens if there is a disturbance in neurotransmission?

c) Discuss the phenomenon of hyperacidity & ulcers. Explain the mechanism. What are the drugs of choice for their management.

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

a) What are common viral infections? Explain how Amantadine, Ribavarin & Acyclovir act as antivirals?

b) Give a short account of fungal diseases & role of Ketoconazole & Amphotericin B in antifungal management.

c) Explain convulsions & the role of Valproic acid, Phenobarbitol & Phenytoin as Anticonvulsants.

SECTION - II

Q4) Answer any two of the following : **[16]**

a) What are the different classes of drugs used as anticancer agents? Explain the mechanism of action of Alkylating agents & intercalators? Why do these drugs have severe side effects.

b) How does the endocrine system maintain homeostasis? Give the function of atleast 4 different hormones. What happens in case of their oversecretion?

c) Explain how the following groups of drugs help in management of CVS disorders. (any 4)

i) β-blocken.
ii) Diuretics.
iii) Vasodialators.
iv) Ca^{++} Channel blocken.
v) ATPase inhibitors.
vi) Thrombolytics.

Q5) Answer any three of the following : **[15]**

a) Give an overview of diabetes & the strategies employed for the management of NIDDM.

b) Explain the mechanism of inflammation? How do Diclofenae & Ibuprofen exhibit antiinflammatory & analgesic effect?

c) Give a brief account of development of alkylating agents from the discovery of mustard gas.

d) Give a commentary on the role of natural products as drugs in disease management & new drug discovery.

Q6) Discuss the mode of action & uses of the following (any 3) : **[9]**

a) Sulbactam.

b) Metronidazole.

c) Amoxycillin.

d) Captopril

e) 5-Fluorouracil.

Total No. of Questions : 6] **[Total No. of Pages : 3**

P413

[3623]-423
M.Sc.
DRUG CHEMISTRY
CH - 463 : Drug Design (Semester - IV)

Time : 3 Hours] ***[Max. Marks : 80***

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.***

SECTION - I

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

a) What is the use of arithmetic mean & standard deviation when we deal with statistical data. Compute standard deviation for the below given data of height in inches of 5 plants 12.5, 13.8, 14.2, 12.9, 13.4

b) In a desert region on an average 4 people fall sick by eating a certain plant every year. Assuming Poisson probability, Find the probability that during a given year.

i) Exactly 2 will fall sick.

ii) Atleast one will fall sick.

iii) No one will fall sick by eating that plant.

c) For the following data of age of husbands (X) and age of their wives (Y) in years given for 5 couples.

Couple No :	1	2	3	4	5
X :	28	32	38	48	52
Y :	26	29	34	42	50

Set up a regression line of Y on X & estimate the age of wife whose husband is 35 years old.

Q2) Answer any two of the following : **[14]**

a) What do you understand by recombinant DNA technology? Discuss the steps involved in r-DNA construction & the enzymes involved.

b) Discuss Gene therapy & its current uses.

P.T.O.

c) Explain any two of the following :

i) Membrane receptors as targets for drug discovery.

ii) Transgenic animals as disease models.

iii) Monoclonal antibodies as drugs against cancer.

Q3) Answer any two of the following : **[14]**

a) Give a brief account of interactions between a drug & receptor. How are these utilised in drug designing?

b) With proper illustrations explain how prodrugs are constructed & discuss their eventual ADMET benefits.

c) Discuss the function of membrane bound receptor super families & explain the steps involved in signal transduction pathways.

SECTION - II

Q4) Answer any three of the following : **[18]**

a) What is meant by forcefield? How is the energy calculated by forcefield different from quantum chemical calculations?

b) Describe three methods of energy minimization, enumerate the strength & weakness of each method.

c) Angiotensin II is involved in hypertension. The structure of Angiotensin Receptor is characterised very well. How will you design a novel hypertensive based on this information. Explain your strategy?

d) Discuss the history & development of QSAR. How was Hansch equation developed & applied for drug designing.

Q5) Answer any two of the following : **[12]**

a) Discuss the application of Topliss Scheme & Craigs plot in lead optimisation.

b) Discuss the following in brief & their applications in drug discovery.

i) Solid phase organic synthesis.

ii) Parallel synthesis.

iii) Split & Mix approach.

c) Explain the following & their significance in QSAR.

i) Coefficient of variable & its sign.

ii) t–test.

iii) Correlation coefficient.

iv) Equation of best fit.

Q6) Answer <u>any two</u> of the following : **[10]**

a) Designing of a drug when the structure of receptor is unknown.

b) Receptor theories of drug action.

c) Role of HTS & Bioinformatics in drug discovery.

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P432

[3623] - 201
M.Sc.
PHYSICAL CHEMISTRY
CH - 210 : Physical Chemistry - II (New)

Time : 3 Hours] ***[Max. Marks : 80***

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 RIGHTSIDE indicate FULL marks.***
4) ***Use of logarithmic table, calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt any three of the following: **[15]**

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

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

c) Distinguish between the selection rules for harmonic and anharmonic oscillations. What are the conditions for dissociation of molecules.

d) Sketch and explain the occurrence of P, Q and R branches of IR spectra of a diatomic molecule.

e) Explain the applications of ESR spectroscopy.

Q2) Attempt any three of the following: **[15]**

a) Explain the quantum theory of Raman effect.

b) Sketch and explain the polarizability ellipsoids for the H_2O molecule.

c) Derive the expression for $V_{max} = \frac{1}{2xe} - 1$ where, *x*e is the anharmonicity constant.

d) Write a note on Fortrat-diagram.

e) Explain the applications of Mössbauer spectroscopy.

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

a) A transition involves an energy change of 4×10^{-22} J/molecule. There are 1000 molecules in the ground state at 20k. Estimate the number of molecules in the excited state.

b) Determine the force constant in SI units for the HCl molecule, $\overline{We} = 2990\ cm^{-1}$. [At. wts : H = 1, Cl = 35.5]

c) Predict the position of the rotational Raman spectral lines for $^{14}N_2$ [$B = 1.99\ cm^{-1}$, excitation frequency = 891 THz]

SECTION - II

Q4) Attempt any three of the following: **[15]**

a) Describe with a neat diagram the construction and working of a G.M. counter.

b) What is breeder reactor? Explain the principle of breeding.

c) What is separation factor? Explain the method for separation of plutonium.

d) Write a note on critical size of a thermal reactor.

e) Give an account of natures, nuclear reactor.

Q5) Attempt <u>any three</u> of the following: **[15]**

a) Discuss how primary radiolytic products of water are formed. Describe briefly Lea-Gray-Platzmann model.

b) What are the various units used for measurement of radiation absorption? How are they related with each other?

c) Discuss the use of a radio isotope in determining thickness of a sample.

d) Explain the different types of diffusion processes and discuss the principle of zone diffusion technique.

e) Describe how phosphorous - 32 and sulphur - 35 are synthesized.

Q6) Solve any two of the following: **[10]**

a) 1 g sample containing 20% manganese was irradiated in a neutron flux of 2.5×10^6n cm^{-2} s^{-1} for 5h. Find the activity of the sample at the end of irradiation. Given r = 100% σ = 13.3b, $t\frac{1}{2}$ of Mn - 56 = 2.58h.

b) Find the molecular and mass absorption coefficient of acetic acid. Given : e^{μ} = 0.211 b/electron.

c) A patient was administered a certain dose of Na - 24 with half - life of 14.96 h. Calculate the time required to reduce the initially administered dose to 10%.

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P432

[3623] - 201
M.Sc.
PHYSICAL CHEMISTRY
CH - 210 : Physical Chemistry - II (Old)

Time : 3 Hours] ***[Max. Marks : 80***

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

P.T.O.

SECTION - I

Q1) Attempt any three of the following: **[15]**

a) Explain the factors determing the width of spectral lines.

b) Explain how isotopic substitution leads to the determination of C-S and O-S bond lengths in the O-C-S molecule from microwave spectra.

c) Show that $I = \mu r^2$ for a diatomic molecule where I is moment of inertia and r is bond length.

d) Explain the Born-Oppenheimer approximation and its breakdown.

e) Discuss the occurence of P,Q,R series in IR spectroscopy for diatomic molecules.

Q2) Attempt any three of the following: **[15]**

a) Write a note on Fortrat diagram.

b) Explain predissociation spectra.

c) Discuss the quantum theory of Raman shift.

d) Explain the mutual exclusion rule.

e) Discuss the applications of ESR spectra.

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

a) The equilibrium vibrational frequency of the H-F molecule is 4138 cm^{-1}. Estimate the value of the force constant. (At. weights : H = 1, F = 19).

b) The anharmonicity constant for a diatomic molecule is 0.006. Which vibrational level leads to dissociation?

c) Which rotational level will show the maximum intensity in the rotational spectrum of a molecule having B = 16 cm^{-1}?

SECTION - II

Q4) Attempt any three of the following: **[15]**

a) Explain the role of a polyatomic gas in G.M. tube. Draw the characteristic curve obtained for a G.M. counter.

b) Write the expressions for the various absorption coefficients. How are they related with each other?

c) Write the various reactions occurring in the radiolysis of water. Explain the terms spur and delta ray tracks.

d) Define rad, Gray, Röntgen, RBE, Rem and Sievert.

e) Explain the photoelectric effect involving γ radiations.

Q5) Attempt <u>any three</u> of the following: **[15]**

a) Describe how the mechanism of oxidation of fummaric acid by acidified $KMnO_4$ was established using ^{11}C radioisotope.

b) Explain the principle of isotope dilution technique. Give its applications.

c) Discuss the technique of neutron activation analysis. What are its advantages?

d) Explain how the use of a Radioisotope of chlorine helps in investigating the mechanism of Friedal-Craft's reaction.

e) How can the defects in industrial casting be detected with gamma radiography?

Q6) Solve any two of the following: **[10]**

a) 0.1 g of Mn powder was irradiated for 90 min. in a neutron flux of 10^6 $ncm^{-2}s^{-1}$. Find the activity of the sample in dpm after a cooling period of 5 hr.

[Given, σ = 13.3b, t½ of ^{56}Mn is 2.58 h, r = 100%]

b) Find out linear, mass and molecular absorption coefficients of benzene. [Given, e^{μ} = 0.211 b/e, density of benzene = 0.879 g/cc]

c) If a Fricke solution is placed near ^{60}Co source it registers a dose of 48 Gy min^{-1}. Calculate the dose absorbed by chloroform placed in the same position if $(\overline{Z/A})_{Fricke}$ = 0.553.

[At.wts : C = 12, H = 1, Cl = 35.5]

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Total No. of Questions : 6] **[Total No. of Pages : 5**

P433

[3623] - 202
M.Sc. - I
INORGANIC CHEMISTRY
CH - 230 : Inorganic Chemistry - II
(Old & New Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:-

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logtables and calculator is allowed.***
6) ***Given Atomic Numbers : Mn = 25, Cu = 29, Co = 27, V = 23, Ni = 28, Cr = 24, Ce = 58, Nd = 60 and Gd = 64.***

SECTION - I

Q1) Attempt any three of the following: **[15]**

a) Prepare a table of Micro states and obtain R.S. term symbols for s^1p^1 configuration.

b) Explain which of the following complexes show orbital contribution to magnetic moment. Justify your answer.

i) $[Mn(CN)_4]^{-2}$ ii) $[Cu\ (H_2O)_6]^{+2}$

c) Explain the following :

i) Rare earth metal complexes give sharp absorption bands while 3d transition metal complexes show broad bands.

ii) $[Co(H_2O)_6]^{+2}$ has pole pink colour while $[CoCl_4]^{-2}$ has intense blue colour.

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

i) $2.^3T_{2g}$ ii) $^1B_{2g}$

iii) d^2 iv) $t_{2g}^{\ 2}\ e_g^2$

v) ^4F

e) Arrange the following transitions in octahedral complex according to increasing intensity. Justify your answer.

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

ii) $A_{2u} \longrightarrow T_{2g}$

iii) $E_g \longrightarrow E_g$

P.T.O.

Q2) Attempt <u>any three</u> of the following: **[15]**

a) Give the full spectroscopic symbol for the ground state term of the following ions.

i) V^{+3} ii) Co^{+2}

iii) Ce^{+3} iv) Nd^{+3}

v) Gd^{+3}

b) How would you account for the magnetic moment of the following complexes.

i) $[Ni(NH_3)_6]SO_4$ $\mu = 2.84$ B.M.

ii) $K_2[Ni(CN)_4]$ $\mu = 0$

c) Give the splitting of ^6H term in weak cubic field using character table for pure rotational point group 'O'.

d) Predict the expected electronic transitions in the following complexes.

i) $[Ni\,(NH_3)_6]^{+2}$ ii) $[Co(H_2O)_6]^{+2}$

e) Ni^{+2}(oh) complex shows 20% increase in its observed magnetic moment value. Calculate spin orbital coupling constant for Ni^{+2} ion. Given $10\ D_q = 8500\ cm^{-1}$.

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

a) Construct correlation diagram for $[V(H_2O)_6]^{+3}$ complex ion on the basis of crystal field theory.

Given

i) R.S. terms of the free V^{+3} ion are ^3F, ^1D, ^3P, ^1G & ^1S in the order of increasing energy.

ii) In a weak octahedral field the R.S. terms split into the following group theoretical terms.

$^3F = {}^3T_{1g} + {}^3T_{2g} + {}^3A_{2g}$

$^1D = {}^1T_{2g} + {}^1E_g$

$^3P = {}^3T_{1g}$

$^1G = {}^1T_{1g} + {}^1T_{2g} + {}^1E_g + {}^1A_{1g}$

$^1S = {}^1A_{1g}$

OR

b) Attempt the following :

i) Write note on Tanabe-Sugano diagram.

ii) The complex hexaaquo chromium (III) chloride shows three spin allowed transitions at 17400 cm^{-1}, 24600 cm^{-1} and 37800 cm^{-1}. Calculate configurational interaction, Racah parameter, crystal field splitting parameter and Nephelauxetic ratio

Given $B_0 = 918\ cm^{-1}$.

SECTION - II

Q4) Answer any three of the following: **[15]**

a) Describe the binding of oxygen with Haemoglobin.

b) Explain the role of metals in metalloprotein and metalloenzymes.

c) Discuss the concept of spontaneous self assembly and model compounds.

d) What are iron-sulfur clusters? Explain the structures of these clusters with electron transfer reactions.

e) Describe the active and passive transport of metal ions in biological processes.

Q5) Write short notes on any three : **[15]**

a) Ferretin.

b) Calmodulin.

c) Zinc-finger.

d) Factor affecting the stability of metal-amino acid complexes.

e) Nitrogen fixation.

Q6) Draw the structures any five : **[10]**

a) Vit.B_{12}

b) Ferridoxin

c) Porphyrin

d) Phenylalanine

e) $[(bipy)pt\ (en)]^{2+}$

f) ATP

DIRECT PRODUCTS

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

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

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

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

(*d*) D_{5d}, D_{5h}, D_5, C_{5v}, C_{5h}, C_5 :

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

$E_1 \times E_2 = E_1 + E_2$.

(*e*) For D_{4d}, S_8.

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

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

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

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

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

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

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

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

6. The complete results for O are :

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

CORRELATION TABLE FOR GROUP O_h

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

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P435

[3623] - 204
M.Sc.
BIOCHEMISTRY
BCH - 270 : Bioenergetics and Metabolism
(Old & New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:-

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

SECTION - I

Q1) Answer any five of the following : **[15]**

a) Give the salient features and mechanism of action of ATP synthase.

b) Define standard redox-potential. How it is determined.

c) What is role of carnitine in fatty acid oxidation?

d) Why hydrolysis of ATP result in release in free energy?

e) Explain the action and regulation of pyruvate dehydrogenase.

f) How epinephrine and glucagon regulate glycogen metabolism.

g) Discuss in brief the regulation of HMP shunt.

Q2) Attempt any three of the following : **[15]**

a) Describe the z-scheme of photosynthesis with the help of a net diagram. Explain the structure of chloroplasts.

b) Explain how palmitoyl CoA is completely oxidized to CO_2 and H_2O.

c) Write a note on fatty acid synthase complex.

d) Discuss the regulation of cholesterol and phospholipids biosynthesis.

e) What are the effects of ionophores on electron transport and oxidative phosphorylation?

P.T.O.

Q3) Give the biochemical reactions involved in the following conversion (any five) : **[10]**

a) Propionyl CoA to succinyl CoA,

b) Choline to phosphatidylcholine.

c) Acetyl CoA to Enoyl-CoA.

d) Ribose 5-phosphate to fructose 6-phosphate.

e) UDP-glucose to 1-ascorbic acid.

f) Acetyl CoA to β-hydroxylbutyrate.

g) Glycerol to pyruvate.

SECTION - II

Q4) Answer any five of the following : **[15]**

a) Give the various types reactions involved in amino acid catabolism.

b) How activity of carbamoyl synthetase - I is regulated.

c) Describe the synthesis and significance of S-adenosyl methionine.

d) Give the structures of cofactors involved in transfer of single carbon group in nitrogen metabolism.

e) Give the schematic diagram to explain the entry of standard amino acids into citric acid cycle.

f) Give the difference between de navo synthesis and salvage pathway of purines. Describe the inborn error of metabolism associated with purine catabolism.

g) Explain the biochemical steps involved in urea synthesis.

Q5) Attempt any three of the following : **[15]**

a) How nitrogen cycle maintain a pool of biologically available nitrogen?

b) Describe the mechanism of ribonucleotide reductase catalyzed formation of deoxyribonucleotides.

c) How isoleucine biosynthesis is regulated?

d) Describe catabolism of purine nucleotides

e) How pyrimidine biosynthesis is regulated?

Q6) Give the biochemical reactions involved in the following conversions (any four) : **[10]**

a) Glutamate to arginine.

b) IMP to ATP and GTP.

c) ATP + riboflavin to flavin adenine dinucleotide.

d) Chorismate to phenylalanine and tyrosine.

e) Tyrosine to epinephrine.

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Total No. of Questions : 6] **[Total No. of Pages : 2**

P436

[3623] - 205
M.Sc.
BIOCHEMISTRY
BCH - 271 : Biophysical Techniques
(Old & New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:-

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

SECTION - I

Q1) Answer any five of the following : **[15]**

a) How hydroxyapatite chromatography separate ss DNA from ds DNA?

b) Explain the process of dialysis and give its applications.

c) Differentiate thin layer chromatography and thin layer gel (filtration) chromatography.

d) Explain the properties of ion exchangers.

e) Certain drugs, such as morphine, bind to specific receptor in neural tissue. Design a procedure for the partial purification of the receptor.

f) Give the principle and application of isoelectric focusing.

g) Distinguish between fiberglass filters and nitocellulose filters.

Q2) Attempt any three of the following : **[15]**

a) Describe any four commercially available matrix ligand systems for affinity chromatography.

b) Draw the schematic diagram of a UV-VIS spectrometer and explain the instrumentation.

c) How electrophoresis can be combined with chromatography? Explain with suitable example.

d) Explain in brief the theory of electrophoresis. Give the types and explain disc PAGE.

P.T.O.

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

a) How molecular weight of a protein can be determined by gel chromatography?

b) Describe the DNA sequencing by Maxam-Gilbert method.

c) What are the transfer techniques for DNA, RNA and proteins to the membrane?

SECTION - II

Q4) Answer any three of the following : **[15]**

a) Give diagrammatic representation of analytical and preparative ultracentrifuge.

b) Explain the circularity Vs linearity of DNA molecules with the help of viscosity measurements.

c) How will you identify buried tyrosines in a hypothetical protein by radioactivity?

d) What is meant by sensitization of autoradiography? How it is done?

e) Discuss the measurement of partial specific volume by pycnometry.

Q5) Explain in brief any three : **[15]**

a) Effect of friction on standard sedimentation coefficient.

b) Meselson-Stahl experiment by using density gradient sedimentation.

c) Measurement of diffusion coefficient and arrangement of subunits of hemoglobin.

d) Viscosity measurement by Ubhelodhe method.

e) Nuclear emulsions used in autoradiography.

Q6) Answer any two of the following : **[10]**

a) What are the various physical arrangements between emitting source and emulsion?

b) Explain liquid scintillation counter.

c) What are the factors that affect sedimentation velocity? Add a note on concentration dependence of S.

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Total No. of Questions : 6] **[Total No. of Pages : 2**

P437

[3623] - 206
M.Sc.
BIOCHEMISTRY
BCH - 273 : Membrane Biochemistry & Nucleic Acid
(New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I
(Membrane Biochemistry)

Q1) Answer any three of the following: **[15]**

a) Fluid mosaic model of biomembrane.

b) Chemiosmotic hypothesis.

c) Receptor mediated endocytosis phenomena.

d) Structure and physiological role of gap junctions.

Q2) Answer any three of the following: **[15]**

a) Structural assembly of acetyl choline receptor channel.

b) Mechanism for sodium-potassium pump action.

c) Bacterial phosphotransferase system.

d) Functioning of lig and gated channels.

Q3) Write short notes on (any two) : **[10]**

a) Gramicidin - a transport antibiotic.

b) Gram negative outer membrane : a barrier to antibiotics.

c) Structural features of virus membrane receptor.

P.T.O.

SECTION - II

(Nucleic acids)

Q4) Answer any three of the following: **[15]**

a) With the diagrams explain the structure of DNA double helix, and mRNA.

b) Explain Mendel's principle of independent assortment with example.

c) Explain bacterial conjugation.

d) Give the control of bacterial tryptophan operon by attenuation.

Q5) Answer any three of the following: **[15]**

a) What is F mediated sexduction in bacteria.

b) Explain any two mechanisms of mutation repair in E coli.

c) Give the steps involved in life cycle of bacteriophage.

d) Explain somatic & germline mutations with one example.

e) Explain what is transduction in bacteria.

Q6) Write short notes on any two : **[10]**

a) Multiple alleles.

b) Use of viruses in genetic studies.

c) Genetic analysis of genetic code.

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P438

[3623] - 401
M.Sc.
PHYSICAL CHEMISTRY
CH - 410 : Molecular Structure

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:-

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt any three of the following: **[15]**

a) Why is a reference used while recording high resolution nmr? What reference is used for high resolution pmr spectra? Why? State two more references used in nmr spectroscopy.

b) With explanation, draw a schematic high resolution nmr spectra of HPF_2 with respect to nuclei of ^{1}H, ^{31}P and ^{19}F.

c) State the essential characteristics of the instrumentation for high resolution nmr.

d) Explain the factors influencing chemical shift in nmr spectroscopy.

e) Explain the concepts of electric field gradient and quadrupole coupling constant.

Q2) Attempt any three of the following: **[15]**

a) Explain the nature of the esr spectrum of naphthalene anion.

b) Why is esr spectrum usually recorded in the first derivative mode?

c) Describe the working of magic T in the instrumentation of esr.

d) Discuss the applications of esr spectroscopy.

e) With the help of a schematic diagram, explain the working of photoacoustic spectrometer.

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

a) Will the radical anion and radical cation of anthracene and naphthalene show esr spectra? If so how many lines are expected in their spectra? How many hyperfine coupling constants can be determined from their spectra?

b) Calculate the transitional frequency of a free electron placed in magnetic field strength of 1.8 KG.

c) A free electron resonates at 9.5 GHz at a magnetic field strength 0.33 T. At what frequency will resonance occur if the magnetic field is 1.6 T?

SECTION - II

Q4) Attempt any three of the following: **[15]**

a) Describe in detail the rotating flat crystal method in X-ray diffraction analysis.

b) State the phase problem in XRDA and outline the techniques used to overcome it.

c) How are X-rays produced? Explain the factors on which the wavelength and intensity of X-rays depend.

d) Discuss the advantages and disadvantages of X-ray diffraction method as an analytical tool.

e) Explain the cause of electron diffraction. How is electron diffraction experimentally verified?

Q5) Attempt any three of the following: **[15]**

a) Discuss the Wierl equation.

b) Give the characteristic properties of diamagnetic, paramagnetic, ferromagnetic and antiferromagnetic substances.

c) Describe with a diagram, the uniform field method for the measurement of magnetic susceptibility.

d) Derive the equation for atomic susceptibility.

e) Explain the basis for calculations of magnetic susceptibility.

Q6) Attempt any two of the following: **[10]**

a) Calculate the molar susceptibilities of dimethylarsine ($C_{10}H_{16}AS_2$) using the following data.

Pascal's constants	(χ_A)	Constitutive corrections (λ)
H	-2.93×10^{-6}	C in ring -0.24×10^{-6}
C	-6.00×10^{-6}	C shared by two rings -3.07×10^{-6}
O_2 (Carboxylate)	-7.95×10^{-6}	C = C bond 5.5×10^{-6}
AS (III)	-20.9×10^{-6}	
O	-4.61×10^{-6}	C ≡ C bond 0.8×10^{-6}
O (Ketone)	$+1.73 \times 10^{-6}$	

b) The separation of the lattice layers in a crystal is 400 pm. At what glancing angle will a reflection occur with Cu - Kα radiation having λ = 153.9 pm?

c) X-ray diffraction studies of NaCl crystals give the cubic cell dimensions as 564 pm. The density of NaCl is 2.165 gm cm^{-3}. Calculate the number of NaCl units in a unit cell.

[Given : Atomic weight of Na = 23, Cl = 35.5).

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P439

[3623] - 402
M.Sc.
PHYSICAL CHEMISTRY
CH - 411 : Solid State and Surface Chemistry

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt any three of the following: **[15]**

a) Define the term imperfections and give their classification in detail.

b) Show that in an intrinsic semiconductor $E_o = \frac{E_c + E_v}{2}$

c) Explain with a suitable diagram the point contact transistor giving its principle and merits.

d) Describe hysteresis in the polarization observed in ferroelectric crystals.

e) Write a note on photovoltaic effect.

Q2) Attempt any three of the following : **[15]**

a) Explain the various processes of the electric break down in an insulator.

b) Write a note on colour centres in halide crystals.

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

d) Discuss the conditions for crystal growth from a molten salt.

e) Draw and explain the sigmoid shape curve obtained in thermal decomposition of a single solid.

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

a) The ratio of the number of Schottky defects at 1000 K to 500 K is 1.58×10^5. Calculate the energy required to move a pair of ions from the crystal's interior to the surface in ionic crystal.

b) Calculate the number of electrons per cm^3 in the conduction band of semiconductor having a bandgap of 0.72 eV at 300 K.

c) Calculate the diffusion coefficient of aluminium in silicon at 1300°C, Given that $\Delta H = 300\ kJmol^{-1}$ $D_0 = 1.55 \times 10^{-4}\ m^2s^{-1}$

SECTION - II

Q4) Attempt any three of the following : **[15]**

a) What is Gibbs monolayer? Show that in dilute solutions, the film of adsorbed solute obeys the equation of state of a two-dimensional ideal gas.

b) What is wetting phenomenon? Enlist the applications of wetting.

c) Derive the expression for energy of adsorption.

d) Briefly discuss the mechanism of chemical adsorption.

e) Discuss the Polanyi theory of multilayer adsorption.

Q5) Attempt any three of the following: **[15]**

a) Give the comparison between B.E.T. and Harkins-Jura equation.

b) Discuss the adsorption behaviour of porous solids.

c) Discuss briefly the theories of catalysis.

d) Describe the procedure for naming of a catalyst and catalyst structure.

e) Explain the role of zeolites in the disposal of radioactive wastes.

Q6) Solve any two of the following: **[10]**

a) The following data were obtained for the adsorption of acetone on charcoal from an aqueous solution at 18°C.

y (millimoles/g)	0.208	0.618	1.075	1.50	2.08	2.88
c (millimoles/ per litre)	2.34	14.65	41.03	88.62	177.69	268.9

Evaluate the constants 'k' and 'n' of the Freundlich equation.

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

$$\gamma = 72 - 0.5C + 0.2C^2$$

where 'C' is the ethanol concentration in moles per litre. Calculate the surface excess of ethanol in moles cm^{-2} for a 0.5M solution at 25°C.

c) A monomolecular film containing 0.82mg protein per m^2 gave the surface tension lowering of 36×10^{-3} dyne/cm at 300K. Calculate the molecular weight of the protein.

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P440

[3623]-403
M.Sc.
PHYSICAL CHEMISTRY
CH - 414 : Polymer Chemistry - II

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) What are nylons? Describe the production of nylon 6 and nylon 66.

b) What are silicone polymers? How are they prepared?

c) What is regenerated cellulose? Describe the properties and uses of viscose rayon and cellophane.

d) Describe the behaviour of polymeric substances on heating.

e) Discuss with a suitable example, the optical isomerism in polymers.

f) What are the different types of spinning techniques? Why is melt spinning preferred over the others?

Q2) Attempt any four of the following : **[20]**

a) Explain the term degree of crystallinity. How is it different from crystallizability?

b) Discuss the effect of plasticizers on glass transition temperature.

c) Describe any two methods of preparation of LDPE.

d) Explain the terms tenacity, crimp, pilling, vulcanization.

e) What is glass transition temperature? Describe the relationship between T_g and T_m.

f) Explain :

i) The glass transition temperature of poly (ethylene adipate) is – 50ºC while that of poly (ethylene terepthalate) is 69ºC.

ii) When polyacrylonitrile undergoes pyrolysis its glass transition temperature increases.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Describe the preparation of HDPE.

b) Describe, with a diagram the reaction injection molding.

c) Describe the geometric isomerism shown by polymer formed from butadiene.

d) What are polyurethanes? Discuss the formation, properties and applications of it.

e) Define the terms : Fiber, denier, crimp, moisture absorption and moisture retention.

f) Describe the process of polymer crystallization.

Q4) Attempt any four of the following : **[20]**

a) Describe the preparation and properties of SBR.

b) Name the polymer and write its structure, which is most suitable for the following applications.

i) Wire and cable insulation.
ii) Bearings.
iii) Blow molded bottles.
iv) Automotive lenses.
v) Textile fiber.

c) Describe the calorimetric method of determination of T_g.

d) Describe the variation of specific volume of polymeric substances with temperature.

e) Discuss the properties and applications of PMMA.

f) Describe with a neat diagram, the technique pultrusion.

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P440

[3623]-403
M.Sc.
PHYSICAL CHEMISTRY
CH - 415 : Environmental Pollution

Time : 3 Hours] ***[Max. Marks : 80***

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) Attempt any four of the following : **[20]**

a) Write a note on atmospheric photochemistry.

b) What is acid rain? Explain the rainwater composition.

c) Describe briefly ecological and health effects of air pollution.

d) Discuss the biochemical cycle. Explain the nitrogen cycle in biosphere.

e) Define and explain pathways of pollutants with suitable examples.

f) What is 'droplets'? Explain wet deposition of gases.

Q2) Attempt any four of the following : **[20]**

a) Discuss the chemistry of pollutants in the lower atmosphere.

b) Write a note on carbon cycle.

c) Define and explain a 'less perfect cycle' with a neat diagram.

d) Define a carcinogen. Enlist the carcinogenic compounds which cause cancer in animals and human beings.

e) Discuss briefly environmental reserviors.

f) Discuss the ecological impact of organochlorine compounds.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Describe the method used for determination of oil and grease.

b) Define - toxic chemical. Discuss the effect of toxic chemicals on enzymes.

c) Write a note on :- Sampling of water.

d) What is alkalinity of water? How is it determined?

e) Explain the importance of physical examination of water with suitable parameter.

f) Explain the following in a water sample.

i) Iron
ii) Phosphate and
iii) Arsenic.

Q4) Attempt any four of the following : **[20]**

a) How the following parameters in water are estimated.

i) BOD.

ii) COD.

b) Explain the method by which total solids estimated.

c) What is smog? Explain the Los Angels smog.

d) Discuss the role of air pollutants in acidic rain.

e) Explain the impact of CFC on Ozone layer.

f) What are the sources of pollutant CO? Explain the biochemical effect of CO and suggest the suitable control.

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P440

[3623]-403
M.Sc.
PHYSICAL CHEMISTRY
CH - 416 : Special Topics in Physical Chemistry

Time : 3 Hours] ***[Max. Marks : 80***

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} $molecule^{-1}$
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13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Derive the expression for saturation kinetics of an enzyme-catalyzed reaction.

b) Explain the dependence of the observed rate constant for oximation of acetone on pH at 25ºC.

c) Define catalyst, inhibitor, poison and selectivity.

d) Give the classification of sensors on the basis of their

i) Principle of conversion and

ii) Purpose

e) Write a note on Chemiresistors.

f) Discuss adsorption isotherms used in sensors.

Q2) Attempt any four of the following : **[20]**

a) What are active and passive sensors?

b) Set up the mass balance on sodium and oxalate in 0.4 M $Na_2C_2O_4$ and acetate in 0.2 M CH_3COOH.

c) Write the charge balance for H_3PO_4 and NaHSe.

d) What is the proton condition for $H_2S_2O_3$ and $NaHCO_3$?

e) Find the concentration of H_2CO_3, HCO_3^- and CO_3^{2-}. The pH of 0.1 M solution of salt of carbonic acid is 5.2.
(Given : $Ka_1 = 4.46 \times 10^{-7}$, $Ka_2 = 5.62 \times 10^{-11}$)

f) Draw a logarithmic concentration diagram for 0.01 M acetic acid.
(Given: pKa = 4.75)

SECTION - II

Q3) Attempt any three of the following : **[15]**

a) Discuss the advantages and disadvantages of a thermister as a temperature measuring device.

b) Draw a ray diagram of the working of a compound microscope.

c) Write a note on - nano robot.

d) Describe any two chemical methods of preparing nano particles.

e) State the four types of actuators. Give one example of each. Which actuator can produce maximum mechanical force?

Q4) Attempt any three of the following : **[15]**

a) Write a note on lithography.

b) Write a note on carbon nanotubes.

c) What are the new developments in advanced composits?

d) What is the design and working of rubber like ceramic smart materials?

e) Draw a neat and labelled diagram of double vane repulsive type moving iron galvanometer.

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

a) Calculate a temperature which is identical in both Celsius and Farenheight thermometers.

b) A galvanometer has 18 Ω internal resistance. It shows maximum deflection for 10 mA current. What should be the resistance of a shunt so that it can be used to measure 0.1 A current?

c) Calculate the resolution of a diffraction microscope used for a medium having refractive index $\frac{3}{2}$, glancing angle 42° and radiation frequency 30 THz.

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P441

[3623]-404
M.Sc. (Part - II)
INORGANIC CHEMISTRY
CH - 430 : Inorganic Solids, Heterogeneous Catalysis and Structural Methods (Revised Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

Q1) Answer any FOUR of the following : **[16]**

a) What do you understand by metal cluster compounds? Explain with the help of suitable examples the effect of pyrolysis on high nuclearity carbonyls?

b) Discuss the importance of pH in crystallization of zeolites.

c) Explain what is meant by "Heterogeneous catalysis". Explain the oxidation of SO_2.

d) Give an account of Heteropolyanions of Molybdenum.

e) Give an account of Inorganic benzene and compare it with organic benzene.

Q2) Attempt the following (any FOUR) : **[16]**

a) What are zeolites? Give an account of their properties and applications.

b) Give an account of SN compounds.

c) Draw the structure of $Rh_6 (CO)_{16}$ and explain it on the basis of orbitals and electrons in the frame work.

d) Write a note on alltrops of carbon.

e) What do you understand by the term phosphazenes? Give the method of synthesis and properties of there compounds.

P.T.O.

Q3) a) Fill in the blanks : **[8]**

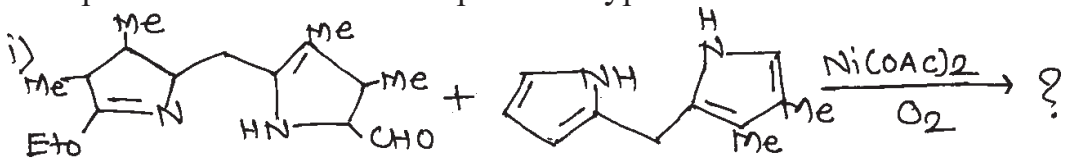
i) $B_5Hg + PMe_3 \longrightarrow ?$

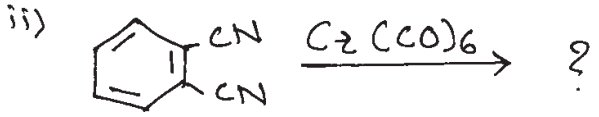
ii) $(PNCl_2)_3 + H_2O \longrightarrow ?$

iii) $S_4N_4 + Ag_2S \longrightarrow ?$

iv) $SCl_2 + NH_3 \longrightarrow ?$

b) Complete the reactions and explain the type of reaction involved.





SECTION - II

Q4) Answer the following (any FOUR) : **[20]**

a) What do you understand by thermogravimetric analysis? Explain the effect of different experimental factors in a thermogram.

b) CrC_2O_4; $2H_2O$ decomposes to Form Cr_2O_3 in two steps. Calculate the weight loss for each step. Write the decomposition reaction for each step.
(At.Wt. Cr = 52, C = 12, O = 16, H = 1)

c) Enlist the similarities and differences in the DTA and DSC.

d) Explain the thermogram of $NiSO_4$; $7H_2O$ in the temperature range 30°–650°C.

e) Molybdenum in BCC structure has a lattice constant 0.315 nm. Calculate a value for its interplanar spacing d_{220} in nanometer.

Q5) Attempt the following (Any FOUR) : **[20]**

a) Calculate the interplanar spacing of a set of planes, if the angle of First Order of reflection is 15.3° when the X-rays of wavelength 1.54 Å are used.

b) Magnesium carbonate was dissolved in aq. oxalic acid & a crystalline product 'A' was obtained when heated in air, 9.20 mg of 'A' lost mass in two stages 2.23 mg were lost at 220° while a further 4.49 mg were lost at 500°C. Write balanced chemical equations for the preparation and decomposition of A.

c) What is meant by Miller indices? Sketch the planes in a cube having Miller indices –

i) [010]
ii) [112]
iii) [312]
iv) [111].

d) Explain the effect of the following factors on a DTA curve.

i) Furnace atmosphere.
ii) Heating rate.

e) Cs in a FCC structure has lattice constant of 0.458 nm. Calculate a value for its interplanar spacing d_{212} in nanometer.

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Total No. of Questions : 6] **[Total No. of Pages : 2**

P442

[3623]-405
M.Sc. - II
INORGANIC CHEMISTRY
CH - 431 : Material and Industrial Inorganic Chemistry
(Revised Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Give the free ion ground term and ligand field ground term for the following complexes.

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

ii) $[Cr\ (H_2O)_6]^{2+}$

Atomic Number of Co = 27, Cr = 24.

b) Explain applications of soft magnetic material.

c) Draw the schematic flow diagram of the cement making process. How the quality of cement is improved?

d) Explain the sol-gel process for synthesis of glasses.

Q2) Attempt any three of the following : **[15]**

a) Differentiate between Portland Cement and non-Portland Cement.

b) Which are physical and chemical process taking place in the furnace during formation of glass?

c) Explain the magnetic super exchange in insulators.

d) Give the examples of electroactive ceramic materials. How are they synthesized?

P.T.O.

Q3) Write notes on any two : **[10]**

a) Oil Well Cement.

b) Biosolids.

c) Carbon based superconductors.

SECTION - II

Q4) Answer any three of the following : **[15]**

a) Explain the role of coordination compounds in electroplating.

b) Write giving appropriate chemical equations, the preparation of white and yellow pigments.

c) Comment on the silver halide diffusion transfer process.

d) "Metal complex azo dyes find extensive use as dyes". Give examples in support of this statement. Explain the nature of bonding by azo group to metal in dyes.

Q5) Answer any three of the following : **[15]**

a) How are inorganic pigments classified? Comment on important properties of pigment.

b) Give an account of electroplating of zinc.

c) What is meant by photosensitive material? Explain with suitable examples, the role of photosensitive material in photography.

d) Give an account of Formazans.

Q6) Write notes on any two : **[10]**

a) Polymer modified electrodes.

b) Phthalocyanins.

c) Metal complexes of hydroxy anthraquinones.

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Total No. of Questions : 9] **[Total No. of Pages : 3**

P443

[3623]-406
M.Sc. (Part - II)
INORGANIC CHEMISTRY
CH - 445 : Inorganic Applications in Material Science, Biotechnology and Environmental Chemistry
(Revised Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***Attempt any TWO sections from the following.***
2) ***Both sections should be written in the SAME answer book.***
3) ***All questions are COMPULSORY.***
4) ***Figures to the RIGHT indicate FULL marks.***
5) ***Neat diagrams must be drawn wherever necessary.***
6) ***Use of logarithmic table/calculator is ALLOWED.***

SECTION - I

(MATERIAL SCIENCE)

Q1) Attempt any three of the following : **[15]**

a) What is photovoltaic effect? How it can be used for conversion of visible light into electrical energy?

b) What do you mean by a transistor? Give its type and explain any one of them.

c) What is Pilling-Bedworth Rule (PBR). How does the P.B. ratio help to know the nature of oxide film?

d) Give preparation, properties and uses of polyvinyl chloride (PVC)

Q2) Attempt any three of the following : **[15]**

a) Distinguish between addition and condensation polymerisation.

b) Give reasons for –

i) Metallic articles such as blades, knife, sword etc are kept highly polished.

ii) Automobile parts corrodes Faster in Mumbai than in Nagpur.

c) Explain how band theory of solid helps to classify the materials into conductors, insulators and semiconductors.

P.T.O.

d) There are 4 polymer molecules of molecular weight 10^4, 15 polymer molecules of molecular weight 10^3 and 30 polymer molecules of molecular weight 10^2, find out No. average mol. wt $(\overline{M}n)$, wt. average mol.wt $(\overline{M}w)$, Z-average mol. wt $(\overline{M}z)$, and viscosity average mol. wt $(\overline{M}v)$, (where a = 1).

Q3) Write short notes on any Two : **[10]**

a) Hall effect.

b) Atmospheric Corrosion.

c) Luminescence.

SECTION - II

(BIOTECHNOLOGY)

Q4) Attempt the following (any three) : **[15]**

a) Explain the different stages in tissue culture with suitable examples.

b) What is the contribution of Robert Koch, Louis Pasteur, Alexander Fleming and Jenner to biotechnology?

c) Outline the main stages in purification of drinking water.

d) Describe an experiment to show the effect of temperature on the action of renin on milk.

Q5) Answer <u>any three</u> : **[15]**

a) Name three groups of antibiotics in common use and explain how they are used to treat different kinds of diseases.

b) Show the cycle of methane production using anaerobic bacteria.

c) What is the "germ theory of disease"? Explain.

d) What is "Food processing"? Explain with suitable examples.

Q6) Write short notes on (any two) : **[10]**

a) Living Cells – Miniature Chemical Factories.

b) Deep Shaft Process.

c) Enzymes & their use in industry.

SECTION - III

(ENVIRONMENTAL CHEMISTRY)

Q7) Attempt any three of the following : **[15]**

a) What is pollutant cycle? Illustrate such a cycle in the environment.

b) How does HPLC helps in separation of arsenical pesticides in soil?

c) List the trace elemental pollutant in natural waters, with source, effects & significance.

d) Write source, sinks, effects of SO_x pollution and its control.

Q8) Attempt any three of the following : **[15]**

a) What is the cause of acid-rain? How can pollutants responsible for acid-rain be controlled?

b) Comment on the origin of soot particles. How would you monitor toxic inorganic and organic in soot particles?

c) Describe the acid-base and ion exchange reactions in soil.

d) How is 'Photochemical smog' formed? State its effects.

Q9) Write short notes on any TWO : **[10]**

a) Biorefractory organic pollutants.

b) Xenobiotics and their interaction with microbes.

c) Ion-Liquid Chromatography (ILC)

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Total No. of Questions : 6] **[Total No. of Pages : 4**

P444

[3623]-407
M.Sc.
ORGANIC CHEMISTRY
CH - 450 : Chemistry of Natural Products

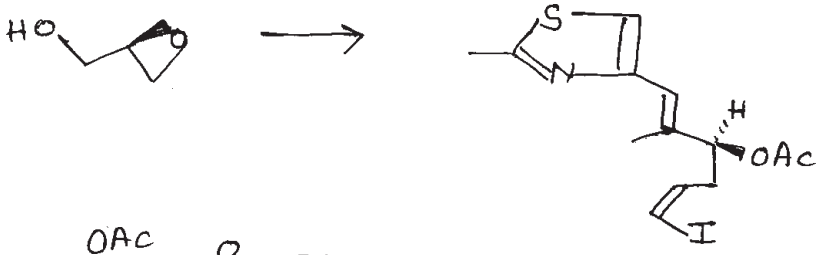
Time : 3 Hours] ***[Max. Marks : 80***

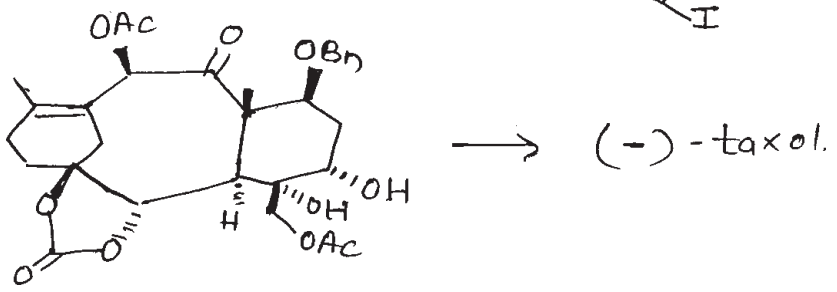
Instructions to the candidates:

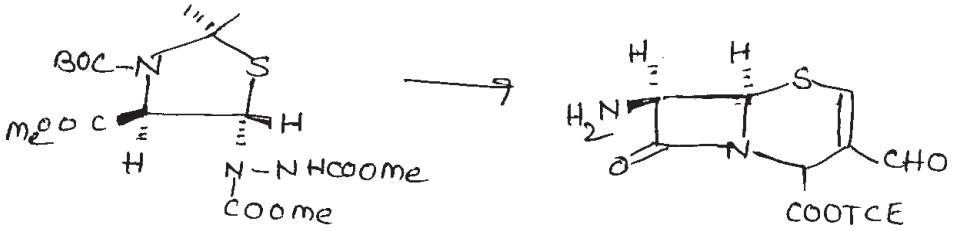
1) ***All questions are compulsory.***
2) ***Figures to the right hand side indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

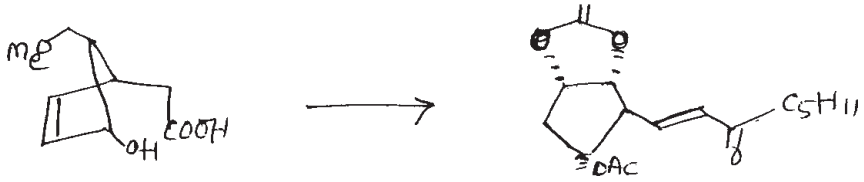
SECTION - I

Q1) Outline the steps in any four of the following synthetic sequences. Indicate the reagents used and discuss the mechanism and stereochemistry involved. **[16]**

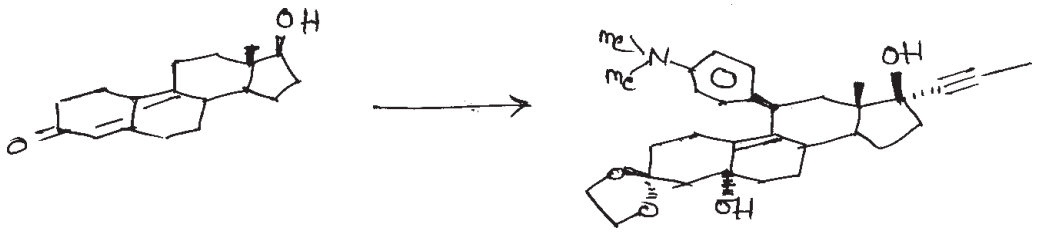
a) 

b) 

c) 

d) 

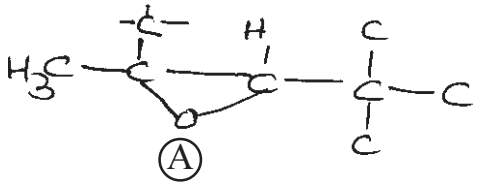
P.T.O.

e) 

Q2) Answer <u>any four</u> of the following : **[12]**

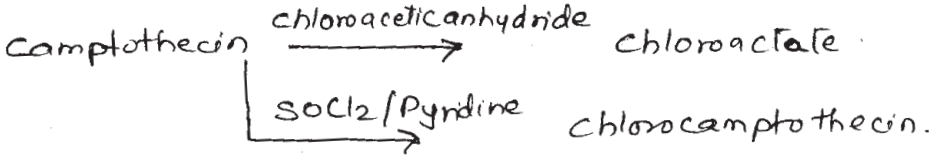
a) Describe importance of Deuterium exchange reaction in determination of structure of hydroxy-camptothecin.

b) How will you arrive at the following skeletal structure Ⓐ in Arteannuin B?



c) Artemisinin $\xrightarrow{NaBH_4}$ Dihydroartemesinin write the complete reaction and how will you study the reaction using spectral techniques.

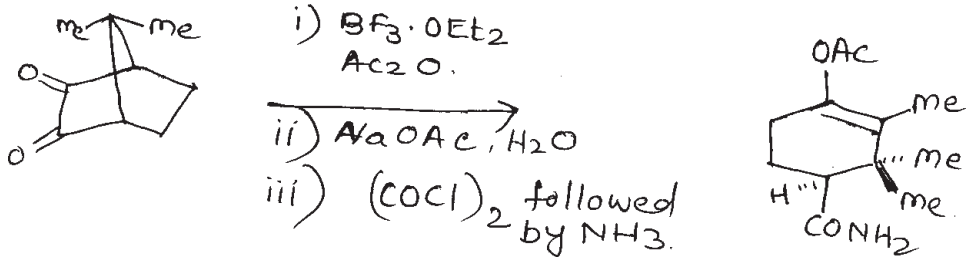
d) Give evidence to establish the stereochemistry of A/B ring fusion in Hardwickiic acid.

e) 

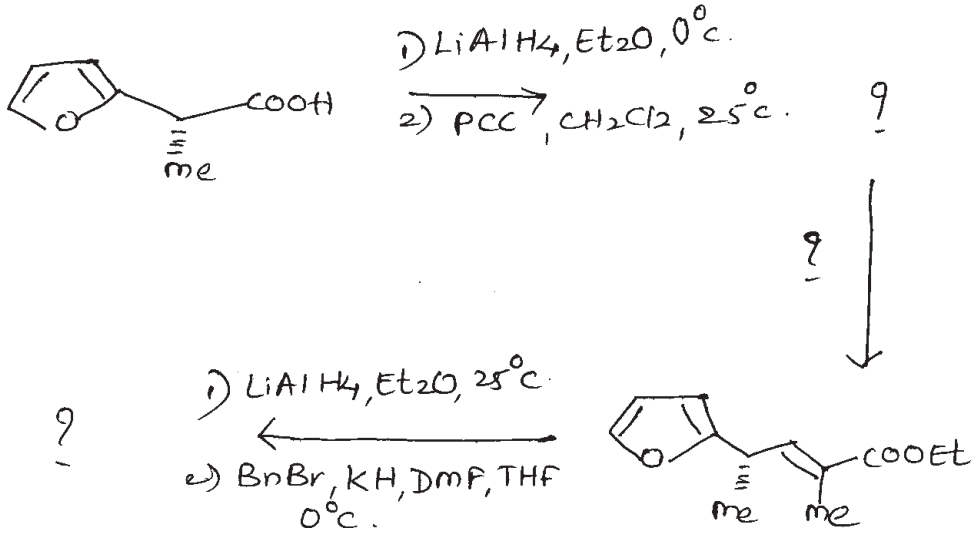
How these reaction helped to establish position of ethyl group in camptothecin?

Q3) Answer the following : **[12]**

a) Complete the following synthesis and give mechanism.

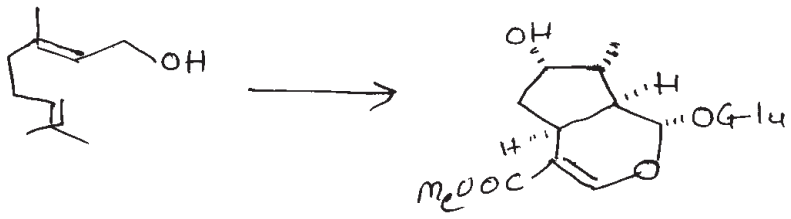


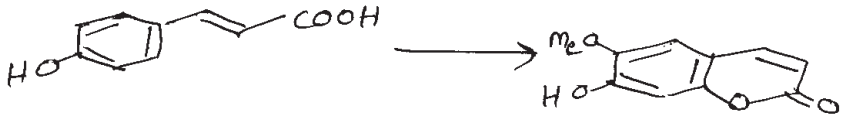
b) Complete the following synthesis. Give mechanism and intermediates involved.

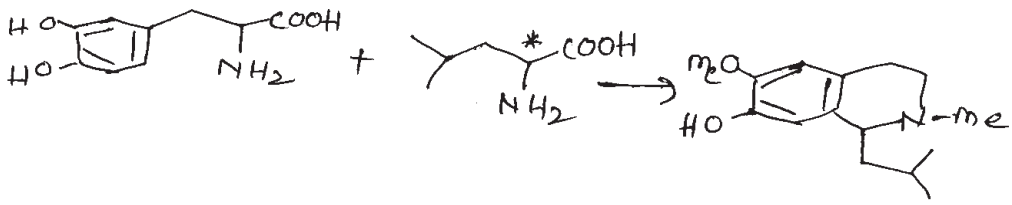


SECTION - II

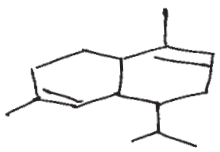
Q4) a) Suggest suitable biogenetic schemes for any three of the following :**[12]**

i) 

ii) 

iii) 

Indicate the position of label in each step and in the final product.

iv) 2Z,6E - farnesylpyrophosphate → 

b) Explain the conversion of Acetyl co-enzyme A into biological isoprene unit with mechanism. **[4]**

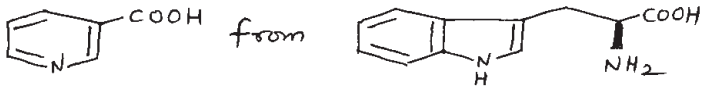
Q5) Answer <u>any two</u> of the following : **[12]**

a) Write all steps in the following biogenetic conversion.

Indicate the position of label in each step and in the final product.

b) Write all steps in the following biogenetic conversion.

c) Explain the biogenesis of

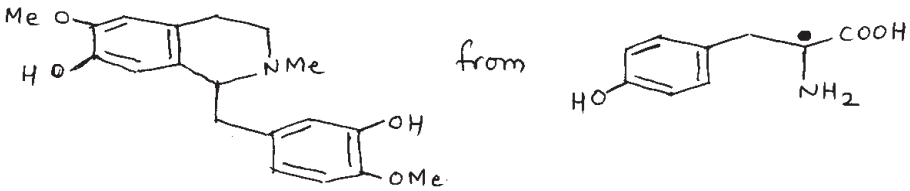


Q6) a) Explain the role of dioxygenase enzymes in biogenetic reactions. **[4]**

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

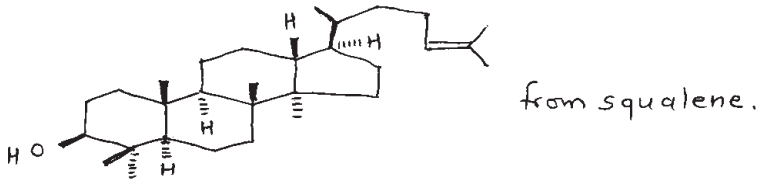
i) Explain primary metabolism and secondary metabolism.

ii) Suggest the biogenetic scheme for



Indicate the position of label in each step.

iii) Suggest the biogenetic scheme for



from squalene.

Total No. of Questions : 6] **[Total No. of Pages : 4**

P445

[3623]-408
M.Sc.
ORGANIC CHEMISTRY
CH - 451 : Synthetic Methods in Organic Chemistry

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

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

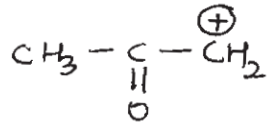
i) Lithiation of N-Methyl benzamide is achieved using n-Buli while that of N, N-Dimethyl benzamide is achieved using sec.-Buli.

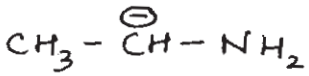
ii) Synthetic uses of organo palladium compounds.

iii) Dilongitolyl borane could be used for the synthesis of optically active alcohols.

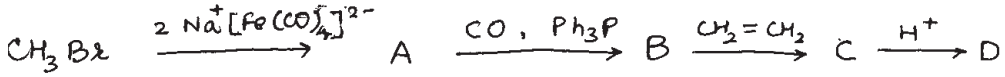
iv) Synthesis of 1,2-dicarbonyl compounds involve umpolung of reactivity.

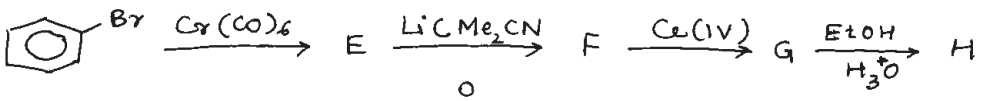
b) Give one reaction with reagent for each synthon given below : **[3]**

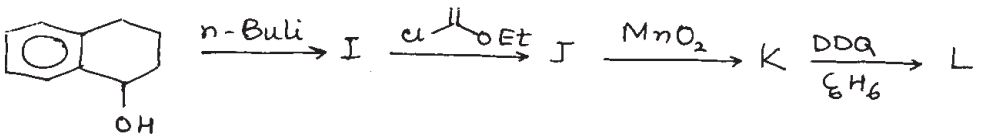
i) 

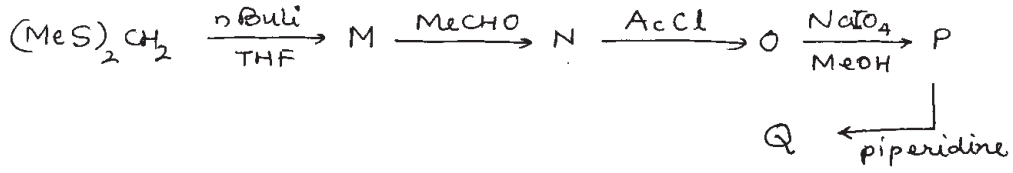
ii) 

Q2) a) Predict the products in <u>any three</u> of the following : **[9]**

i) 

ii) 

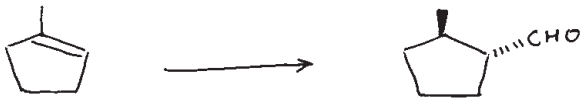
iii) 

iv) 

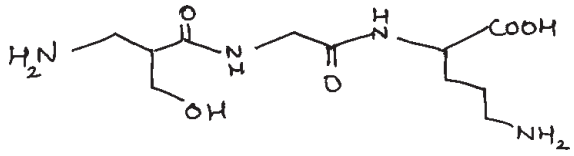
P.T.O.

b) Complete <u>any one</u> of the following transformation using suitable reagents. **[3]**

i) 

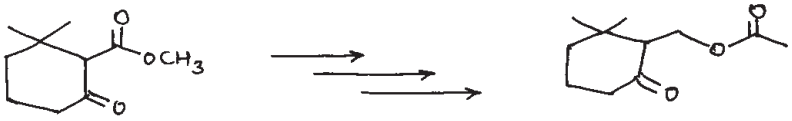
ii) 

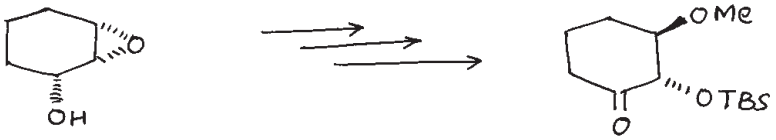
Q3) a) Suggest a synthesis of this non-protein peptide emphasizing the choice of protecting groups. **[4]**

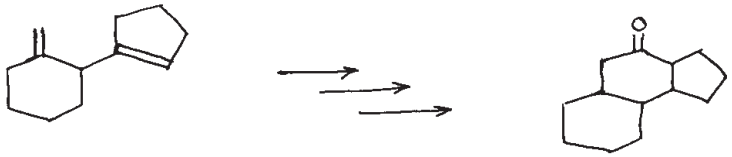


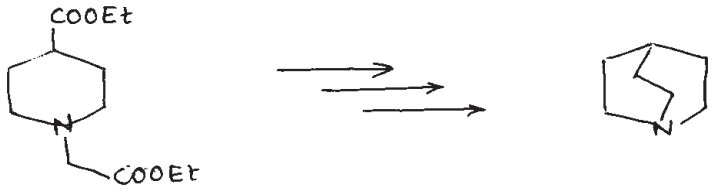
b) Complete the following transformations and justify your answer. (Any four) **[12]**

i) 

ii) 

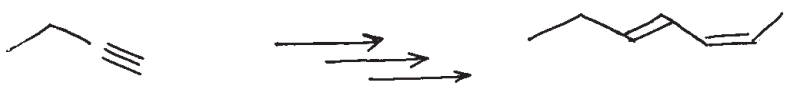
iii) 

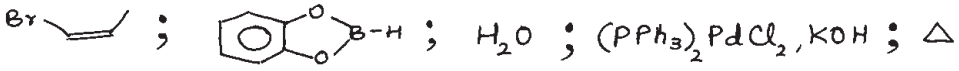
iv) 

v) 

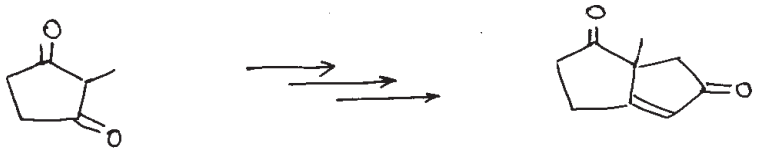
SECTION - II

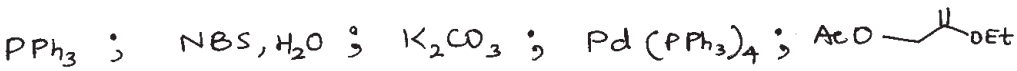
Q4) a) The reagents and conditions required for conversion of the following compounds to the products are shown. Arrange them in proper order to achieve the conversion. Write the structures of the intermediate compounds. Attempt <u>any three</u>. **[9]**

i) 



ii) 

iii) 



iv) 

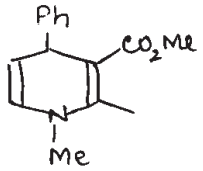
b) Discuss the use of any two of the following reagents with one application. **[3]**

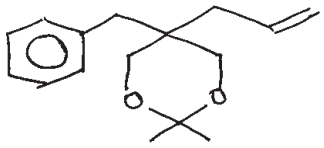
i) Grubbs Catalyst
ii) $Ni(COD)_2$
iii) Me_3Al
iv) 1, 3 - Dithiane.

Q5) Write short notes on any three of the following : **[12]**

a) Suzuki Coupling.
b) Noyori annulation.
c) Olefin Metathesis reactions.
d) Merrifield Solid Phase Peptide Synthesis.

Q6) Using reterosynthetic analysis, suggest convenient route for the synthesis of <u>any four</u> of the following : **[16]**

i) 

ii) 

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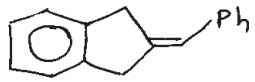
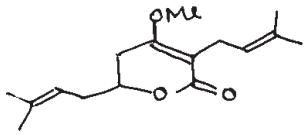
iv) 

v) 

vi) 

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Total No. of Questions : 12] **[Total No. of Pages : 7**

P446

[3623]-409
M.Sc.
ORGANIC CHEMISTRY
CH - 452 : Pericyclic Reactions, Chiron Approach, Chemotherapy, Medicinal Chemistry, Vitamins, Antibiotics etc.

Section I : **Pericyclic Reactions, Photochemistry and Green Chemistry**
Section II: **Medicinal Chemistry**
Section III: **Chiron Approach and Newer Methods in Organic Synthesis**
Section IV: **Vitamins, Antibiotics and Hormones**

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

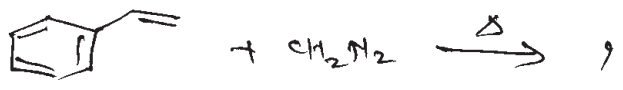
1) ***Solve any two sections out of four.***
2) ***All questions are compulsory from both sections.***
3) ***Figures to the right indicate full marks.***
4) ***Answers to the two sections should be written in separate answer books.***

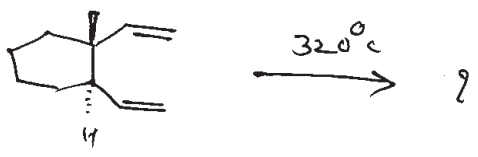
SECTION - I

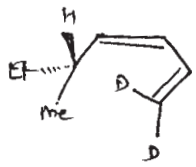
Q1) a) Construct the correlation diagram for the disrotatory opening of cyclohexadiene to hexatriene and predict whether the reaction is thermally or photochemically allowed on the basis of conservation of orbital symmetry. **[6]**

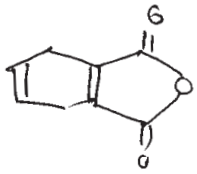
b) Predict the product/s in any four of the following and justify your answer. **[8]**

i) E, Z, E -2, 4, 6 - Octatriene $\xrightarrow{132^{\circ}C}$?

ii) 

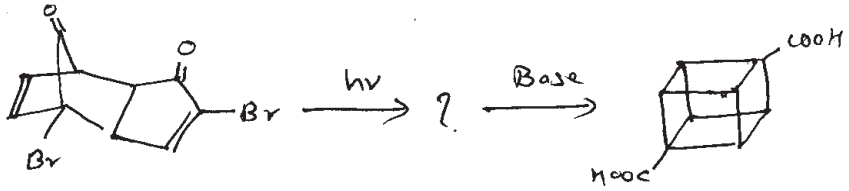
iii) 

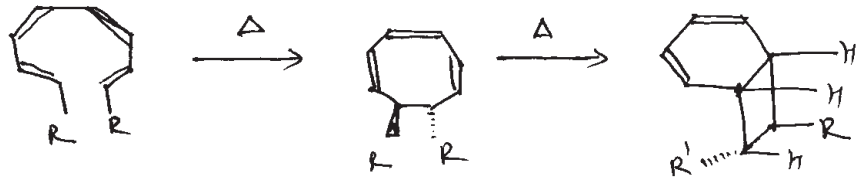
iv)  $\xrightarrow{\Delta}$ A + B [Both optically active acyclic dienes]

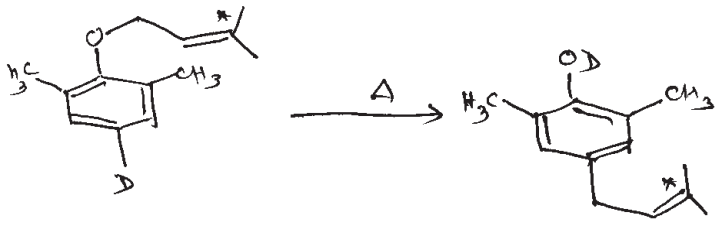
v)  + $H_3C-C\equiv C-CH_3 \xrightarrow{h\nu}$?

Q2) a) Assuming electronic factors to be determined is $\pi^{6s} + \pi^{4s}$ cycloaddition of 1, 3, 5 - hexotriene to 1, 3 - butadiene, predict wheather Exo or Endo cycloaddition should occur. **[5]**

b) Suggest Mechanism for Any Two of the followings : **[6]**

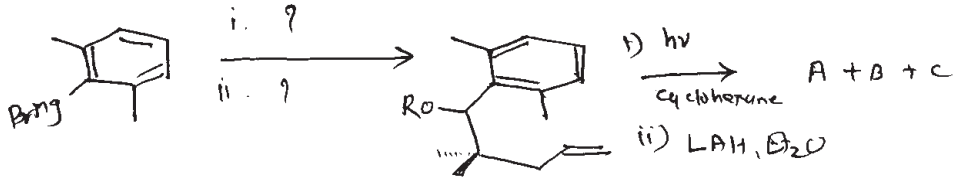
i) 

ii) 

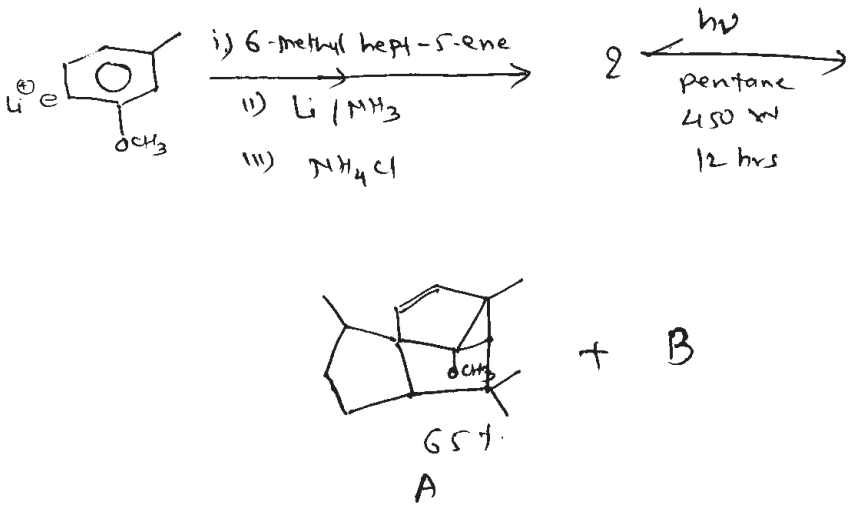
iii) 

c) Explain the concept of 'Atom Economy'. How it is calculated. Give suitable example. **[3]**

Q3) a) Complete the following synthetic sequence indicating all intermediates and reagents required. **[8]**

i) 

ii)



b) Write short note on 1, 3 - photo addition of olefins to arenes. **[4]**

SECTION - II

Q4) Answer any four of the following : **[16]**

a) Give a brief account of Tuberculosis & leprosy. Which are the drugs of choice for their treatment.

b) What are the characteristics expected of an ideal drug? Explain selective toxicity.

c) Discuss the following :

i) Pharmacokinetics.
ii) Pharmacodynamics.
iii) Prodrugs.
iv) Therapeutic Index.

d) What are the various classes of anticancer drugs? Discuss the intercalators used in Anticancer therapy.

e) Give a brief overview of development of Ist & IInd generation Cephalosporins.

f) Compare & contrast Aminoglycosides & β lactan antibiotics.

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

a) What is drug designing? Discuss how computational methods are used in designing of drugs. Explain the rationale involved.

b) Discuss the development of Hansch equation. Explain the significance of the following terms in Hansch analysis.

i) std. deviation
ii) F & t-test
iii) Correlation coefficient

c) Explain

i) Topliss Operational scheme.

ii) Structure based drug design.

Q6) a) Discuss the mode of action & uses of <u>any four</u> drugs. **[8]**

i) Erythromycin.

ii) Ampicillin.

iii) Methotrexate.

iv) Griseofulvin.

v) AZT.

vi) 5 Fluorouracil

b) Discuss any two of the following. **[6]**

i) Benefits of semisynthetic penicillin over Benzylpenicillin.

ii) Drug Resistance.

iii) Plants as source of drugs.

SECTION - III

Q7) a) What are glycosans? How are they prepared? How will you prepare epoxides of sugars? How they are different from the normal glycosans? **[4]**

b) Define anomer. Draw structures for **[4]**

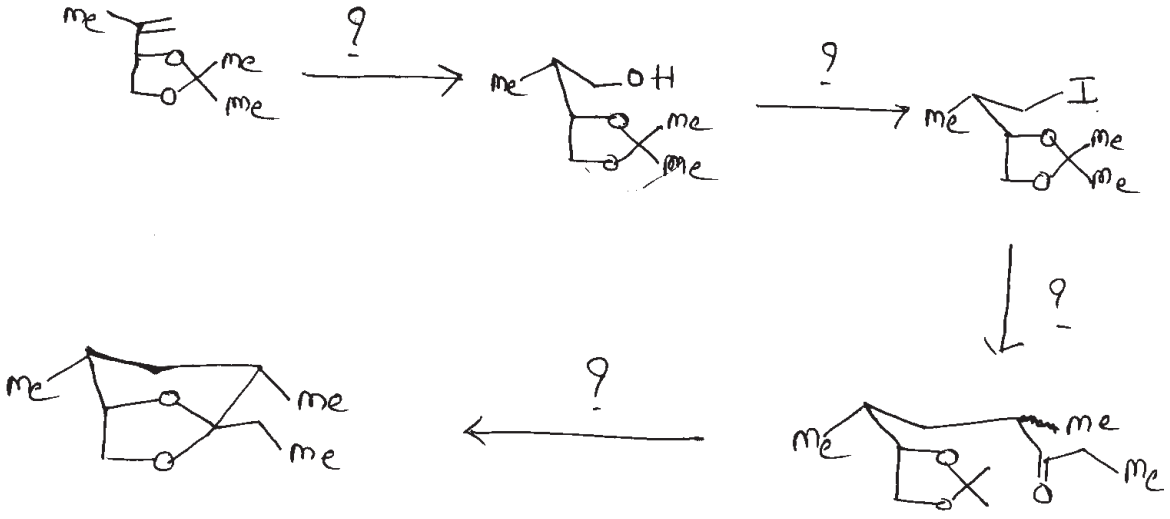
i) 2, 3, 5-tri-O-Methyl-L-arabinose.

ii) Methyl-β-D-fructopyranoside.

iii) β-D-(+)- glucofuranose.

c) Write a short note on Kiliani Synthesis. **[4]**

d) Write the appropriate reagents in the following course of reactions and rewrite the complete sequence of reactions. **[4]**



i)
H
O

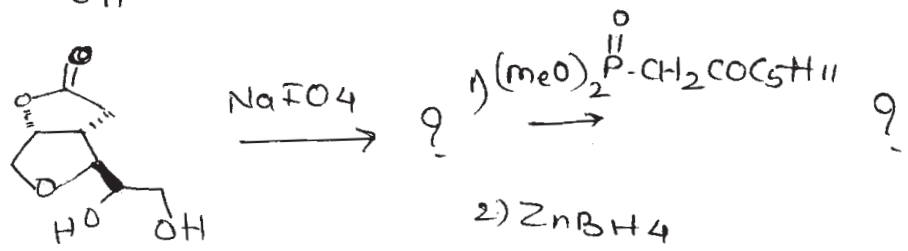
3
+

ii) Li I, acetone, reflux
iii) 3-pentanone enamine derivative
iv) MgMg I, ether
v) Ph_3 P = CH_2, DMSO
vi) T_SCl, Pyridine
vii) B_2H_6, NaOH, H_2O_2
viii) alk. $KMnO_4$.

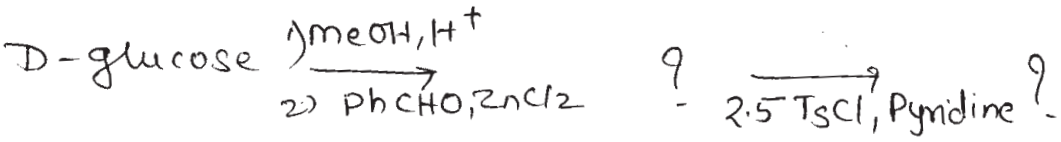
Q8) a) What is "Scaffold process"? How it is a unique form of manipulating the carbohydrate structure? **[4]**

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

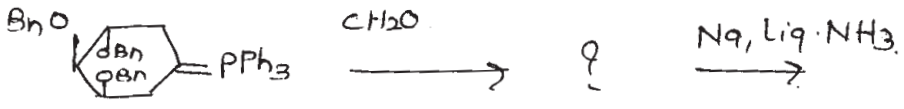
i)



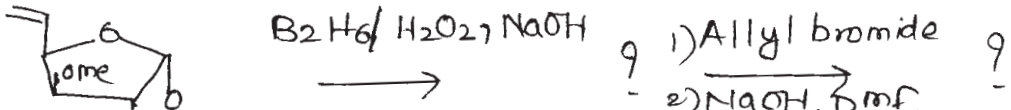
ii)



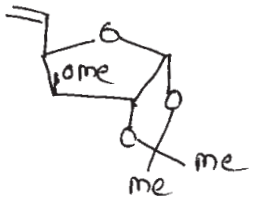
iii)



iv)



v)

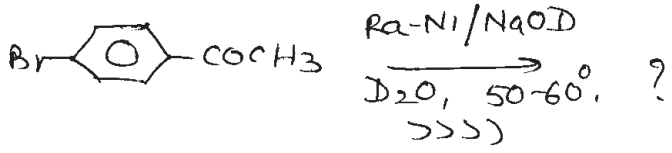


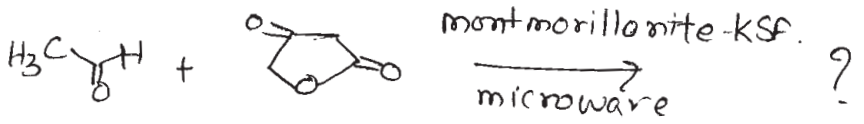
Q9) Answer any three of the following : **[12]**

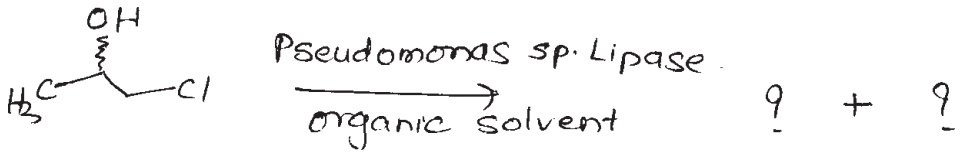
a) Describe the advantages of Biocatalysts in organic synthesis.

b) What are the advantages in using microwave oven for organic synthesis? Mention the precautions to be taken during such synthesis.

c) Complete the following sequence of reactions.

i) 

ii) 

iii) 

iv)

d) What do you understand by immobilization? Explain the technique of ionic binding for immobilization.

SECTION - IV

Q10) Answer any four of the following : **[16]**

a) Discuss the mode of action of penicillins & chloramphenicol.

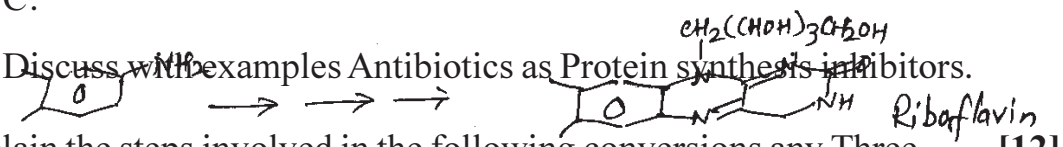
b) Discuss the role of Biotin & vitamin B_6. Explain the mechanism of carboxylation & transamination with vitamins.

c) Give a brief commentary on the role of steroid hormones.

d) Draw the structure of folic acid & explain its biosynthesis.

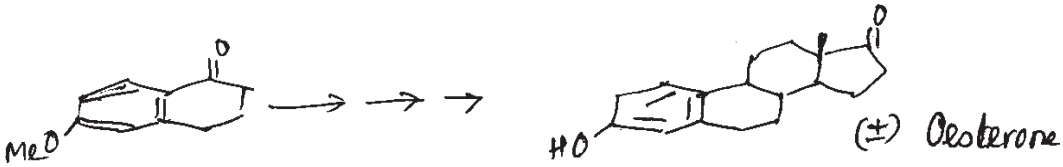
e) Explain the various degradation products of penicillin & cephalosporin C.

f) Discuss with examples Antibiotics as Protein synthesis inhibitors.



Q11) Explain the steps involved in the following conversions any Three. **[12]**

a)



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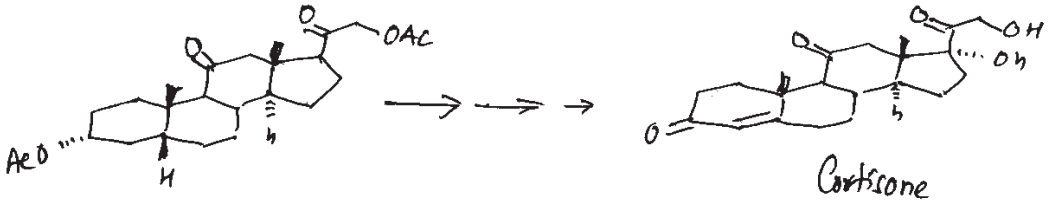

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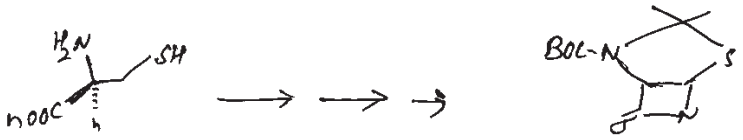

d)

Q12) Describe the evidences to establish the presence of the given structural features in any three of the following : **[12]**

a) Structure & presence of side chain in Biotin.

b) Presence & structure of thiazole ring system in vitamin B_1.

c) Streptose sugar in streptomycin.

d) Presence of 1, 4 - Napthoquinone moiety in vitamin K_1.

e) Nature & positions of hydroxyl groups in estradiol.

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Total No. of Questions : 6] **[Total No. of Pages : 2**

P447

[3623]-410
M.Sc.
BIOCHEMISTRY
BCH - 470 : Biochemical Endocrinology and Plant Biochemistry

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I
Biochemical Endocrinology

Q1) Answer any three of the following : **[15]**

a) Discuss the function and pathophysiology of mineralocorticoids.

b) How steroid hormones regulate the rate of gene expression?

c) Give the structural features, physiological role and disorders of prolactin.

d) How secretion of thyroid hormone is regulated?

Q2) Attempt any three of the following : **[15]**

a) Give the function and mode of action of gastrointestinal hormones.

b) Describe the metabolic conversions that are required to produce the active form of calcitriol. Indicate its physiological role.

c) How are blood levels of glucagon and insulin controlled?

d) What are the physiological effects of the thyroid hormones?

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

a) EGF.

b) Target cell insensitivity.

c) Role of ACTH.

P.T.O.

SECTION - II

Plant Biochemistry

Q4) Attempt any three of the following : **[15]**

a) Comment on cyclic and noncyclic electron flow in photosynthetic system.

b) What do you know about tissue culture techniques? Give its applications.

c) Describe working model of nitrogenase complex.

d) Explain in brief plant hormones.

Q5) Attempt any three of the following : **[15]**

a) Give classification of fertilizers and add a note on their positive and negative aspects with respect to longterm usage.

b) Which are major plant diseases? Add a note on their Management.

c) What are principles of plant breeding? Explain with suitable example.

d) Describe biochemistry of seed germination.

Q6) Write short note on any two of the following : **[10]**

a) Alkaloids.

b) Phytochrome action and circadian rhythm.

c) Somatic hybridization.

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Total No. of Questions : 4] **[Total No. of Pages : 2**

P448

[3623]-411
M.Sc. (Semester - IV)
BIOCHEMISTRY
BCH - 471 : Biochemical and Environmental Toxicology

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

Q1) Answer any five of the following : **[20]**

a) Give the detail classification of toxic agents.

b) Define acute and chronic toxicity. How are they determined?

c) What do you understand the term antagonism? Discuss various types of antagonism.

d) Which factors are responsible for selective toxicity of a toxicant?

e) How delayed neurotoxity of toxicant is evaluated?

f) What are the sources of water and soil pollution? How it is degraded?

g) Give the industrial applications of toxicology.

Q2) Attempt any four of the following : **[20]**

a) Give the toxic effects of methanol and chloroform.

b) Explain the mechanism of xenobiotic biotransformation catalyzed by glucuronosyl transferase.

c) Which toxins are secreted by amphibians? What are their toxic effects?

d) How alcohol produce the liver injury and fetal alcohol syndrome?

e) Give the mechanism of phototoxicity and chemical injury caused by plant toxins.

f) What do you understand by the term dose-response relationship? How it is determined by mortality frequency and mortality probit unit?

P.T.O.

Q3) Answer any five of the following : **[20]**

a) Which underline mechanism of lipid peroxidation is cause of cell death? How oxidative transformation of $CC1_4$ leads to peroxidative damage to organs?

b) In which condition microsomal cytochrome P-450 catalyzes reductive type of biotransformation of xenobiotics? Explain the reductive type reactions catalyzed by cytochrome P-450.

c) What are the advantages for the toxicology of choosing the rats as an experimental model? What are the main differences between the preliminary test on mammals and definitive tests?

d) What do you understand by the term bioactivation? How reactions catalyzed by N-acetyl transferase and glutathiane S-transferase leads to cellular damage?

e) Intoxication of certain chemicals results in decrease in levels of circulating lipoproteins. Explain.

f) Which are the factors that contribute to the kidney's particular sensitivity to the toxic effects of large number of xenobiotics?

g) Discuss the metabolic route of carbaryl. How it is excreted from the body?

Q4) Give the pathogenesis of any five of the following : **[20]**

a) Hematopoietic effects due to lead.

b) Micromercurialism.

c) Renal dysfunction by cadmium.

d) Muscarinic effects by organophosphorous insecticides.

e) Renal dysfunction by glycositic antibiotics.

f) Eudarteritis by arsenic.

g) Liver necrosis.

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Total No. of Questions : 4] **[Total No. of Pages : 2**

P449

[3623]-412
M.Sc.
BIOCHEMISTRY
BCH - 472 : Genetic Engineering and Molecular Biochemistry

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right hand side indicate full marks.***
3) ***Draw necessary diagram wherever required.***

Q1) Attempt any two of the following : **[20]**

a) What are different modifying enzymes? Give the modifications brought about by them and their use in Gene Manipulation.

b) Explain Agrobacterium mediated transformation of plant cell.

c) What is PCR? Give its working and applications.

Q2) Attempt any two of the following : **[20]**

a) Explain in detail transformation of bacillus and streptomyces.

b) Discuss the concept of protein engineering with suitable examples.

c) Describe the protocol for preparation of plasmid DNA from E.Coli cell.

Q3) Attempt any two of the following : **[20]**

a) What are cloning vectors? Add a note on different vectors used in recombinant DNA technology. Mention their applications.

b) Give in detail the construction of genomic and cDNA libraries.

c) Give suitable Methods for screening of recombinant clones.

P.T.O.

Q4) Write short note on <u>any four</u> of the following : **[20]**

a) Invitro Mutagenesis.

b) Genetic engineering in agriculture.

c) Transgenic animal.

d) Restriction mapping.

e) DNA sequencing.

f) Cosmids.

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Total No. of Questions : 4] **[Total No. of Pages : 2**

P450

[3623]-415
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 481 : Bioanalytical and Forensic Science

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Explain the terms :
   i) Cannabis (Hemp).
   ii) Manufacturer.
   iii) Narcotic drugs.
   iv) Poppy straw.

b) Explain the rules related to manufacture of manufactured drug.

c) Write note on bounded manufactory.

d) State the principle and explain the technique for the extraction of caffeine from biological sample.

e) Urine sample was analyzed for amphetamine containt using gas chromatographic method which gives following observations.
   i) Internal standard content in chloroform = 1.84 μg/ml.
   ii) Peak height for amphetamine = 8.34.
   iii) Peak height for amphetamine in standard reference solution = 4.28.
   iv) Peak height for standard in specimen = 2.78.
   v) Peak height for internal standard in reference solution = 1.29.
   vi) Volume concentration factor for internal standard = 0.59. Calculate concentration of amphetamine in urine sample.

P.T.O.

Q2) Attempt any four of the following : **[20]**

a) Give the classification of vitamines with suitable examples.

b) State principle for estimation of phosphatage. Outline analytical procedure for estimation of phosphatage.

c) How are total carbohydrates determined?

d) Give the principle for estimation of protein by

i) Lowry's method

ii) Bradferd method.

e) 0.87 g of ascorbic acid was dissolved in buffer and diluted to 100 ml. An aliquot of 10.0 ml titrated with 0.1 N iodine solution gave burette reading 9.2 ml. Calculate percentage of ascorbic acid.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Describe a method used for the estimation of starch from flour.

b) Outline analytical method for the estimation of pectin content from Jam.

c) Explain the rancidity of oil. Give the procedure for the estimation of peroxide value of the oil.

d) Write note on : Food Preservatives.

e) A sample of caffeine 4.567 g. was subjected to Kjeldah's Method and the volatile base was distilled and absorbed in 50.00 ml of decinormal H_2SO_4. The excess acid was titrated against 0.1N NaOH and required 8.7 ml of it. Calculate the percentage of caffeine sulphate (M.wt. Caffeine Sulphate = 486)

Q4) Attempt any four of the following : **[20]**

a) What is pasteurization? How is it verified?

b) Outline the analytical procedure for the estimation of theobromine from Cocoa.

c) Explain the method used to estimate HMF content of honey.

d) Describe the method for the estimation of tannin from tea sample.

e) 9.5 ml sample of milk was analysed for the lactic acid content by titration method with decinormal sodium hydroxide. The titre value was 4.32 ml. Calculate percentage of Lactic acid in milk (Given molecular wt of Lactic acid = 90.00)

Total No. of Questions : 4] **[Total No. of Pages : 3**

P451

[3623]-416
M.Sc.
ANALYTICAL CHEMISTRY
CH - 490 : Analytical Spectroscopy
(Semester - IV)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Explain the terms
   i) Molar absorptivity.
   ii) Bremsstrahlung and
   iii) Band pass filter.

b) Enlist the different detectors used in uv-visible spectrophotometry. Explain construction and working of any one commonly used detector in uv-visible spectrophotometer.

c) Explain the use of ultraviolet spectroscopic technique in qualitative and quantitative analysis.

d) When a certain metal was irradiated with light of frequency 3.2×10^{16} Hz, the photoelectrons ejected had twice the kinetic energy as did photoelectrons emitted when the same metal was irradiated with light of frequency 2.0×10^{16} Hz. Calculate the threshold frequency (υ_0) for the metal.

e) How many milligrams of potassium permanganate should be dissolved in 100 ml of water, so that the resulting solution after 20 fold dilution gave an absorbance 0.45 in 1.0 cm cell. If the molar absorptivity of potassium permanganate is 4.2×10^3 cm^2. $mole^{-1}$.
(Given – At. Wt – K = 39, Mn = 54.95 O = 16)

P.T.O.

Q2) Attempt any four of the following : **[20]**

a) Explain the theory behind chemical analysis by X-ray absorption.

b) Explain the principle of chemiluminescence. Mention their types. Give an account of chemiluminescence titrations.

c) Write a note on –

i) ESCA satelite peak.

ii) Absorptive edge method.

d) Aluminium crystalises in cubic system, with edge length 4.050 Aº. If density of aluminium is 2.70 gm, cm^{-3}, and its atomic weight is 26.98. Determine type of unit cell and radius of aluminium atom.

e) A certain photomultiplier tube has several dynodes, each dynode emits an average of 2.37 electrons for each impinging electron. If the amplification factor of photomultiplier tube is 419.99, calculate the number of dynode in photomultiplier tube.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Explain the following :

i) Sources used in ESR and NMR spectrometers.

ii) Hetero and homonuclear double resonance.

b) Give critical account of solvents and shift reagents used in NMR spectroscopy.

c) Explain the following

i) g - Factor is dimensionless.

ii) Gyromagnetic ratio.

d) Calculate the relative number of protons in the higher and lower magnetic states when sample is placed in a magnetic field of 4.69 Tesla at 20ºC.

Given : Magnetogyric ratio for proton = 2.6752×10^{8} radian $T^{-1}s^{-1}$
Planck's constant = 6.63×10^{-34} JS
Boltzmann constant = 1.38×10^{-23} J K^{-1}

e) Calculate the number of multiplets for each band and their relative peak areas in the first order NMR spectrum of CH_3 CH Br CH_3.

Q4) Attempt any four of the following : **[20]**

a) Draw the schematic diagram for ESR spectrometer and describe the working of various components of instrument.

b) Explain the mechanism of spin-lattice, spin-spin and quadrupolar relaxation in NMR spectroscopy.

c) Draw a schematic diagram of scanning electron microscope, label it's various components. Explain how two pairs of electromagnetic coils are used for scanning with scanning electron microscope.

d) Discuss ENDOR and ELDOR techniques in EPR spectroscopy with suitable examples.

e) The EPR Spectra of series of a standard solutions and of sample were recorded. The same peak in each spectrum was doubly integrated and the values are given in the table. Determine the concentration of sample. Use the formula and also working Curve Method.

Concentration in PPM	Relative area
2.00	9.75
4.00	19.52
6.00	29.35
8.00	39.10
10.00	48.90
Sample	21.35

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Total No. of Questions : 4] **[Total No. of Pages : 2**

P452

[3623]-417
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 491 : Polymer Technology

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Answers to the two sections must be written in separate answer books.***
3) ***Draw diagrams wherever necessary.***

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Give the salient features of suspension polymerization.

b) How will you differentiate between the following polymers –

i) Plastics and liquid resins.

ii) Organic and inorganic polymers.

c) Write short note on – Electrochemical polymerisation.

d) Give reasons for the following :

i) Aromatic polyesters are rigid while rubber is flexible.

ii) Molecular weight of a polymer is always expressed as an average.

e) Discuss the mechanism of free-radical polymerisation.

Q2) Answer any four of the following : **[20]**

a) Discuss the kinetics of anionic polymerisation.

b) Give the methods of preparation and applications of silicone rubbers.

c) Write a note on – Cross-linking reactions.

d) Give the method of preparation and applications of following polymers-

i) Polyvinylchloride.

ii) Nylon66.

P.T.O.

e) Attempt the following :

i) Explain the terms – Inhibitors, CMC.

ii) Calculate the degree of polymerization of polypropylene polymer whose molecular weight is 41158.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Describe in detail the high-speed membrane osmometric method for determination of number-average molecular weight ($\overline{M}x$) of a polymer sample.

b) Explain the terms –

i) Abrasion resistance.

ii) Colourants.

iii) Transparency.

iv) Gloss.

v) Plasticizers.

c) Give an account of electrical properties of polymeric materials.

d) Discuss in detail the different types of intermolecular forces present in polymers.

e) 0.775g of HTPB sample was dissolved in 30 ml mixture of ethyl alcohol and toluene (1 : 3) and solution was titrated with 0.125N alcoholic potassium hydroxide solution. The burette reading was 4.6 ml. Calculate the number-average molecular weight ($\overline{M}x$) of polymer sample.
(Given – Functionality of HTPB is 2)

Q4) Answer <u>any four</u> of the following : **[20]**

a) Explain the term sol-gel and gelation. Give a brief account of aqueous chemistry of metal oxide.

b) Write an account of blow moulding.

c) What is fibre spinning? Describe in detail the melt spinning process.

d) Write note on – use of TGA in polymer characterization.

e) Calculate weight average molecular weight for a system containing equal number of particles with molecular weights 10,000 and 20,000.

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Total No. of Questions : 5] **[Total No. of Pages : 4**

P669

[3623]- 31
M.Sc.
PHYSICAL CHEMISTRY
CH - 310 : Quantum Chemistry, Statistical Thermodynamics and Phase Rule
(Old)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

Physico - Chemical Constants

1.	Avogadro Number	N	$= 6.022 \times 10^{23} mol^{-1}$
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg $K^{-1} molecule^{-1}$
			$= 1.38 \times 10^{-23}$ JK^{-1} $molecule^{-1}$
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	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}
			$= 8.314 JK^{-1}$ 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	$= -9.274 \times 10^{-24}$ JT^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ JT^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) Attempt <u>any four</u> of the following : **[20]**

a) Explain the properties of the raising and lowering operators.

b) Show that if 'a' is an eigen value of an operator $\hat{L}$ then 'a^n' is an eigen value of the operator $[\hat{L}]^n$, where n is an integer.

c) What is the need of approximate methods in quantum chemistry? Compare perturbation method with the variation method.

d) Formulate the Hamiltonian operators for

i) H_2 molecule and

ii) H_2^- ions. State the terms involved in each of these.

e) Explain the following :

i) Resonance integral.
ii) Overlap integral.
iii) Orthogonal integral.
iv) Exchange integral.

f) Obtain an expression for the energy of ground state of the Helium atom using the first order perturbation theory.

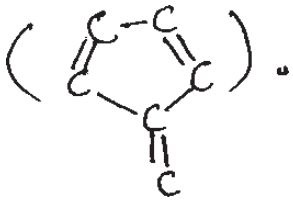
Q2) Attempt <u>any four</u> of the following : **[20]**

a) Obtain the delocalisation energy for butadiene molecule using HMO theory.

b) Set up the secular determinant for hexatriene electrons in the Hückel approximation. Determine the energies of the HMO's in terms of α and β and calculate delocalisation energy.

c) What is 4m + 2 rule of Hückel? Explain the pnemonic model used to obtain the MO energies of annulenes.

d) Give the secular equation for fulvene,



e) What are the drawbacks of Hückel approximations? Obtain the energy levels for the benzene molecule on the basis of these approximations and show how they are modified in case of pyridine.

f) Sketch the HMO energy levels and nodes in HMO's of C_4H_4 and C_6H_6. Discuss the effect of increasing 'n' on the stability of annulenes.

SECTION - II

Q3) Attempt any three of the following : **[15]**

a) Obtain the relationship between the Gibbs energy and the partition function for indistinguisable independent particles.

b) Briefly outline the procedure for calculating the rotational partition function.

c) Verify that entropy is expressed as

$S = (K/N) / nw, N \rightarrow \infty$

d) How the Helmholtz energy and pressure are determined from the knowledge of canonical partition function.

e) Explain the significance of the term 'molecular partition function'. Obtain the expression for internal energy interms of molecular partition function.

Q4) Attempt any three of the following : **[15]**

a) Derive the statistical distribution law according to Fermi-Dirac statistics.

b) State and justify the equipartition principle. What is its limitation?

c) Explain the lever rule. Why are supercritical fluids stored in thick container? Name three of these fluids.

d) Define the terms :

i) Phase
ii) Component
iii) Species and
iv) Eutectic

e) Compare :

i) Bose-Einstein
ii) Fermi-Dirac and
iii) Maxwell-Boltzmann statistics.

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

a) Construct the liquid-liquid phase diagram for two partially immiscible liquids A and B with the following data :

T ^{o} C	80	70	52	38	26
Wt% $(B)_1$	15	17	21	28	39
Wt% $(B)_2$	92	86	76	68	58

Calculate the temperature and composition of the lower consolute.

b) Calculate the constant volume heat capacity of a monoatomic gas.

c) The moment of inertia for nitrogen is $14 \times 10^{-40} gcm^2$. Calculate the rotational partition function for N_2 at $25^{o}C$.

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P670

[3623]-32
M.Sc.
PHYSICAL CHEMISTRY
CH - 311 : Nuclear and Radiation Chemistry (Old)

Time : 3 Hours] ***[Max. Marks : 80***

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) Attempt any three of the following : **[15]**

a) Discuss the merits and demerits of shell model of nucleus.

b) What are thermonuclear reactions? Explain proton-proton chain mechanism.

c) Discuss the principle and working of breeder reactor.

d) Define the term reaction cross section. Describe the variation of neutron capture cross section with energy of the neutron.

e) Write a note on critical size of a nuclear reactor.

Q2) Attempt any three of the following : **[15]**

a) Discuss with suitable examples various types of nuclear reactions.

b) Explain the terms square well potential, cumulative fission yield spin & parity.

c) Deduce the four factor formula for infinite medium.

d) Discuss the various types of moderators & coolants used in a nuclear reaction.

e) Give an account of natural nuclear reactor.

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

a) Find out the geometric cross section for ^{197}Au and ^{75}As
Given $r_0 = 1.4 \times 10^{-15}$m.

b) Calculate the binding energy of the last two neutrons in $^{37}C1$, given the mass difference between $^{35}C1$ & ^{37}Cl is 1.997 042 *amu*.
Given mass of n = 1.008 66J *amu*.

c) In the Fission of $^{235}_{92}U$ the end stable products are $^{94}_{40}Zr$ and $^{140}_{55}Ce$.
What are the primary fragments?

SECTION - II

Q4) Attempt any three of the following : **[15]**

a) Distinguish between intrinsic and extrinsic semiconductors. What are requirements of a semiconductor to be a good radiation detector?

b) Discuss the role of cupric ions in modified ferrous sulphate dosimeter.

c) Discuss the chemistry of recoil atoms.

d) Describe the mechanism of radiation annealing.

e) Write a brief note on reactor safety.

Q5) Attempt any three of the following : **[15]**

a) Distinguish between somatic and genetic effects of radiations.

b) Discuss the after effects of three miles island nuclear accident.

c) Discuss the ICRP recommendations for maximum permissible dose.

d) Enlist the various radiation protecting materials used for safety purposes.

e) Explain the terms : retention in nuclear reaction, yield of a nuclear reaction and G-value in dosimeter.

Q6) Solve any two of the following : **[10]**

a) Find out the dose due to 150 mCi of Cr-5l at a distance of 4 meters. Give E_v = 320 keV.

b) Find out the thickness of copper needed to decrease a gamma dose from 4.1 Gy/min to 1.0 Gy/min. Given $\mu_{cu} = 0.52\ cm^{-1}$.

c) Calculate the gamma dose absorbed by CH_3OH in 2h if dose absorbed by Fricke solution at same position is 2.0Gy/min. Given (Z/A) of Fricke sol.^{n} = 0.553.

Total No. of Questions : 6] **[Total No. of Pages : 3**

P671

[3623]- 33
M.Sc.
PHYSICAL CHEMISTRY
CH - 312 : Electrochemistry and Physicochemical Methods of Analysis
(Old Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Describe the structure of water when an ion is present in it.

b) Assuming the expression for charge density ρ_r show that the total charge density on ionic atmosphere around positive ion is equal to $-Zie_o$.

c) Describe the ways of transport of matter in solution. What are the driving forces behind these?

d) Define the following terms :

i) Volta potential.
ii) Galvani potential.
iii) Surface potential.
iv) Electrochemical potential.

e) Explain the term ionic strength. How does it affect :

i) Thickness of ionic atmosphere.
ii) The mean activity coefficient.

Q2) Attempt any three of the following : **[15]**

a) Discuss the electrical double layer theory using Helmholtz model.

b) Obtain Tafel equation from Butler-Volmer expression.

c) Explain the principles involved in the methods of preventing corrosion.

d) Explain the concept of corrosion current and corrosion potential and write the equation for rate of corrosion explaining the term involved in it.

e) Enlist the desirable trends in order to maximize the energy density and power output in a cell for producing electrical energy.

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

a) If the Tafel constants a and b have values 1.48V and 0.125V respectively for electronation reaction of monovalent ion at cathode. Calculate the transfer coefficient α and exchange current density i_o at 300K.

b) Find out the ionic strength of following solution.

i) 200ml 0.01M H_3PO_4 + 100ml 0.02 M $ZnCl_2$
ii) 300ml 0.1M KCl + 100ml 0.2M KNO_3

c) Calculate the electricity storage density and energy density for iron electrode whose reversible electrode potential ($Fe^{+2} + 2e \rightleftharpoons Fe$) is 0.44V (atomic mass of iron is 55.85).

SECTION - II

Q4) Attempt any three of the following : **[15]**

a) Discuss the choice of post irradiation treatment in activation analysis.

b) Draw and explain the working of DTA apparatus.

c) Derive the equation $\frac{M}{Z} = \frac{B^2 r^2}{2E}$ and explain the terms involved there in.

d) Discuss the principle of PIXE technique. What are its advantages?

e) Draw and explain with suitable example titration of three ions where in an ion getting precipitated first and last is labelled.

Q5) Attempt any three of the following : **[15]**

a) Describe in brief spectral splitting and application of ESCA.

b) Explain the electron bombardment ionization in mass spectrometry.

c) Discuss the detection and analysis of x-ray in PIXE.

d) Explain the working of thermobalance used in TGA.

e) Explain how radiometric titrations based on complex formation are carried out, draw the corresponding experimental setup.

Q6) Solve any two of the following : **[10]**

a) One gram of sample containing 1.2% indium was irradiated in neutron flux of 2.2×10^6 n cm^{-2} s^{-1} for one hour. Find out activity of the sample after a cooling period of 30 min. Given γ = 90%, σ = 65 barn, t½ of ^{116}In = 54.1min.

b) 100ml K*I solution was titrated with 0.02m $AgNO_3$. Addition of 2.5cc of $AgNO_3$ followed by separation of precipitate showed a decrease in activity from 4300 counts for one min to 5066 counts for 5 min. Find out concentration of K*I if B.C = 100 for 5 min.

c) In a particular time of flight mass analyzer an ion with M/Z = 198 required 1.16μ S to strike the detector after emission from the source. Determine the time needed for an ion with M/Z = 300 to strike the detector.

Total No. of Questions : 6] **[Total No. of Pages : 3**

P672

[3623]- 34
M.Sc.
PHYSICAL CHEMISTRY
CH - 314 : Polymer Chemistry - I
(Old)

Time : 3 Hours] ***[Max. Marks : 80***

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	$\beta_e = -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	$\beta_n = 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	$m_e = 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) Derive the expression for $\bar{x}_n$ and $\overline{M}_n$ of a polymer formed by condensation in absence of a catalyst and show that it is proportional to square root of the time.

b) 'Chemical reactivity is independent of molecular size'. Explain.

c) Define functionality. Give examples of monomers which are monofunctional, bifunctional and trifunctional. Show that a monomer can show different functionality under different conditions.

d) Distinguish between addition and condensation polymers. Dibromodecane reacts with sodium. Is the polymer formed addition or condensation type?

e) Discuss the statistics of condensation polymerization. Derive expression for N_x and W_x.

Q2) Attempt any three of the following : **[15]**

a) Write a note on emulsion polymerization.

b) Compare the merits of the four polymerization processes.

c) Derive expression for

i) Overall rate of polymerization and

ii) Degree of polymerization for cationic chain polymerization.

d) What are copolymers? What are the advantages of using copolymers?

e) What is suspension polymerization? Describe the changes occurring after the isotherm.

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

a) 180 g of butadiene ($r_1 = 0.76$) are copolymerized with 344 g of methyl acrylate ($r_2 = 0.05$). Calculate the instantaneous composition of the copolymer formed (H = 1, C = 12, O = 16).

b) A condensation polymerization reaction is 98% complete. Find $\bar{x}_n$, $\bar{x}_w$, PI and weight fraction of $\bar{x}_n$ mers.

c) Classify the copolymer formed in the following cases. Justify your answer.

	r_1	r_2
case - I	$\rightarrow 0$	$\rightarrow 0$
case - II	$\rightarrow 0$	$\rightarrow \infty$
case - III	$\rightarrow \infty$	$\rightarrow \infty$

SECTION - II

Q4) Attempt any three of the following : **[15]**

a) Derive expression :

i) Overall rate of polymerization and

ii) Number average degree of polymerization for free radical chain polymerization.

b) Describe the chain transfer reactions in free radical chain polymerization.

c) Why is it necessary to express the molecular weight of a polymer sample as some average of molecular weight? Define $\overline{M}_n$, $\overline{M}_w$, $\overline{M}_u$ and $\overline{M}_z$.

d) Discuss the two types of termination reactions in free radical chain polymerization.

e) What are vinyl monomers? Why do they undergo addition reaction? What are the types of addition polymerization? Name the chain carriers in these.

Q5) Attempt any three of the following : **[15]**

a) Discuss the principle of membrane osmometry.

b) Describe with a neat diagram the gradient elution technique.

c) Write a note on GPC.

d) Discuss the principle of sedimentation velocity method.

e) Describe the partial dissolution method used for fractionation of a polymer sample.

Q6) Solve any two of the following : **[10]**

a) Calculate the molecular weight of a polymer ($k = 4 \times 10^{-3}$ml/g, $\alpha = 0.72$) from the data :

C (g/dl)	0	0.2	0.4	0.6	0.8	1.0
t (s)	99	116	140	172	212	260

b) The molecular weight of a polymer is determined by sedimentation equilibrium method. It was found that the aqueous solution was 1.9 times as concentrated at a distance 10cm from the axis of rotation as at a distance 6 cm. rotor speed = 6000 rpm. Temp = 25°C, ρ = 1.2g/cc, $\overline{V}$ = 0.6.

c) Calculate the molecular weight of a polymer in cyclobenzene at 25°C. From the data :

c (g/ml)	0.004	0.008	0.012	0.016
h (cm of water)	0.24	0.88	1.92	3.36

Total No. of Questions : 4] **[Total No. of Pages : 3**

P673

[3623]- 36
M.Sc.
PHYSICAL CHEMISTRY
CH - 316 : Environmental Chemistry
(Old Course)

Time : 3 Hours] ***[Max. Marks : 80***

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.***

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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}
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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) Attempt any four of the following : **[20]**

a) Discuss in brief "inorganic pollutants".

b) With labelled diagram explain different regions of troposphere and stratosphere.

c) Explain following terms with suitable examples :

i) Carcinogens.
ii) Trade effluent.
iii) TLV.
iv) Pollutant.

d) Discuss in brief the segments of environment.

e) How can one control SO_x pollution?

f) Explain atmospheric photochemistry.

Q2) Attempt any four of the following : **[20]**

a) Explain the role surfactants in pollution problem.

b) Discuss briefly main point and non-point sources of water pollution.

c) Write a note on modified detergents.

d) What are causes and effects of acid rain?

e) Write in short about "organic pollutants".

f) What is lithosphere? Explain it.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Discuss the harmful effects of radioactive pollutants on soil.

b) Explain the role of photosensitizer additives in polymer degradation.

c) What are the sources of industrial pollution? Discuss the harmful effects of industrial pollutants on soil.

d) Write a note on 'the role of photosensitizer additives in polymer degradation'.

e) Enlist the sources of thermal pollution. Describe the methods to measure the thermal pollution.

f) How do the modern agricultural practices pollute the soil?

Q4) Attempt <u>any four</u> of the following : **[20]**

a) Explain the following :

i) Decibel

ii) Thermal noise and

iii) Environmental noise.

b) Define 'chemical toxicology'. Classify highly toxic solids with their recommended limit in ppm.

c) Discuss the biochemical effects of lead on human being.

d) What are carcinogenic compounds? Discuss their ill effects.

e) Explain with suitable examples, the enzyme inhibition by toxic metals in human beings.

f) Describe a 'cooling tower' to prevent thermal pollution.

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P674

[3623]- 42
M.Sc.
ORGANIC CHEMISTRY
CH - 350 : Organic Reaction Mechanism
(2005 Pattern) (Old Course)

Time : 3 Hours] ***[Max. Marks : 80***

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) Write short notes on any three of the following : **[12]**

a) Newman's rule of six.

b) Michael Reaction.

c) Isotope labelling used in determining reaction mechanism.

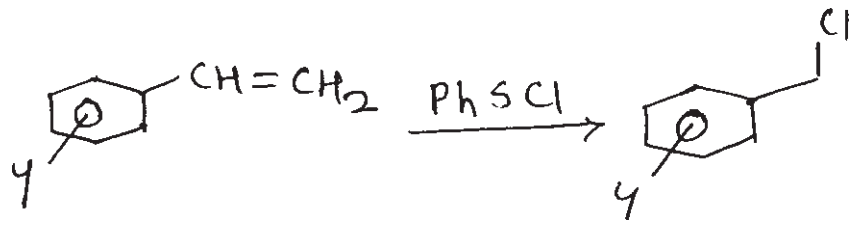
d) Reductive amination in nature.

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

a) The value of ρ is a measure of the efficiency of transmission of electronic effects by various groups. Explain.

b) Calculate how much faster p-chloroaniline is benzoylated in benzene at 25°C than p-nitroaniline using the data $\rho = -2.78$, $\sigma_{p\text{-}NO_2} = 0.78$ and $\sigma_{p\text{-}cl} = 0.23$.

c) Suggest the mechanism of the following reaction having $\rho = -2.7$.

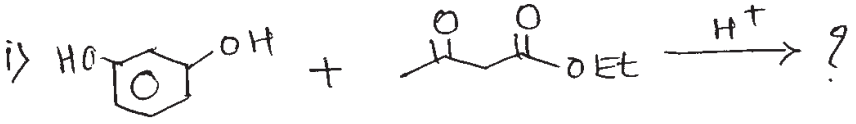


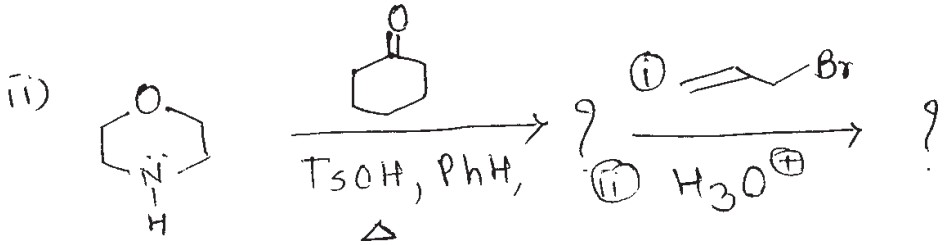
P.T.O.

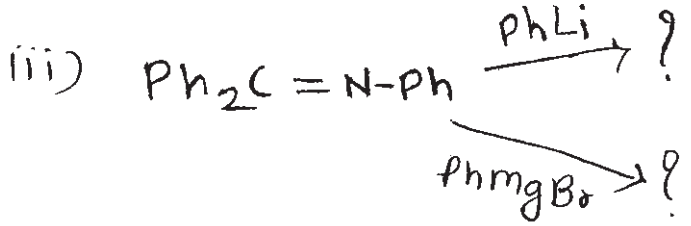
d) Account for the given σ values.

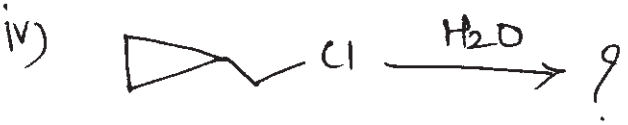
	σ_m	σ_p
–OH	0.12	–0.37
$-OCH_3$	0.12	–0.27
$-NO_2$	0.72	0.78
$-N^+Me_3$	0.88	0.82

Q3) Predict the products in <u>any four</u> of the following reactions and give mechanisms. **[16]**

i) 

ii) 

iii) 

iv) 

v) 

SECTION - II

Q4) Answer <u>any three</u> of the following : **[12]**

a) Benzoin condensation fails when $-\ddot{N}Me_2$ group is present at para position on benzaldehyde.

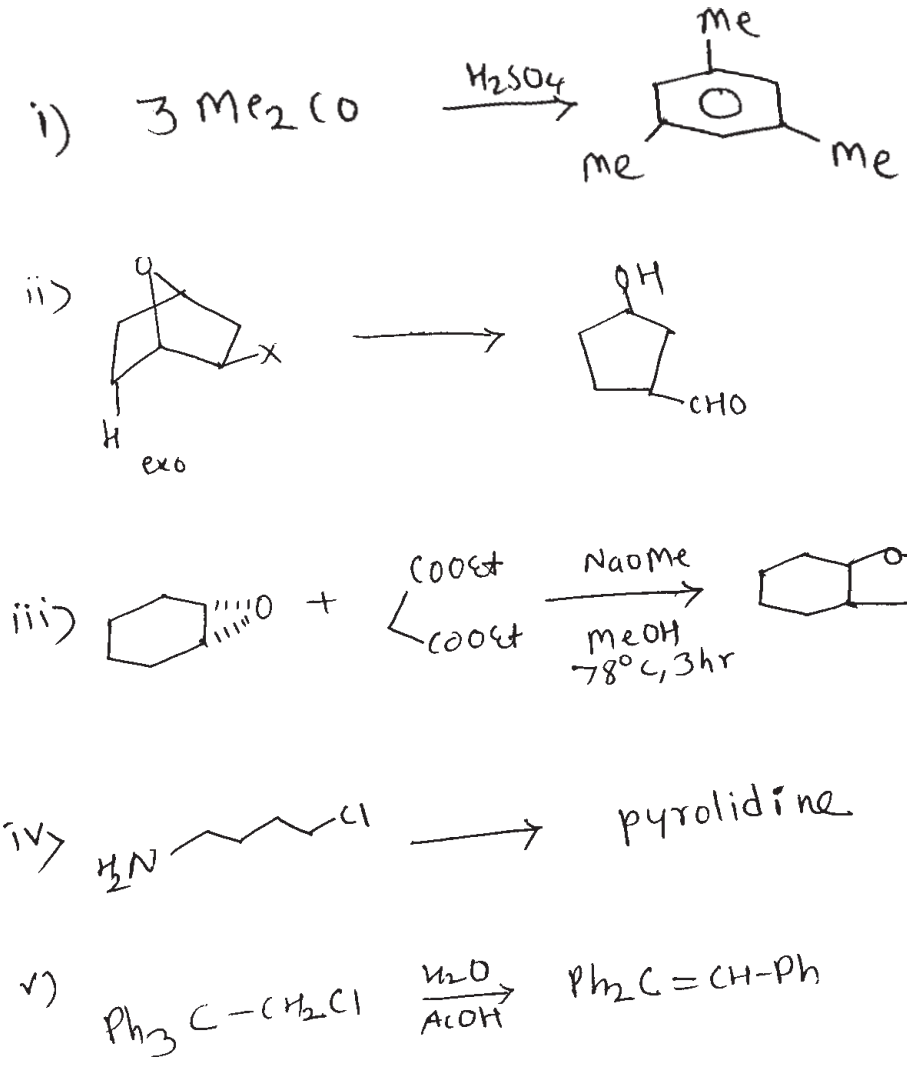
b) Explain BAC^2 mechanism.

c) Account for the enolic content of the following :

1,2-cyclohexanedione-40%
1,2-cyclopentanedione 90%

d) Explain the use of NAD^+ and NADH in biotransformation.

Q5) Suggest mechanism for the following reactions (any four) : **[16]**



Q6) Answer the following (any three) : **[12]**

a) Use of enamines in organic synthesis - Explain.

b) Explain the role of haemoglobin in human metabolism.

c) Explain anchimeric assistance of π bond and –OAC group.

d) Write a note on transesterification reaction.

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Total No. of Questions : 6] **[Total No. of Pages : 5**

P675

[3623]- 43
M.Sc.
ORGANIC CHEMISTRY
CH - 351 : Spectroscopic Methods in Structure Determination
(2005 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

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

i) Both cyclopentanone and cyclohexanone shows a base peak at m/e = 55 in their MS.

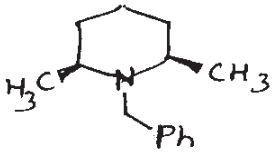
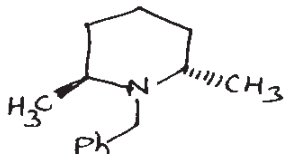
ii) Coupling constant J and integration is not used for interpretation in CMR, as is used in PMR.

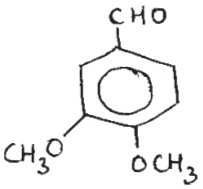
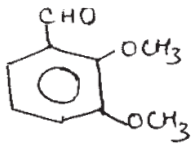
iii) The geometric isomers can be differentiated using PMR if PMR of both the isomers is given.

iv) Methylene protons of 2,3-dibromo methyl propionate show two different signals in ^1H NMR.

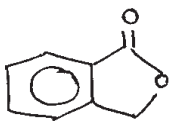
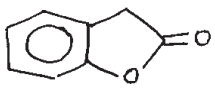
v) In the ^1H NMR spectrum of $H_3C\text{-}P(OR)_2$ methyl protons appear as doublet with J = 13HZ.

b) Distinguish between the following pairs by using the indicated spectral methods (any four) : **[8]**

i)  and  pmr

ii)  and  cmr

iii) 2 - hexanone and 3 - hexanone mass

iv)  and  pmr

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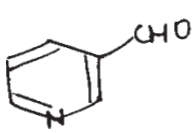
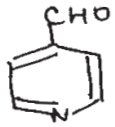
v)  and  cmr

Q2) Answer <u>any three</u> of the following : **[12]**

a) Predict the structure and justify your answer
M.F. : $C_6H_9NO_2$
CMR : 21, 23, 26, 28, 136, 150
DEPT 90 : 136 up
DEPT 135 : 21, 23, 26, 28 down 136 up

b) The ^{13}C NMR spectrum (PND) of acetyl acetone shows the following signals. Assign the signals and comment on the chemical shifts.
δ : 24.8(q), 30.9(q), 58.7(t), 101.1(d), 192.6(s) 203.5(s).

c) Deduce the structure and justify your answer
M.F. : $C_{13}H_{16}O_3$.
PMR : 1.1(t, J = 6Hz, 15mm); 6.66(d, J = 8Hz, 5mm)
2.5(q, J = 6Hz, 10mm); 6.91(d, J = 2Hz, 5mm)
3.77(s, 30mm); 6.96(dd, J = 8 and 2Hz, 5mm)
6.57(d, J = 16Hz, 5mm); 7.30(d, J = 16Hz, 5mm)

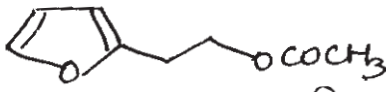
d) Deduce the structure from the spectral data given below :
C = 64.3% H = 8.8%
IR : 1195, 1670, 1720cm^{-1}
Mass : 114, 99, 86, 69, 41
PMR : 1.3 (t, J = 7Hz, 3H); 2.0(d, J = 7Hz, 3H)
4.2(q, J = 7Hz, 2H); 5.8(d, J = 16Hz, 1H)
6.9(dq, J = 7 & 16Hz, 1H)

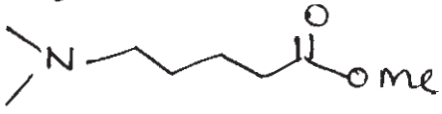
Q3) Write short notes on <u>any three</u> : **[12]**

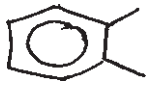
a) DEPT experiment.
b) FAB mass spectrometry.
c) Karplus equations for predicting coupling constants.
d) Nuclear overhauser effect.

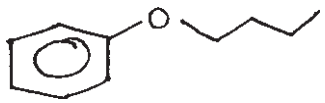
<u>SECTION - II</u>

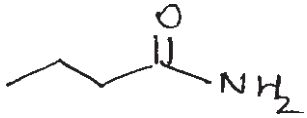
Q4) a) Explain the genesis of the ions for <u>any four</u> of the following : **[8]**

i)  41, 43, 94, 112, 154

ii)  159, 128, 74, 59, 58

iii)  106, 91, 77, 65, 51, 39

iv)  150, 107, 94, 93, 66, 65

v)  87, 71, 59, 44, 43, 16

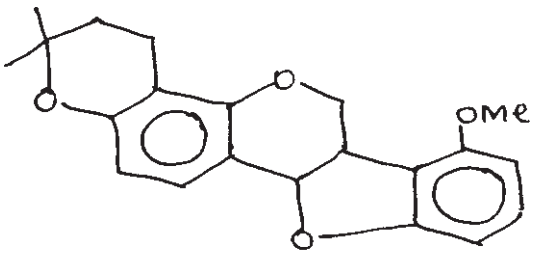
b) Mass spectral data for the isomeric octanes, n-octane, 2-methylheptane and 2,2, 4-trimethyl pentane are given below. Identify which is which?

A [m/z (%)] : 114(9), 100(2), 99(2), 85(13), 71(8), 57(17), 56(9), 43(100), 29(9).

B [m/z (%)] : 99(3), 57(100), 56(22), 43(15).

C [m/z (%)] : 114(7), 99(12), 71(10), 70(16), 57(50), 43(100), 42(40), 41(28). **[4]**

Q5) a) Assign the ^{1}H NMR signals to the various protons in the compound A. Justify your assignments. **[8]**



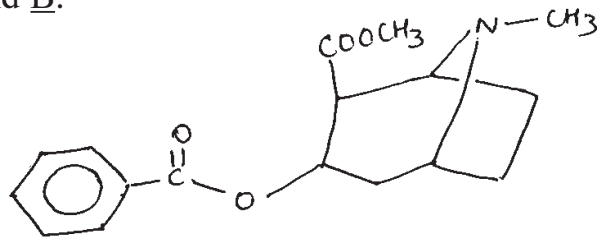
A

1.42(s, 6H); 3.69(m, 1H)
3.76(m, 1H); 3.85(s, 3H)
4.33(m, 1H); 5.45(d, 7Hz, 1H)
5.56(d, 10Hz, 1H);
6.45(dd, 8 & 2Hz, 1H);
6.50(dd, 8 & 2 Hz, 1H);
6.53(d, 9Hz, 1H);
6.67(d, 10Hz, 1H);
7.05(d, 9Hz, 1H);
7.12(t,8Hz, 1H).

NOE/Spin decoupling Expt.

Irradiation at	Change at
1) 3.69 δ	5.45 (d) → (s) 3.76 (m) → d (13Hz) 4.33 (m) → d (13Hz)
2) 3.85 δ	17% enhancement at 3.69 δ

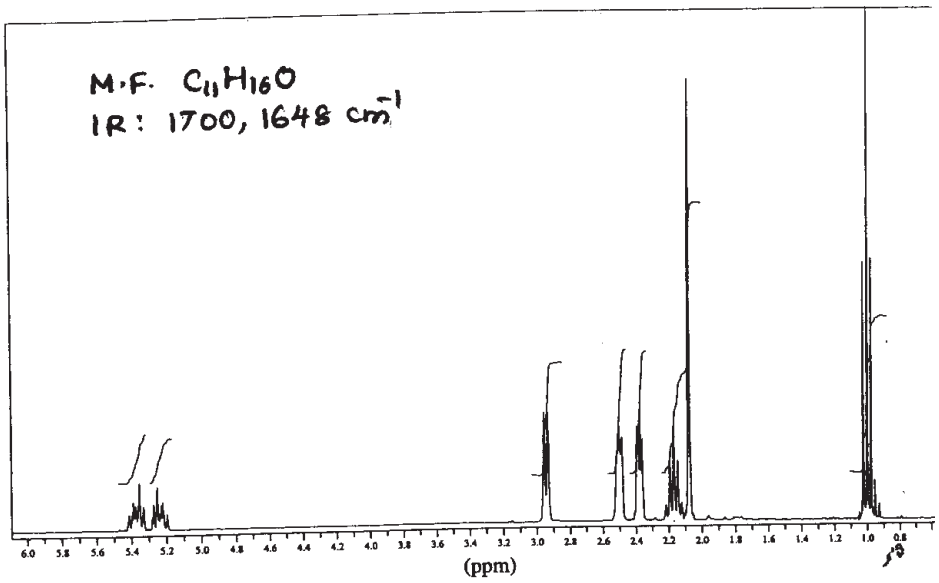
b) Assign the given ^{13}C NMR signals to the various carbons in the given compound B. **[8]**

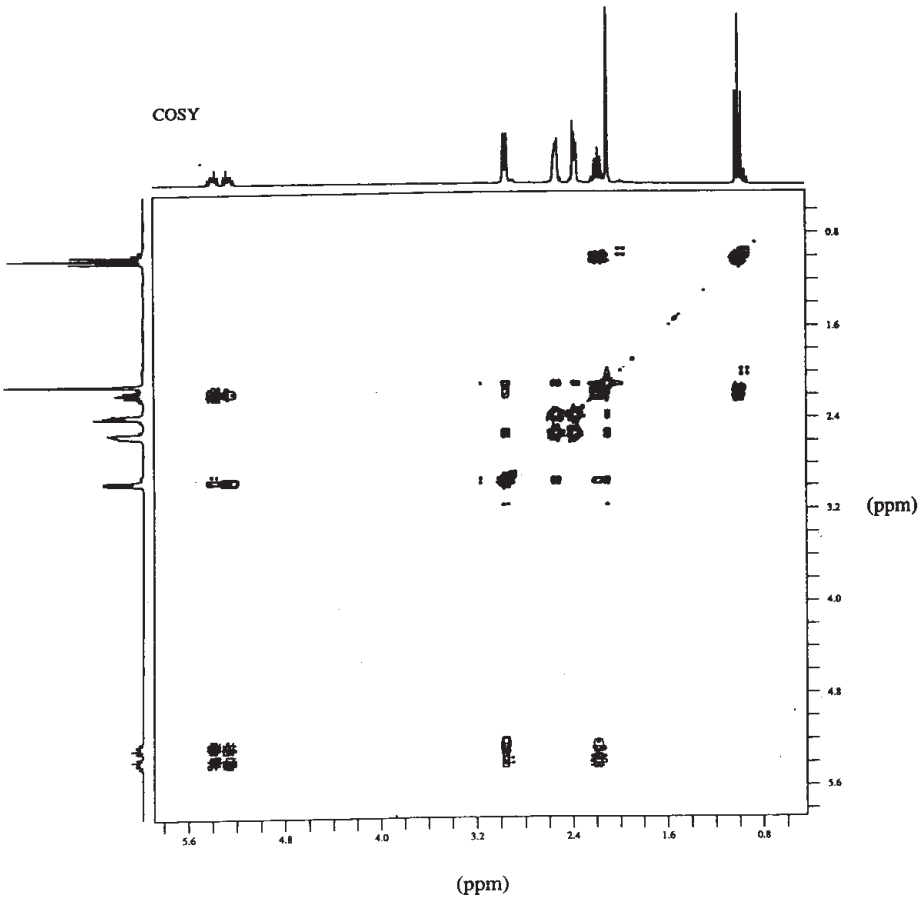


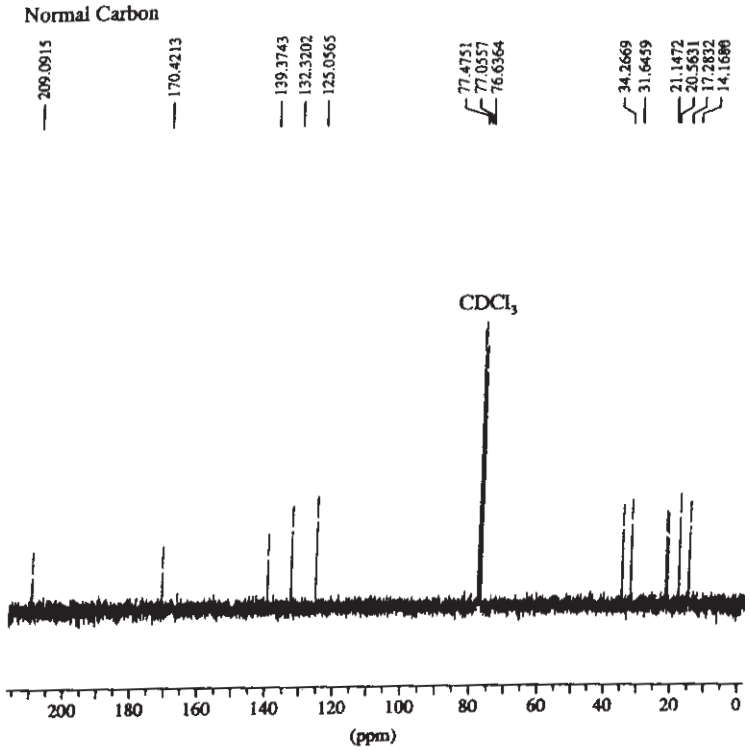
B

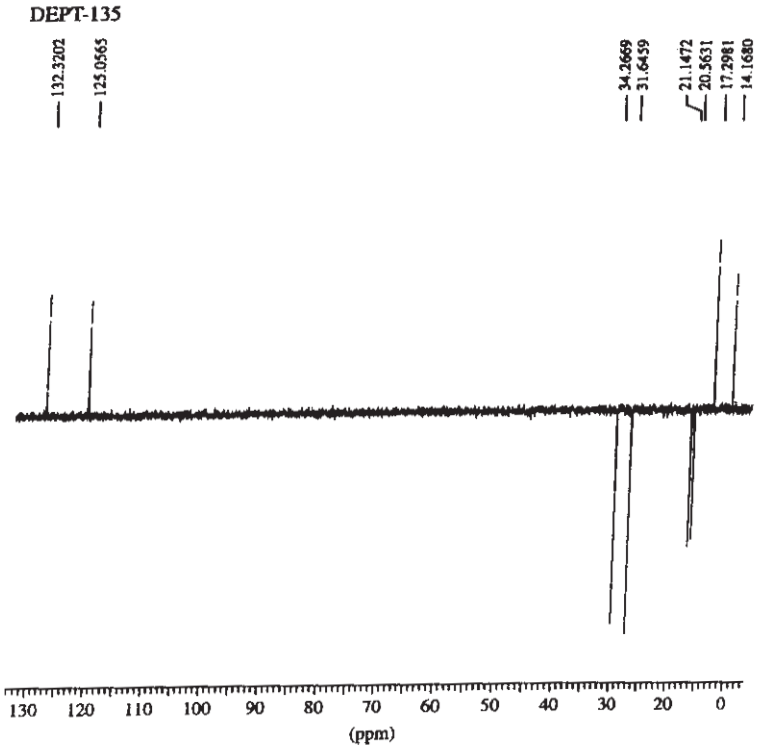
25.8(t, str), 35.9(t), 41.4(q), 50.8(d), 51.5(q) 62.1(d), 65.4(d), 67.5(d), 129.1(d), 130.5(s) 131.0(d), 133.6(d), 167.1(s), 171.6(s).

Q6) A compound exhibits the following spectral properties shown on the attached sheets. Suggest the structure for the compound and explain the spectral data. **[12]**






Normal Carbon
209.0915
170.4213
139.3743
132.3202
125.0565
77.4751
77.0557
76.6364
34.2669
31.6459
21.1472
20.5631
17.2832
14.1680
CDCl3
200
180
160
140
120
100
80
60
40
20
0
(ppm)


DEPT-135
132.3202
125.0565
34.2669
31.6459
21.1472
20.5631
17.2981
14.1680
130
120
110
100
90
80
70
60
50
40
30
20
0
(ppm)

☒☒☒☒

Total No. of Questions : 6] **[Total No. of Pages : 4**

P676

[3623]-44
M.Sc. - II
ORGANIC CHEMISTRY
CH - 352 : Organic Stereochemistry
(2005 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

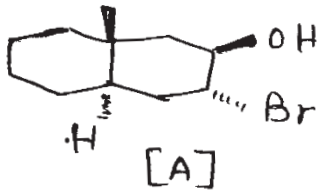
Instructions to the candidates:

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 sheets.***

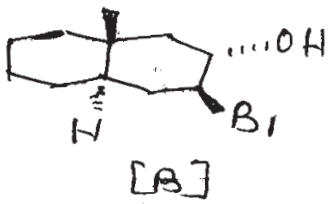
SECTION - I

Q1) Answer any four of the following : **[16]**

a) Which of the following two compounds (A and B) would form an epoxide on treatment with base?



[A]



[B]

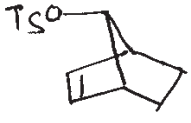
b) Reduction of camphor with LAH gives mainly isoborneol. Explain with stereostructures.

c) Draw the stereostructures for the most stable and least stable conformations of per hydroanthracene. Give nomenclature of these isomers.

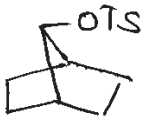
d) Anti-elimination occurs readily for cis but not for trans-1-bromo-4-(1, 1-dimethylethyl) cyclohexane. Explain.

e) Relative rate of acetolysis for the following compounds are mentioned below.

10^{11}



10^{4}

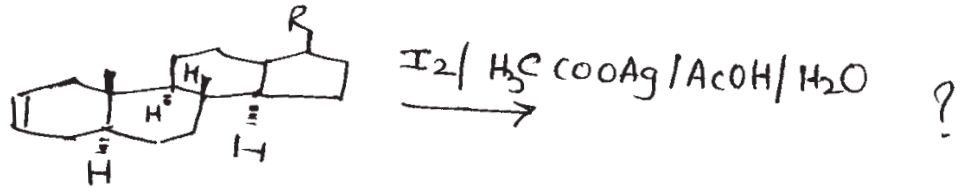


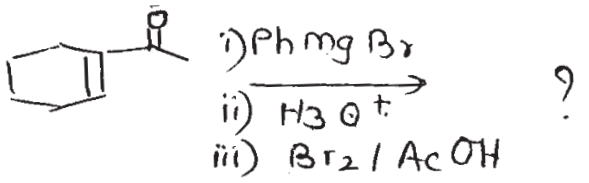
1.

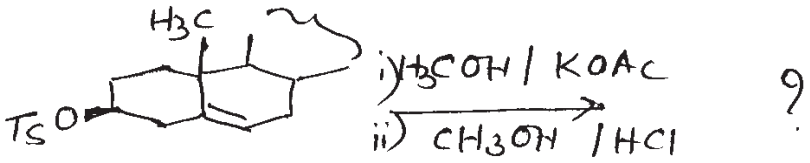
explain.

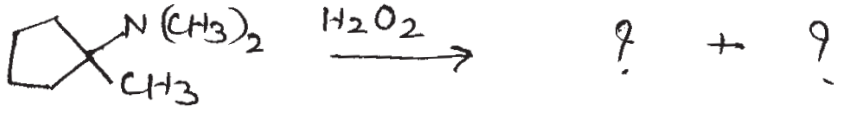
P.T.O.

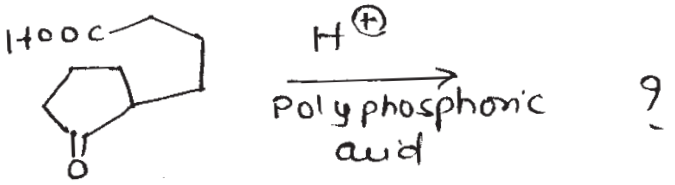
Q2) Predict the product/s in any four of the following and explain the stereochemical principles involved. Justify. **[12]**

a) 

b) 

c) 

d) 

e) 

Q3) Explain <u>any three</u> of the following : **[12]**

a) 2-alkyl keto effect.

b) I-strain.

c) Stereostructures and stability of conformers of bicyclo [3, 3, 1] nonane.

d) Effect of angular methyl group in stability of cis-and trans-decalins.

SECTION - II

Q4) Answer <u>any three</u> of the following : **[12]**

a) Explain the following term :

i) Plane curve.

ii) CD.

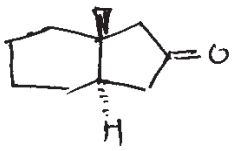
b) Explain the stereochemistry of C_6 & C_{13} in dihydroisocodin.

c) Draw the structure of Enhydrin. Give the reaction sequence of enhydrin with diazomethon. How these reactions help to prove transfusion.

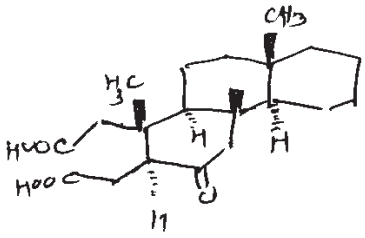
d) Explain the stereochemistry of C_8 - C_9 bond any C_3 - Vinyl bond in quinacidine.

Q5) a) Using Octant rule predict the sign of cotton effect (Any two) : **[6]**

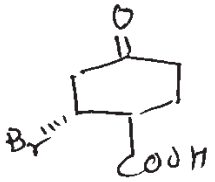
i)



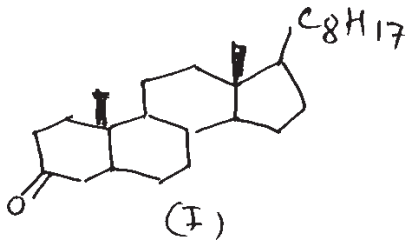
ii)



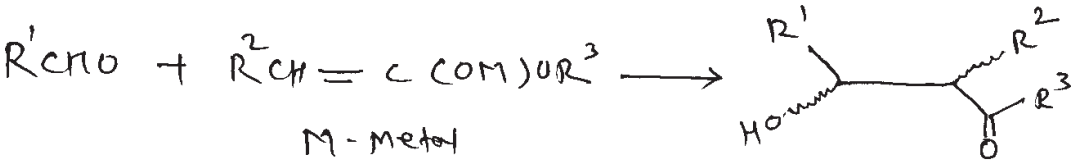
iii)



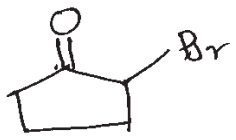
b) Bromination of 2-α-Methyl cholestane-3-one(I) yield 2-bromo compound, which showed –ve cotton effect and bothochromic shift in uv. Also the this 2-bromo compound do not show any change in carbonyl frequency. Determine the position of bromine in the compound. **[6]**

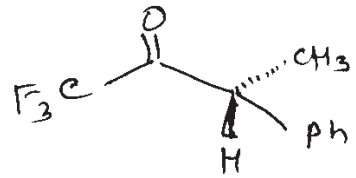


Q6) a) Explain the stereochemistry of the major product and draw transition state in the following aldol condensation between Z-enolate of an ester and aldehyde. **[4]**

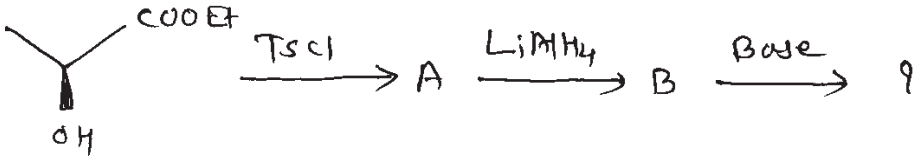


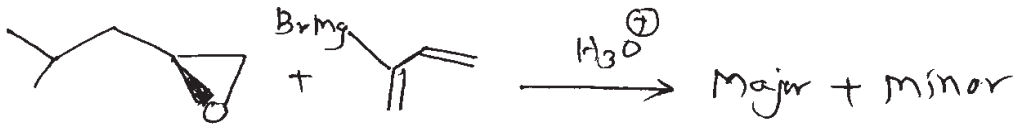
b) Give Re and Si faces of following compound **[3]**

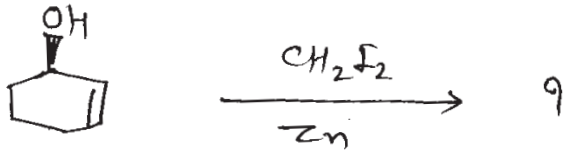


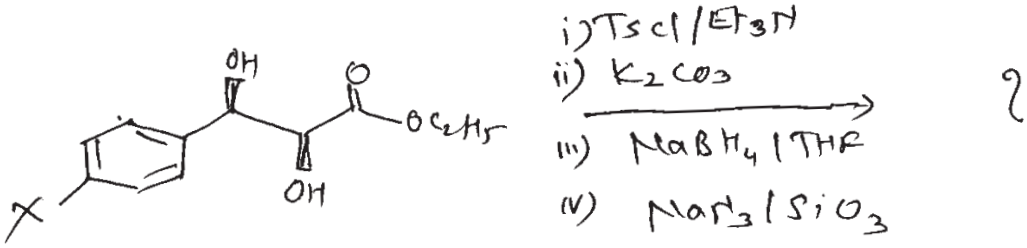


c) Predict the product/s and write stereochemistry of the following reaction (Any Three) : **[9]**

i) 

ii) 

iii) 

iv) 

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Total No. of Questions : 6] **[Total No. of Pages : 4**

P677

[3623]-45
M.Sc. - II
ORGANIC CHEMISTRY
CH - 353 : Heterocyclic Chemistry, Photochemistry and Free Radicals
(2005 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

Q1) a) Explain any three of the following : **[6]**

i) Imidazole has pKa = 7 and thiazole has pKa = 2.5

ii) 1-Aminoquinoline on diazotisation gives 1-quinolone.

iii) Pyridine-2-carboxylic acid undergoes easy decarboxylation than benzoic acid.

iv) Furan can be obtained from Xylose (Pentosans).

b) Write notes on any two of the following : **[8]**

i) Nenitzescu indole synthesis.

ii) Hantzsch pyrrole synthesis.

iii) Use of thiourea in Heterocyclic synthesis.

Q2) a) How following Heterocycles can be prepared by any method? (any two): **[6]**

i) 2-Carbethoxy benzofuran

ii) 2, 5 - Dimethyl Oxazole

iii) 9-H-Purine

b) Predict the product when the given heterocycle reacts with the respective reagents (any one) : **[4]**

1) Pyridine

i) Conc. H_2SO_4/Conc. HNO_3, 300ºC

ii) $Hg(OAC)_2$/R.T.; 130ºC

iii) $[PhCOO]_2$, Δ

iv) PhCOCl/Pet. ether, –20ºC

P.T.O.

2) Benzofuran

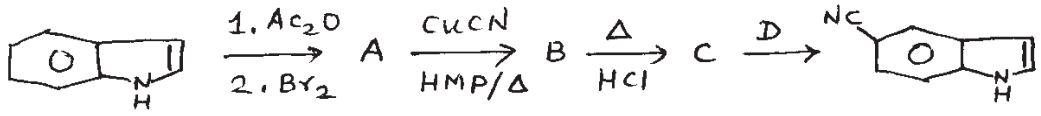
i) n-Buli, ether; DMF

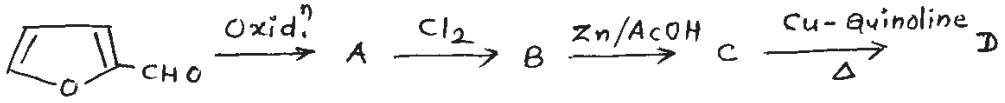
ii) AC_2O, $SnCl_4$

iii) $Cl_3CCOOC_2H_5$, $NaOCH_3$, hexane, 0°C

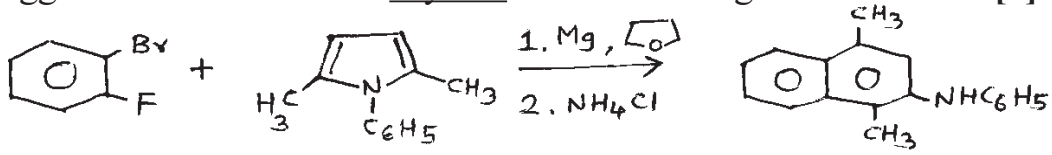
iv) Na, C_2H_5OH

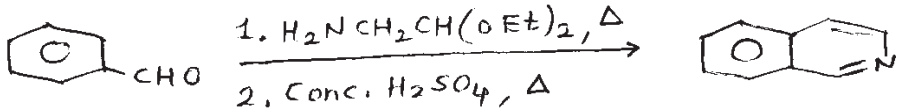
Q3) a) Complete the following reaction sequences by filling the blanks with suitable reagents and products; (any one) **[4]**

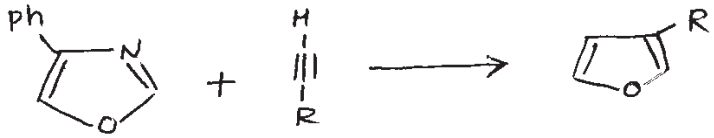
i) 

ii) 

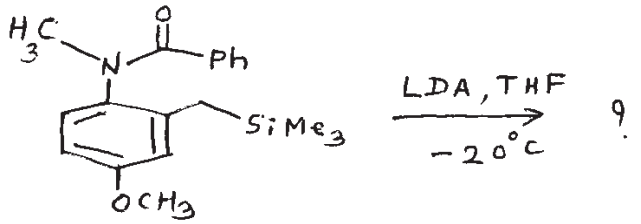
b) Suggest the mechanism for any two of the following : **[6]**

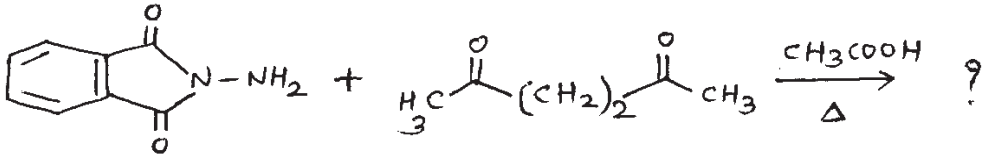
i) 

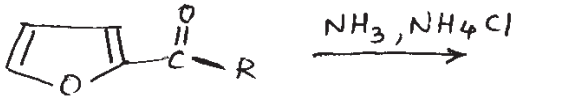
ii) 

iii) 

c) Predict the product in any two of the following : **[6]**

i) 

ii) 

iii) 

SECTION - II

Q4) Write short notes on <u>any three</u> of the following : **[12]**

a) Stability of triarylmethyl radicals.

b) Di–Π Methane rearrangement.

c) Free radical addition reactions.

d) Photo sensitisation and Quenching.

Q5) a) Explain any two of the following : **[6]**

i) Relative rates of free radical chlorination at the various positions in 1-Fluorobutane are as shown below :

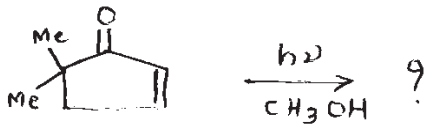
$H_3C - CH_2 - CH_2 - CH_2 - F$

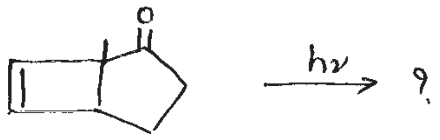
1.0 3.7 1.7 0.9

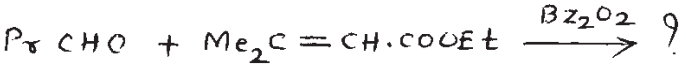
ii) Photochemically induced addition of CF_3I to acrylonitrile gives a mixture of telomeric products whereas addition of the same halide to $CH_2 = CHF$ yields the expected monomeric product.

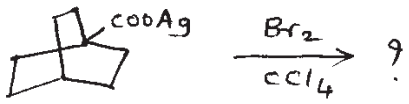
iii) Two ways to prove the existence of an enol form in photoenolisation reaction.

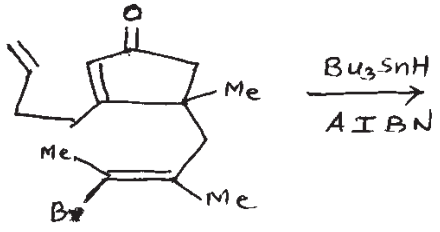
b) Predict the product/products indicating mechanism in <u>any five</u> of the following : **[10]**

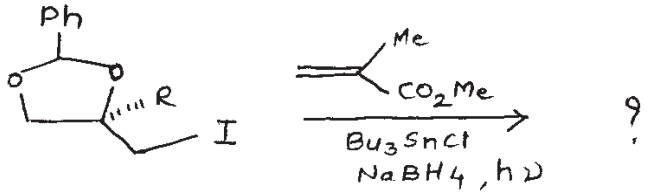
i) 

ii) 

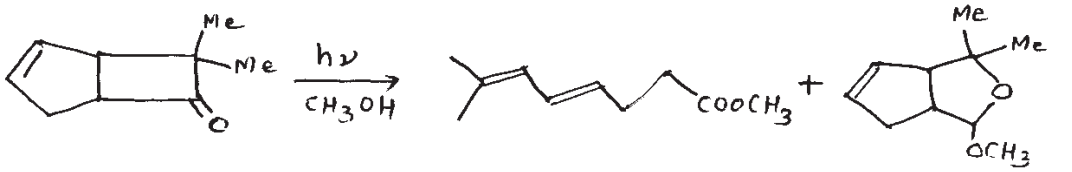
iii) 

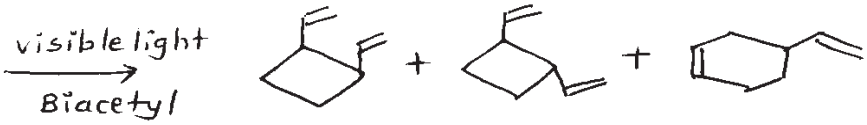
iv) 

v) 

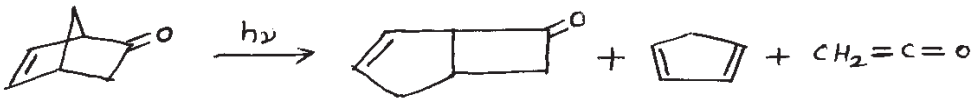
vi) 

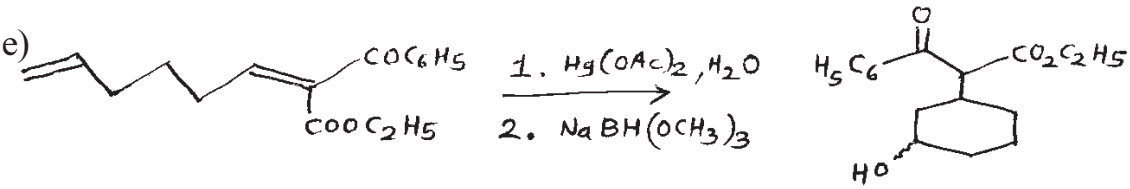
Q6) Suggest suitable mechanism for any four of the following : **[12]**

a) 

b) Butadiene 

c) $Ph(CH_2)_5CH=CH_2$ 

d) 

e) 

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P678

[3623]-101
M.Sc.
PHYSICAL CHEMISTRY
CH - 110 : Physical Chemistry - I (New)

Time : 3 Hours] ***[Max. Marks : 80***

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) Attempt any three of the following : **[15]**

a) Derive the expression for Wmax in the adiabetic expansion of an ideal gas.

b) Derive the Van't Hoff's reaction isochore and give its applications.

c) Write a note on steam distillation and its applications.

d) Explain why the attainment of zero Kelvin temperature is not thermodynamically possible.

e) Explain Clausius inequality.

Q2) Attempt any three of the following : **[15]**

a) State first law of thermodynamics. What are its inadequencies?

b) Define and explain the term azeotropes. Give their types and methods of separation.

c) Sketch and explain the phase diagram for water.

d) Write a note on blackbody radiation and ultraviolet catastrophe.

e) State Heisenberg's uncertainty principle and explain its experimental evidence.

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

a) A nanogram particle (*ng*) travels a km in a millisecond. Find its de Broglie wavelength.

b) Find the degeneracy of the levels for which total energy of a particle in a box is $27x$, where x is the energy spacing factor = $\frac{h^2}{8ma^2}$

c) At 25ºC the density of 50% by mass of ethanol-water mixture is 914 kg/m^3. Find the partial molar volume of ethanol. [Partial molar volume of water = 17.4 cm^3mol^{-1}].

SECTION - II

Q4) Attempt any three of the following : **[15]**

a) Derive the expression for the rate constant of a second order reaction with unequal concentrations.

b) State Arrhenius equation explaining clearly the terms involved in it. How is the energy of activation of a chemical reaction obtained?

c) Derive the expression for the rate constant of enzyme catalyzed reaction.

d) What is a fast reaction? Describe the stopped flow method to study fast reaction.

e) Explain the mechanism of explosive reactions.

Q5) Attempt any three of the following : **[15]**

a) Derive the expression for the velocity constant of the biomolecular reactions on the basis of the absolute reaction rate theory.

b) Explain the effect of ionic strength on rate of reaction.

c) Explain what is Kinetic isotope effect, giving suitable example.

d) What is partition function? Obtain an expression for the internal energy of a molecule in terms partition function.

e) Derive the expression for Fermi-Dirac statistics and comment on the nature of the system for which the statistics is applicable.

Q6) Solve any two of the following : **[10]**

a) What will be the initial rate of a reaction if its rate constant is 10^{-3} min^{-1} and the concentration of reactant 0.2 $moldm^{-3}$. How much of reactant will be converted into product in 200 minutes?

b) Calculate vibrational partition function of

i) molecular hydrogen.

ii) molecular chlorine at 300K, ω for hydrogen = 4405cm^{-1} and ω for chlorine = 565 cm^{-1}.

c) Calculate the rotational partition function of CO at 298K.

Given, I = 14.48×10^{-47} kgm^2, $\sigma = 1$.

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P678

[3623]-101
M.Sc.
PHYSICAL CHEMISTRY
CH - 110 : Physical Chemistry - I (Old)

Time : 3 Hours] ***[Max. Marks : 80***

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	$= 6.022 \times 10^{23} mol^{-1}$
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3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s $= 6.626 \times 10^{-34}$ J s
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10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

Q1) Attempt any three of the following : **[15]**

a) What is photoelectric effect? Give its significance in quantum theory?

b) Explain the de Broglie wave length of a particle. How does it account for the dual nature of matter?

c) Deduce the time independent Schrodinger wave equation. Explain the terms therein.

d) State and explain the Zeroth and First laws of thermodynamics with their significance.

e) Explain the principle, experimental setup and important applications of steam distilation.

Q2) Attempt any three of the following : **[15]**

a) Discuss the sign of free energy change along with magnitude of temperature T, to explain spontaneity of exothermic and endothermic reactions.

b) Define chemical potential. Derive the expression for the change in entropy when two ideal gases are mixed.

c) What is Claussius inequality? How does it lead to the thermodynamic functions G and A?

d) What is Van't Hoff factor '*i*'? How is it related to the degree of dissociation of an electrolyte?

e) Define and explain the terms entropy and free energy.

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

a) Calculate the energy of a particle of mass 2.00×10^{-26}g in a one dimensional box of length 4.00 nm in second exited state ($n = 3$).

b) Henry's constant for CO_2 in water is 167×10^6 Pa. Estimate the solubility of CO_2 in water at 25ºC at a partial pressure of 1.0 bar.

c) Calculate ΔH, ΔS and ΔG when 10.0 ml of water is evaporated at its normal boiling point.
L_V for water = 2.259 kJg^{-1}.

SECTION - II

Q4) Attempt any three of the following : **[15]**

a) What are partial molal quantities? Explain the method of density measurements for determination of partial molal quantities.

b) How are molecular weights of immisable liquids determined by steam distillation?

c) Derive the expression for the velocity constant of a biomolecular reaction on the basis of absolute reaction rate theory.

d) Obtain an expression for the enzyme catalyzed reaction.

e) Write a short note on activation energy.

Q5) Attempt any three of the following : **[15]**

a) Describe the Lindemann theory of unimolecular reaction.

b) Explain the terms initiation, propagation, inhibition and termination. Discuss with suitable examples the phenomenon of chain reaction.

c) Explain the primary salt effect. Derive the expression for the dependence of rate of reaction on the concentration of the salt.

d) Discuss in brief the factor affecting the rate of a reaction in solution.

e) Give a brief account of the various fast reaction techniques used to study reaction in solution.

Q6) Solve any two of the following : **[10]**

a) The CFO radical decay by second-order rate law. If the initial concentration is 2.5×10^{-5} mol dm^{-3}. Calculate its half-life and concentration of CFO radicals after 4 minutes.
Given, $k = 2.25 \times 10^{7} dm^{3} mol^{-1} s^{-1}$.

b) Calculate the frequency factor for a reaction having a rate constant 4×10^{-7} units at 200ºC, Ea = 10kJ mol^{-1}, R = 1.987 cal deg^{-1} mol^{-1}.

c) The enzymatic conversion of substrate at 25ºC has a Michaelis constant 0.035. The rate of reaction is 1.2×10^{-3} MS^{-1}, when the substrate concentration is 0.11M. What is the rate constant of enzymolysis of the initial concentration of enzyme is considered constant.

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Total No. of Questions : 6] **[Total No. of Pages :4**

P679

[3623] - 103

M.Sc. - I

ORGANIC CHEMISTRY

CH - 150 : Organic Reaction Mechanism & Stereochemistry

(2008 Pattern)

Time : 3 Hours] ***[Max. Marks :80***

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.***
4) ***Students admitted 2008 onwards must attempt new pattern (2008 pattern).***

SECTION - I

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

a) Dehydrobromination of meso-1, 2-dibromo 1, 2 diphenyl ethane gives cis-2-bromostilbene while (±) isomer gives trans-2-bromostilbene. Explain.

b) Rate of solvolysis of the following alkyl halides decreases in the following order. Explain.

c) Predict the stereochemical outcome of hydroxylation of maleic and fumaric acids with O_5O_4.

d) 2,6-Di-t-butyl pyridine is a weaker base than either pyridine or 2,6-dimethyl pyridine. Explain.

e) Why α-bromopropionate on treatment with methanol doesnot undergo the normal SN^2 reaction?

Q2) a) Write short notes on any two of the following. **[8]**

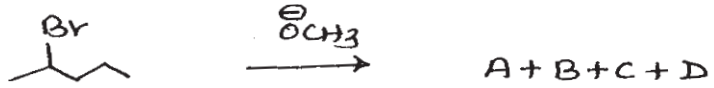
i) Atropisomerism.
ii) Cyclodextrins.
iii) SNi mechanism.

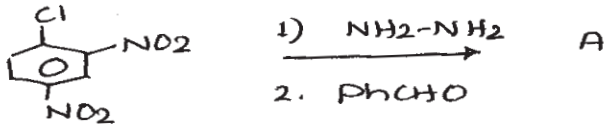
b) Explain any two of the following conversions by giving complete reaction sequence. **[8]**

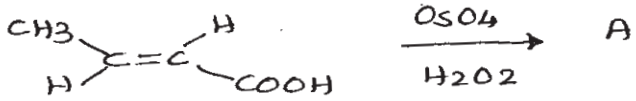
i) Nitrobenzene to p-nitroaniline.
ii) Acetylene to 1-Hexyne.
iii) Toluene to phenyl acetic acid.

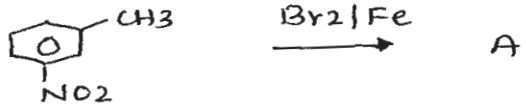
P.T.O.

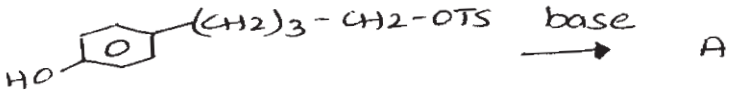
Q3) Predict the product/s in <u>any four</u> of the following and justify your answer. **[12]**

a) 

b) 

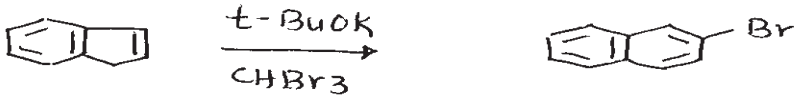
c) 

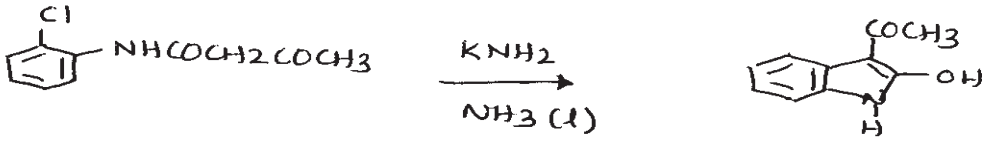
d) 

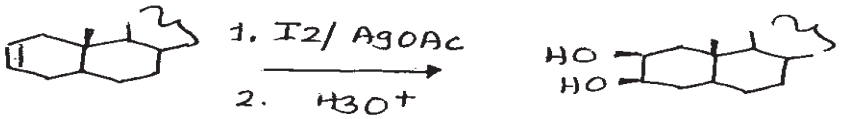
e) 

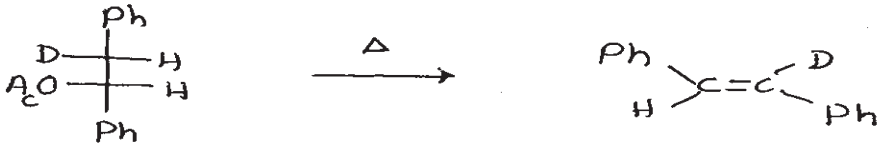
SECTION - II

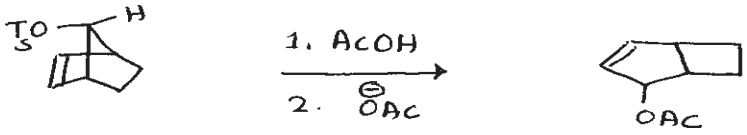
Q4) Suggest mechanism for <u>any four</u> of the following : **[12]**

a) 

b) 

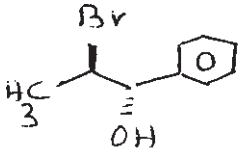
c) 

d) 

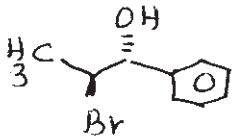
e) 

Q5) Attempt <u>any eight</u> of the following : **[16]**

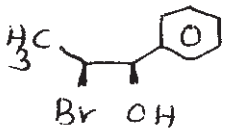
a) What is the stereochemical relationship between the following compounds?



I

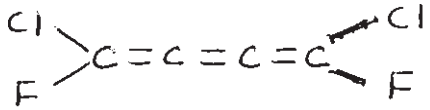


II

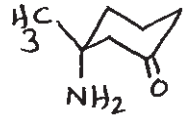


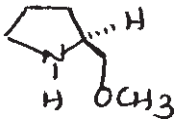
III

b) Which of the following is optically active? Justify.



c) Assign R/S configuration in the following molecules.





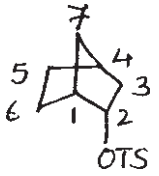
d) From the following compounds A and B, which is a stable compound? Why?

A

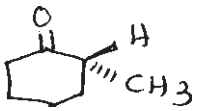
B

e) Why isocyanic acid (H-N=C=O) and cyanic acid (N≡C-OH), have the same conjugate base?

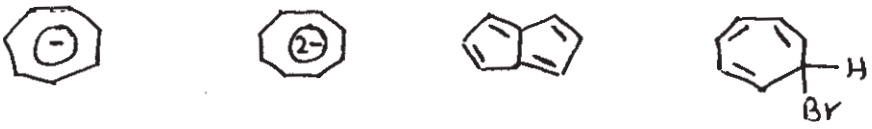
f) Explain, why the following tosylate fails to provide anchimeric assistance of C1– C7 bond.



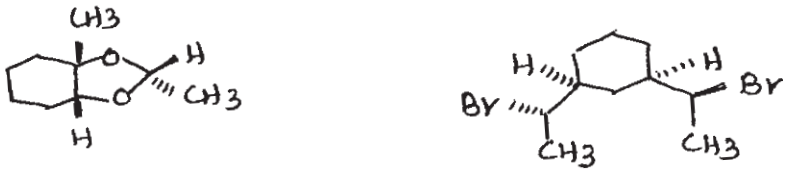
g) Why the following ketone racemizes on treatment with a trace of an acid or a base?



h) Identify aromatic, antiaromatic, non-aromatic and pseudoaromatic from the following compounds.

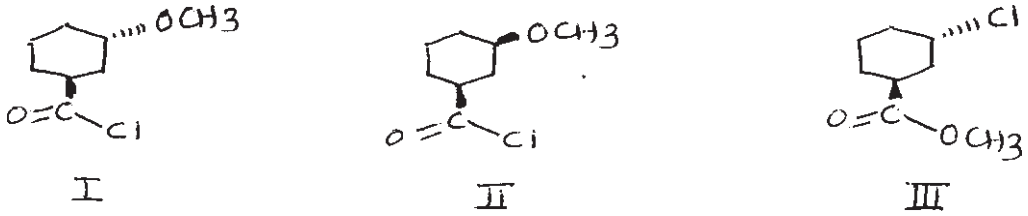


i) Calculate the no. of stereoisomers in the following compounds.



Q6) Attempt <u>any four</u> of the following. **[12]**

a) One of the compounds I and II reacts with Cl^- to give III. Identify the compound and give the mechanism of its formation.



b) The yield of P-Toluedine from the amination of m-bromotoluene is considerably greater than that from the m-chlorotoluene. Explain.

c) Write a short note on phase transfer catalyst.

d) Explain giving mechanism, why the addition of bromine to 2-butene is a stereospecific reaction.

e) Explain. Eicb mechanism with a suitable example.

✪✡✪✡

Total No. of Questions : 6] **[Total No. of Pages :6**

P679 **[3623] - 103**

M.Sc.

ORGANIC CHEMISTRY

CH - 150 : Organic Reaction Mechanism & Stereochemistry

(2005 Pattern)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

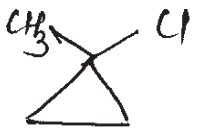
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***
4) ***Students admitted before 2008 should attempt this paper.***

SECTION - I

Q1) Attempt any four of the following : **[16]**

a) Anisole gives higher ortho-para ratio when nitrated with N_2O_5 than with nitrating mixture.

b) Explain, relative rates of solvolysis of the following compounds are



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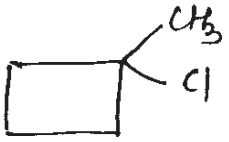

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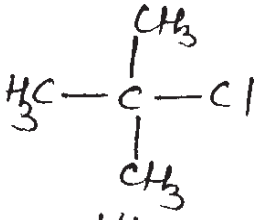


14

c) For synthesis of Ph–O–R which route is preferable A or B.

Route A — $Ph\text{-}\overset{\ominus}{O}$ + R–X ⟶ Ph - O R

Route B — ph–X + $R\text{-}\bar{O}$ ⟶ ph–O–R

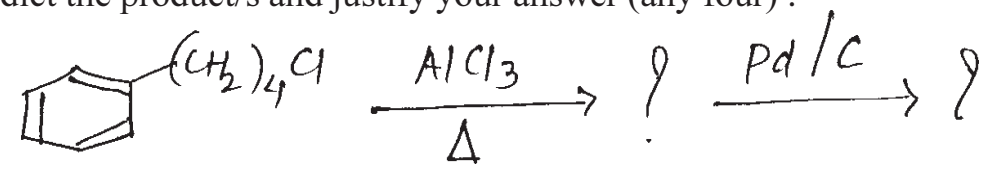
d) Arrange the following nucleophiles in order of increasing nucleophilicity. Justify your answer.

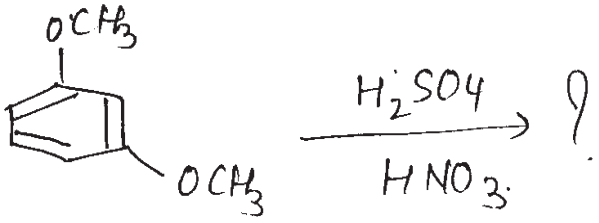
$\overset{\ominus}{O}me$, $\overset{\ominus}{O}-\overset{O}{\overset{\|}{C}}-CH_3$, $\overset{\ominus}{O}$-ph , $\overset{\ominus}{O}H$, $\overset{\ominus}{O}C_2H_5$

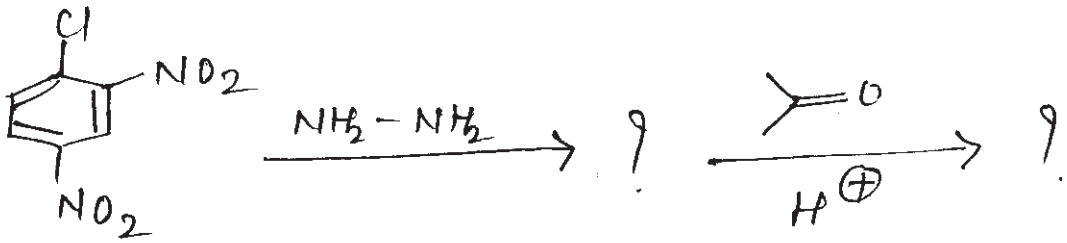
e) Cyclooctatetraene is not aromatic.

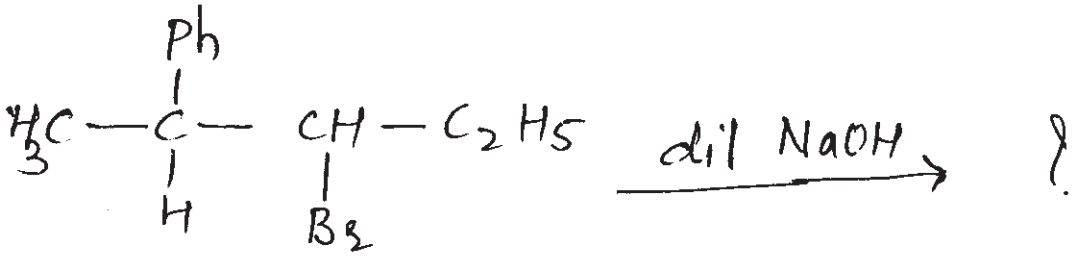
P.T.O.

Q2) Predict the product/s and justify your answer (any four) : **[12]**

a) 

b) 

c) 

d) 

e) 

Q3) Write short notes on <u>any four</u> of the following : **[12]**

a) Non classical carbocations.

b) Hoffman and saytzeff Elimination.

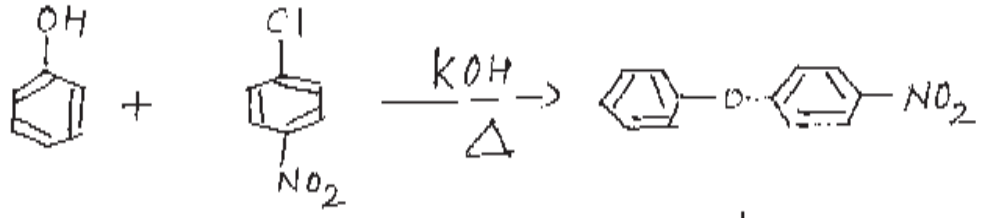
c) Ortho-para effect in aromatic electrophilic substitutions.

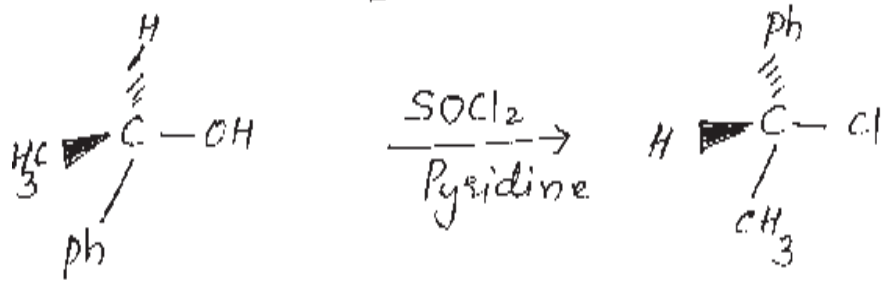
d) Benzyne intermediate.

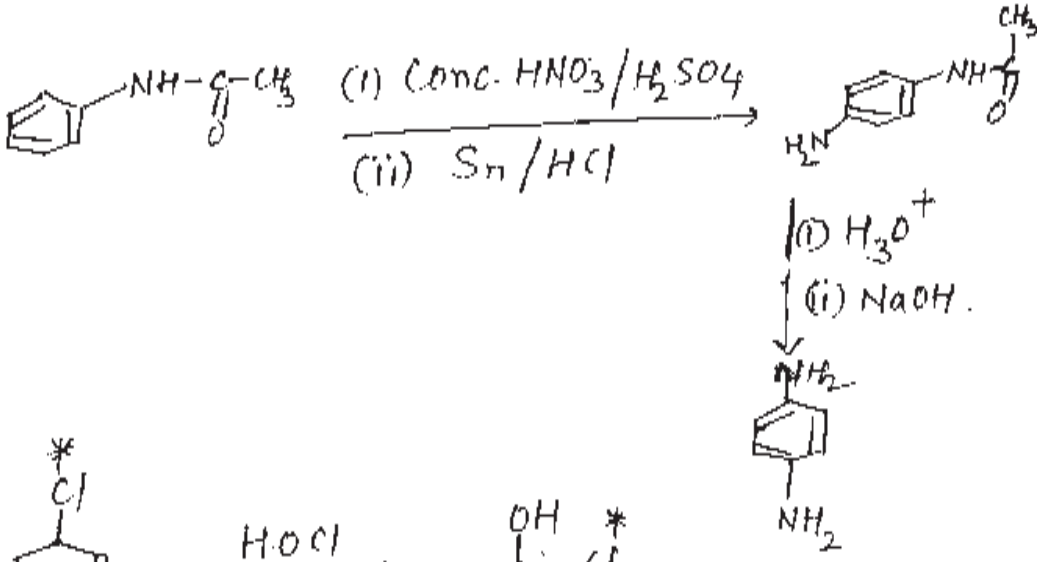
e) Prochiral relationship.

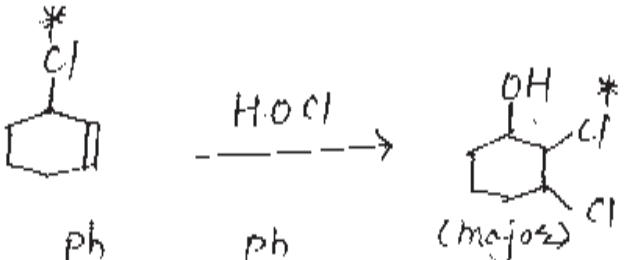
SECTION - II

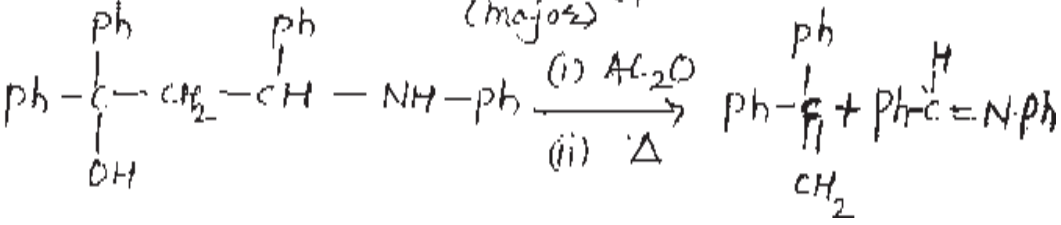
Q4) Suggest the mechanism for <u>any four</u> of the following : **[12]**

a) 

b) 

c) 

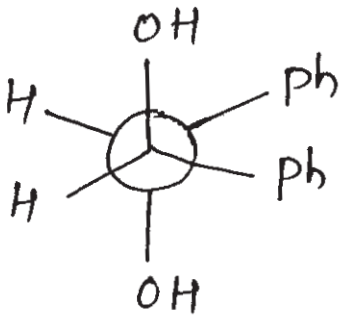
d) 

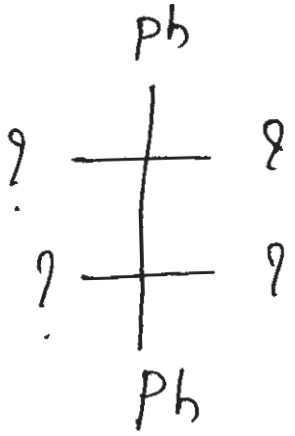
e) 

Q5) Attempt any <u>eight</u> of the following : **[16]**

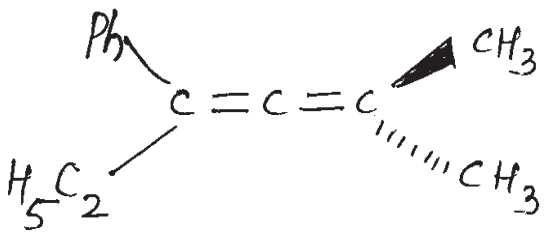
a) The proportion of gauche conformation of Ethylene glycol is more than expected explain.

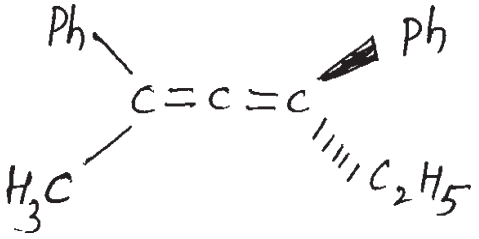
b) Make the conversion from Newman projection into Fischer Projection by writing the correct substituent in place of question marks and assign R/S configuration to chiral centre.





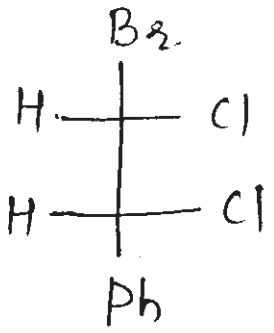
c) Decide from the following pair which is optically active justify.

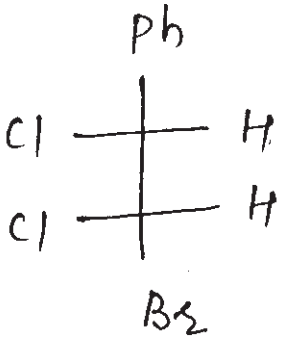


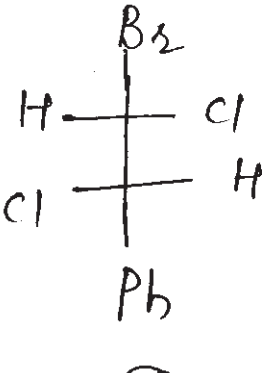


d) Draw cis and trans 1, 2 dimethyl cyclohexane in chair conformation and explain their stability.

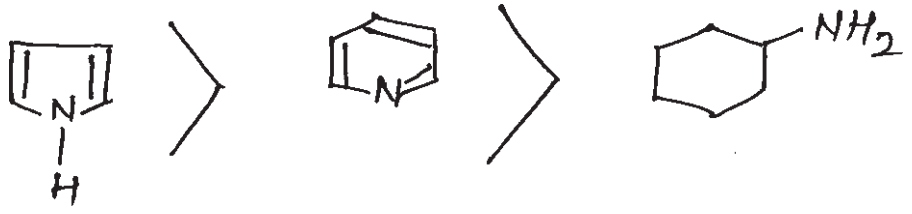
e) Identify the diastereomers.



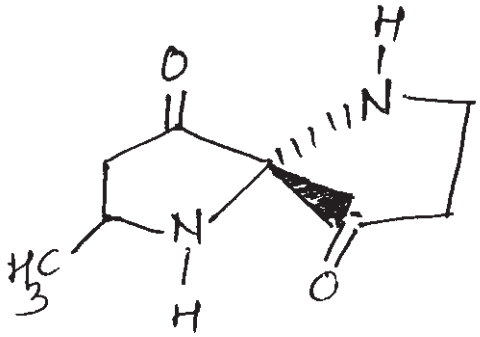


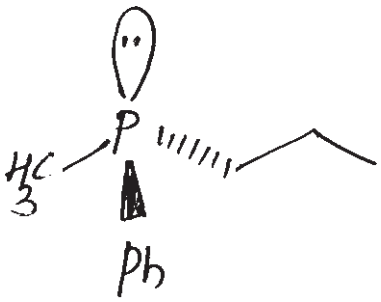


f) Explain the decreasing acid strength in the following compounds.



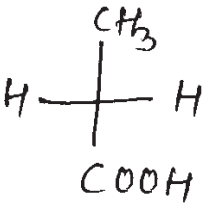
g) Assign R/S configuration to the following compounds.

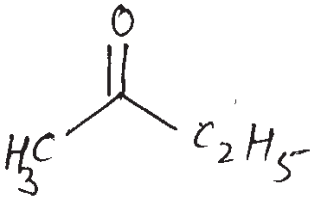


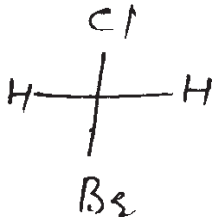


h) Calculate the observed rotation of organic acid having concentration 2gm/ml in 20c.m. tube. Specific rotation of organic acid at 20°C is + 4.36.

i) Assign Pro - R/S or Re/Si faces from the following compounds.

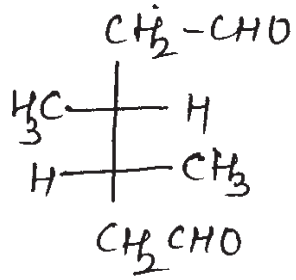




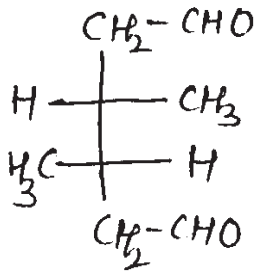


Q6) Answer any four of the following : **[12]**

a) Ozonolysis of  can give



I



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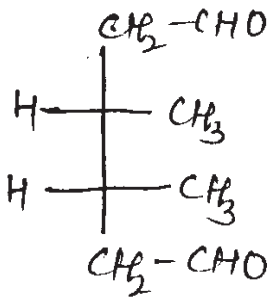


III

b) Explain the following conversion by giving complete reaction sequence.

i) (R) 2-bromobutanol to (S) 2-bromobutanol.

ii) Bromobenzene to Acetanilide.

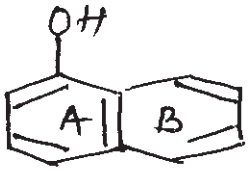
c) Explain prochiral relationship.

d) Distinguish between the following :

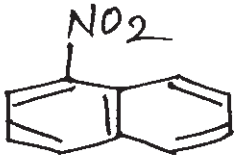
i) Carbene and carbonium ion.

ii) Thermodynamically and kinetically controlled reaction with examples.

e) Nitration of (I) gives product with NO_2 group in ring (A). However nitration of (II) gives product with NO_2 group in the ring (B).



(I)



(II)

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Total No. of Questions : 6] **[Total No. of Pages : 4**

P680

[3623] - 301

M.Sc.

ORGANIC CHEMISTRY

CH - 350 : Organic Reaction Mechanism

(New Course - 2008 Pattern)

Time : 3 Hours] ***[Max. Marks : 80***

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) Write short notes on any three of the following: **[12]**

a) Different ways of making carbene.

b) Isotope labeling in determination of reaction mechanism.

c) Pyridoxal transamination.

d) AAC2 mechanism.

Q2) Attempt any four of the following: **[12]**

a) Explain with suitable example formation of enamine and its synthetic applications.

b) Pyruvic acid reduction by $NaBH_4$ gives racemic lactic acid, but the product of enzymatic reduction by NADH is optically active.

c) ρ value for alkaline hydrolysis of methyl benzoate is 2.39 and the rate for unsubstituted ester is 2×10^{-4}, calculate the rate for m-CH_3 and m-nitro methyl benzoate. How much faster m-NO_2 ester will hydrolyse than m-methyl ester.

Given : $\sigma_m\ CH_3 = -0.07,\ \sigma_m NO_2 = 0.71$

d) Calculate how much more acidic is p-nitrophenol than phenol.

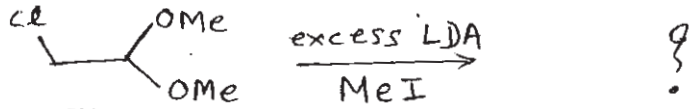
Given $\rho = 2.113\ \sigma_{p\text{-}NO_2} = 0.78$.

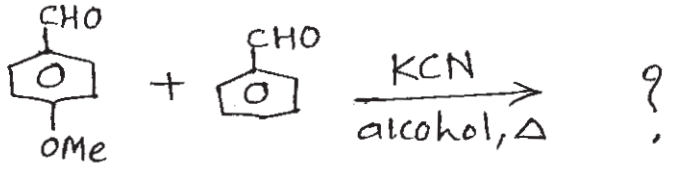
P.T.O.

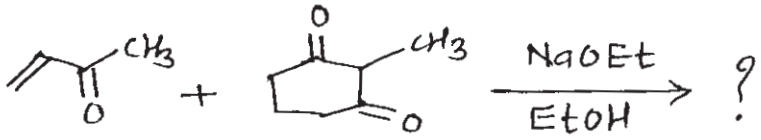
e) Explain with suitable example neighbouring group participation by aryl group and -$COO^{\ominus}$ group.

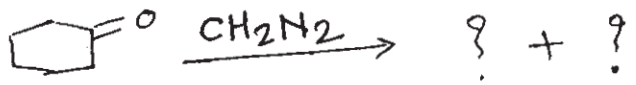
f) Hydrolysis of $PhSCH_2CH_2Cl$ is considerably slower than that of Et SCH_2CH_2Cl.

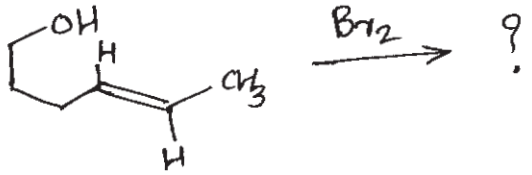
Q3) Predict the products with mechanism for <u>any four</u> of the following : **[16]**

a) 

b) 

c) 

d) 

e) 

SECTION - II

Q4) Explain <u>any four</u> of the following : **[12]**

a) Acid and base catalysed halogenation of carbonyl compounds.

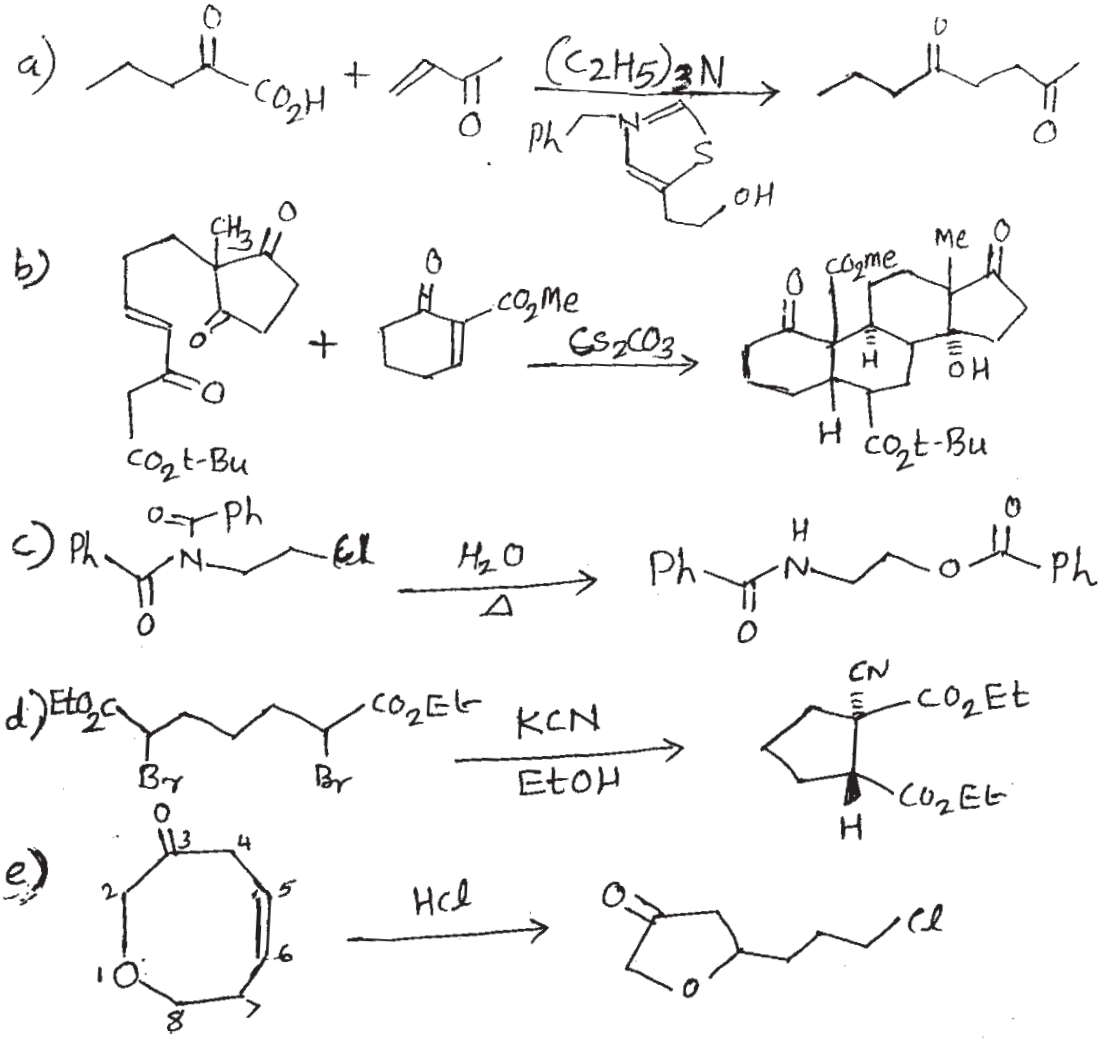
b) Transannular Rearrangements.

c) The formation of diazocarbonyl compounds from diazomethane and tosyl azide with suitable example.

d) Hammett equation is a linear free energy relationship.

e) Role of NAD^+ and NADH with suitable example in biotransformations.

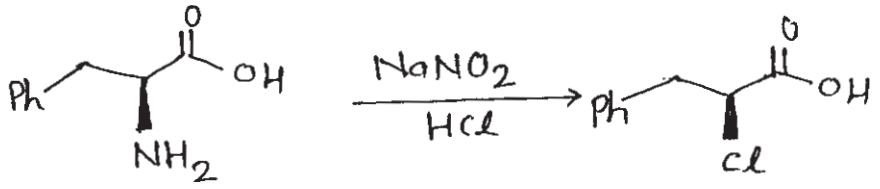
Q5) Suggest the mechanism for <u>any four</u> of the following: **[16]**



Q6) Answer <u>any four</u> of the following: **[12]**

a) Explain the Cis-isomer of 1,2-dimethyl cyclohexane -1,2-diol undergoes Pinacol rearrangement very easily in presence of dil. H_2SO_4 where as the trans-isomer under similar conditions undergo ring contraction.

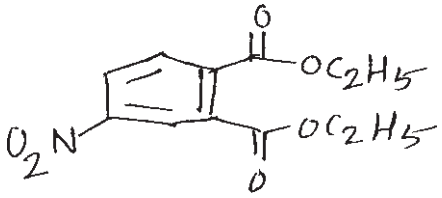
b)



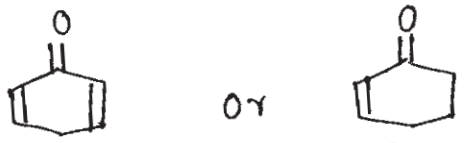
Note the stereochemistry of product and explain the reaction mechanism of reaction.

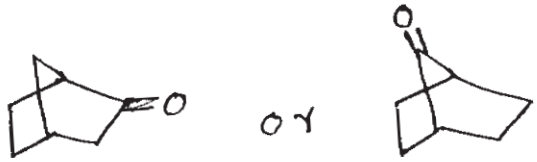
c) Explain malonic acids and β-γ-unsaturated acids undergo decarboxylation on heating.

d) In the following compound, which ester group will undergo saponification first and why. Explain.



e) Predict which member in each of the following pair is the more extensively enolized.

i) 

ii) 

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Total No. of Questions : 6] **[Total No. of Pages :6**

P681

[3623] - 302

M.Sc.

ORGANIC CHEMISTRY

CH - 351 : Spectroscopic Methods in Structure Determination

(2008 Pattern)

Time : 3 Hours] ***[Max. Marks :80***

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.***
4) ***Spectroscopic data : IR, PMR, CMR is not provided.***

SECTION - I

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

a) Straight chain methylesters from C_6 to C_{26} manifest base peak at m/e = 74.

b) Protonated carbons exhibits stronger signals in CMR.

c) NOE is a very good technique to study the stereochemistry of the molecule.

d) 2-Hydroxy tropolone exhibits the following signal in its PMR

7.23, 7.35, 6.99 and 4.58 (exchangeable).

e) Ethylacetoacetate shows nine signals in its CMR.

Q2) Answer any four of the following : **[16]**

a) Predict the structure and justify your answer.

M.F	:	$C_5H_{10}O$
IR	:	3500, 1610 cm^{-1}
PMR	:	1.8 (s, 3H) ; 2.1 (bs, 1H) ; 2.3 (t, J = 6.3 Hz, 2H) ; 3.72(t, J = 6.3 Hz, 2H) ; 4.75 (q, J = 1Hz, 1H) ; 4.85 (bs, 1H)
CMR	:	22, 41, 60, 112, 142,
DEPT 135	:	22, up 41, 60, 112 down 142 absent
DEPT 90	:	22, 41, 60, 112, 142 absent.

P.T.O.

b) Deduce the structure.

M.F	:	$C_8H_{12}O$
CMR	:	23.5 (t), 25.6 (t)*, 40.1 (t)*
		68.7 (s), 72.8 (d), 88.4 (s)
		* Equally strong
Mass	:	124 (M^+), 123, 109, 95, 81, 68, 53, 39.

c) Determine the structure.

M.F	:	$C_{10}H_{15}N$
IR	:	3420, 3349, 1625 cm^{-1}
PMR	:	0.9 (t, J = 7Hz,3H) ; 1.5 (sexlet, J = 7Hz, 2H) 1.6 (quinlet, J = 7Hz, 2H) ; 2.5 (t, J = 7Hz, 2H) 3.5 (bs, 2H, exch.) ; 6.7 (d, J = 8.1Hz, 2H) 6.9 (d, J = 8.1Hz, 2H)

d) Two isomeric compounds with mole formula $C_{10}H_{12}O$ show the following spectral data. Deduce the structures from the given data.

IR	:	1715, 1600 – 1450 cm^{-1}
Isomer A	:	PMR : 1.0 (t, 3H), 2.45 (q, 2H), 3.7 (s, 3H) 7.25 (m, 4H)
Isomer B	:	PMR : 2.1 (s, 3H), 2.75 (t, 2H), 2.85 (t, 2H) 7.20 (m, 5H)

e) Deduce the structure.

M.F	:	$C_{10}H_{15}NO$
UV	:	225 ($\in$ = 7000) shows bathochromic shift on addition of alkali
IR	:	3300 (broad), 1590, 1495, 850 cm^{-1}
PMR	:	1.85 (quinlet, J = 8Hz, 12mm) ; 2.45 (s, 18mm) ; 2.60 (t, J = 6Hz, 12mm) 2.72 (t, J = 6Hz, 12mm) ; 4.85 (bs, exch., 12mm) 6.75 (d, J = 8Hz, 12mm); 7.1 (d, J = 8Hz, 12mm).

Q3) Write note on <u>any three</u> of the following : **[12]**

a) Application of double irradiation technique in NMR.

b) Dirac model of spin - spin coupling.

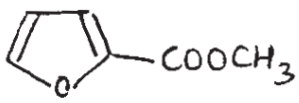
c) Solomon's diagram in NOE.

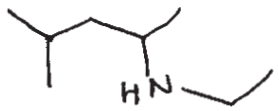
d) Fragmentation pattern of carbonyl compounds in MS.

SECTION - II

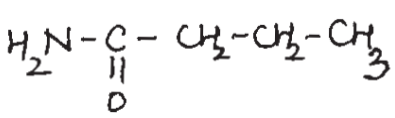
Q4) a) Explain the gensis of the ions for <u>any four</u> : **[8]**

i) cyclohexanol 99, 82, 57

ii)  126, 96, 95, 67

iii)  129, 114, 72(b), 44, 30

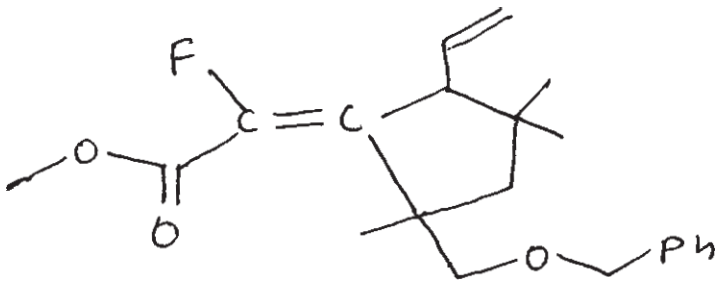
iv)  159, 144, 116

v)  87, 71, 59, 44, 43

b) A ketone $C_{17}H_{34}O$ shows important ions at m/e = 254 (M^+), 226, 212, 198, 184, 169, 141, 113, 85. Assuming that the compound has only four methyl groups. Propose a structure for this compound. Metastable ions indicate that each of the ions m/e 226, 212, 198 & 184 is directly formed from m/e 254. **[4]**

Q5) a) Assign the chemical shifts and comment on the observed coupling constants & Spin - decoupling expt. **[8]**

Note : C - CH_3 and aromatic signals are not given

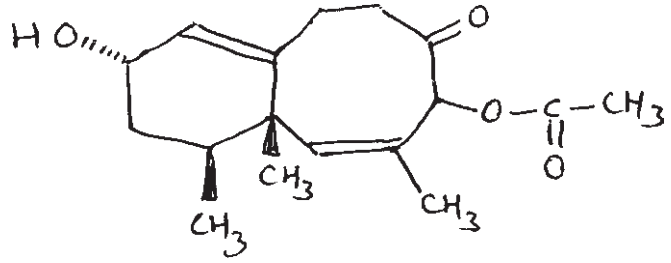


1.47 (d, 13 Hz, 1H) ; 1.82 (d, 13 Hz, 1H) ;
2.88 (dd, 9 & 2Hz, 1H) ; 3.46 (d, 8Hz, 1H) ;
3.63 (s, 3H) ; 3.94 (d, 8Hz, 1H) ; 4.51 (s, 2H) ;
5.07 (dd, 17 & 2Hz, 1H) ; 5.27 (dd, 10 & 2Hz, 1H) ;
5.56 (ddd, 17, 10, 9Hz, 1H)

NOE / Spin decoupling expt.

Irradiation at	change at
2.88 δ	5.56 (ddd) → dd (17, 10 Hz)
1.82 δ	7% increase at 2.88 δ

b) Assign the chemical shifts to various carbon atoms. **[4]**

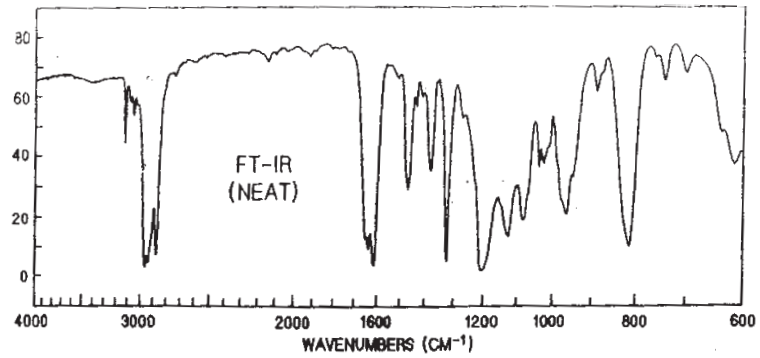


190.8, 170.4, 149.5, 138.7, 127.1, 125.9,
76.2, 63.4, 44.2, 43.8, 35.8, 34.1,
28.3, 20.9, 20.5, 18.1, 16.6

c) An eight carbon compound shows following spectral data. Find the structure and assign the signals. **[4]**

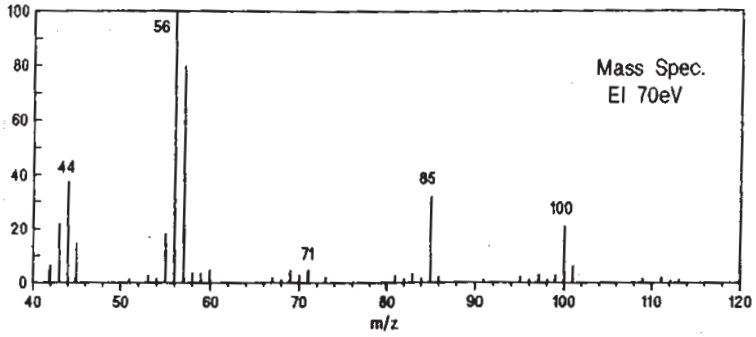
UV : 199 (∈ 19200) 245 (∈ 10900)
IR : 1690, 1600, 690 cm^{-1}
PMR : 4.6 (s, 11mm) ; 7.5 (m, 17 mm)
7.9 (dd, J = 2 & 8 Hz, 11 mm)
Mass : 77, 91, 105(b), 106, 154, 156

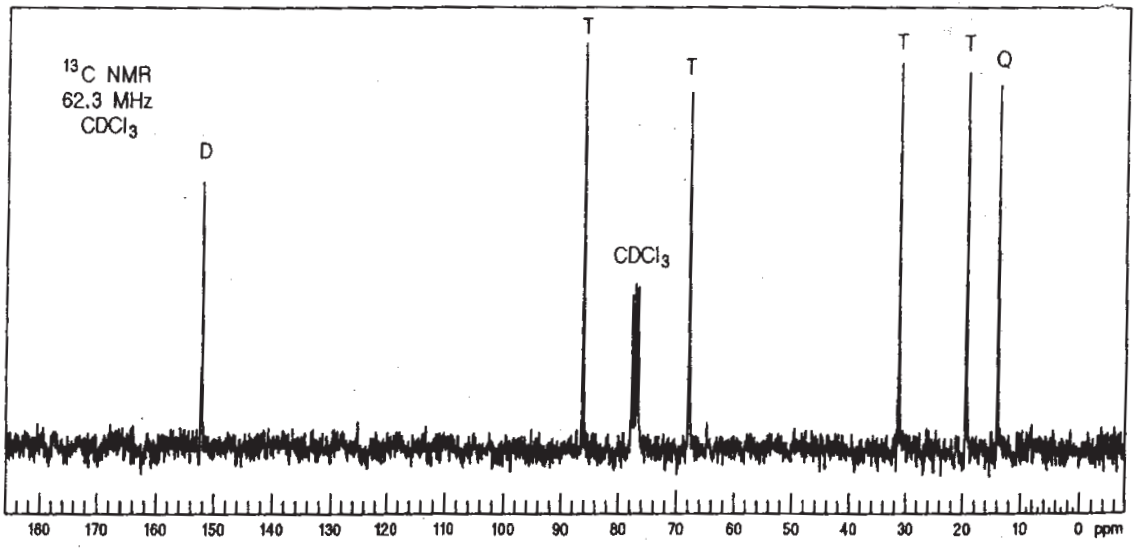
Q6) You are provided with the spectras of a compound. Analyse these spectras and arrive at a structure consistent with the data. Justify your structure. **[12]**

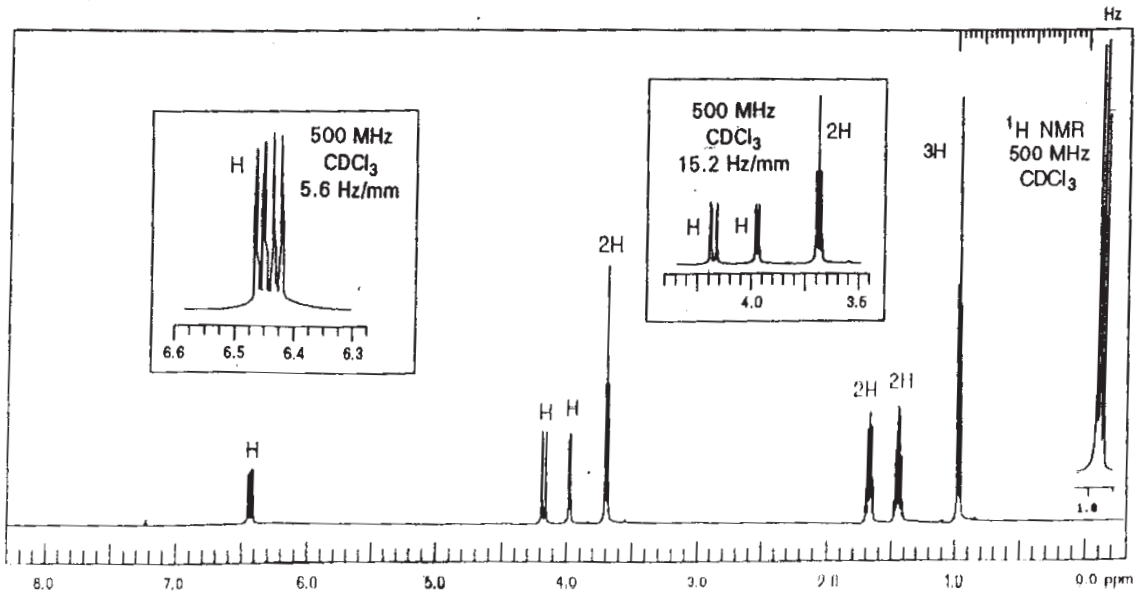


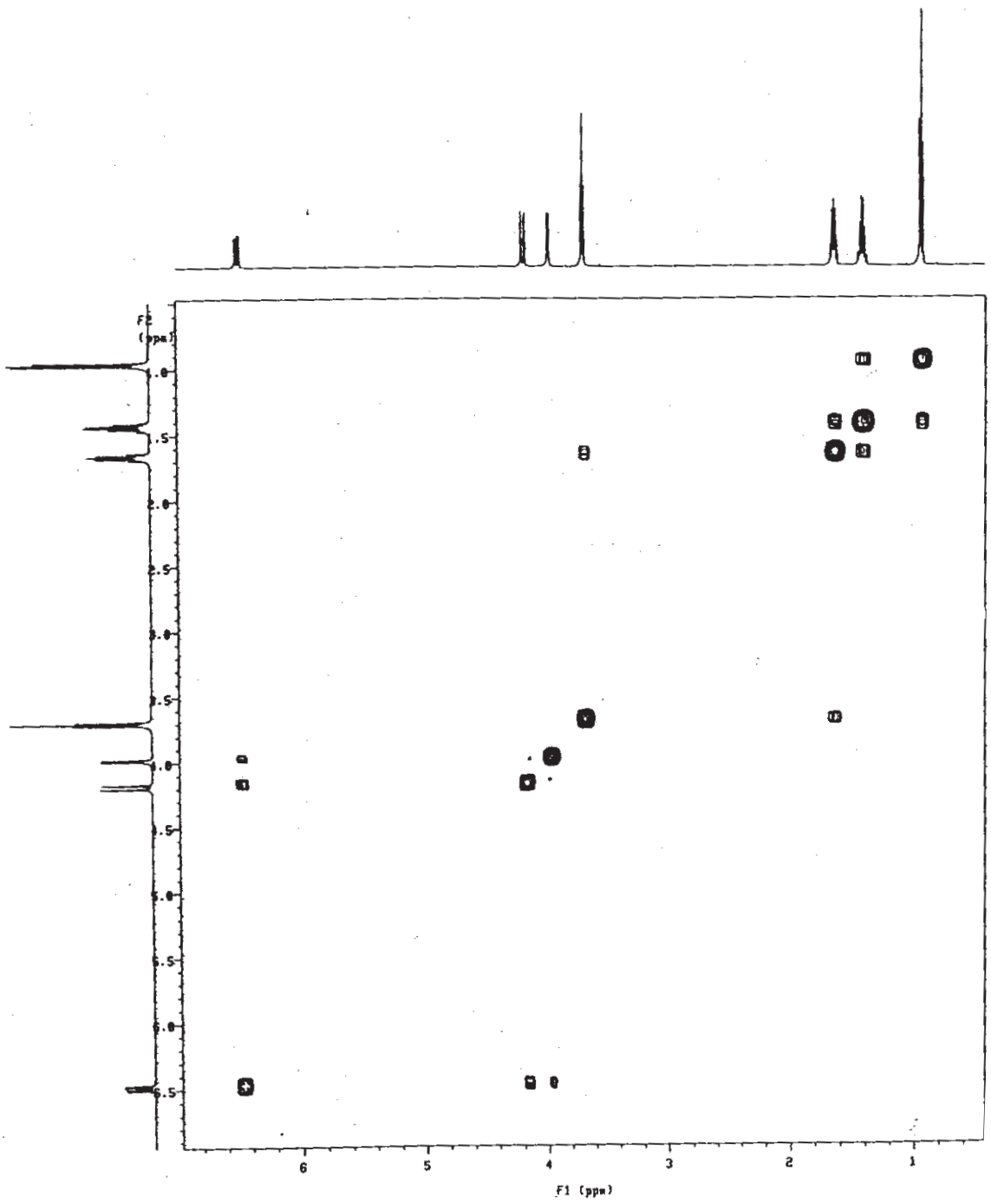
Exact M.S. (EI) = 100.0888

UVλ_{max} = BLANK








F2 (ppm)
F1 (ppm)

✪✡✪✡

Total No. of Questions : 6] **[Total No. of Pages :5**

P683

[3623] - 304

M.Sc. II

ORGANIC CHEMISTRY

CH - 353 : Free Radicals, Photochemistry and Pericyclic Reactions

(2008 Pattern)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

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

SECTION - I

Q1) a) Write short notes on any two of the following : **[8]**

i) Photorearrangement of Benzene.

ii) Sandmeyer reaction.

iii) Radical cyclisation in organic synthesis.

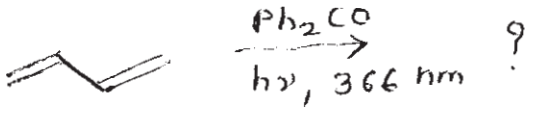
b) Explain any two of the following : **[6]**

i) Free radical chlorination of either n-propylor isopropyl bromide gives l - bromo - 2 - chloropropane and of either isobutyl or tertiary butyl bromide gives l - bromo - 2 - chloro - 2 - methyl propane.

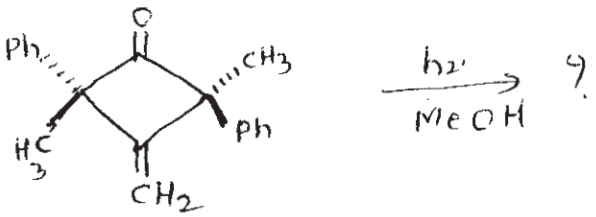
ii) Irradiation of benzophenone in the presence of $(ph)_2$ CH OH gives benzpinacol as the only product.

iii) What is quantum yield? How is it calculated? What is its importance?

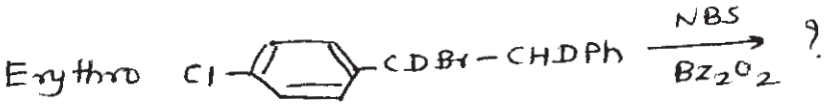
Q2) Predict the product/s indicating mechanism in any seven of the following. **[14]**

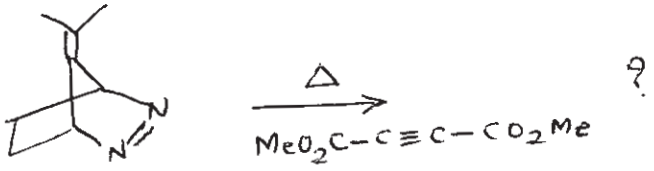
a) 

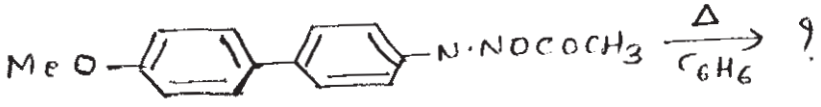
P.T.O.

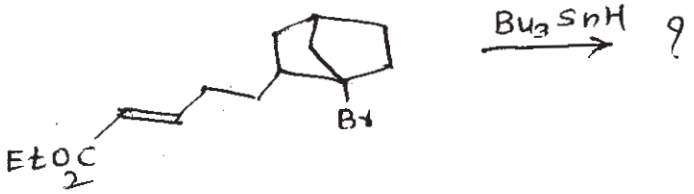
b) 

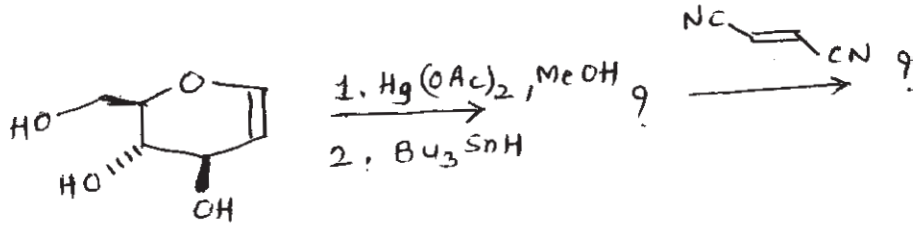
c) 

d) 

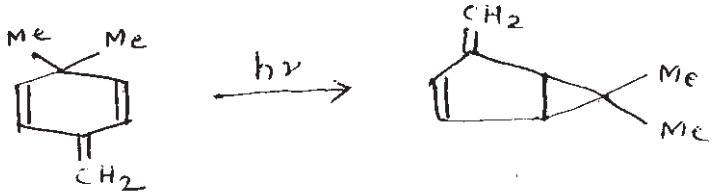
e) 

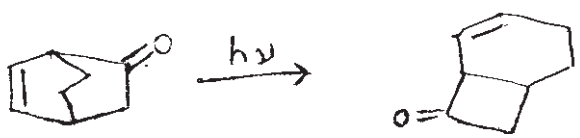
f) 

g) 

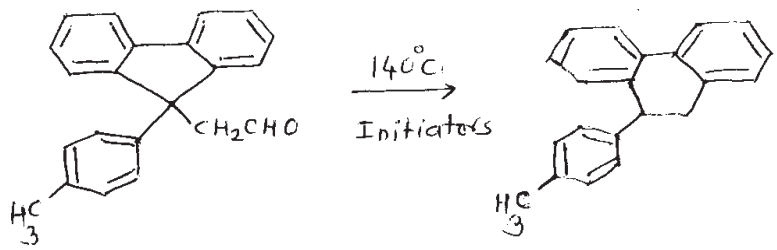
h) 

Q3) Suggest suitable mechanism for <u>any four</u> of the following. **[12]**

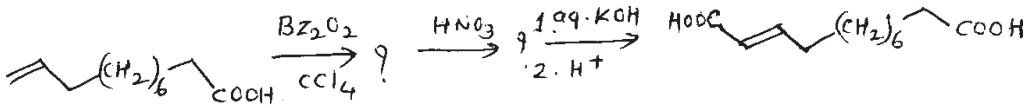
a) 

b) 

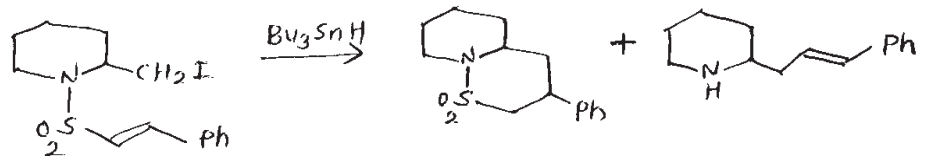
c)



d)



e)

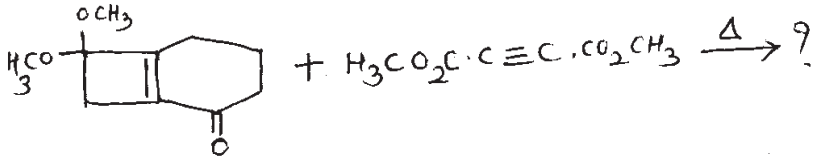


SECTION - II

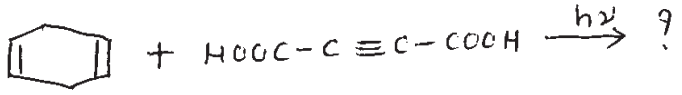
Q4) a) Draw the correlation diagram for $\Pi^{4s} + \Pi^{2s}$ cycloaddition reaction and predict whether this reaction will be thermally allowed or photochemically allowed. **[6]**

b) Predict the product/s and explain the mechanism for <u>any four</u> of the following. **[8]**

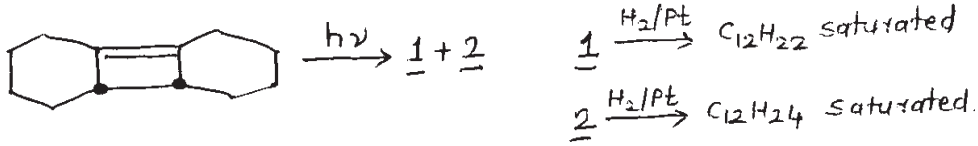
i)



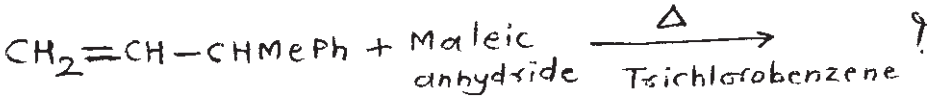
ii)



iii)



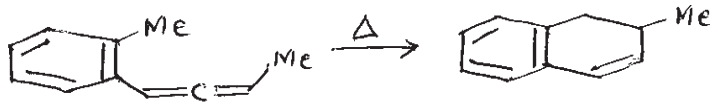
iv)

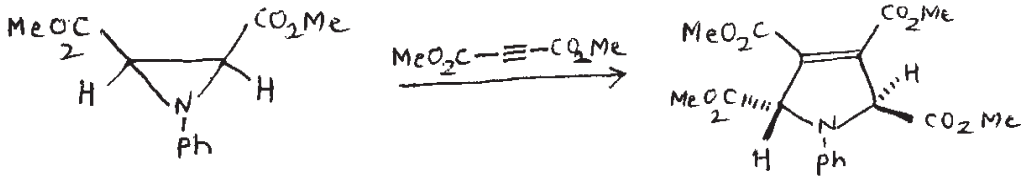


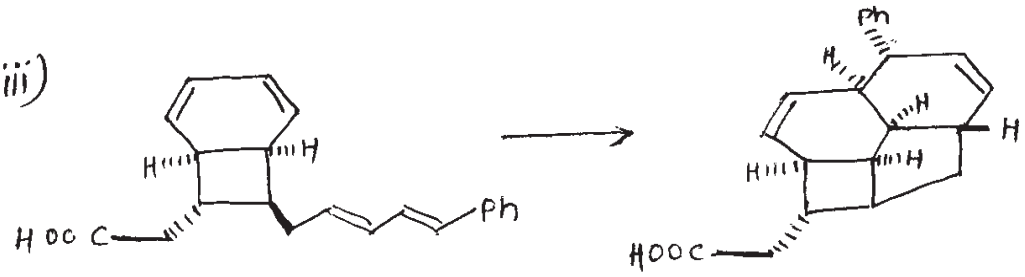
v)

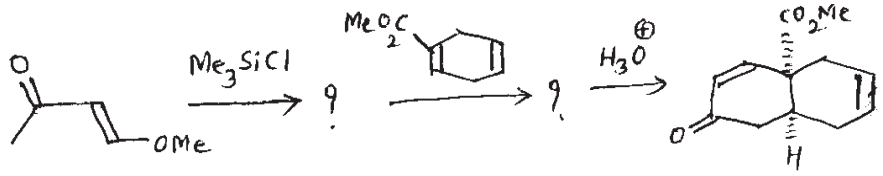
Q5) a) Explain with the help of FMO approach whether antarafacial [1, 5] sigmatropic H shift is thermally or photochemically allowed. **[4]**

b) Explain the mechanism for <u>any four</u> of the following. **[8]**

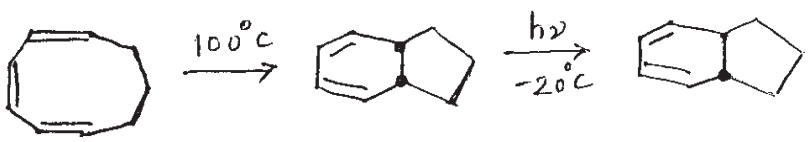
i) 

ii) 

iii) 

iv) 

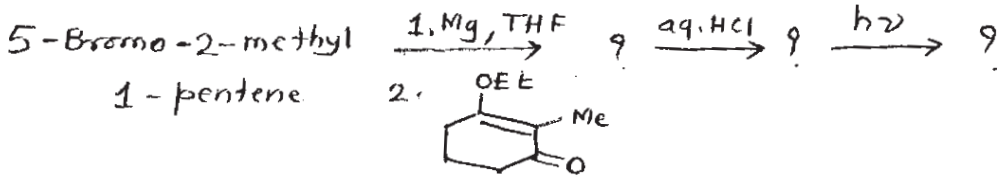
write the intermediate products and explain the mechanism.

v) 

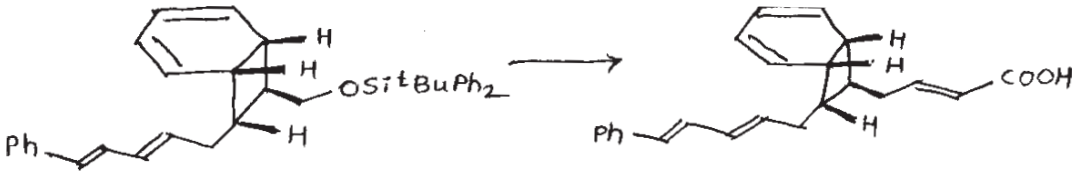
Q6) a) Answer <u>any two</u> of the following. **[8]**

i) Complete the following synthetic sequence indicating all intermediates and reagents required.

ii) Complete the following synthetic sequence indicating all intermediates and the final product.



iii) Complete the following synthetic sequence indicating all intermediates and reagents required.



b) Explain Black's hypothesis for the biosynthesis of Endiandric acids A – D. **[6]**

Total No. of Questions : 5] **[Total No. of Pages : 3**

P684

[3623] - 309
M.Sc.
PHYSICAL CHEMISTRY
CH - 310 : Quantum Chemistry and Solid State Chemistry (New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:-

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Prove that

$$(pq - qp)\,\psi = \frac{h}{2\pi i}\,\psi$$

where $p = \frac{h}{2\pi i} \cdot \frac{\partial}{\partial q}$, q is the operator for position.

b) Find the eigen values for the eigen functions

i) $6\cos 4x$

ii) $3e^{-5x}$ and

iii) $\sin 3x$ for the operator $\frac{d^2}{dx^2}$

c) Deduce the quantum mechanical operator for linear momentum.

d) Formulate the Hamiltonian operators for

i) Hz molecule and

ii) He atom. State the terms involved in each of these.

e) State and prove the variation theorem.

f) Compare the variation and perturbation methods on the basis of principle, precision and convergence.

Q2) Attempt any four of the following : **[20]**

a) Deduce the secular equation for butadiene and sketch the HMO energies for the first four levels.

b) Why is $K_2C_8H_8$ stable but not cycloactatetraene?

c) Explain the basic Hückel approximations. How are there justified.

d) Comment, giving examples on the positive or negative nature of REPE value for a molecule.

e) Write a note on the limitations of the 4m + 2 rule of Huckel.

SECTION - II

Q3) Attempt any three of the following : **[15]**

a) Explain the various types of defects found in crystalline solids.

b) Discuss briefly the occurance of elastic and plastic deformations in solids.

c) Explain the optical properties of semiconductors.

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

e) Write a note on Kirkendall effect.

Q4) Attempt any three of the following : **[15]**

a) What are the different methods to grow crystals from their melts? Describe the merits and demerits of any two such methods.

b) Discuss the various factors that can affect solid-state reactions.

c) Discuss Hall effect.

d) How is the parabolic rate law useful in explaining the mechanism of a gas-solid reaction?

e) Write a note on piezoelectricity in ionic crystals.

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

a) The diffusion coefficient of Li in Ge at 500°C is 10^{-6} cm^2/s. What is the distance penetrated in one hour.

b) The energy to remove a pair of oppositely charged ions from a sodium chloride crystal is 2 eV. The number of Na^+ and Cl^- ions in 1 cm^3 of salt is 10^{22}. Calculate the number of schottky defects present in the crystal.

c) Calculate the relaxation time for Cu.

[At.Wt. of Cu = 63.5, density = 8.92 g / cc]

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P685

[3623] - 310
M.Sc.
PHYSICAL CHEMISTRY
CH - 311 : Nuclear and Radiation Chemistry (New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:-

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt any three of the following: **[15]**

a) Discuss the characteristics of thermal, fast and intermediate reactors.

b) Draw a schematic diagram of nuclear reactor system for generating electric power.

c) Discuss the Bohr Wheeler theory of nuclear fission.

d) Discuss with suitable examples the significance of magic numbers.

e) Discuss the charge distribution on the fission fragments and deduce the expression for the atomic numbers of primary fission fragments.

Q2) Attempt any three of the following: **[15]**

a) Discuss the various features of fermi gas model.

b) Describe variation of capture cross section with neutron energy. Why thermal neutrons have highest capture cross section?

c) Explain proton-proton chain reaction and C-N cycle for nuclear fusion.

d) What are the basic components of an accelerator?

e) Explain the terms : Excitation energy of compound nucleus on cms, moderator, spallation and evaporation.

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

a) Find out the binding energy of α in a compound nucleus formed by the reaction $^{24}Mg\ (\alpha, p)\ ^{27}A1$

Given mass of $^{24}Mg = 23.985\ 045$ amu

$\alpha = 4.002\ 60$ amu

$^{28}Si = 27.9763$ amu

b) Calculate the fission energy, barrier energy and activation energy for symmetric fission of $^{114}_{50}Sn$.

Given : mass of $^{114}Sn = 113.9030$ amu

$^{57}Mn = 56.9383$ amu

c) Calculate the approximate critical dimension of ^{239}Pu reactor to function in a steady state (k = 1.04). Given : the migration area of this reactor is 0.032 m^2 in the case where the reactor is of a cubical shape.

SECTION - II

Q4) Attempt any three of the following: **[15]**

a) Discuss the role of pulse height analyzer in a scintillation counter & explain its working.

b) Explain the role of cupric ions in ferrous sulphate-cupric sulphate dosimeter.

c) Discuss the mechanism of annealing in Szilard-Chalmer's reaction.

d) Discuss the principle of PIXE technique. What are the advantages of this technique?

e) Describe various modes of nuclear retention.

Q5) Attempt any three of the following: **[15]**

a) What is personal dosimetry? Describe the working of quartz fibre dosimeter.

b) Enlist various natural & manmade sources of radiations.

c) Discuss the various stages of interaction of radiation with biological cells.

d) Discuss the somatic effects of acute radiation exposure.

e) Explain the terms : MPD, intrinsic semiconductor, recoil energy and efficiency of detector.

Q6) Solve any two of the following: **[10]**

a) Find out the thickness of lend required to reduce the activity from 15000 cpm to 5000 cpm. Given : linear mass absorption coefficient of Pb = 0.57 cm^{-1}.

b) Find out strength of Co - 60 radiation source in C_i if its dose at 2m is 4.0 Gy/h Given E_v = 1330 & 1170 keV.

c) Find out the dose absorbed by methanol in 2h when exposed to gamma radiation in terms of rads. Given : dose absorbed by Fricke solution at same position = 3.2 Gy/min (Z/A) of Fricke solution = 0.553.

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P686

[3623] - 311
M.Sc.
PHYSICAL CHEMISTRY
CH - 312 : Advanced Instrumental Methods of Analysis (New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:-

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt any three of the following: **[15]**

a) State and explain the various types of capture cross-section of a nuclear reaction.

b) Enlist the applications of mass spectrometry.

c) Write a note on pulsed-neutron activation analysis.

d) Why is comparator method preferred over absolute method in NAA technique?

e) What is chemiluminescence? Give its mechanism? Why is the lowest excited state for most organic molecules a triplet rather than a singlet state?

Q2) Attempt any three of the following: **[15]**

a) Draw a neat labelled diagram of magnetic analyzer and explain its working.

b) How are X-rays generated? Explain with a neat labelled diagram.

c) Explain the 'S' route and 'T' route mechanisms for electro chemiluminescence.

d) Discuss briefly the factors affecting the photoluminescence.

e) Discuss the electron microprobe technique.

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

a) 0.5 gm steel sample was analyzed for its molybdenum content. The sample was irradiated in a neutron flux of $10^7 ncm^{-2}s^{-1}$ for 8 minutes. Its activity was found to be 13,450 dpm after a cooling period of 15 minutes. Find out the percentage of molybdenum in steel.

(Given : r = 9.63%, σ = 0.199 barn, $t_{½}$ of $^{101}M_o$ = 4.6 min.)

b) Calculate the magnetic flux density required to focus an ion with $\frac{m}{z}$ 215 on the exit slit of a magnetic analyzer in which the accelerating potential is 6490V and the radius of curvature of the ionic beam at the exit slit is 23.0cm.

c) Find the mass absorptive coefficient at 0.436 nm of an alloy consisting of 76.0 percent Fe, 6.0 percent Ni, 8.0 percent Cu and 2.0 percent Zn. The mass absorptive coefficients for the pure element at 0.436 nm are 610, 715, 760 and 910 cm^2/g respectively for Fe, Ni, Cu and Zn.

SECTION - II

Q4) Attempt any three of the following: **[15]**

a) What is a plasma? State its types. Describe with a neat diagram a typical ICP source.

b) Discuss briefly the applications of ICP-AES technique.

c) State the principle of thermogravimetric analysis (TGA). Explain the factors affecting a TGA curve.

d) Describe with a neat labelled diagram, a typical differential thermal analyzer.

e) Enlist the applications of ESCA.

Q5) Attempt any three of the following: **[15]**

a) What is the principle of coulometry? State its types. Briefly discuss any one type as used for the analysis.

b) Give the applications of coulometry technique.

c) Define the terms, (i) fermi level (ii) binding energy (iii) work function and (iv) recoil energy as used in ESCA.

d) What is voltammetric analysis? Describe different excitation signals used in the analysis.

e) State the principle of hydrodynamic voltammetry. Describe different electrodes used in the technique.

Q6) Solve any two of the following: **[10]**

a) A constant current of 10.0mA passed through a chloride solution for 200 sec. Calculate the weight of chloride reacting with Ag anode.

b) Calculate the binding energy for fluorine if the incident x-ray photon that was used to create the inner-shell vacancy had a wavelength of 834 pm. The work function of the spectrometer was 3.78 eV and the kinetic energy of the measured electron was 670 eV.

c) A thermogravimetric thermal curve was obtained for a sample that contained magnesium sulphate heptahydrate. The mass of the sample was 2.89 mg and the heating rate was 5 k/min. The purge gas was air. A single step was observed in the thermal curve at an onset temperature of 378k corresponding to the formation of magnesium sulphate monohydrate. The mass loss for the step was 0.59 mg. Determine the percentage of $MgSO_4.7H_2O$ in the sample.
[At.Wts : Mg = 24.3, S = 32, O = 16, H = 1]

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Total No. of Questions : 6] **[Total No. of Pages : 3**

P687

[3623] - 312
M.Sc.
PHYSICAL CHEMISTRY
CH - 314 : Polymer Chemistry (New)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:-

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt any three of the following: **[15]**

a) Distinguish between thermoplastic and thermosetting polymers.

b) Describe the secondary bond forces in polymers.

c) Deduce expressions for enthalpy, entropy and free energy of mixing of polymer solutions.

d) Describe the four steps of anionic chain polymerization, with the help of a suitable example.

e) What are copolymers? What are the advantages of copolymers over homopolymers?

Q2) Attempt any three of the following: **[15]**

a) Derive the expression for instantaneous composition of a copolymer. Assume copolymer equation.

b) Discuss the effect of degree of crystallinity on hardness, modulus and permeability.

c) Explain :

i) Tg of poly (methyl acrylate), Poly(ethyl acrylate) and poly (butyl acrylate) are 10°C, –24°C and –54°C respectively.

ii) Poly (Vinyl carbazole) has high Tg (150°C).

d) Explain : Polyethylene is crystalline while a random copolymer of polyethylene and polypropylene is amorphous.

e) Discuss the elastomer forming properties of a polymer.

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

a) 430 g vinyl acetate is copolymerized with 125 g vinyl chloride. Calculate the composition of the polymer formed instantaneously if the monomer reactivity ratios of vinyl acetate and vinyl chloride are 0.23 and 1.68 respectively. (Atomic Weights : H = 1, C = 12, O = 16, Cl = 35.5).

b) The values of reactivity ratios of some monomers are given below.

Predict, giving reasons, the type of copolymer formed,

Case I $r_1 \to 0$ $r_2 \to 0$

Case II $r_1 \to 0$ $r_2 \to \infty$

Case III $r_1 \to \infty$ $r_2 \to \infty$

c) A linear step polymerization is 99% complete. Calculate $\bar{x}_n$, $\bar{x}_w$ and the weight fraction of $\bar{x}_n$ – mers.

SECTION - II

Q4) Attempt any three of the following: **[15]**

a) Discuss the use of TGA and DTA techniques in the analysis of polymers.

b) Describe microscopic analysis for study the polymers.

c) Explain how NMR and ESR spectroscopy useful in analysis of polymers.

d) Describe 'end group analysis' for the determination of molecular weight of polymer.

e) Define viscosity, relative viscosity, specific viscosity, reduced viscosity, inherent viscosity and intrinsic viscosity. How are the constants K and α for a polymer-solvent system determined?

Q5) Attempt any three of the following: **[15]**

a) What is characterization of polymers? Why do we use the term average molecular weight for a polymer? Define $\overline{M}_n$, $\overline{M}_w$ and polydispersity index.

b) Discuss the principle of membrance osmometry.

c) Describe the process of dyeing a fibre.

d) What are different types of spinning techniques? Why is melt spinning preferred over the others?

e) Discuss the kinetics and mechanism in block copolymerization.

Q6) Solve any two of the following: **[10]**

a) A polymer with M = 100000 obeys the Mark-Houwink equation with $K = 1 \times 10^{-4}$ and $\alpha = 0.80$. Huggins constant is 0.33. Calculate the relative viscosity at C = 0.3 *g/dl*.

b) Three samples of polymer are mixed with out reaction. Calculate $\overline{M}_n$ and $\overline{M}_w$ for the mixture.

Sample	$\overline{M}_n$	$\overline{M}_w$	Weight in mixture / g
A	1.2×10^5	4.5×10^5	200
B	5.6×10^5	8.9×10^5	200
C	10.0×10^5	10.0×10^5	200

c) Why are the thermodynamic methods not useful for the determination of molecular weights of polymer samples? If the degree of polymerization in LDPE sample is 1000, evaluate the monomer weight of the sample.

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Total No. of Questions : 4] **[Total No. of Pages :3**

P688

[3623] - 313

M.Sc.

PHYSICAL CHEMISTRY

CH - 315 : Special Topics in Physical Chemistry (New)

Time : 3 Hours] ***[Max. Marks :80***

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) Attempt any four of the following : **[20]**

a) Classify the sensors on the basis of their principle of conversion and the technology of the production.

b) Why are ceramics used in sensors?

c) Explain the dependence of adsorption on temperature in sensors.

d) Write proton condition for $H_2 C_2 O_4$ and NaHS.

e) Write a note on conductimetric sensors.

f) Define the terms selectivity, stability, inhibitor and saturation kinetics as used in catalysis.

Q2) Attempt any four of the following : **[20]**

a) Discuss the influence of the reducing gases and water vapour on the properties of semiconductor ceramics.

b) Calculate the pH and concentration of all ionic species for 0.1 N H_3PO_4. (Given : $Ka_1 = 5.9 \times 10^{-3}$, $Ka_2 = 6.15 \times 10^{-8}$, $Ka_3 = 4.8 \times 10^{-13}$).

c) Write mass balance on potassium and oxalate in 0.2M $K_2C_2O_4$ and charge balance on HCN.

d) Discuss the catalytic cycle for acetal hydrolysis in aqueous acid solution.

e) The pH of a 0.02M solution of a salt of carbonic acid is 6.89. Find the concentration of H_2CO_3, HCO_3^-, CO_3^{2-} in the solution.
(Given : $Ka_1 = 4.46 \times 10^{-7}$, $Ka_2 = 5.62 \times 10^{-11}$).

f) Derive the rate equation for an enzyme-catalyzed reaction.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Write a note on Biomimics.

b) Explain what is active smartness with suitable examples.

c) Explain the method of preparation of nano carbon tubes. What is the use of these tubes in our day to day life?

d) Write a note on aerogel.

e) Discuss the principle of fractional distillation.

f) What is the principle of steam distillation?

Q4) Attempt any four of the following : **[20]**

a) Write a note on atomic force microscope.

b) Discuss the applications of nanoparticles.

c) Write a note on advanced composites.

d) How an intelligent material functions like human brain?

e) Discuss the phase diagram of lead-silver system.

f) Derive Gibbs phase rule.

Total No. of Questions : 4] **[Total No. of Pages : 2**

P828

[3623]-37
M.Sc. - II
INORGANIC CHEMISTRY
CH - 326 : Organometallic Compounds in Synthesis and Homogeneous Catalysis
(Old Course) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Use of log table & calculators are allowed.***
4) ***Figures to the right indicate full marks.***
5) ***At.No: Cr = 24, Mn = 25, Fe = 26, Co = 27, Ru = 44.***

Q1) Answer the following (Any FOUR) : **[20]**

a) What is EAN rule? Do the following compounds obey the $18\bar{e}$ rule.

i) $Co_2(CO)_8$,

ii) $[Cr(\eta^5 - C_5H_5)(\eta^6 - C_6H_6)]$

iii) $Ru(PPh_3)_2(CO)_2$,

iv) $[Mn(CO)_4(NO)]^-$

v) $Fe_2(CO)_9$

b) What are the spectral features in the bonding of carbonyl ligand to transition metals?

c) "Coordinated alkenes are suceptible to nucleophilic attack", justify the statement with suitable reaction.

d) Discuss the bonding interaction in Ferrocene.

e) Explain with the help of appropriate reaction the steps involved in isomerisations of alkenes.

Q2) Attempt <u>any FOUR</u> of the following : **[20]**

a) Explain the typical reactions of $Fe(CO)_5$.

b) What is meant by insertion reaction? Explain in detail a catalytic cycle involving insertion reaction.

c) Differentiate between Fischer Carbene and Schrock carbene.

P.T.O.

d) Reaction of $Ru(CO)_5$ with PF_3 produces a series of complexes of which all but one exhibit IR-bands in the region 2150-1800 cm^{-1}.

e) IR spectroscopy is an important tool to establish the structures of compounds with formula $M(PPh_3)_2(CO)_4$

Q3) Attempt any FOUR of the following : **[20]**

a) Write an account of application of organometallic compounds in agriculture and horticulture.

b) Propose method for converting carbonyl to carbene ligand and acyl ligand.

c) Explain the role of organometallic compounds as protecting agent.

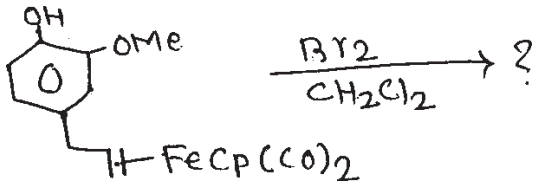
d) Predict the products :

i) $MnCl_2 + Na\ C_5H_5 + MgBrPh \longrightarrow ? + ?$

ii) $Co(\eta^5\ C_5H_5)_2 + PhC \equiv CPh \longrightarrow ?$

iii) $LnCl_3 + NaCp \xrightarrow{THF} ?$

iv) $Mn_2(CO)_{10} + H_2 \longrightarrow ?$

v) 

e) Draw the structures :-

i) $[Mn(\eta^5 - C_5H_5)(CO)_2PPh_3]$

ii) $[V(\eta^5 - C_5H_5)(\eta^7 - C_7H_7)]$

iii) $Os_3(CO)_{12}$

iv) $[Re_2(C1)_8]^{2-}$

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

vi) $[Mn(CO)_4Br]_2$

Q4) Write short notes on : (any FOUR) **[20]**

a) Group V - Organometallics in medicine.

b) Fluxional behaviour of organometallic compounds.

c) Activation of O_2 and H_2 by organometallic compounds.

d) Metal-arene complexes.

e) Elimination reactions.

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Total No. of Questions : 4] [Total No. of Pages : 3

P829

[3623]-38

M.Sc. (Part - II)

INORGANIC CHEMISTRY

CH - 330 : Co-ordination Compounds and Structural Methods

(Old) (Semester - III)

Time : 3 Hours] [Max. Marks : 80

Instructions to the candidates:

1) All questions are compulsory and carry equal marks.
2) Neat diagrams must be drawn wherever necessary.
3) Use of logarithmic tables and calculator is allowed.
4) Atomic numbers: Nb = 41, Re = 75, Co = 27, Pd = 46, Os = 76, Rh = 45, Ni = 28, Mo = 42, Mn = 25.

Q1) a) Attempt any four of the following : **[20]**

i)

ii)

iii)

iv)

P.T.O.

v)

b) Draw the structure of the following compounds.

i) Tetrahydro tetra-μ-carbonyl, decacarbonyl tetraosmium (O).
ii) Bis [dicarbonyl-μ-chloro Rhodium (I)].
iii) Quadro Bis (dimethylglyoximato) Nickel (II).
iv) Tetrahydro tri-μ-carbonyl nonacarbonyl tetra cobalt (O).
v) Quadro-tetrakis [tetracarbonyl osmium (O)]

c) Discuss the various models to account for the anomalous magnetic behaviour for transition metal complexes.

d) Define the terms :

i) Magnetically dilute system.
ii) Magnetically concentrated system.
iii) Anomalous magnetic moment.
iv) In $Na_4[Co(NO_2)_6]$ complex, μ = calculated is 1.73 Bm while μobs = 1.88 Bm. Explain it?

Q2) Attempt any four of the following : **[20]**

a) Write a note on quadrapole bonding?

b) What is mean by mixed valence complexes? Why they shows strong colour intensity? Explain its mechanism and applications.

c) Why are the complexes $K_4[Mo(CN)_8]$ and $K_2[Cl_5Mo\ OMoCl_5]$ diamagnetic?

d) Predict the type of magnetic exchange which occurs via the 90° exchange pathway in the systems d_1-d_1, d_2-d_2, d_3-d_3, d_8-d_8 and d_9-d_9.

e) Why $Mn(CO)_5$ are paramagnetic and $Mn_2(CO)_{10}$ diamagnetic.

Q3) Attempt any four of the following : **[20]**

a) Using selection rules, show the possible transitions in ESR spectrum of methyl radical.

b) Write about instrumentation of cyclic voltometric technique.

c) How Mossbauer spectroscopy is used to determine structural aspects of carbonyl compounds.

d) Give the criteria for reversible electron transfer reactions.

e) ^{31}P NMR spectrum for $HPO(OH)_2$(1) and $H_2PO(OH)$(2) shows doublet for (1) and for (2). Predict structure of (1) and (2).

Q4) Attempt any Four of the following : **[20]**

a) Explain the principle of ESR technique using selection rules show the possible transitions for dueterium (^2_1H). Draw the ESR spectrum for dueterium.

b) Which are the main parameters determined by Mossbauer spectroscopy?

c) How decomposition of Ti (III) EDTA complex at pH 6.9 is confirmed by ESR spectroscopy?

d) Explain the principle and limitations of NQR technique.

e) What is the significance of spin-spin coupling in NMR? How is it useful in structure determination of compounds?

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Total No. of Questions : 4] **[Total No. of Pages : 2**

P830

[3623]-39
M.Sc. (Part - II)
INORGANIC CHEMISTRY
CH - 331 : Inorganic Reaction Mechanism
(Old Course) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Use of log tables and calculators is allowed.***
3) ***Neat diagrams must be drawn wherever necessary.***

Q1) Attempt any four of the following : **[20]**

a) Discuss the mechanism in case of one electron transfer with reference to inner sphere reactions.

b) Explain in brief the base hydrolysis of cobalt (III) ammine complexes.

c) Write a note on Template reactions.

d) Discuss in brief any three important factors, which influence the reactivity of solid state reactions.

e) Which isomer can you obtain from the following two synthetic pathways? Give. Precise explanation and correct structure of the products.

i) $[PtCl_4]^{2-} \xrightarrow{NH_3} ? \xrightarrow{NH_3} ?$

ii) $[Pt(NH_3)_4]^{2+} \xrightarrow{Cl^-} ? \xrightarrow{Cl^-} ?$

Q2) Attempt any four of the following : **[20]**

a) Discuss the relationship between the 'd' electron configuration of the metal and the lability of a complex.

b) What is mixed-order substitution reaction? Explain it with suitable examples.

c) Write in brief about Anation reactions.

d) What are the different applications of photochemistry of co-ordination compounds?

P.T.O.

e) Write a note on, "Mechanism of oxidation of SO_3^{2-} by one electron and two electron oxidants".

Q3) Answer <u>any four</u> of the following : **[20]**

a) Give the difference between SN^1 and SN^2 mechanism.

b) Write a note on, Recemization of trischelate complexes.

c) Explain the mechanism of oxidative addition with the help of a suitable examples.

d) Write a note on, Reactions of co-ordinated ligands.

e) Complete the following chemical equations.

i) $O_3S^{--} + OCl^- \longrightarrow \square + \square$

ii) $[Co(CN)_5Cl]^{3-} + H_2O \longrightarrow \square + \square$

iii) $[Fe(CN)_6]^{4-} + [Fe(CN)_6]^{3-} \longrightarrow \square + \square$

iv) $[Co(NH_3)_5Cl]^{2+} + OH^- \rightleftharpoons \square + H_2O$

v) $[(CO)_5MnCH_3] + L \rightleftharpoons \square$

Q4) Write a notes on any four of the following : **[20]**

a) Polarisation theory.

b) Acid hydrolysis.

c) Non-complementary reactions.

d) Reductive elimination reactions.

e) Fluorescence and phosphorescence.

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Total No. of Questions : 4] **[Total No. of Pages : 2**

P831

[3623]-40
M.Sc. - II
INORGANIC CHEMISTRY
CH - 332 : Metalloproteins and Bioinorganic Medicines
(Old) (Semester - III)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***

Q1) Answer the following (Any Four) : **[20]**

a) What are radionuclides? Which are the important aspect which make a radionuclide suitable for a medical applications. Give examples.

b) Name the major enzymes of Molybdenum and their functions. Explain the reaction involving a molybdenum enzyme.

c) Give an account of the biologically important manganese.

d) Which are the main copper proteins found in living systems? Explain their important features.

e) Explain the use of gold compounds as antianthritis drugs.

Q2) Answer the following (any Four) : **[20]**

a) Explain the mechanism of nitrate reduction. Which enzyme is responsible for this reduction.

b) Name the bioinorganic compounds found in living systems. Draw their structures and mention their functions.

c) Which is the metal responsible for Wilson's disease. Give names and functions of two proteins containing this metal.

d) Which enzyme is present in jackfruit? Write a brief account of this enzyme.

e) How are radionuclides transferred to food stuff? Explain in detail.

P.T.O.

Q3) Explain the following (any two) : **[20]**

a) Write in brief the significant role of each of the elements in biological process: Mn, Co, Zn, Fe, Cu

b) Explain the role of metal complexes as

i) Metallofoot printing agent.

ii) Conformational probes.

c) Explain the main features and functions of the enzyme Xanthin Oxidase.

Q4) a) Draw two structures of each of the following : **[10]**

i) Intercalators.

ii) Dioxygen carriers.

iii) Anticancer drugs.

iv) Manganese clusters.

b) Write notes (any two) : **[10]**

i) Radiopharmaceuticals and bone density measurements.

ii) Uptake of iron.

iii) Tungsten enzyme.

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Total No. of Questions : 4] **[Total No. of Pages : 2**

P832

[3623]-53
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 380 : Pharmaceutical Analysis
(Old Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) Answer any four of the following :

a) Explain the manufacturing hazards in brief.

b) Mention the conditions for adequate storage. Discuss the effect on products of inadequate storage conditions.

c) What are capsules? Describe disintegration test for capsules in detail.

d) What are emulsions? How are they prepared?

e) 1.45 g of aspirin ($C_9H_8O_4$) tablet was dissolved in 50 ml, 0.5 N sodium hydroxide. This solution was titrated with 0.5 N hydrochloric acid using phenolphthalein indicator. It gave 21.2 ml as burette reading and blank titration reading was found to be 50.0 ml. Calculate percentage of aspirin.

Q2) Attempt any four of the following :

a) What are diluents? Explain the role of diluents in tablet.

b) Define the term saponification value. How is it determined?

c) What are syrups? Give preparation method for syrups.

d) Give brief account of douches and enamas.

e) 1.910 g sample containing calcium carbonate was treated with 50 ml, 1 N Hcl. After dissolution, excess Hcl was titrated with 1 N NaOH gave burette reading as 28.5 ml. Calculate percentage of $CaCO_3$.

P.T.O.

SECTION - II

Q3) Attempt any four of the following :

a) What is pyrogen? Explain pyrogen test in detail.

b) How self life of pharmaceutical product is determined?

c) Give experimental procedure for determination of water insoluble matter and sulphated ash from vegetable drugs.

d) Explain major steps involved in developing new drugs.

e) 1.38 g of given sample acetylated and titrated with 0.5 N alcoholic KOH gave burette reading 4.1 ml and blank titration reading as 10.0 ml. When same sample dissolved in alcohol and titrated with 0.1 N NaOH gave burette reading 6.2 ml. Calculate hydroxyl value of compound.

Q4) Write short note on any four :

a) Aerosols.

b) Standardization of Karl-Fischer reagent

c) Limit test for lead.

d) Dry heat sterilization.

e) Media for microbial limit test.

Total No. of Questions : 4] **[Total No. of Pages : 2**

P833

[3623]-54
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 381 : Medicinal Chemistry
(Old Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Define any two of the following terms :
   i) LD_{50} and ED_{50}
   ii) Isosterism.
   iii) Partition coefficient.

b) Give the synthesis of ampicilin.

c) Write short note on chiral drugs.

d) Give brief account on development of new drug.

e) What are drugs? How are they classified on the basis of therapeutical action?

Q2) Attempt any four of the following : **[20]**

a) Define any two of the following terms :
   i) Liphophilicity.
   ii) Soft drugs.
   iii) Anasthetics.

b) Give the method of synthesis of sulphonamides.

c) Explain mode of action of Quinolan antibacterial.

d) Discuss in brief the different theories of drug action.

e) Write short note on chemical assay of Aspirin.

P.T.O.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Explain the mode of action of alkylating agent in treatment of cancer.

b) Give the synthesis of sulphamethoxaxole.

c) Explain chemistry of tetracyclines.

d) With the help of suitable examples give a brief account of cardiovascular drugs.

e) Give the synthesis of Sorbitrate.

Q4) Write short note on any four of the following : **[20]**

a) Immunological assay.

b) Recent development in cancer therapy.

c) Psycoactive drugs.

d) History and development of QSAR.

e) Hormones.

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P834

[3623]-55
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 390 : Electro Analytical and Current Analytical Methods in Industries
(Old Course)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

SECTION - I

Q1) Attempt any four of the following :

a) Discuss briefly factors affecting the limiting current in polarography.

b) Discuss the analytical applications of anodic stripping voltametry.

c) What is meant by hydrodynamic voltametry? Explain the electrodes used for hydrodynamic voltametry and working in detail.

d) A 5 ml unknown amount of Cu (II) ions produces 12.3 μA on DC polarography. By adding 0.1 ml of 1×10^{-3}M Cu(II) ions to the above solution, the new current is 28.2 μA. Calculate unknown amount of Cu(II) ions.

e) What weight of Nickel will be deposited by passing constant current of 2.5 ampere for 57 minutes through a solution of Nickel salt?
(Given : At. Wt of Ni = 58.7)

Q2) Attempt any four of the following :

a) Explain the principle of amperometric titration. Draw & discuss the nature of amperometric titration curve when an electroactive reagent is added into an electroinactive solution.

b) What are the applications of coulometric titration? List the advantages and limitations of coulometric titration.

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c) Explain construction and working of rotating platinum microelectrode. What are advantages of this electrode over D.M.E.?

d) 2.132 gram of ore containing copper is dissolved in acid and it is electrolysed. 8.04 minutes are required for electrolysis using constant current of 2.0 ampere. Calculate the percentage of copper in the ore. (Given: At. Wt of Cu = 63.54)

e) In coulometric titration 20 ml $K_2Cr_2O_7$ solution is titrated with Fe(III) solution, which took 30 minutes to reduce completely; when 225 mA of current was used. Calculate the normality of dichromate.

SECTION - II

Q3) Attempt any four of the following :

a) Write a critical note on thermometric titrations.

b) Explain principle and instrumentation of turbidimetry. Give typical application of this method.

c) Explain the following terms :

i) Flux.
ii) Saturation activity.
iii) Quenching.

d) A 150 mg of sample containing manganese shows on activity 500 dps when irradiated in the neutron flux of 1.5×10^8 n $cm^{-2}s^{-1}$ for 10 hours. Find the percentage of manganese in the given sample.

(Given : Isotopic abundance of ^{56}Mn is 100%, σ = 13.3 b $t_{\frac{1}{2}}$ (^{56}Mn) = 2.58 h.)

e) Turbidimetry was used to examine a sample. The transmittance of sample was 0.368, cell path length was 1 cm and the concentration was 112 mg/L. Determine the turbidity coefficient of sample.

Q4) Attempt any four of the following :

a) Explain principle and applications of spectro electrochemistry.

b) State and explain the principle of isotope dillution analysis. Give its application.

c) Write a note on enzyme catalysed reaction and reaction rate constant.

d) The thermal curve of a 125.7 mg sample that contain mixture of CaC_2O_4: H_2O & thermally stable salt had mass loss of 6.98 mg at 140ºC due to vaporisation of water. Determine the percentage of calcium oxalate in the mixture.
(Given: At.Wt of Ca = 40, C = 12, O = 16, H = 1)

e) Copper(II) forms a 1 : 1 complex with the organic complexing agent in acidic medium, which was studied by kinetic method. Find the concentration of Cu(II) in an unknown solution from the following tabulated data.

Cu^{2+} Conc (ppm)	Rate (s^{-1})
3.0	3.6×10^{-3}
5.0	5.4×10^{-3}
7.0	7.9×10^{-3}
9.0	1.03×10^{-2}
Unknown	7.0×10^{-3}

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Total No. of Questions : 4] **[Total No. of Pages :3**

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[3623] - 56

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 391 : Environmental and Analysis of Industrial Materials

(Old Course)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

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

SECTION - I

Q1) Attempt any four of the following :

a) Give the analytical procedure for the estimation of potassium from fertilizer.

b) What are cosmetics? Give the procedure for the estimation of fatty acid from it.

c) What is portland cement? Give an account of composition of cement.

d) What are colouring constituents of glass? Describe a method for determination of any colouring constituent in the glass.

e) 0.444 g. of nitrogen fertilizer was kjeldhalized and the NH_3 produced was absorbed in 50 ml N/10 H_2SO_4. The excess of acid required 16 ml of N/10 NaOH solution for neutralization. Find the percentage of nitrogen in the fertilizer.

Q2) Attempt any four of the following :

a) What is pigment? Describe importance of pigment volume concentration in surface coating industries.

b) What are deodarants? Discuss the analytical procedure to determine Aluminium from it.

c) Explain the term detergent. Give the analytical procedure for the determination of iron from detergent.

d) A sample of cupronickel alloy weighing 0.620 gm disintegrated completely and the volume was made upto 100 ml in a volumetric flask. In iodometric

P.T.O.

determination of copper 10 ml aliquot of diluted solution requires 20.30 ml of 0.025 N $Na_2 S_2 O_3$ solution for complete reaction. In gravimetric estimation of nickel as $Ni(DMG)_2$, 50 ml of above diluted solution gave 0.4950 gm. ppt. after removal of copper. Calculate the percentage of Cu and Ni in given sample of alloy
[Given : At. wts Ni = 58.70, Cu = 63.54]

e) 0.55 g brass sample was dissolved in a mix of HNO_3 and H_2SO_4. A 250 ml stock solution was prepared. 50 ml aliquot was taken for the determination of Zn as $Zn_2 P_2 O_7$ gravimetrically. The weight of ppt obtained was 0.087 gm. Calculate percentage of Zn in brass
[Given : At. wt. Zn = 65, P= 30.97, O = 15.99].

SECTION - II

Q3) Attempt any four of the following :

a) What is steel? Discuss the analytical method for determination of nickel from steel.

b) Explain the analytical procedure for estimation of Uranium from Monazite sand.

c) Outline the analytical procedure for determination of any two of the following

i) Titanium from Ilmenite.

ii) Copper from Brass.

iii) Iron from Bauxite.

d) A 0.715 g ilmenite ore sample was fused with $K_2S_2O_7$ and the mass was extracted with 20% H_2SO_4. After removal of insoluble matter, the filtrate was diluted to 250 ml. A aliquot of 100 ml was used for precipitation of Ti - Cupferron complex after removal of Fe. The weight of TiO_2 was 0.2250 gm. Calculate the percentage of TiO_2.

e) A sample of phosphate detergent weighing 0.410 g was ignited to red hot to destroy organic matter. The residue dissolved in dil HCl and phosphate was ppted as $MgNH_4PO_4$ - 6 H_2O by addition of Mg^{+2} ions followed by aq. ammonia. The residue after filtration, washing, drying and ignition at 1000ºC weighed. The weight of residue $Mg_2P_2O_7$ was 0.308 gm. Calculate the percentage of phosphorous in the given sample.
[At. wt P = 30.97 , Mg = 24.31, O = 15.99].

Q4) Attempt <u>any four</u> of the following :

a) Explain trickling filter process for waste water treatment.

b) How CO_x is generated. Explain it's hazardous effect on material, how is it controlled?

c) Explain the term dissolved oxygen and discuss the method for estimation of dissolved oxygen from water.

d) How does catalytic converter reduce the air pollution from petrol powered vehicle.

e) Write note on any one

i) Electrostatic precipitator

ii) Actirated sludge process.

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Total No. of Questions : 4] [Total No. of Pages :2

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[3623] - 57

M.Sc. II

ANALYTICAL CHEMISTRY

CH - 392 : Advanced Analytical Techniques

(Old Course)

Time : 3 Hours] *[Max. Marks :80*

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are compulsory and carry equal marks.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Use of non-programable calculator / logarithmic table is allowed.***
5) ***Use of graph paper is allowed.***

SECTION - I

Q1) Attempt any four of the following : **[20]**

a) Draw circuit symbol of the following :
   i) P – n junction diode ii) Zener diode
   iii) Light emiting diode iv) Photodiode.
   v) Photoresistor.

b) State and explain Faraday's law of electrolysis. Give its important applications.

c) Describe the use of operational amplifier as a summing amplifier and obtain the relation for its out put voltage.

d) Explain the band structure of conductor, Insulator and semiconductors. Discuss the important applications of semiconductors.

e) A constant current of 0.400 Amper flowed across resistor affler application of a potential of 50 V. Calculate the resistance and the conductance of the resistor. Determine amount of power that is dissipated in the resistor.

Q2) Attempt any four of the following : **[20]**

a) Explain the use of RC circuit as high pass and low pass filter.

b) Sketch a dual-gate MOSFFT. What are the major advantages of MOSFFT in comparison to JEET.

c) Draw block diagram of digital computer. How it works.

d) Calculate output voltage of the transformer with turns ratio 5 : 1 when voltage of 100 V is applied to the primary coil.

e) Write binary equivalents of number 28 and 38. Add these binary numbers and convert answer into decimal.

P.T.O.

SECTION - II

Q3) Attempt any four of the following : **[20]**

a) Define and explain the following terms with respect to AAS.

i) atomization ii) hydride generator.

iii) nebulizer iv) ionisation sppressor.

b) Explain the principle and working of hallow cathod lamp.

c) Mention various evaluation method used in flame emission technique and discuss with suitable example any of these method.

d) A sample of ash was dissolved in HCl and diluled to 100 ml it was further analysed for calcium by FES and the emission signal was found to 43 unit on the scale. The standard calcium solution gave the following reading

Ca | PPM	20	40	60	80
Signal	30.5	39.6	50.9	61.8

Calculate concentration of calcium in PPM in the sample.

e) Write short note on. Applications of mass spectrometry.

Q4) Attempt any four of the following : **[20]**

a) List the various elements used as microneutrients for the healthy growth of crops. Discuss the suitable method for the determination of boron.

b) Explain the principle of super critical fluid chromatography give its advantages of it.

c) Write short note on" "immuno electrophoresis".

d) Compare RIA and ELISA techniques. Explain merits and demerits of each.

e) The soil sample was analysed for determination of iron at 535 nm in air acetylene flame by AAS. Observations are tabulated below.

Iron in PPM	Absorbance
0.0	0.009
0.2	0.0657
0.4	0.1345
0.6	0.1987
0.8	0.2678
1.0	0.3298
sample	0.1567

Calculate the concentration of Iron in the unknown sample.

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Total No. of Questions : 4] **[Total No. of Pages :2**

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[3623] - 317

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 380 : Pharmaceutical Analysis (New Course)

Time : 3 Hours] ***[Max. Marks :80***

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Draw diagrams, equations wherever necessary.***
4) ***Use of logarithmic table/nonprogrammable calculator is allowed.***

SECTION - I

Q1) Attempt any four of the following :

a) Describe in brief sources of impurities in raw materials.

b) How self life of drug is estimated?

c) What are limit tests? Give limit test for arsenic.

d) Explain a procedure for sampling of vegetable drugs. Give method for preparation of test sample.

e) 0.725 g ascorbic acid sample was dissolved in 25 ml of water and diluted to 100 ml. 10.0 ml of this sample solution was titrated with 0.1 N iodine solution using starch as an indicator. The titration reading was 1.9 ml Calculate percentage of ascorbic acid in given sample.

Q2) Attempt any four of the following :

a) Give the procedure for determination of thiomersal.

b) Discuss preliminary testing in microbiological limit test.

c) Explain desintigration test for tablet in detail.

d) Describe microbiological assay of antibiotics with respect to standard preparation and unit of activity.

e) 0.97 g ibuprofen sample ($C_{13}H_{11}O_2$) was dissolved in 10 ml of alcohol and solution was transfered in 100 ml volumetric flask. It is diluted up to mark using preneutralized alcohol. 25ml from this solution was titrated with sodium hydroxide solution gave burette reading 10.1ml. When 10 ml sodium hydroxide solution titrated with 0.1 N oxalic acid solution gave burette reading 9.6 ml. Calculate percentage of ibuprofen in given sample.

P.T.O.

SECTION - II

Q3) Attempt any four of the following :

a) Discuss 'use of powders as a dosage form'.

b) Explain good manufacturing practices with respect to control of component and drug product.

c) Describe Investigational new drug application in detail for development of new drug.

d) How pharmaceutical industries are controlled by FDA.

e) 0.382 g ointment sample containing benzoic acid ($C_7H_6O_2$) was dissolved in alcohol and titrated with sodium hydroxide solution gave burette reading 11.1 ml. When 10 ml of oxalic acid titrated with sodiumhydroxide gave burette reading 9.2 ml. Calculate percentage of benzoic acid in given sample.

Q4) Give an assay of any four :

a) Mannitol.

b) Sodium benzoate.

c) Aspirin.

d) Saline.

e) Sulphacteamine.

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Total No. of Questions : 6] **[Total No. of Pages : 2**

P1225 **[3623] - 48**

M.Sc. (Sem. - III)
BIOCHEMISTRY

BCH-371 : Medical Biochemistry and Immunology (Old & New)

Time : 3 Hours] ***[Max. Marks : 80***

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.***

SECTION - I

(Medical Biochemistry)

Q1) Answer any three of the following : **[15]**

a) Differentiate between the mechanism of action of Penicillin and Tetracyclin.

b) Although Tamiflu is a very effective drug to treat H1N1 virus, yet it is not sold in retail for free public consumption. Justify the reason behind it by explaining the underlying mechanism involved.

c) Describe the role of various clotting factors involved in the cascade of blood coagulation.

d) Discuss the abnormality that leads to sickle cell Anaemia and β-Thalassemia.

Q2) Answer any three of the following : **[15]**

a) Explain the biological role of lysosomes in an eukaryotic cell.

b) Define analgesics. Discuss the mechanism of action of Aspirin or Ibuprofen.

c) Give the composition of cerebrospinal fluid and the diagnostic significance of CSF.

d) What are Carcinogens? Discuss the effect of Carcinogens in humans with suitable examples.

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

a) Apoptosis.

b) LSD's role as hallucinogen.

c) Methotrexate and Aminopterin.

P.T.O.

SECTION - II

(Immunology)

Q4) Answer any three of the following : **[15]**

a) Differentiate between competitive ELISA and Sandwich ELISA. List out the advantages of ELISA technique over RIA.

b) Discuss the features of Innate Immunity and Acquired Immunity with suitable examples.

c) Describe the structural characteristics of various human immunoglobulins and list out the primary functions of immunoglobulins.

d) List out some examples of autoimmune diseases. Explain the mechanism of development of autoimmunity.

Q5) Answer any three of the following : **[15]**

a) Give the structural feature of Class I MHC and Class II MHC molecules and their role in antigen processing and presentation.

b) Differentiate between monoclonal and polyclonal antibodies.

c) Explain the immunological abnormality caused by HIV in AIDS patients and discuss the various phases of infection.

d) Discuss the role of complement activation in immune system.

Q6) Write short notes on : **[10]**

a) Allergy and Antihistamines.

b) O Antigens and Rh factor.

c) Ouchterlony technique.

Total No. of Questions : 6] **[Total No. of Pages : 2**

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M.Sc.

BIO CHEMISTRY

BCH-372 : Signal Transduction Pathways (New)
Membrane Biochemistry and Specialized Tissues (Old)

Time : 3 Hours] ***[Max. Marks : 80***

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) ***Candidates of Old course should attempt membrane biochemistry as Section - I and for specialized tissues Section I of S.T.P as Section II.***

SECTION - I

Q1) Answer any two of the following : **[10]**

a) Describe in detail the molecular organization of thick and thin filaments.

b) Explain the mechanism of generation of action potential.

c) Describe in detail the biochemistry of retina.

Q2) Answer any three of the following : **[15]**

a) Explain the biochemistry of hearing.

b) Describe in detail the primary events in visual cycle.

c) Write an account on neural plasticity learning.

d) Describe in detail cardiac muscle contraction.

Q3) Write short notes on (any three) : **[15]**

a) Cell motility.

b) Colinergic receptors.

c) Biochemistry of taste.

d) Neurotransmitters.

SECTION - II

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

a) How is action potential generated and propagated?

b) Discuss how coordination between nervous and endocrine systems is brought about.

P.T.O.

Q5) Answer any three of the following : **[15]**

a) Write a short account on turnover and regulation of neuropeptides.

b) Describe in detail the chemical composition of the brain.

c) Describe the various factors affecting the development of CNS.

d) Write short note on neurotransmitters.

Q6) Write short note on (any three) : **[15]**

a) Peripheral nervous system.

b) EEG patterns.

c) Calcium signaling.

d) Synapse structure.

SECTION - I

(Membrane Biochemistry)

Q1) Answer any three of the following : **[15]**

a) Describe antibody-induced patching and capping of cell surface protein on a WBC.

b) How is the transport of a solute across the membrane checked? Explain with suitable example.

c) Describe Singer - Nicholson's Fluid Mosaic Model of membrane structure.

Q2) Answer any three of the following : **[15]**

a) Discuss the mode of transport of any three drugs in bacterial cell.

b) What is phospho-transferase system?

c) Write short note on ATP/ADP exchanger.

d) Explain in brief protein targeting.

Q3) Write short notes on (any two) : **[10]**

a) Bacterial toxins.

b) Gap junctions.

c) Osmoregulation.

Total No. of Questions : 6] **[Total No. of Pages : 2**

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M.Sc.

BIO CHEMISTRY

BCH-373 : Recent Trends in Biochemistry and Toxicology (New)

Time : 3 Hours] ***[Max. Marks : 80***

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.***

SECTION - I

(Recent Trends in Biochemistry)

Q1) Answer any three of the following : **[15]**

a) Draw the schematic diagram of NMR and explain the instrumentation.

b) What is polarization of fluorescence? List the basic rules for interpreting it.

c) Discuss the intellectual property rights.

d) Explain the special uses of LCMS in biology and biochemistry.

Q2) Answer any three of the following : **[15]**

a) What is fluoresence spectrum? Give its application.

b) Explain the major application of biosensors in environmental pollution monitoring.

c) Explain the relationship between electrical response and rate of diffusive flux.

d) Write a short account on helix-turn-helix motif.

Q3) Write short notes (any two) : **[10]**

a) Application of ESR.

b) WTO Regulation of patent.

c) Application of ORD.

P.T.O.

SECTION - II

(Environmental Toxicology)

Q4) Answer any five of the following : **[15]**

a) Explain the role of different experties in the toxicology.

b) Discuss about dose-response relationship.

c) What do you understand the terms : Additive and synergestic effects.

d) Explain how cytochrome P-450 catalizes reductive type of biotransformation?

e) What are the general toxic effects of solvents and vapors?

f) How soil pollutants are degraded?

g) What are the toxic effects of ozone and peroxyacetyl nitrate?

Q5) Give the pathogenesis and clinical manifestations of any three of the following : **[15]**

a) Eucephalopathy due to lead.

b) Micromercurialism.

c) Chronic obstructive pulmonary disease due to cadmium.

d) Farmers lung.

e) Perivascular disease due to arsenic.

Q6) Answer any two of the following : **[10]**

a) Discuss the toxic effects produced by Organophosphrous insecticides.

b) Explain the factors responsible for selective toxicity of toxic agent.

c) How animals develops the tolerance against the toxicant? Explain with suitable examples.

Total No. of Questions : 4] **[Total No. of Pages : 1**

P1227 **[3623] - 50**

M.Sc.

BIO CHEMISTRY

BCH-373 : Recent Trends in Biochemistry (Old)

Time : 3 Hours] ***[Max. Marks : 80***

Instructions to the candidates:

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

Q1) Answer any four of the following : **[20]**

a) Give the principle and application of light scattering.
b) What is the effect of glycerol and freezing on ESR Spectra?
c) What is fluorescence polarisation? Give its application.
d) Distinguish between ORD and CD.
e) Describe the techniques used for studing protein folding pathway.

Q2) Answer any four of the following : **[20]**

a) How conformational changes are studied in DNA - histone interaction by CD analysis?
b) Give the application of fluorescence spectroscopy.
c) Distinguish between NMR and ESR.
d) How will you differentiate the generations of biosensor on the basis of redox reaction?
e) Give the principle and application of X-ray diffraction in biochemistry.

Q3) Answer the following : (any two) **[20]**

a) Draw schematic diagram of NMR and explain the instrumentation.
b) Explain the principle and working of nuclear gamma rays resonance spectroscopy.
c) What is ligand binding? Discuss the methods used to measure ligand binding.

Q4) Write short notes (any four) : **[20]**

a) Enzyme Immunosensors.
b) Helix-turn-helix motif.
c) Eximers.
d) Application of light scattering.
e) Methods of enzyme immobilization.

✦✦✦✦