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

P810

[3923]-320
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) ***Figures to the right side indicate full marks.***
3) ***Answers to the two sections should be written in, separate answer books.***

SECTION - I

(Medical Biochemistry)

Q1) Answer any three of the following : **[3 × 5 = 15]**

a) Explain the cascade mechanism involved in the intrinsic pathway of apoptosis after release of Cytochrome C from mitochondria.

b) Discuss the mechanism of action of antibiotics like tetracyclin and erythromycin at the molecular level.

c) Elaborate the mechanism that leads to the activation of the zymogen fibrinogen to fibrin.

d) "Mutant hemoglobins helped in the study of structure-function relationships in proteins". Explain the above statement by quoting suitable example.

Q2) Answer any three of the following : **[3 × 5 = 15]**

a) What is the normal composition of cerebrospinal fluid? How is cerebrospinal fluid useful in diagnosis of diseases?

b) Explain the mechanism involved in induction of carcinogenesis by chemical carcinogens.

c) Discuss the significance of hydrolytic enzymes of lysosomes in human Physiology.

d) What is the normal level of Cholesterol in blood? Explain how hypercholesterolemia is a causative factor for cardiovascular Problems.

P.T.O.

Q3) Answer any two of the following : **[2 × 5 = 10]**

a) Fibronectins.

b) Hallucinogens.

c) Fibrinolysis.

SECTION - II

(Immunology)

Q4) Answer any three of the following : **[3 × 5 = 15]**

a) Compare the complement activation events of the classical pathway with those of alternate pathway.

b) What are natural killer cells? What role do they play in the defense of the body?

c) What are the useful properties of hybridomas? How are they developed.

d) Why are antibodies termed Immunoglobins? List out the different class of Immunoglobulins and write a note on their functions in the body.

Q5) Answer any three of the following : **[3 × 5 = 15]**

a) List out the four major types of hypersensitivity reactions and discuss their features.

b) Explain the principle, procedure and applications of ELISA technique.

c) What are Immunodeficiency diseases? Discuss the features of one such disease.

d) How do vaccines work? Why we cannot have vaccines for each and every disease?

Q6) Answer any two of the following : **[2 × 5 = 10]**

a) Rocket Immunoelectrophoresis.

b) Blood group substances.

c) Phagocytosis.

■ ■ ■

Total No. of Questions : 9] **[Total No. of Pages : 3**

P811

[3923] - 321
M.Sc.
BIOCHEMISTRY
BCH-372 : Signal Transduction Pathways (Old & New)
Membrane Biochemistry and Specialized Tissues (Old)
(Sem. - III)

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.***
4) ***Candidates of old course should attempt Membrane Biochemistry as Section I and Section I (Signal Transduction Pathways) of new course as Section II (Specialised Tissues) of old course.***

SECTION - I

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

a) How Ca^{++}, tropomyosin and troponin regulate the interaction between actin and myosin?

b) Explain the mechanism of generation of action potential.

c) Explain in detail the biochemistry of retina.

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

a) Write an account of on neural plasticity learning.

b) Describe in detail the effects of neurotoxins on the nervous system.

c) Explain in detail the molecular structure of sodium channels and give their role.

d) Describe in detail the biochemistry of hearing.

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

a) Colinergic receptors.

b) Cell motility.

c) Physiology of gustation.

d) Neurotransmitters.

P.T.O.

SECTION - II

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

a) Explain in detail how coordination between nervous and endocrine systems is brought about.

b) What are neurotransmitters? Describe in detail the metabolism of neurotransmitters.

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

a) How is action potential generated and propagated.

b) Explain in detail the chemical composition of brain.

c) Describe in detail the structure and function of synapse.

d) Describe the carbohydrate and lipid metabolism in brain.

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

a) Zinc fingers.

b) EEG patterns.

c) Neuropeptides.

d) CSF and its significance.

SECTION - I

(Membrane Biochemistry) (Old)

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

a) Describe Singer- Nicholson's fluid mosaic model of membrane structure.

b) Explain how mitochondrial proteins are imported.

c) Describe in detail protein targeting.

d) Describe how the transport of solute across the membrane is checked? Explain with suitable example.

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

a) Discuss in detail the chemiosmotic hypothesis of mitchell.

b) Write short note on membrane glycosylation.

c) Explain in detail ATP/ADP exchanger.

d) Describe phospho-transferase system.

Q3) Write short notes on (any two) : **[10]**

a) Flip - flop.

b) Osmoregulation.

c) Bacterial toxins.

■ ■ ■

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

P812

[3923] - 322
M.Sc.
BIOCHEMISTRY
BCH-373 : Recent Trends in Biochemistry & Toxicology
(Old & New) (Sem. - III)

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) Explain the pathway in protein folding mechanism.

b) Describe conformational analysis of peptide bond? What is the contribution of Ramchandran's plot to it.

c) Describe the instrumentation of CD spectrometer.

d) Explain biological applications of ESR.

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

a) Give an account on GC-MS technique.

b) Nuclear Magnetic Resonance phenomena.

c) Applications of Fluorescence in biochemical studies.

d) Patenting of biological inventions.

Q3) Write short notes (any two) : **[10]**

a) Various types of protein motifs.

b) Biosensors based on immunochemical reactions and its applications.

c) MALDI and its significance.

P.T.O.

SECTION - II

(Toxicology)

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

a) Explain the mechanism of cell injury caused by toxicant .

b) What do you understand the terms acute toxicity and chronic toxicity? How are they evaluated?

c) Explain how teratogenic potential of chemical is screened?

d) Discuss the biochemical reactions involved in benzene biotransformation.

e) How soil and water pollutants are degraded?

f) Explain the mechanism of xenobiotic metabolism catalized by glutathione S-transferase.

g) What are the toxic effects caused by SO_2 and O_3?

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

a) Biologic diversity is responsible for selutine toxicity. Justify.

b) Explain the factors that influence the metal toxicity.

c) Discuss with examples the antagonistic effects.

d) What are the toxic effects caused by DDT? Explain the mechanism of toxic effects caused by DDT.

e) Give the composition of snake venom.

Q6) Give the pathogenesis and clinical manifestations of any two : **[10]**

a) Delayed neurotoxicity due to organophosphrous insecticides.

b) Chronic pulmonary obstructive disease by cadmium exposure.

c) Pink disease due to mercury.

d) Hypolension and shock by snake venom.

■ ■ ■

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

P813

[3923] - 331

M.Sc. (Semester - III)

DRUG CHEMISTRY

CH-361 : Chemistry of Heterocycles and Biological Active Compounds

(2008 Pattern) (New)

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) Pyrrole 2-aldehyde does not respond to Tollen's reagent.

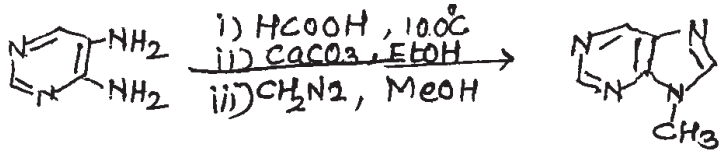
b) Electrophilic attack on pyrazole is hindered in acid medium.

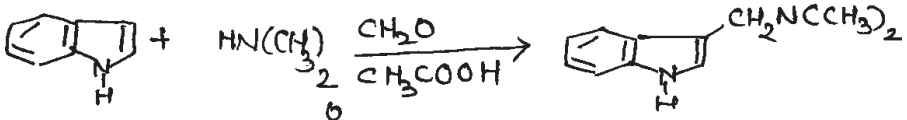
c) Differences in the chemical behaviour of Benzene, Pyridine and Pyrrole.

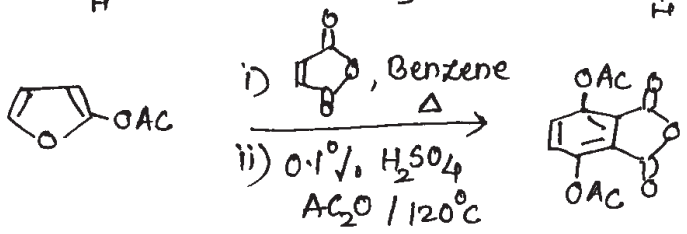
d) 2-Ethyl pyridine reacts with aq. formaldehyde in weak basic conditions, while pyridine does not.

e) 2, 6, 8-trichloropurine on reaction with aq. NH_3 at 100^oC gives 2, 8 dichloro-6-aminopurine.

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

a) 

b) 

c) 

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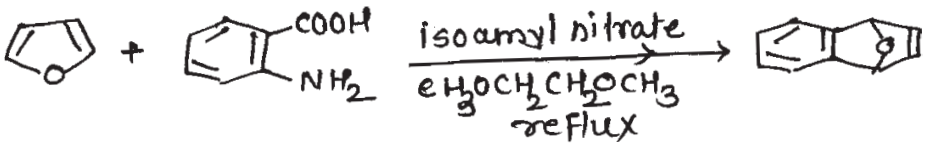
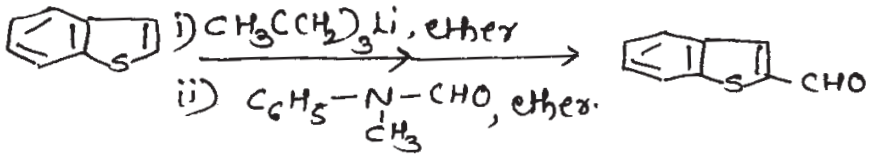
d) 

e) 

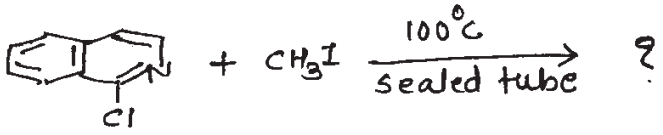
Q3) a) Give synthesis of <u>any two</u> of the following : **[7]**

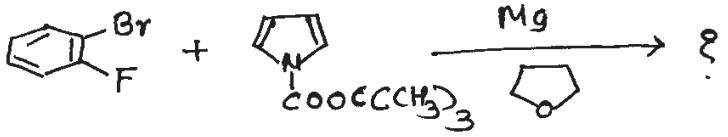
i) Knorr Pyrrole Synthesis.

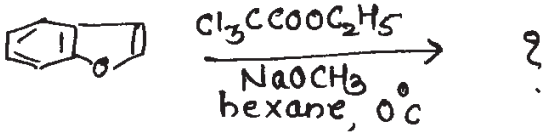
ii) Madelung Indole Synthesis.

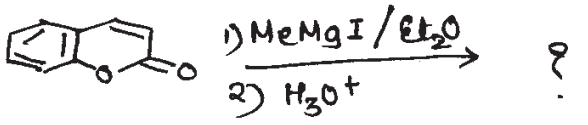
iii) Skraup Quinoline Synthesis.

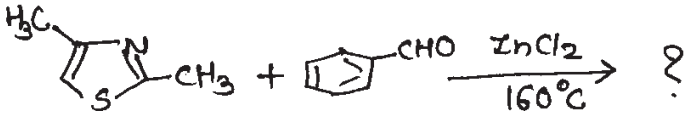
b) Predict the products with mechanism of <u>any three</u> of the following : **[9]**

i) 

ii) 

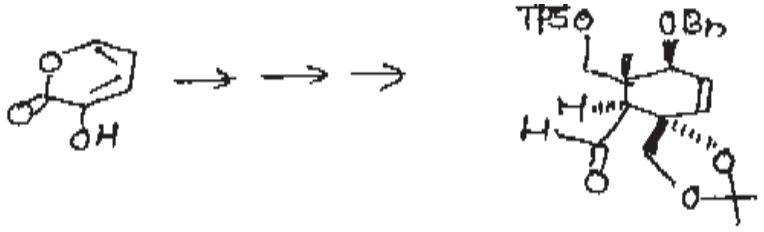
iii) 

iv) 

v) 

SECTION - II

Q4) Discuss the steps involved in the following transformations comment on steps indicating mechanism and reagents used. (<u>any three</u>) : **[15]**

a) 

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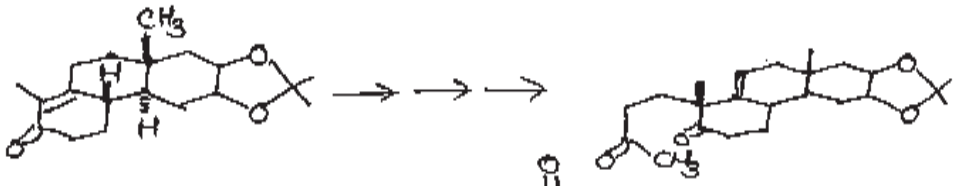

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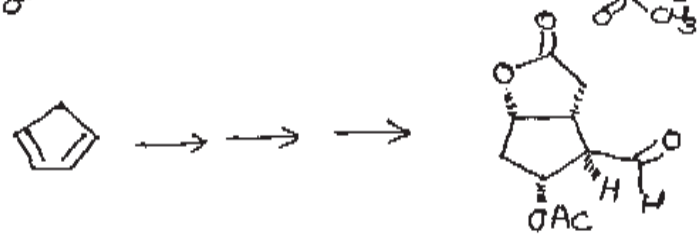

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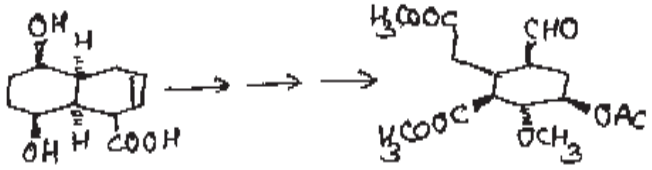

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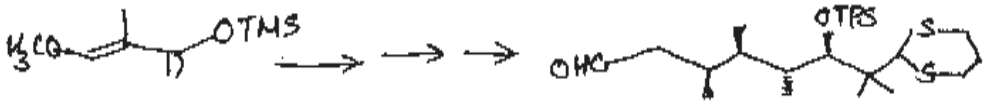
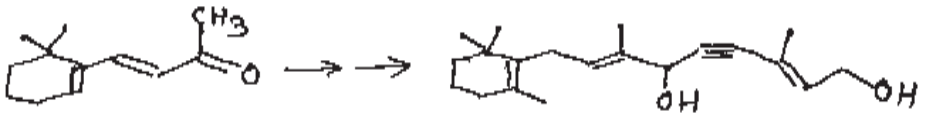


Q5) Discuss the steps involved in the synthesis of following drug molecules. Explain the mechanism involved. (<u>any four</u>) : **[16]**

a)



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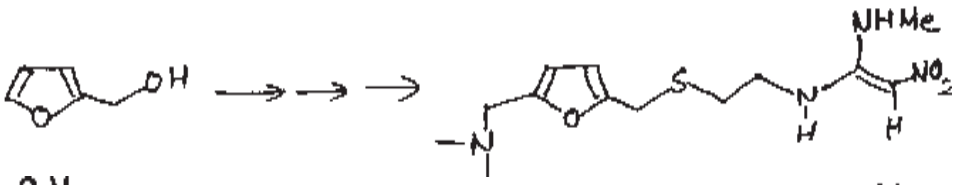

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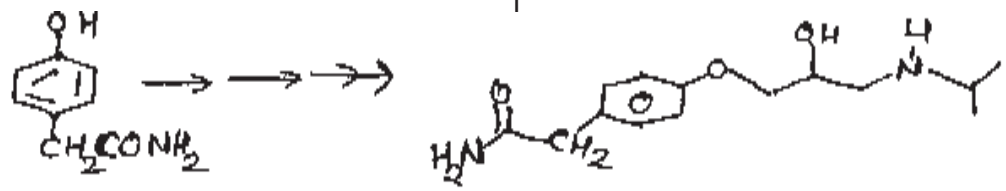

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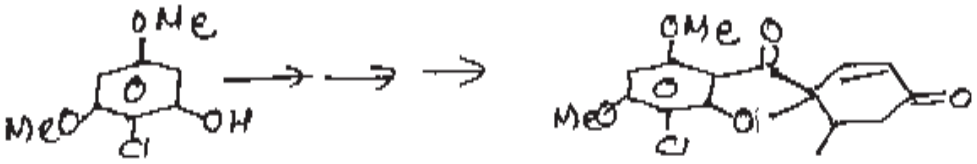

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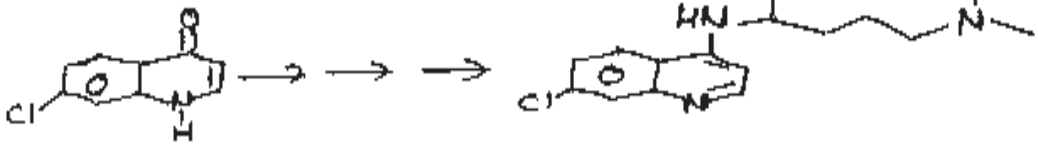
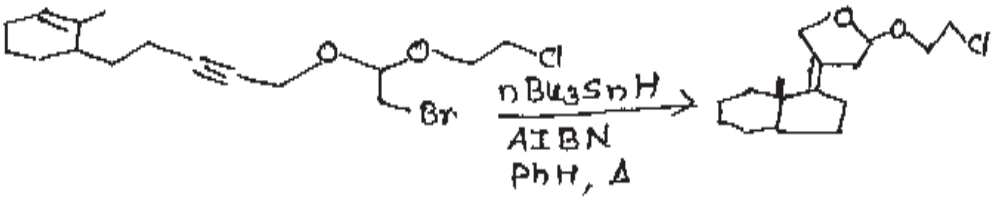


Q6) Answer <u>any two</u> of the following : **[9]**

a) Explain the mechanism in following Synthesis.

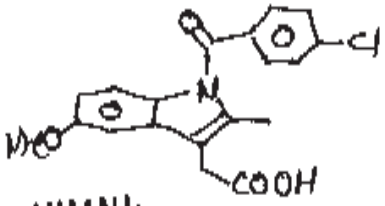
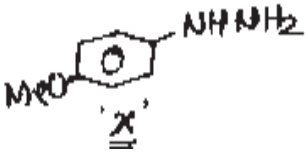


b) Explain with examples the following (any two).

i) Mc Murray Pinacol coupling.

ii) Shapiro Reaction.

iii) Suzuki Coupling.

c) Indomethacin  is synthesized from  via a series of steps. Do reterosynthetic analysis of Indomethacin and attempt to give a synthetic route from '<u>X</u>'

■ ■ ■

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

P813

[3923] - 331

M.Sc. (Semester - III)

DRUG CHEMISTRY

CH-361 : Chemistry of Heterocycles and Biological Active Compounds

(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) Pyridine has a large dipolemoment ($\mu = 2.26D$) compared to its perhydro counterpart, piperidine, which has $\mu = 1.17D$.

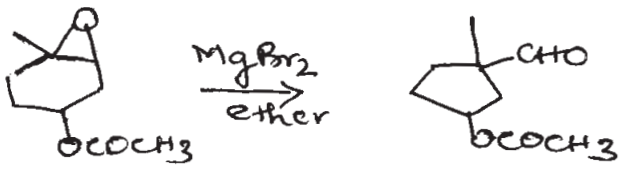
b) Among 1,3 azoles, reactivity order towards electrophile is found as imidazole >thiazole>oxazole.

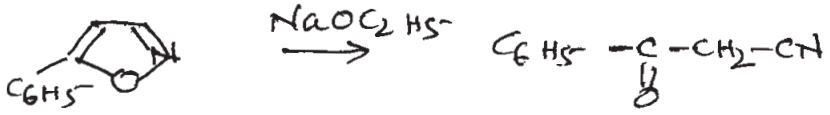
c) Furan behaves as a typical diene in Diles-Alder reaction, whereas pyrrole undergoes such reaction with more difficulty.

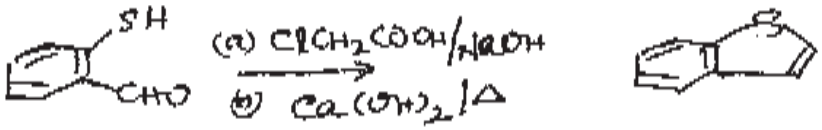
d) At lower acid strength, quinoline undergoes substitution initially at the 3-position, followed by the reaction at 6 - and 8 - position.

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

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

a) 

b) 

c) 

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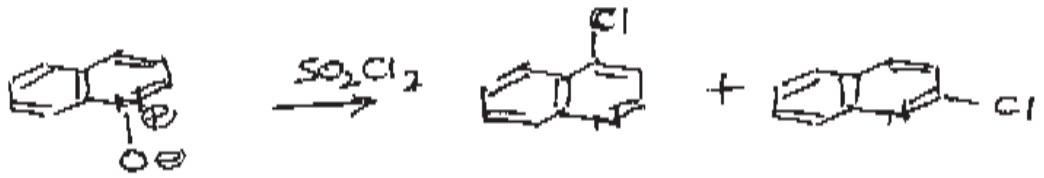
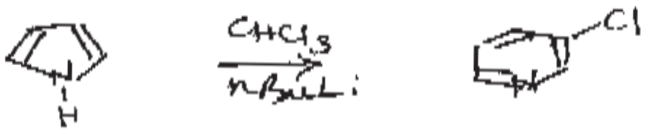
d) 

e) 

Q3) a) Write short notes on <u>any three</u> of the following : **[9]**

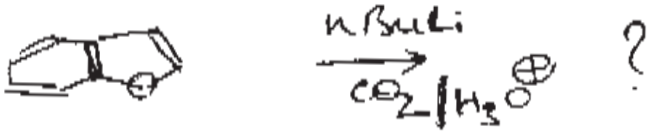
i) Gabriel synthesis of thiazole derivatives.

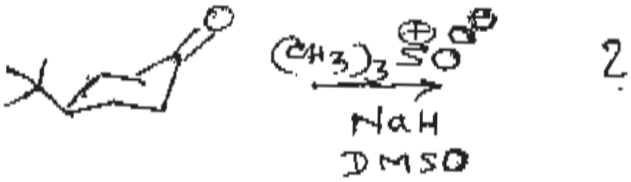
ii) Reissert synthesis.

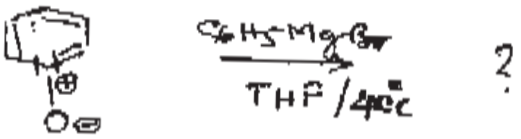
iii) Darzens Reactions.

iv) Paal-knorr synthesis of furan.

b) Predict the product with mechanism <u>any two</u> : **[7]**

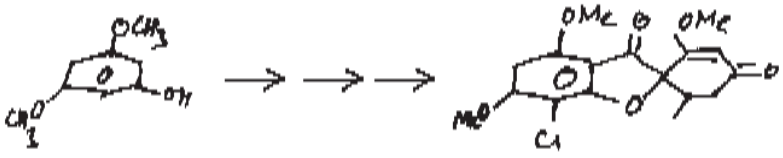
i) 

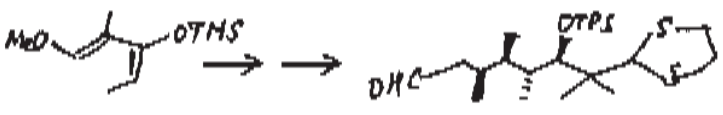
ii) 

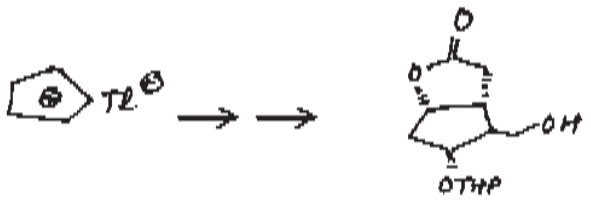
iii) 

SECTION - II

Q4) Discuss the steps involved in the synthesis of following molecules. Explain all the steps involved indicating mechanisms (<u>any three</u>) : **[15]**

a) 

b) 

c) 

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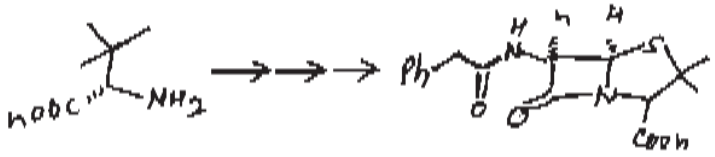
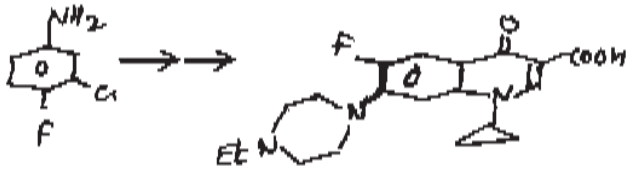
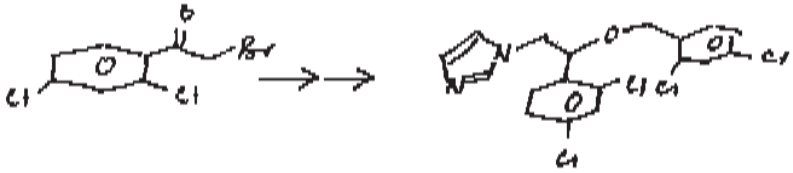
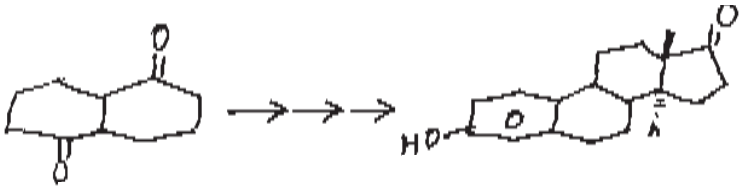
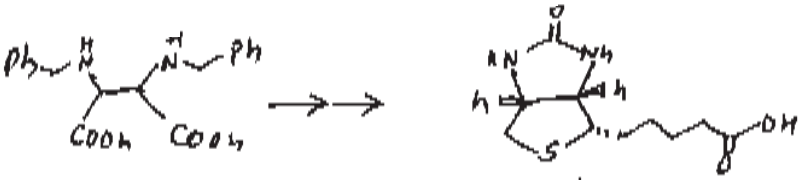
e) 

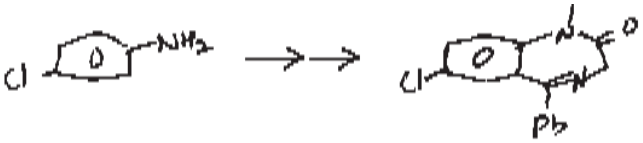
Q5) Explain the synthesis routes for the following drug molecules from the precursors shown. Explain the steps involved. (<u>any four</u>) : **[16]**

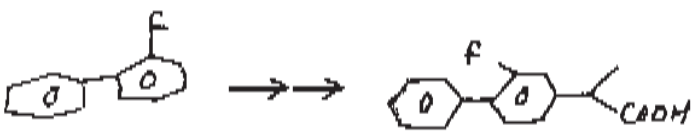
a) 

b) 

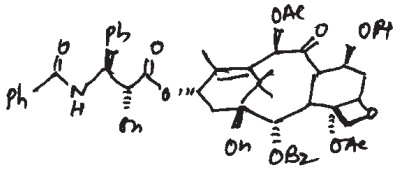
c) 

d) 

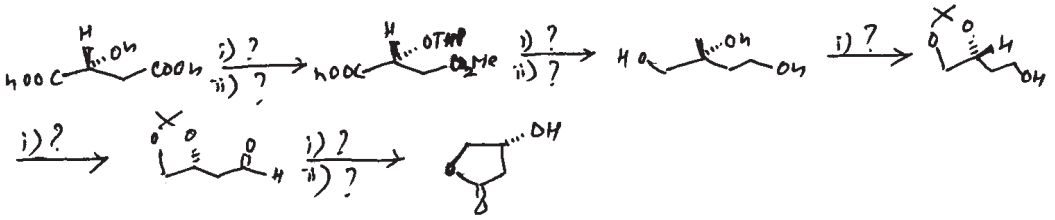
e) 

f) 

Q6) a) Do a retrosynthetic analysis of toxol. Discuss the important reactions involved. **[5]**



b) Complete the following sequence of reaction by inserting the relevant reagents in proper places. Explain the steps. **[4]**



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

P815

[3923]-333

M.Sc. (Sem. - III)

DRUG CHEMISTRY

CH-363 : Drug Development

(New) (2008 Pattern)

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 right indicate maximum marks.***

SECTION - I

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

a) What is continuous culture? Differentiate between a chemostat and turbidostat.

b) Name the different parts of fermetor and explain any two in detail.

c) Comment on any two methods of strain improvement of a bacterium used in fermentation.

d) Why effluent from pharmaceutical or any industrial fermentation process is to be treated before disposal?

e) Which factors are to be considered before selecting the raw material to be used for preparing medium for fermentation.

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

a) Diagrammatically explain the development of immune response cells from pluripotent bone marrow stem cell.

b) Explain classical or alternative complement activation pathway.

c) Explain intrinsic and extrinsic properties of immunogen.

d) Name five cytokines and their significance in immune response.

e) Comment on the role of Tc and NK cells.

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

a) Discuss in brief the various sources of drugs. How are drug molecular obtained from these sources. Explain.

b) Hypertension is a very common cardiovascular disorder observed in many people. How would you start a drug discovery program to discover novel antihypertensive agent? Discuss and justify your approach.

P.T.O.

c) Give a brief account of the function performed by the following in a pharma industry.
   i) R&D
   ii) Industrial Hygiene and Safety
   iii) QA.

SECTION - II

Q4) Answer any two of the following : **[14]**

a) Explain in brief pharmacokinetics of drug action. Discuss the factors responsible for the absorption of a drug and its bioavailability in different organs, what strategies could be applied to increase bioavailability and E_{tyz}?

b) Discuss in brief :
   i) When is an NCE allowed to enter clinical trials?
   ii) What is the role of FDA and Institutional Review Board in clinical trials?
   iii) What is the difference between Phase II and Phase III? Explain.

c) Explain the concept of Intellectual Property rights? What are the benefits of patenting a NCE? Discuss in brief the components of an patent application like claims, prior art, embodiments etc.

Q5) Answer any three of the following : **[18]**

a) Explain the following terms and their significance.
   i) LD_{50} ii) Carcinogenicity iii) Mutagenicity
   iv) Genotoxicity v) Hepatotoxic vi) Nephrotoxic.

b) Discuss in brief how chemical and biological development of a lead compound is carried out. Explain with examples.

c) Compare and contrast the various dosage form interms of their benefits and shortcomings.

d) Discuss in brief the following
   i) Drugs from natural sources.
   ii) Drug Targets.

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

a) Pharmacological assays.

b) Process Development of a synthetic process.

c) Ayurveda.

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

P815

[3923]-333

M.Sc. (Sem. - III)

DRUG CHEMISTRY

CH-363 : Drug Development

(Old)

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 right indicate maximum marks.***

SECTION - I

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

a) Explain :
   i) The process of removal of toxic waste from industrial fermentation waste.
   ii) Maintaining industrially useful strain of organism.

b) What is antimicrobial assay? How is it performed.

c) What do you mean by batch, fed batch and continuous culture? Which mode is preferred for secondary metabolite production? Why?

d) Discuss:
   i) Designing fermentation media.
   ii) Role of baffles and agitators in fermentation vessel.

Q2) Answer any four of the following : **[16]**

a) What leads to autoimmune diseases? Give any two examples of autoimmune diseases.

b) What are Chemokines and Cytokines? Explain the role of IL-8, IL-4, IL-5 and INFα in destryoing invading foreing substance.

c) What is an antigen? What properties a substance should have to be an antigen?

d) Explain the role of NK cells and T cells.

e) Give a commentary on Immunoelectrophoresis and Radioimmunoassay.

Q3) Answer any three of the following : **[9]**

a) Explain Clonal Selection Theory.

b) Discuss the role of Ayurveda in Future drug development.

c) Explain the role of QA&QC in Pharma Industry.

d) Characteristics of an Goal drug.

P.T.O.

SECTION - II

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

a) What is Bioavailability? Explain how it depends on dosage form? What are the strategies to improve Bioavailability.

b) Explain the following terms:

i) Pharmacophore

ii) Therapeutic window

iii) First pass effect

iv) Partial agonist

v) GLP

c) Cinnamon (Dalchini) is known in folklore to lower the blood triglyceride and cholesterol level in humans. How would you approach towards discovering a drug from Cinnamon for lowering Blood cholesterol levels.

d) What is the need of toxicological evaluation of drugs? Discuss the major tests performed and their implications.

Q5) Answer any three of the following : **[18]**

a) What is a patent? What are the essential requirements of patentability? Discuss the matter claims and process claims in an patent application.

b) Discuss the aims and objectives of the four phases of clinical trials. Explain how are clinical trials conducted?

c) Describe the steps involved in drug action after an oral drug is administered? What are the various drug targets?

d) Give a brief account of phases of chemical development of a drug in the industry. Discuss the issues involved in scale up and process development.

Q6) Answer any two of the following : **[7]**

a) Give a brief account of testing drugs invitro and invivo.

b) Discuss the strategies toward developing a lead compound.

c) Routes of drug administration.

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

P817

[3923]-401
M.Sc.
PHYSICAL CHEMISTRY
CH-410 : Molecular Structure and Spectroscopy (New)
(Sem. - IV) (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) ***Use of logarithmic tables/calculator is allowed.***
4) ***Neat diagrams must be drawn wherever necessary.***
5) ***Figures to the right side indicate full marks.***

Physico-Chemical Constants

1.	Avogadro Number	N	=	$6.022 \times 10^{23} mol^{-1}$
2.	Boltzmann Constant	k	=	1.38×10^{-16} erg K^{-1} $molecule^{-1}$
			=	1.38×10^{-23} J K^{-1} $molecule^{-1}$
3.	Planck Constant	h	=	6.626×10^{-27} erg s
			=	6.626×10^{-34} J s
4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} $ergK^{-1}$ mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
			=	1.987 cal K^{-1} mol^{-1}
7.	Faraday Constant	F	=	96487 C $equiv^{-1}$
8.	Speed of light	c	=	2.997×10^{10} cm s^{-1}
			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
11.	Bohr magneton	β_e	=	-9.274×10^{-24} J T^{-1}
12.	Nuclear magneton	β_n	=	5.051×10^{-27} 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) What is the need of reference for recording high resolution nmr? Explain the advantages of TMS.

b) Discuss the quantum mechanical theory of nmr.

c) Explain the terms in nmr.

i) Spin- spin relaxation ii) Chemical shift scale

iii) Precessional Frequency iv) Coupling constant.

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

e) Explain the concepts of electric field gradient and quadrupole coupling constant in nqr spectroscopy.

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

a) Describe the instrumentation used in esr spectroscopy with a suitable diagram.

b) What is g-value? Explain the factors affecting it.

c) How many esr lines are expected in the esr spectra of anthracene anion? Explain.

d) Write the Mc connell relation. Explain the terms involved in it, and discuss its applications.

e) Explain the technique of PAS with a suitable diagram.

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

a) α, β and γ positions in anthracene anion exhibit hyperfine splitting constants 2.7 mT, 5.3 mT and 1.5 mT respectively in the esr spectrum. Calculate the spin density at these sites. [Given: Q = 2.25 mT]

b) Calculate the frequency separation of the nuclear spin states in ^{13}C nucleus with a magnetic field 14.4 T, the magnetogyric ratio being $6.73\times10^{7}\ T^{-1}S^{-1}$.

[Given : I = ½ for ^{13}C]

c) Compare the number of lines in esr of radicals $\dot{X}H_2$ and $\dot{X}D_2$, $\dot{X}$ has spin $5/2$.

SECTION - II

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

a) How can powder diffraction pattern be used in the study of crystal structure?

b) How can a primitive cubic system be identified on the basis of systematic absences in diffraction patterns?

c) Define the terms : i) Scattering factor ii) Structure factor and iii) X - ray diffraction.

d) Discuss the applications of the electron diffraction technique.

e) Explain the principle of electron diffraction technique. State its limitations.

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

a) Derive the Wierl equation used in electron diffraction technique.

b) Describe with a neat labelled diagram, the experimental set-up of neutron diffraction technique.

c) Discuss any two types of magnetic bodies.

d) Define and explain the terms magnetic susceptibility per unit volume and specific susceptibility.

e) Derive the expression for the determination of gram susceptibility (χ_g) in a uniform field method.

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

a) The gram susceptibility of a compound is 9.28×10^{-6} cgs unit at 25°C. Find the susceptibility at 303 K.

b) Find the molar diamagnetic susceptibility of the oxalate dianion.

Given : χ_A of C = -6.00×10^{-6} cgs / g.atom

χ_A of O_2 (carboxylate) = -7.95×10^{-6} cgs / g.atom.

c) The mass and density of an atom are 63.5 and 8.94 g cm^{-3} respectively. The atom has FCC structure. Calculate the radius of the atom.

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

P818

[3923] - 402
M.Sc.
PHYSICAL CHEMISTRY
CH-411 : Surface and Electrochemistry (New)
(2008 Pattern) (Sem. - 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) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table/calculator is allowed.***

Physico-Chemical Constants

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

P.T.O.

SECTION - I

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

a) What is surface excess? Give one method of its determination.

b) How is flotation technique used to separate minerals in ores in mining industry?

c) Derive the equation of the energy of adsorption.

d) Describe the volumetric method for measurement of adsorption.

e) Give a critical comparison of the various multilayer models.

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

a) What is a condensed film? Give its equation. How is the 'concept' used to determine the surface area of a solid?

b) Explain the phenomenon of hysteresis with the help of Zsigmondy's theory.

c) Discuss 'chemical approach' to explain the phenomenon of heterogeneous catalysis.

d) Write a note on heterohomogeneous catalysis.

e) Explain the disposal of 'radioactive waste' using zeolites.

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

a) Calculate the surface area of a catalyst that adsorbs 10^3 cm^3 of nitrogen (calculated at 1.013 bar and 0^oC) per gram in order to form a monolayer. The adsorption is measured at -195^oC and the effective area occupied by a nitrogen molecule on the surface is 16.2×10^{-20} m^2 at this temperature.

b) For H_2 adsorbed on W powder the following data were found :

θ	0.005	0.005	0.10	0.10	0.10
p/torr	0.0007	0.03	8	23	50
$t/^oC$	500	600	500	600	700

Where t is the Celsius temperature and p is the H_2 pressure in equilibrium with the tungsten at fractional surface coverage, θ. For $\theta = 0.005$, find the average $\Delta \overline{H}a$ over the range 500 ^oC to 600 ^oC.

c) The surface tensions of dilute solutions of phenol in water at 30 °C were :

wt % phenol	0.024	0.047	0.118	0.471
γ, dyne cm^{-1}	72.6	72.2	71.3	66.5

Calculate Γ from the Gibbs isotherm for a 0.1% solution.

SECTION - II

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

a) Derive the expression for the enthalpy of solvation using Bernal-Foulter model.

b) Explain the terms i) diffusion ii) conduction iii) hydrodynamic flow and state Ficks First law of steady state diffusion, explain the terms involved in it.

c) Derive the extended Debye-Huckel equation applicable for appreciable concentration.

d) Write the Butter-Volmer equation and explain the terms involved in it.

e) Describe the stern theory of electrical double layer.

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

a) Describe the various types of potentials contributing to total potential across electrode-electrolyte interface.

b) Discuss the Wagner-Traud theory for corrosion of ultrapure metals.

c) Describe with neat labelled diagram H_2–O_2 fuel cell.

d) Write a short note on electro synthesis.

e) With suitable example describe secondary cell.

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

a) Calculate Zeta potential in Helmholtz layer in a solution having dielectric const. 78, ionic charge density 10^{15} esV and the separation between Helmholtz layers is 10^{-5} cm.

b) Calculate the ionic strength of a mixture of 50 ml 0.1 N $ZnCl_2$ and 50 ml 0.2 N NH_4Cl.

c) Under potential gradient of 0.05 V cm^{-1}, the drift velocity of ion is 2×10^{-5} cm/s. Find absolute mobility and conventional mobility of ion.

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P819

[3923] - 403

M.Sc.

PHYSICAL CHEMISTRY

CH-414 : Biophysical Chemistry and Related Techniques (New) (Optional) (2008 Pattern) (Sem. - 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.***
3) ***Figures to the RIGHT SIDE indicate FULL marks.***
4) ***Use of logarithmic table/calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

Physico-Chemical Constants

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

P.T.O.

SECTION - I

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

a) State the Loewy definition of the cell. Sketch and explain the structure of mitochondria. State its functions.

b) Explain the Pauling-Corey concept of the structure of proteins.

c) Write a note on the functions of proteins.

d) Discuss the randomly coiled polymer chain model. Define – R_{rms} and R_{mp}.

e) Calculate R_{rms} for a polymer having 260 monomer units and 500 nm long.

f) Write a note on Chaperones and protein folding.

Q2) Attempt **any four** of the following. **[20]**

a) Write a note on the blood buffering system.

b) Calculate the pH of a litre solution containing 5 cm^3 5 M acetic acid and 5 ml 1 M sodium acetate (pKa = 4.75).

c) Explain the effect of directionality on the strength of a hydrogen bond.

d) Discuss the role of Caldesmon in smooth muscle contraction.

e) Write a note on phosphonhydride bond in ATP.

f) Explain the role of reverse osmosis in biology.

SECTION - II

Q3) Attempt **any four** of the following. **[20]**

a) Explain the structure of cell membrane on the basis of Fluid mosaic model.

b) Discuss the mechanism of ion transport through cell membrane.

c) What is a nerve impulse? Explain the mechanism of conduction.

d) Derive Michaelis-Menton equation for enzyme catalysis.

e) Write a note on oscillatory reactions.

f) What are biopolymers? State their characteristics. How is the size of bio-polymers determined by ultra-filtration method?

Q4) Attempt **<u>any four</u>** of the following. **[20]**

a) Describe the sedimentation equilibrium method to determine the molecular weight of a biopolymer.

b) What is electrophoresis? State its types. Explain any one in detail.

c) Explain the light scattering method for determining the molecular weight of biopolymers.

d) Write a note on helix-cell transitions.

e) Explain the role of optical rotary dispersion forces involved in structural stability.

f) Explain the biological significance of Donnan membrane phenomenon.

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P820

[3923] - 404

M.Sc.

PHYSICAL CHEMISTRY

CH-415 : Special Topics in Nuclear Radiation Chemistry

(2008 Pattern) (Sem. - IV) (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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4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} $ergK^{-1}$ mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
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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
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} JT^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) What are the desirable nuclear properties of indicator radionuclide for diagnostic purposes? Explain the synthesis of I - 131 isotope.

b) Write a note on Positron Emission tomography. Which radionuclides are used for this purpose?

c) Describe how radioactive liquid waste is categorised. Explain the various methods for its management.

d) Explain the role of shielding in radioactive waste management. What are the various materials used for shielding purposes?

e) Explain any one in-vitro method of analysis.

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

a) Explain the p-p chain reaction.

b) Define the terms : Planck era, GUT era, Premordial nucleosynthesis.

c) Explain with underlying principle-separation of lithium isotopes.

d) Give the method of separation for boron isotope.

e) Discuss the synthesis of B and Li in cosmos.

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

a) 99mTc activity was found to be 8300 cpm when extracted after 10 hours of loading of 99 Mo in the generator. Find out the initial activity of loaded Mo-99. Given : $t_{1/2}$ of 99Mo = 66.6h and of 99mTc = 6.01h.

b) Find out the dose due to 100 μCi Cs - 137 source at a distance of 2.5 meters. Given : gamma energy of Cs - 137 is 0.67 MeV.

c) Find out the thickness of lead required to decrease a dose from 100 mGy/h to 20 mGy/h. Given : $e\mu = 0.211$ b Z of Pb = 82 and A of Pb = 207. Density of lead = 11.35 g/cm^3.

SECTION - II

Q4) Attempt **any four** of the following. **[20]**

a) Discuss the radiolysis of saturated aliphatic hydrocarbons.

b) Explain the radiolysis of methyl alcohol.

c) In which experiments thin targets are required?

d) Write a note on carriers.

e) Explain the techniques used for the measurement of different ranges of energy and intensity of the bombarding particles.

f) Explain molecular kinetics based on the Arrhenius law.

Q5) Attempt **any four** of the following. **[20]**

a) Discuss competition kinetics with a suitable example.

b) Explain Sworski and Schwarz theory for the yields of molecular products and the solute concentration.

c) Describe the radiometric titration curve for the titration of a mixture of two halides in which ions precipitating last are labelled.

d) Draw a neat labelled experimental set-up used for beta back-scattering titration. State its advantages and limitations.

e) Draw the apparatus for extraction radiometric titration used by Duncan and Thomas. Explain the procedure for it.

f) 25 ml of K^*I was titrated with 0.1 M $AgNO_3$ solution. Addition of 1 ml $AgNO_3$ followed by removal of Ag^*I precipitate showed a change in activity of solution from 5000 counts for 2 min to 4000 counts for 2 min. Find the amount of iodide ions in the solution.

(Given : Atomic weight of : K = 39.1, I = 127, Ag = 108)

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

P836

[3923]-41

M.Sc.

PHYSICAL CHEMISTRY

CH-410 : Molecular Structure

(Old) (2005 Pattern) (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) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right side indicate full marks.***
5) ***Use of logarithmic table/calculator is allowed.***

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt <u>any three</u> of the following: **[15]**

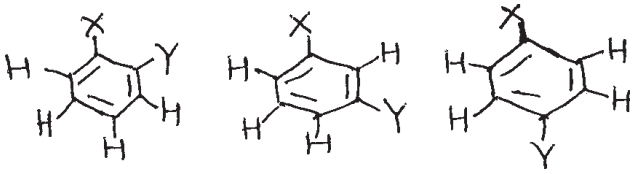
a) Why does a signal for a particular set of protons split in to multiplet? Explain with suitable examples the term "spin-spin coupling".

b) Explain the classical and quantum mechanical approach to nmr.

c) Describe the instrumentation used in nmr spectroscopy with a suitable diagram.

d) Explain the concepts of electrical field gradient (EFG) and quadrupole coupling constant.

e) How many ^{1}H nmr signals would you predict for each of the following when X = Y and X ≠ Y.



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

a) What are the general rules governing the number of lines observed in esr spectroscopy? Give suitable examples.

b) Explain the principle of esr. Why does the source have to be from the microwave region for observing esr?

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

d) Define the following terms :

i) Spin polarization.

ii) Unpaired spin density.

iii) Hyperfine coupling constant.

iv) Zero field splitting.

e) Give an account of factors affecting the intensity of signal in PAS.

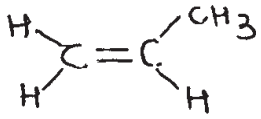
Q3) Solve <u>any two</u> of the following: **[10]**

a) Calculate the precessional frequency of a proton in a field of 15000 G. The g-factor for proton is 5.585.

b) Calculate the nmr frequency of ^{35}Cl in magnetic field of intensity 1.6 T.

[Given : I = $3/2$, μ = 1.06 in units of β_n]

c) How many nmr signals would you expect from following compounds?

i) 

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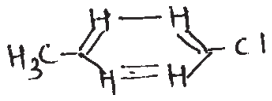
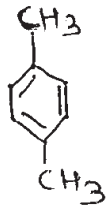
iii) 

iv) 

SECTION - II

Q4) Attempt <u>any three</u> of the following: **[15]**

a) How is the Fourier synthesis used to determine a unit cell?

b) How are X-rays produced and detected? Explain the principle of X-ray diffraction?

c) Discuss the applications of X-ray diffraction in structural analysis.

d) Explain the important applications of electron diffraction.

e) Describe powder method used in XRD.

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

a) Discuss the advantages of electron diffraction technique compared to XRD method.

b) Distinguish between uniform field and non-uniform field method for determination of magnetic susceptibility.

c) Derive the Van-Vleck formula for magnetic susceptibility.

d) Explain the working of Faraday balance with suitable diagram.

e) What is spin only magnetic moment? Find it for a metal complex with three unpaired electrons.

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

a) Calculate the magnetic susceptibility of molecules having three and four unpaired electrons at 25°C.

b) The gram susceptibility of $Ni(en)_3S_2O_3$ is 11.03×10^{-6} cgs units at 17 °C. Find the susceptibility at 27 °C.

c) X - ray diffraction studies of sodium chloride crystals gave the unit cell dimensions as 564 p_m. Find the number of atoms in the unit cell.
[Given : Density of NaCl = 2.165 g cm^{-3}
At. wt. of Na = 23, Cl = 35.5]

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

P837

[3923]-42

M.Sc. (Sem. - IV)

PHYSICAL CHEMISTRY

CH-411 : Solid State and Surface Chemistry (Old)

(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) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic table/calculator is allowed.***

Physico - Chemical Constants

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4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
			=	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 <u>any three</u> of the following: **[15]**

a) Give the classification of imperfections and define each one of them.

b) Derive the equation for the number of Frenkel defects at temperature T.

c) Show that in an intrinsic semiconductor, $E_o = \frac{(E_v + E_c)}{2}$.

d) With a neat diagram explain the point contact transistor.

e) Draw the energy band model for p-n junction and explain forward and reverse bias.

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

a) Explain the origin of piezoelectricity and ferroelectricity. What are pyroelectric crystals?

b) Explain the various mechanisms of diffusion in an insulator. How is ionic conductivity related to diffusion coefficient?

c) State and explain the Kirkendall effect.

d) Discuss the factors affecting the progress of a solid - solid reaction.

e) Discuss the Prout- Tompkins equation for the decomposition reaction in solids.

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

a) If 2 eV is the energy required for the pair of ions to move from the crystal's interior to the surface, what is the proportion of vacancies $\left(n/N\right)$ present at 500 K ?

b) Calculate the electrical conductivity of a pure semiconductor at 300 K from the following data.

$E_g = 0.70$ eV, $\mu_n = 0.38\ m^2\ v^{-1}\ s^{-1}$, $\mu_p = 0.18\ m^2\ v^{-1}\ s^{-1}$.

c) Assuming that only Na^+ contributes to the ionic conductivity in NaCl, what is the value of the diffusion coefficient per unit area for Na^+ in NaCl, if the measured conductivity of NaCl is 10^{-6} mho cm^{-1} at 600 K.

The edge length of unit cell of NaCl crystal is 5.63 $\mathring{A}$.

SECTION - II

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

a) Write the Gibbs adsorption equation and explain the terms involved in it. Describe any one method of its verification.

b) What is floatation? Explain its mechanism. Give the important applications of the technique.

c) Describe the volumetric method for the measurement of adsorption of a gas on solid surface.

d) Write the BET equation explaining the terms involved in it. How it is used to determine the specific surface area of solid?

e) Distinguish between physical adsorption and chemisorption.

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

a) Define heat of adsorption. Describe isosteric method to determine heat of adsorption.

b) What is capillary condensation? Describe hysteresis phenomenon in adsorption on porous solids.

c) Give the names of catalyst for following heterogeneous catalysis.

i) Hydrogenation

ii) Oxidation of butene to benzene

iii) Oxidation of ammonia to NO

iv) Hydrocracking

v) Oxychlorination.

d) Write a short note on heterohomogeneous catalysis.

e) What are zeolites? With suitable examples explain, how they act as molecular sieves?

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

a) A monomolecular film containing 8.2×10^{-4} g protein per m^2 gave the surface tension lowering of 0.036 dyne cm^{-1} at 300 K. Calculate the molecular weight of the protein.

b) The adsorption of butane vapour on 1.85 g of catalyst was studied at $0^{o}C$.The data when fitted in BET equation, yielded a linear polt with the slope of 38.95×10^{-3} $m1^{-1}$ and intercept of 1.85×10^{-3} $m1^{-1}$. The area occupied per molecule of butane is 44.6 $\mathring{A}^{2}$. Determine the specific surface area of the catalyst.

c) The surface tension of ethanol-water mixture follows the equation $\gamma = 72 - 0.5c^2 + 0.2c$, where c is the ethanol concentration is moles per litre. Calculate the surface excess of ethanol in moles cm^{-2} for 0.5 m solution at $25^{o}C$.

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

P838

[3923] - 43

M.Sc.

PHYSICAL CHEMISTRY

CH - 414 : Polymer Chemistry - II

(2005 Pattern) (Old) (Sem. - 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.***
3) ***Figures to the RIGHT SIDE indicate FULL marks.***
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5) ***Neat diagrams must be drawn WHEREVER necessary.***

Physico - Chemical Constants

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5.	1 eV		=	23.06 k cal mol^{-1}
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			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
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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 with suitable examples how polymers can be classified on the basis of i) applications ii) method of preparation.

b) Describe the experiment which proves that chemical reactivity is independent of molecular weight.

c) Discuss the salient features of addition polymerization.

d) Derive and plot the number addition and weight distribution functions for linear step reaction polymerization.

e) Describe the chain transfer reaction in free radical chain polymerization.

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

a) Write a note on emulsion polymerization.

b) What is anionic polymerization? What are living polymers? How are they useful?

c) Explain why styrene can undergo polymerization by all modes viz. free radical, cationic, anionic and condensation.

d) What are copolymers? What are the advantages of using copolymers?

e) Derive the copolymer equation.

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

a) A condensation polymerization reaction is 97% complete.

Find $\bar{x}_n, \bar{x}_w$, PI and fraction of $\overline{X}_n$ – mers.

b) 108g of butadiene (r_1 = 0.76) are copolymerized with 344g of methyl acrylate (r_2 = 0.05). Calculate the instantaneous composition of copolymer formed (H = 1, C = 12, O = 16).

c) 138.5g of P-chlorostyrene (r_1 = 0.45) is co-polymerized with 33.5g methyl acrylonitrile (r_2 =0.73). Find the instantaneous composition of the copolymer. (H = 1, C = 12, O = 16, Cl = 35.5, N = 14).

SECTION - II

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

a) Explain the distribution of molecular weight in a polymer sample with the help of MWD curve. Show the positions of different averages on the curve. Define these averages.

b) What are the possible configurations of monomer units in the polymer chains? Which of these is the most probable? Why?

c) Explain the terms- retardation, inhibition, induction period. Discuss the mechanism of retardation.

d) Discuss the two types of termination reactions in free radical chain polymerization.

e) How is enthalpy of free radical chain polymerization calculated? Why is the observed value of enthalpy a little lower than the theoretically calculated value.

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

a) Explain the terms - viscosity, relative viscosity, specific viscosity, reduced viscosity, inherent viscosity and intrinsic viscosity.

b) Describe with a neat diagram the gradient elution technique.

c) Describe the fractional precipitation method used for fractionation of a polymer sample.

d) Write a note on GPC.

e) Discuss the principle of membrane osmometry.

Q6) Attempt 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)	0.2	0.4	0.6	0.8	1.0
t (s)	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. rotar speed = 6000 rpm. Temp. = 25°C, $\rho = 1.2$g/CC, $\overline{V} = 0.6$ cm^3.

c) Calculate the molecular weigtht of a polymer in benzene ($\rho = 0.8682$) at 30°C from the data.

C (%)	0.2	0.4	0.6	0.8
h (cm of benzene)	0.1	0.28	0.54	0.88.

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P838

[3923] - 43

M.Sc.

PHYSICAL CHEMISTRY

CH - 415 : Environmental Pollution

(2005 Pattern) (Old) (Sem. - 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.***
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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5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
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7.	Faraday Constant	F	=	96487 C equiv^{-1}
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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) Discuss the biochemical effects of CO.

b) Write a note on atmospheric photo chemistry.

c) Discuss the biochemical cycle. Explain the nitrogen cycle in biosphere.

d) What is 'droplets'? Explain wet deposition of gases.

e) What are the health effects of air pollutants?

f) Explain the sulphur cycle in the atmosphere.

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

a) What is residence time? Explain the relation $T = {[A]}/{K[A]}$.

b) Define deposition velocity. Explain the dry and wet deposition of gases.

c) Discuss briefly environmental reservoirs.

d) Write a note on carbon cycle.

e) Explain the particle composition and its deliquescent behavior.

f) Explain the ecological impact of organochlorine compounds.

SECTION - II

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

a) Define the following terms :

i) BOD ii) DO

iii) COD iv) Acidity of water.

b) What is hardness of water? How it is determined?

c) Explain the impact of CFC on ozone layer.

d) What are the sources of pollutant CO? Explain the biochemical effect of CO and suggest the suitable control.

e) Discuss the various effects of noise pollution on human health.

f) What are permissible limits for residual chlorine in water? How it is estimated?

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

a) What are the sources of pollutant NO_x? Explain biochemical effect of NO_x.

b) Explain the mechanism of effect of toxic chemicals on enzymes with suitable examples.

c) Describe the method used for determination of oil and grease.

d) What is alkalinity of water? How is it determined?

e) What is tolerance limit? What are the tolerance limits for the following impurities in water sample?

i) Arsenic.

ii) Fluorid.

iii) Cynide.

f) Explain the term biomagnification. Discuss the biochemical effect of DDT.

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P838

[3923] - 43

M.Sc.

PHYSICAL CHEMISTRY

CH - 416 : Special Topics in Physical Chemistry

(2005 Pattern) (Old) (Sem. - 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.***
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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) Explain the influence of oxygen medium on the properties of surfaces and ceramic grain boundaries in porous substances.

b) Write charge balance, mass balance and proton condition on thiosulphate in a 0.4 $MH_2S_2O_3$ solution .

c) Give the classification of sensors on the basis of their

i) Principle of conversion and

ii) Purpose.

d) Discuss adsorption isotherms used in sensors.

e) Write proton condition for $H_2C_2O_4$ and NaHS .

f) Define inhibitor, activity, selectivity, stability and poison.

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

a) Give the mechanism of the phenol-acetone condensation reaction to get bisphenol A.

b) Find the concentration of H_2CO_3, HCO_3^- and CO_3^{2-}

(Given : pH = 5.0, $Ka_1 = 4.4 \times 10^{-7}$, $Ka_2 = 5.6 \times 10^{-11}$)

c) What are active and passive sensors?

d) Draw a logarithmic concentration diagram for 0.01M acetic acid. [Given: PKa = 4.75]

e) Discuss the dependence of the rate constant on pH for oxidation of acetone at 25°C.

f) Write the charge balance for 0.1 N NaCN and 0.2N HCN.

SECTION - II

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

a) Draw a neat and labelled diagram of TEM.

b) Write a note on fullerines.

c) Explain the term active smartness. Explain with suitable examples.

d) Derive Raoult's law for solutions.

e) Discuss in brief sushi test.

f) Derive and state limitations of the phase rule.

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

a) Write a note on azeotropic mixtures.

b) Discuss the applications of nanoparticles.

c) Explain the principle of steam distillation.

d) Describe lithography as a technique of building nanomaterials.

e) How aerojets are prepared? What are their applications?

f) How are carbon nanotubes produced? What are their uses?

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P839

[3923]-44

M.Sc. (Part - II)

INORGANIC CHEMISTRY

CH-430 : Inorganic Solids, Heterogeneous Catalysis and Structural Methods

(Old) (2005 Pattern) (Sem. - IV)

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

Instructions to the candidates :

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

SECTION - I

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

a) What is meant by poly-organo-siloxanes? Explain with suitable chemical reactions, the synthesis of poly-organo-siloxanes.

b) Give an account of Inorganic benzene and compare it with organic benzene.

c) Give the different methods of synthesis of multidentate macrocyclic ligands.

d) What do you understand by Heterogeneous catalysis? Explain it with the help of potential energy diagram.

e) Write an account of ZMS - 5 and ZMS - 15 Zeolites.

Q2) Answer the following (any four) : **[16]**

a) Draw the structures of following :

i) $Fe_5(CO)_{15}C$ ii) $[Ni_5(CO)_{12}]^{2-}$

iii) $Ir_4(CO)_{12}$ iv) $(PNCl_2)_3$

b) Draw the structure of $[Rh_7(CO)_{16}]^{3-}$

and explain it on the basis of electron framework.

c) Explain the Molecular orbital energy level diagram for $B_4C_2H_6$.

P.T.O.

d) Complete the following equations :

i) $B_6H_{12} + Me_3P \longrightarrow ? + ?$

ii) $NH_3 + S_4N_4 \longrightarrow ? + ?$

iii) $NH_4Cl + BCl_3 \longrightarrow ? + ?$

iv) $n\,PCl_5 + n\,NH_4Cl \xrightarrow{?} ? + ?$

e) Write a note on polymorphic forms of carbon.

Q3) Write short notes on (any two) : **[8]**

a) Polyoxyanions.

b) Polyphosphates.

c) Carboranes and Metalloboranes.

SECTION - II

Q4) Attempt any four : **[20]**

a) How will you determine the particle size by X -ray crystallography.

b) Write a note on the working of DSC instrument.

c) Explain the thermogram of conversion of $Ca\,C_2\,O_4 \cdot H_2O$ to CaO.

d) Draw the schematic diagram for the instrumentation of DTA and explain the importance of every component.

e) What are miller indices ? Compute the miller indices for faces having the intercept as.

i) 3,2,5

ii) $\frac{1}{2}, \frac{1}{3}, 1$

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

iv) 2, 1, ∞

Q5) Attempt <u>any four</u> : **[20]**

a) Lead has a FCC structure and a Lattice constant of 0.495 nm calculate the value for its interplanar spacing d_{111} and d_{220} in nanometer.

b) A diffraction pattern of a cubic crystal of lattice parameter a = 4.16 A^o is obtaine with a monochromatic X - ray beam of wavelength 1.84 A^o. The first four lines on this pattern were observed to have following values

line	2θ (in degrees)
1	20.3
2	29.2
3	36.7
4	43.6

Determine interplanar spacing and miller indices of the reflecting planes.

c) $Fe C_2 O_4 . 2H_2O$ decomposes to form $Fe_2 O_3$ in two steps. Calculate weight loss for each steps. Write the decomposition reaction for each step. (Given at. wt. Fe = 55.85, C = 12.0, H =1, O =16.0)

d) Explain any one application of DTA.

e) A crystal plane makes intercepts 3,2,1 on the crystal axes a, b and c calculate the miller indices.

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

P840

[3923] - 45

M.Sc. (Part - II) (Sem. - IV)

INORGANIC CHEMISTRY

CH-431 : Material and Industrial Inorganic Chemistry (Old)

(2005 Pattern)

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

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Answers to the two sections must 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 tables/calculator is allowed.***

SECTION - I

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

a) Depending on different laws how the hard magnetic material is used in magnetic compass, loud speaker and microwave oven?

b) Give the schematic flow diagram of cement making process.

c) Give the Zachariasen-Warren hypothesis and rules for formation of glasses from Silica.

d) With the help of magnetisation curves explain Type I and Type II superconductors.

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

a) Write about Josephson Junction and Super conducting quantum interference derive.

b) What are molecular magnets? Draw the structure of first organic Ferromagnet.

c) Give the applications of Simple Ceramic Oxides.

d) How the quality of cement is improved?

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

a) Applications of soft magnetic materials.

b) Oxide Superconductors.

c) Special Cements.

P.T.O.

SECTION - II

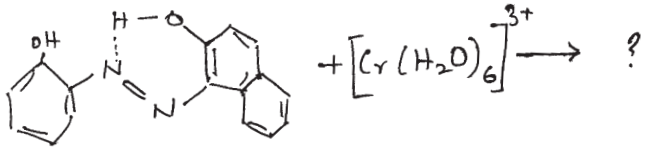
Q4) Attempt any three : **[15]**

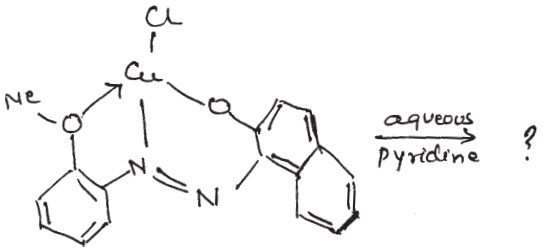
a) Classify the following compounds as developing agents, Bleaching agents, filter dyes emulsifiers Sensitizers.

$K_2[IrCl_6]$; $AuCl_3py$; $(NH_4)_2[PdCl_4]$; $[Fe(C_2O_4)]^{-2}$ $[Fe(CN)_6]^{-3}$, $Na_2S_2O_3$,

Copper phthalocyanin derivatives, $[FeEDTA]^-$, Ni–pyrazolone complex, $Na[AuCl_4]$

b) Complete the following reactions :

i) 

ii) 

iii) $BaSO_4 + C \rightarrow \underline{?} + \underline{?}$

c) What are metallized dyes? How are they obtained? Where are they used? Give giving suitable examples.

d) What are addition agents? Explain their role in electroplating with the help of suitable examples.

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

a) Define the terms i) Paint ii) Pigment. Name two natural pigments vital to living kingdom. List important properties of pigments.

b) Which types of isomerism are seen in chromium and cobalt complexes of azo compounds. Explain any one type of isomerism.

c) What do you understand by photothermography. Give examples of photothermographic compounds and explain cobalt systems.

d) Explain electrodeposition of copper.

Q6) Write notes on (any two) : **[10]**

a) Addition reagents.

b) Ferrocene modified electrodes.

c) Electrophotography.

■ ■ ■

Total No. of Questions : 9] **[Total No. of Pages : 4**

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[3923]-46

M.Sc. (Part - II)

INORGANIC CHEMISTRY

CH-445 : Inorganic Applications In Material Science, Biotechnology And Environmental Chemistry

(Sem. - IV) (Old) (2005 Pattern)

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 corrosion? Explain in brief atmospheric corrosion and immersed corrosion.

b) Define polymer? Explain weight average and number average mol. wt concept of polymer.

c) Explain how band theory of solids helps to classify the materials into conductors, insulator and semiconductors.

d) Distinguish between low density polyethylene (LDPE) and high density polyethylene (HDPE).

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

a) Give preparations, properties and uses of Nylon.

b) Explain the effect of foreign atom substitution on semiconductors behaviour.

P.T.O.

c) Give band picture of Beryllium and sodium on the basis of band theory of solids.

d) Find out the nature of film, when chromium (Cr) oxidises to chromium oxide (Cr_2O_3).

Given : Atomic wt. of oxygen = 16.00 gm.
Atomic wt. of Cr = 52.00 gm.
Density of Cr = 7.9 gm/cm^3
Density of Cr_2O_3 = 10.28 gm/cm^3

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

a) Distinguish between unvalcunised (Raw) and valcunised rubber.

b) Explain Hall effect and Hall coefficient.

c) Define :-

i) Passivity.

ii) Tinning.

iii) Organic and Inorganic Polymer.

iv) Degree of Polymerization.

v) Electroluminescence.

SECTION - II
Biotechnology

Q4) Attempt <u>any three</u> of the following : **[15]**

a) Explain about Pruteen and Methane Production by biotechnology.

b) Discuss the effect of temperature on the action of renin on milk.

c) Explain monoclonal antibodies and their function.

d) Describe the process of producing food from bacteria.

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

a) State and explain main stages involved in making cheese.

b) What is a Fermenter? Compare between batch Fermenter and continuous Fermenter.

c) What is the starting material for making vinegar? Explain the method with different steps involved in making vinegar.

d) Give examples of the early applications of Biotechnology in food production.

Q6) Write short notes on <u>any two</u> : **[10]**

a) Tissue culture.

b) Vaccines.

c) Food Processing.

SECTION - III

Environmental Chemistry

Q7) Attempt <u>any three</u> of the following : **[15]**

a) What effect upon soil acidity would result from heavy fertilization with ammonium nitrate accompained by exposure of the soil to air and the action of aerobic bacteria?

b) What are primary air pollutant? Choosing any one air pollutant give information regarding the following points.

i) Human health effects.

ii) Environmental effects.

c) What are specific compounds in both a particular animal waste product and a major fertilizer?

d) Explain the reaction of pb $(C_2H_5)_4$ on combustion of gasoline.

Q8) Attempt <u>any three</u> of the following : **[15]**

a) Comment on the origin of soot particles. How would you monitor toxic inorganics and organics in soot particles?

b) Compare aerobic treatment process with anaerobic treatment process.

c) What is the primary detrimental effect upon organism of salinity in water arising from dissolved NaCl and Na_2SO_4?

d) What temperature and moisture conditions favour the build up of organic matter in soil.

Q9) Attempt <u>any two</u> of the following : **[10]**

a) Name the instrumental methods for estimation of metals such as Hg, As, Cd, Cu and Fe from polluted water. Explain in detail the spectrophotometric method for the determination of copper from polluted water.

b) Write short note on : Bhopal disastor.

c) Define the terms :

i) Pollutant.

ii) Dissolved oxygen.

iii) Detergents .

iv) Fertilizers.

v) Arosol.

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

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[3923]-47

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

ORGANIC CHEMISTRY

CH-450 : Chemistry of Natural Products

(Old Course) (2005 Pattern)

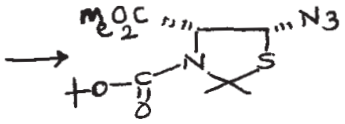
Time : 3 Hours] ***[Max. Marks : 80***

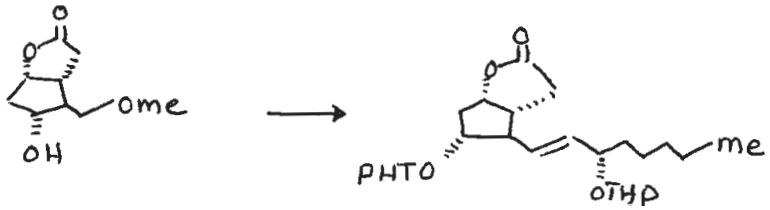
Instructions to the candidates :

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

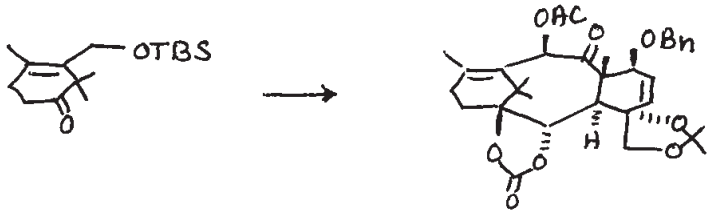
SECTION - I

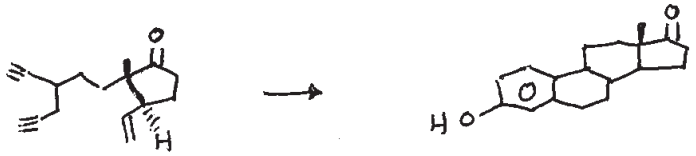
Q1) Outline the steps involved in the following synthetic sequences. Indicate the reagents used and discuss the mechanism and stereochemistry involved (any four). **[16]**

a) L(+) cystein 

b) 

c) 

d) 

e) 

P.T.O.

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

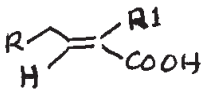
a) Give the evidences to show that camptothecin contains

i) Pyridone

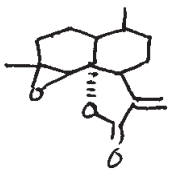
ii) $Ar - CH_2 - N - CO$ group

b) Give evidences to establish

i) β–substituted furan ring

ii)  group in Hardwickiic Acid.

c) Arteannuin B has structure 1. Give evidence to show that it has an epoxide ring and methylene γ–lactone.



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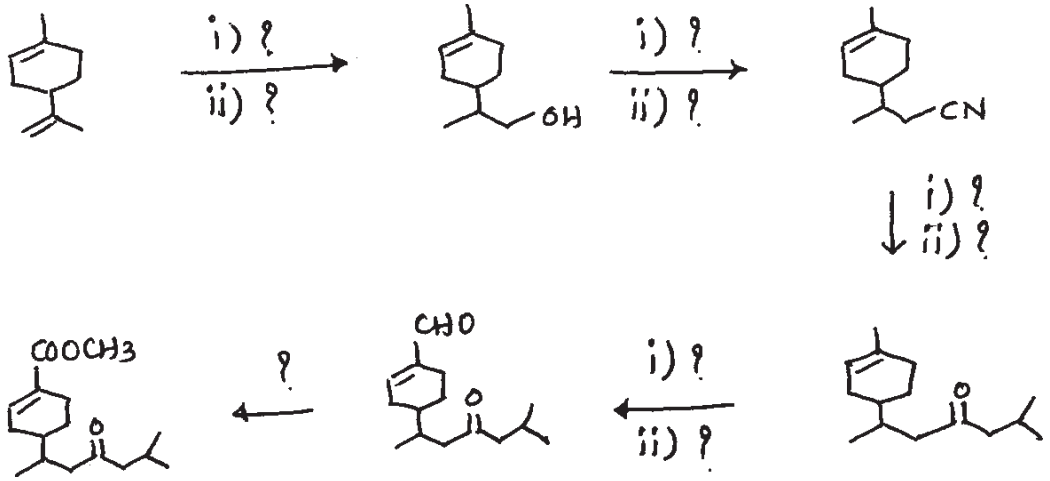
d) Nature and position of oxygen atoms in Estrone.

Q3) a) The following terpene molecule was prepared in the given steps. Fill in the reagents for the following conversions and explain the steps involved. **[6]**



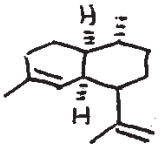
b) Discuss the retrosynthetic analysis of Taxol and explain any two strategic reactions involved in its synthesis. **[6]**

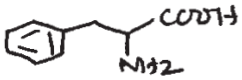
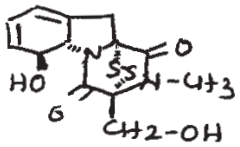
SECTION - II

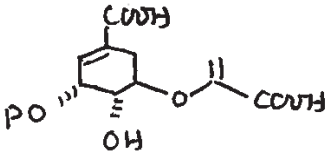
Q4) a) Explain the role of co-enzymes NAD^+ and FAD in the reactions catalysed by dehydrogenase enzymes. **[4]**

b) Suggest suitable biogenetic schemes for any three. **[12]**

i) NPP ⟶ 

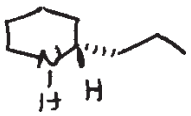
ii) 2Z,6E FPP ⟶ 

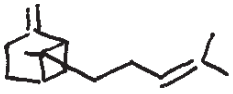
iii)  ⟶ 

iv)  ⟶ 

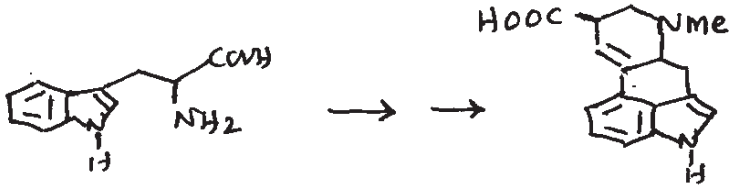
Q5) Answer any two of the following: **[12]**

a) Write all the steps involved in the following biogenetic conversion. Indicate the position of label in each step.

$\left[1-{}^{14}C\right]$ – acetate ⟶ 

b) Suggest biogenetic route for  from $\left[4-{}^{13}C\right]$ – Mevalonic acid. Clearly indicate the position of label in each step.

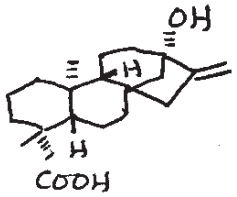
c) Discuss the steps involved in the biogenesis of D(+) Lysergic acid from Tryptophan.



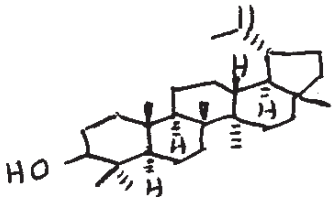
D(+) Lysergic acid

Q6) a) Give the probable biogenetic mechanism for the formation of Lanosterol from farnesyl pyrophosphate. **[6]**

b) Suggest suitable biogenetic scheme for any one of the following. **[6]**

i) GGPP ⟶ 

ii) Squalene – 2, 3–epoxide to Lupeol.



Lupeol

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

P843

[3923] - 48
M.Sc. (Sem. - IV)
ORGANIC CHEMISTRY
CH-451 : Synthetic Methods in Organic Chemistry
(2005 Pattern) (Old Course)

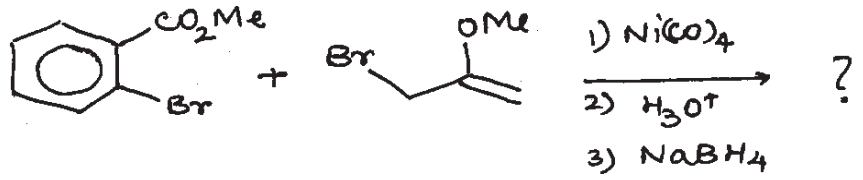
Time : 3 Hours] ***[Max. Marks : 80***

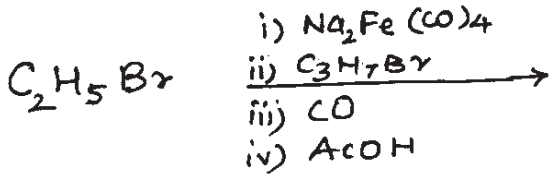
Instructions to the candidates :

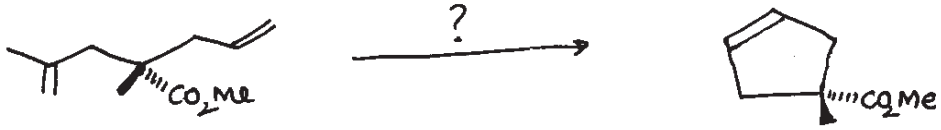
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

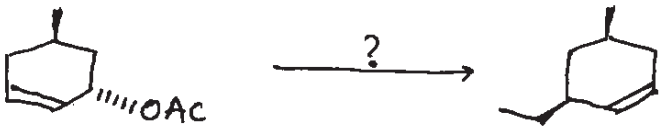
SECTION - I

Q1) a) Predict the product/reagents in the following conversions. (any three) : **[6]**

i) 

ii) 

iii) 

iv) 

b) Write short notes on <u>any two</u> of the following : **[6]**

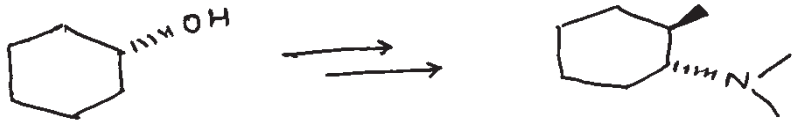
i) Combinitorial Chemistry.
ii) Enamines in organic synthesis.
iii) Organo sulphur compounds in umpolung reactions.

Q2) a) Complete <u>any two</u> of the following conversions by using suitable reagents: **[6]**

i) 

P.T.O.

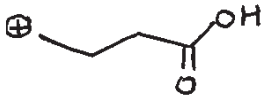
ii) 

iii) 

b) Give synthetic equivalents of <u>any two</u> and illustrate your answer with one example. **[4]**

i) 

ii) 

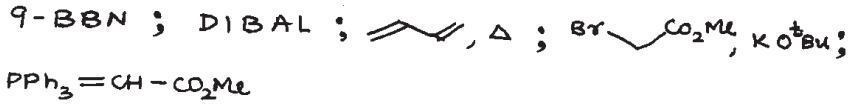
iii) 

c) Arrange the reagents given in proper order to achieve <u>any two</u> of the following conversions. **[6]**

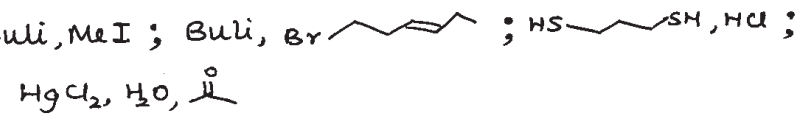
i) 

Reagents : ^{n}BuBr, THF; Oxalic acid, steamdistill; $NaBH_4$, THF, H_2O; n-BuLi, THF

ii) 

Reagents : 

iii) 

Reagents : 

Q3) Explain <u>any four</u> of the following : **[12]**

a) Use of 1-ethyl-3-(3-dimethyl aminopropyl) Carbodiamide in organic synthesis.

b) Advantages of urethane protection in peptide synthesis.

c) Synthesis of optically active alcohols using organo boranes.

d) Solid phase peptide synthesis.

e) Synthesis of stereoregular polymers using $TiCl_4/AlEt_3$.

SECTION - II

Q4) a) Explain the use of following reagents in organic synthesis in brief (any three) : **[9]**

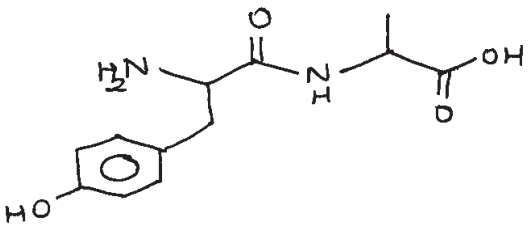
i) $Ni(COD)_2$

ii) Ceric ammonium nitrate

iii) Collman's reagent

iv) $Pd(pph_3)_4$

b) Discuss the steps involved in the synthesis of the dipeptide. **[3]**



Q5) a) Attempt any three of the following : **[9]**

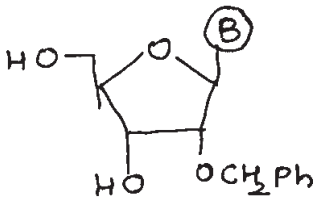
i) Explain that pyrrolidine enamine of 2-methyl cyclohexanone on reaction with allyl bromide gives 2-Methyl, 6-allyl-cyclohexanone as the major product after work-up.

ii) Discuss the role of Pd(O) in Heck reaction.

iii) Discuss the role of 1, 3-dithiol in umpolung reactions.

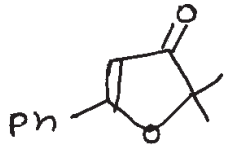
iv) Explain the role of organo nickel in large ring formation.

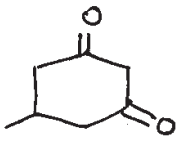
b) Discuss the steps involved in the synthesis of compound X. **[3]**

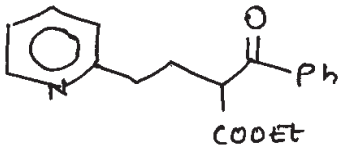


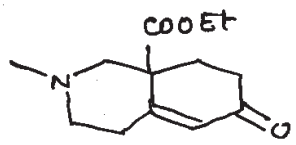
X

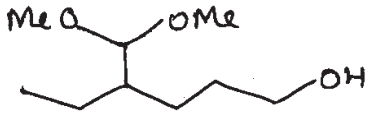
Q6) Using reterosynthetic analysis, suggest suitable synthetic strategy for the synthesis of <u>any four</u> of the following compounds. **[16]**

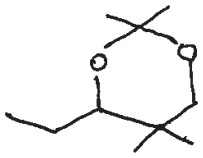
a) 

b) 

c) 

d) 

e) 

f) 

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

P788

[3923] - 204

M.Sc. (Sem. - II)

BIOCHEMISTRY

BCH - 270 : Bioenergetics and Metabolism (Old and 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.***

SECTION - I

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

a) Draw the structure of ATP and list out its significance.

b) Show the reaction sequence involved in the metabolism of glycerol via glycolysis.

c) Write note on fate of pyruvate in anaerobic condition.

d) What happens to the rate of glycogen breakdown if a muscle preparation containing glycogen phosphorylase is treated with epinephrine.

e) Show Hill reaction and give its significance.

f) Write note on lactose intolerance and galactosemia.

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

a) Differentiate between cyclic and non-cyclic photophosphorylation.

b) Describe the sequence of enzyme catalysed reactions that catabolise acetylcoA to CO_2.

c) How does the flow of electrons through the respiratory chain channel energy into the synthesis of ATP? Show the complete sequence of events.

d) Explain the synthesis of glucose from any two non carbohydrate precursors.

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

a) Explain the mechanism with which some plants prevent photorespiration.

b) Discuss the role of glycogenin in glycogenesis.

c) Describe the reaction sequence involved in pentose phosphate pathway and give its significance.

P.T.O.

SECTION - II

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

a) How are ketone bodies formed from acetylcoA.

b) Differentiate between α, β, ω oxidation of fattyacids.

c) Write the steps involved in preparation of AMP and GMP from IMP.

d) What are polyamines? How are they synthesised from S-Adenosyl Methionine.

e) Give the significance of pyridoxal phosphate in amino acid metabolism.

f) Write note on decarboxylation of amino acids and give its significance.

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

a) Elaborate the enzyme catalysed reactions involved in biosynthesis of pyrimidine nucleotides.

b) Show the steps involved in the biosynthesis of serine, glycine and cysteine from 3.phosphoglycerate.

c) Explain the sequence of events that occurs during synthesis of a fattyacid with the help of fatty acid synthase complex.

d) Discuss the steps involved in Urea cycle and give its significance.

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

a) Discuss the biochemical lesion, clinical manifestation of phenylketonuria and alkaptonuria.

b) Outline the steps that convert Purines to uric acid.

c) Explain the role of CDP in phospholipid biosynthesis.

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

P789

[3923] - 205
M.Sc.
BIOCHEMISTRY
BCH - 271 : Techniques for Characterization of Biomolecules
(New) (Sem. - II)

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.***

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

a) Define sedimentation coefficient and ultracentrifugation. Derive an expression for sedimentation.

b) What is viscosity? Write a note on Ostwald's capillary viscometer.

c) List the various counters used in detection of radiation and measurement. Explain the principle and working of G.M. counter.

d) Write a note on radiolysis of water.

e) Define radioactivity and explain its characteristic features. Explain the different types of radioactive decay with example.

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

a) Describe the theory of partial specific volume and diffusion. Explain any two methods of density determination.

b) Explain the factors affecting sedimentation. Describe any one Beckman's centrifuge.

c) What is autoradiography? Explain the dipping method with its application in demostration that starvation prevents DNA synthesis in bacteria.

d) Write a note on methods of enzyme immobilization for development of biosensor.

e) What is immunosensor? Explain the use and advantages of immunosensor.

P.T.O.

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

a) Draw schematic diagram of GC-MS and explain the instrumentation.

b) Give the principle, working and application of ESR.

c) Explain the principle and working of ORD instrument.

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

a) Conductometric biosensors.

b) Application of CD.

c) Atomic absorption spectroscopy.

d) Chemical shift.

e) Fluorescence.

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

P789

[3923] - 205

M.Sc.

BIOCHEMISTRY

BCH - 271 : Biophysical Techniques

(Old) (Sem. - II)

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.***

SECTION - I

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

a) Explain the principle of freeze drying process.

b) "Thin-layer chromatography is superior to other types of chromatographic methods" Explain this statement.

c) Write a short note on zone electrophoresis.

d) Describe any two applications of ion-exchange chromatography.

e) Explain the principle and applications of DNA-cellulose chromatography.

f) What is hydrophobic interaction chromatography?

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

a) Distinguish between fiberglass filters and nitrocellulose filters.

b) Explain the purpose of each of the chemical reagents that are used for PAGE.

i) Sodium dodecyl sulfate

ii) N, N, N', N' - methylene bis-acrylamide.

iii) TEMED

iv) Bromophenol Blue

v) Coomassie Brilliant Blue.

c) Describe the effect of pH and relative orientation of neighbouring chromophores on absorption properties of a chromophase.

d) "Ion-exchange materials may be classified in terms of acidic or basic strength of the functional group attached to the polymer matrix". Explain this statement.

e) Explain the principle and application of isoelectric focusing.

P.T.O.

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

a) How molecular weight of a protein can be determined by gel chromatography.

b) Why are 'salting out' procedures often used or an initial purification step following the production of a crude extract by centrifugation.

c) Describe any four commercially available matrix-ligand systems for affinity chromatography.

SECTION - II

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

a) Write short note on density gradient centrifugation?

b) What is diffusion coefficients and how it can be measured.

c) What are the types of radiations? Give their features.

d) Write note on radiation dosimetry.

e) What are the applications of airfuge?

f) Define the term quenching. List out different factors that result in quenching.

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

a) Explain the working of Liquid scintillation counting and give its applications.

b) What is partial specific volume? How can it be measured.

c) Discuss the applications of radioisotopes in biochemistry.

d) Explain the working principle and applications of analytical ultracentrifuge.

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

a) Elaborate on the type of rotors used in ultracentrifuges and give their significance.

b) Write note on factors affecting sedimentation velocity.

c) Discuss the working of Ostwald's viscometer and list out its uses in viscosity measurements.

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

P790

[3923] - 206
M.Sc. (Sem. - II)
BIOCHEMISTRY

BCH - 273 : Membrane Biochemistry and Genetics(New)/Nucleic acids (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
(Membrane Biochemistry)

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

a) Freeze Fracture technique.

b) Carbohydrate content in membrane and its detection.

c) ATP-ADP exchanger.

d) Symport and antiport phenomena with appropriate examples.

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

a) Patch clamp technique.

b) Acetyl choline receptor - a ligand gated channel.

c) Proton gradient coupled to ATP synthesis.

d) Active transport of calcium.

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

a) Structural features of virus membrane.

b) Group translocation phenomena.

c) Receptor mediated endocytosis.

P.T.O.

SECTION - II

(Genetics - new / nucleic acids - old)

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

a) Describe in detail inborn errors of metabolisms caused due to mutations.

b) What is bacterial transduction? Explain its mechanism in brief.

c) Explain in detail the structure and function of tRNA.

d) Explain the Mendel's law of dominance with suitable example.

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

a) Explain the concept of one gene one cistron hypothesis.

b) Describe in detail the biochemical and genetic analysis of the genetic code.

c) Give the various evidences that prove DNA as genetic material.

d) Describe in detail the semiconservative type of DNA replication.

Q6) Write short notes on any two: **[10]**

a) Significance of tetrad analysis in fungi.

b) Complementation test.

c) Human teratogenesis.

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

P797

[3923] - 307

M.Sc. - II

INORGANIC CHEMISTRY

CH - 330 : Co-ordination Chemistry Magnetism and Reaction Mechanism

(New) (Sem. - III) (2008 Pattern)

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 number: Cr = 24, Ni = 28, Co = 27.***

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

a) Draw the structures of the following:

i) $[Co(en)_2\ C1(NO_2)]C1$

ii) fac-triaquo-trinitro Cobalt (III).

iii) Penta ammine Cobalt (III) - μ - thiocyanato pentacyano Cobalt (III).

iv) Bis (Acetato) diammine Pd(II).

v) Triangulo-tri-μ-chloro hexachlorotri Rhenium (III).

b) Which of the following should have comparatively more intense d-d transitions. Explain.

i) Trans - $[CrCl_2\ (H_2O)_4]^+$ and Cis - $[CrCl_2\ (H_2O)_4]^+$

ii) $[Ni(CO)_4]$ or $[Fe\ (CO)_5]$

c) Why mixed valence Complexes shows intense colour? Give it's applications.

d) What is meant by Antiferromagnetism? Discuss it's different models?

e) Explain the terms

i) Anomalous Magnetic moment.

ii) Magnetically dilute system.

iii) Magnetically Concentrated System.

P.T.O.

Q2) Answer <u>any four</u> of the following: **[20]**

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

i) $K_2[Ni(CN)_4]$, $\mu = 0$.

ii) $[CoCl_2(OPPh_3)_2]$, $\mu = 4.91$ B.M.

b) Explain with one example quadrapole bonding.

c) Write a note on

i) Charge transfer transition.

ii) d-d transition.

d) What are group transfer reactions? Discuss such reactions along with their mechanism.

e) Explain why Δ_0 increases in the order

$CrCl_3^{3-}$, $Cr(NH_3)_6^{3+}$, $Cr(CN)_6^{3-}$.

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

a) Suggest the mechanism of the reaction.

$[Fe(CN)_6]^{4-} + [M_o(CN)_8]^{3-} \rightarrow [Fe(CN)_6]^{3-} + [M_o(CN)_8]^{4-}$

b) Write a note on equation and anation.

c) Explain in detail two electron transfer reactions.

d) Complete the following reaction.

i) $[PtCl_4]^{2-} \xrightarrow[-Cl^-]{+NH_3} A \xrightarrow{PPh_3} B$

ii) $[Pt(PPh_3)_4]^{2+} \xrightarrow{+Cl^-} A \xrightarrow{+Cl} B$

$H_3N < Cl^- < PPh_3$ - Trans effect.

e) Explain in detail how equilibrium constant and rate constant is related to thermodynamic and kinetic stability.

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

a) Write down the difference between SN^1 and SN^2 mechanisms.

b) How will you find out overall stability constant of Metal ligand complex formation reaction.

c) Explain sterric assistance in SN^1 and SN^2 mechanism.

d) Write a note on chelate and macrocyclic effect?

e) How frank condon principle is important in electron transfer reactions? Explain with the support of P.E. diagram.

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P824

[3923] - 408

M.Sc.

ORGANIC CHEMISTRY

CH - 450 : Chemistry of Natural Products

(New Course) (2008 Pattern) (Sem. - IV)

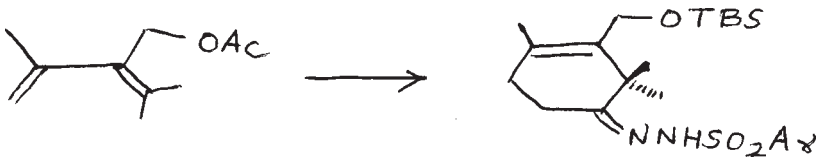
Time :3 Hours] *[Max. Marks :80*

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) Outline the steps involved in the following synthetic sequences. Indicate the reagents used and discuss the mechanism and stereochemistry involved (any four). **[16]**

a) 

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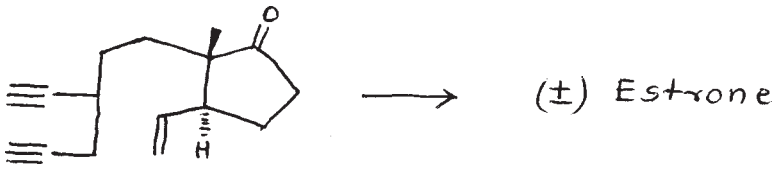
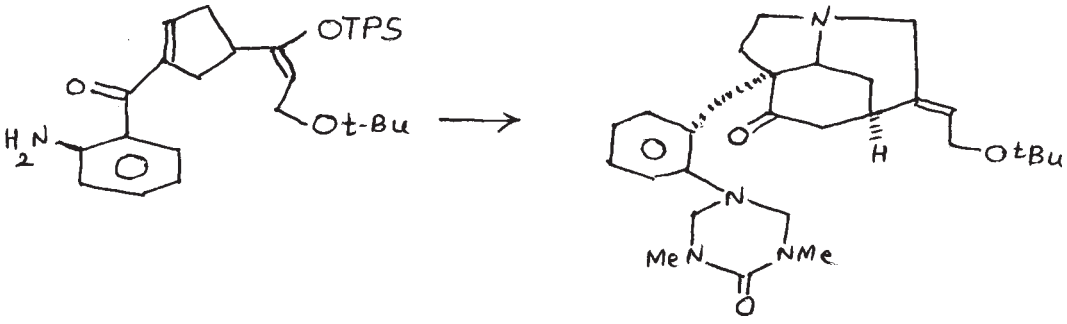
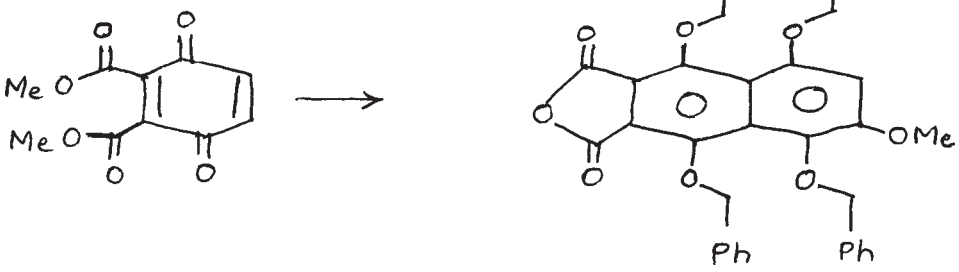
c) 

d) 

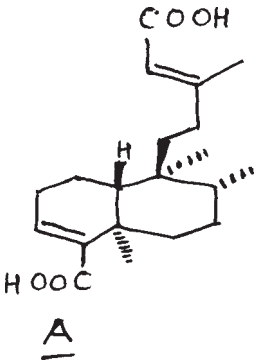
P.T.O.

e)



Q2) Answer <u>any three</u> of the following: **[12]**

a) Give spectral and chemical evidences to prove the following in compound <u>A</u>.



<u>A</u>

i) Nature of double bonds.

ii) Position of carboxylic groups.

b) How can we detect and determine the position of phenolic –OH group in hydroxy camptothecein?

c) Give evidences to establish the following in Hardwickiic acid.

i) The presence of β - substituted furan ring.

ii) Presence and stereo chemistry of C-9 methyl group.

d) Give evidences to establish the relationship between podophyllotoxin and picropodophyllin.

Q3) a) Determine the structure of naturally occurring alkaloid <u>A</u> ($C_8 H_{15} NO$; B.P. 193–195°C; sp. rotation – 1.3°) based on the data given below. Draw conclusion from each experiment and indicate giving reasons the structures of <u>A</u> to <u>E</u>. **[8]**

i) <u>A</u> contains keto group and basic tertiary nitrogen.

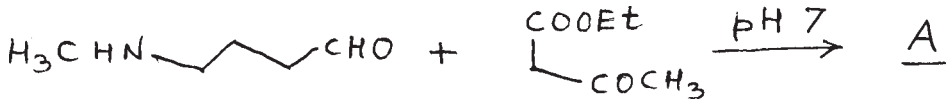
ii) <u>A</u> $\xrightarrow{\text{oxidation}}$ amino acid <u>B</u> ($C_6H_{11}NO_2$) $\xrightarrow{\text{pyrolysis}}$  $+CO_2$

iii) $Br(CH_2)_3Br + \overset{\ominus}{C}H(COOEt)_2\ \overset{\oplus}{Na} \xrightarrow{-NaBr}$ <u>C</u> ($C_{10}H_{17}O_4Br$)

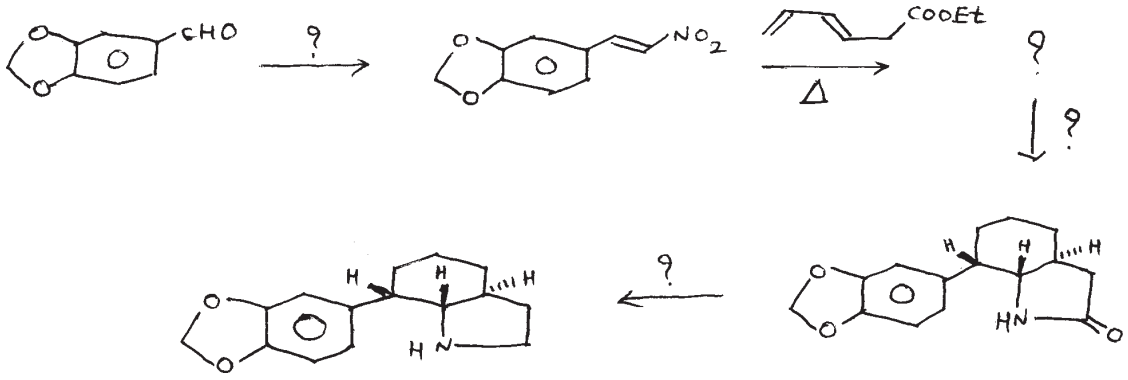
$\downarrow Br_2$

<u>B</u> $\xleftarrow{H_2O/\Delta}$ <u>E</u> ($C_{11}H_{19}O_4N$) $\xleftarrow{CH_3NH_2}$ <u>D</u> ($C_{10}H_{16}O_4Br_2$)

iv) Structure A was confirmed by the following conversion.



b) Place the appropriate missing reagents/intermediates in the following conversion and explain each step. **[4]**

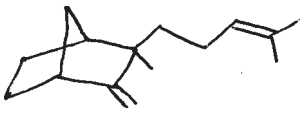


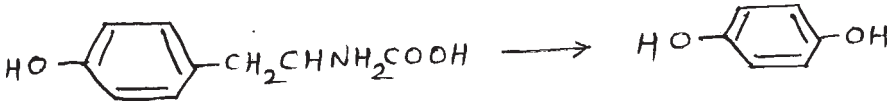
SECTION - II

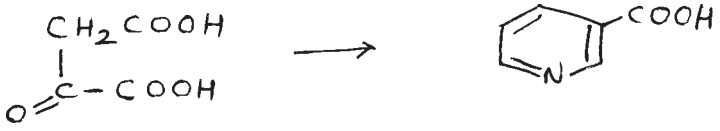
Q4) a) Explain the role of S-Adenosylmethionine in the formation of O-Methyl, N-Methyl and C-Methyl linkages giving one example of each. **[4]**

b) Suggest biogenetic scheme for any three of the following: **[12]**

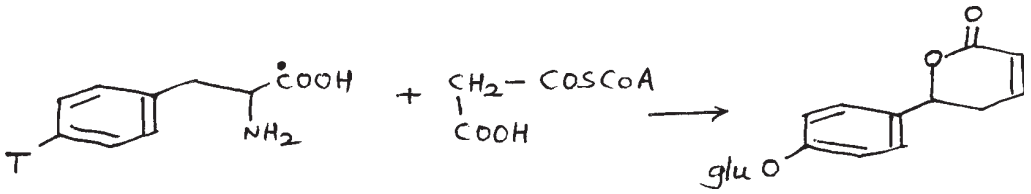
i) Linalyl pyrophosphate → 

ii) 2Z, 6E – FPP → 

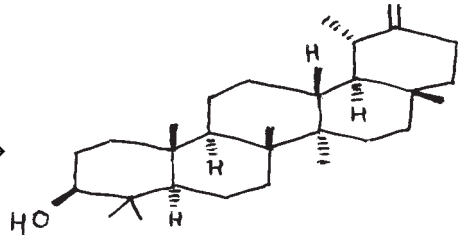
iii) 

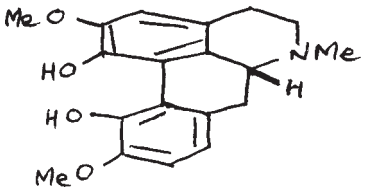
iv) 

Q5) Write the steps involved in <u>any two</u> of the following biogenetic conversions: **[12]**

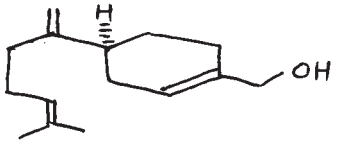
a) 

Indicate the position of label in each step and in the final product.

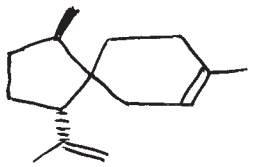
b) Squalene monoepoxide → 

c) Tyrosine → 

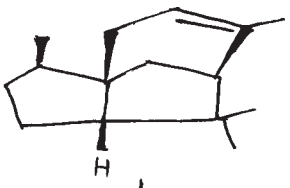
Q6) a) In plants, β - acoradiene and β -bisabolenol co-occur with cedrene. Give the biogenesis of cedrene from FPP and explain the co-occurrence of β - acoradiene and β -bisabolenol. **[6]**



β - bisabolenol

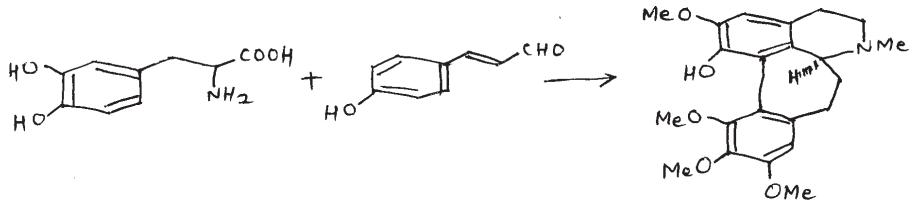


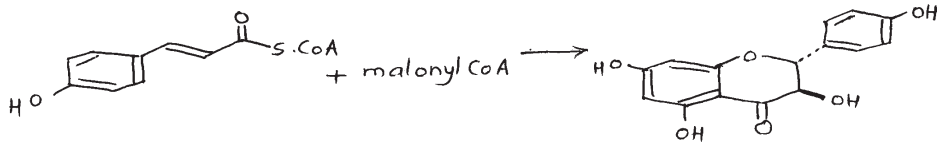
β - acoradiene



cedrene

b) Suggest biogenetic scheme for <u>any one</u> of the following: **[6]**

i) 

ii) 

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

P826

[3923] - 410

M.Sc.

ORGANIC CHEMISTRY

CH - 452 : Heterocyclic Chemistry, Chiron Approach and Medicinal Chemistry (2008 Pattern) (New Course) (Sem. - IV)

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 the following (any three) : **[6]**

i) N-acyl indole are more easily hydrolysed than acetamide.

ii) Imidazole (pKa = 7.1) is a much stronger base than pyrazole (pKa = 2.5).

iii) Quinoline undergoes nucleophilic substitution at 2 & 4 - position while isoquinoline undergoes at 1 - position.

iv) 2 - Acyl pyrrole undergoes nitration at 4 - position and not the vaccant 5 - position.

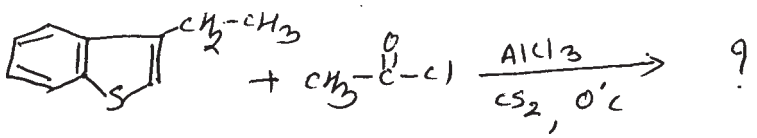
b) Attempt any two of the following: **[4]**

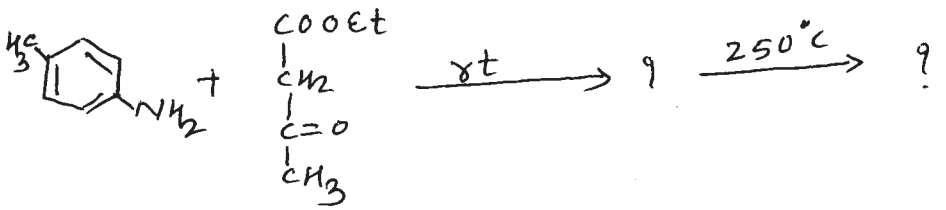
i) Furan behaves more of diene than aromatic compound.

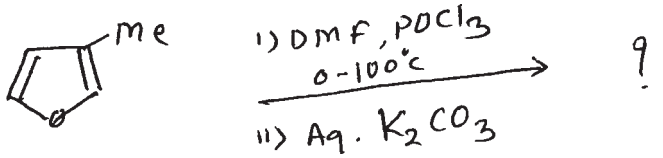
ii) Benzofuran undergoes metalation at 2 - position.

iii) 4-chloro-3- nitropyridine hydrolyses readily even in warm water.

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

i) 

ii) 

iii) 

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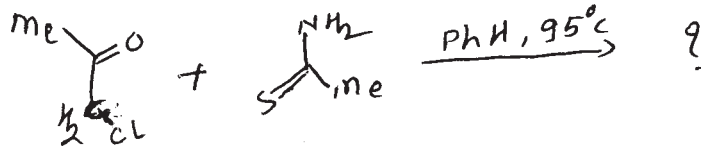
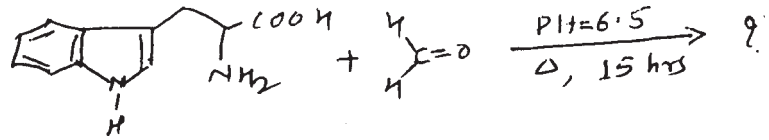
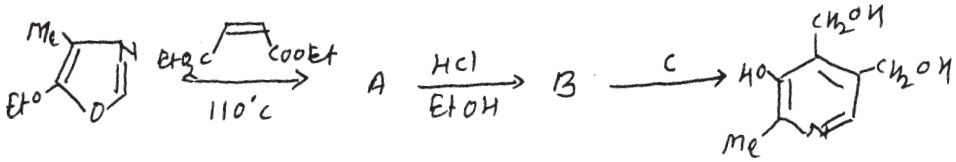
iv) 

v) 

b) Identify A, B, C in the following conversion. **[3]**



c) Give the reactions of the following reagents with thiophene. **[3]**

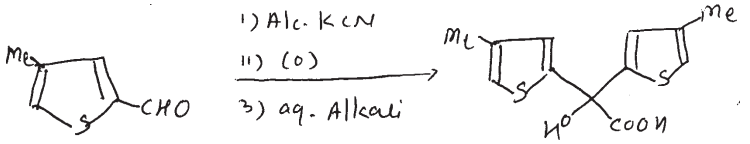
i) $Ph - \overset{\overset{O}{\|}}{C} - Cl$, $SnCl_4$ / Ph H

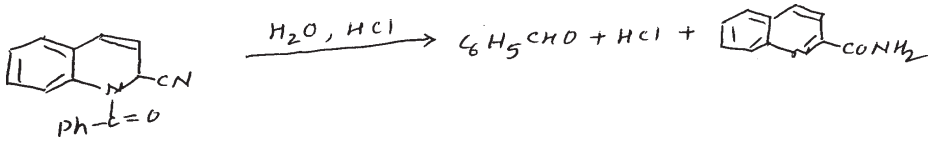
ii) N_2 CHCOOEt / hν

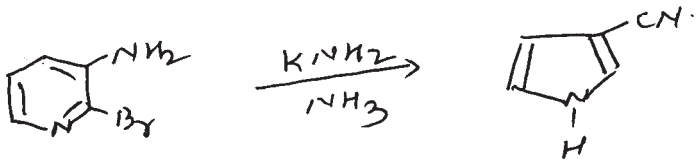
iii) Na / EtoEt, NH_3 (liq.).

iv) Br_2, $CHCl_3$, Zn / ACOH, 100°C

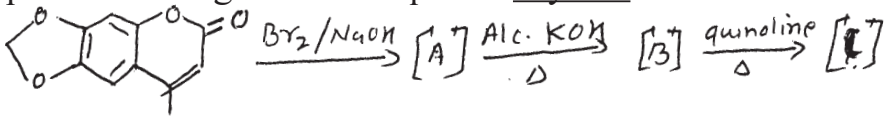
Q3) a)Suggest suitable mechanism for <u>any two</u> of the following: **[6]**

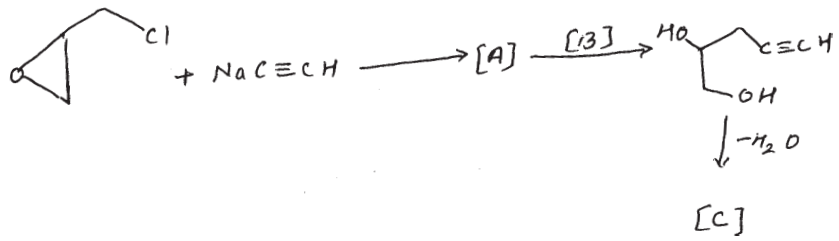
i) 

ii) 

iii) 

b) Complete following reaction sequence <u>any two</u> : **[4]**

i) 

ii) 

iii) 

c) Write notes on <u>any two</u> of the following: **[6]**

i) What is supramolecular chemistry.

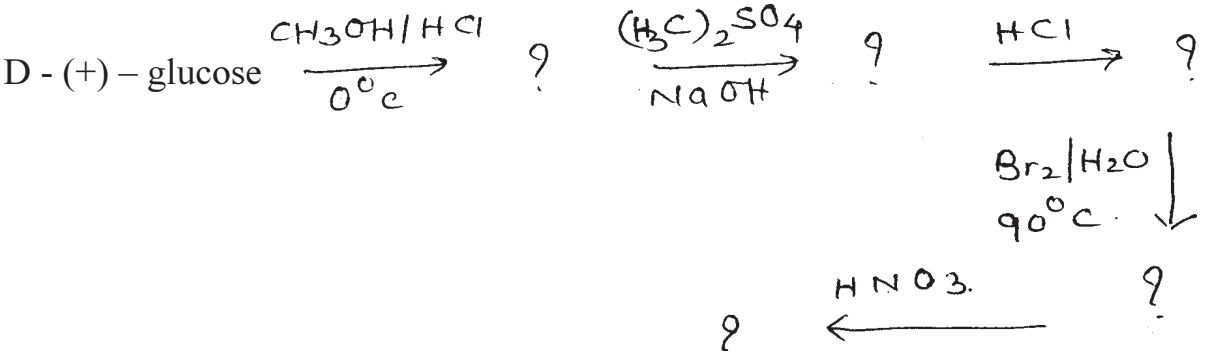
ii) Reissert Indole Synthesis.

iii) The Hinsberg Thiophene Synthesis.

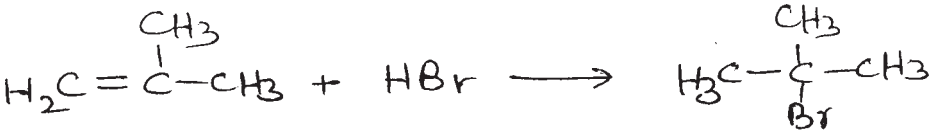
SECTION - II

Q4) Answer <u>any four</u> of the following: **[16]**

a) Complete the following sequence of reactions and explain how it will prove furanose structure for D - (+) – glucose?



b) For the given following addition reaction calculate % atom economy.



c) Draw D - and L - glucopyranose in $^4C_1$ and $^1C_4$ conformations and comment on the stability of each form. Justify.

d) Aldotetrose (A) on oxidation gives meso-dicarboxylic acid (B).

(A) $\xrightarrow[\text{Reaction}]{\text{kiliani}}$ C + D.

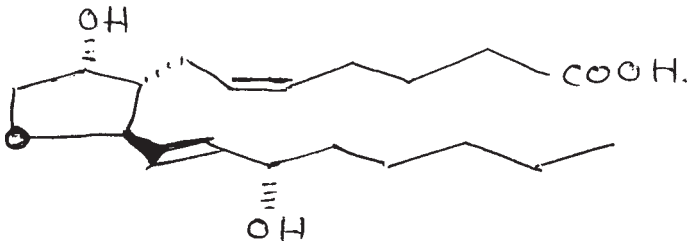
C & D $\xrightarrow[\text{phenyl hydrazine}]{\text{excess}}$ same osazone.

C $\xrightarrow{(O)}$ Active dicarboxylic acid (E)

D $\xrightarrow{(O)}$ Inactive dicarboxylic acid (F). Identify A, B, C, D, E & F.

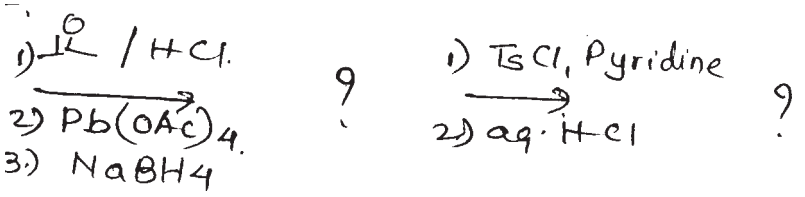
e) Write a note on mutarotation and explain the mechanism of the same.

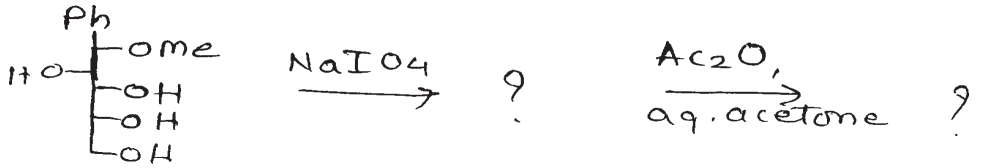
Q5) a) Give the retrosynthetic analysis of 11- oxaprostaglandin $F_{2\alpha}$. **[6]**

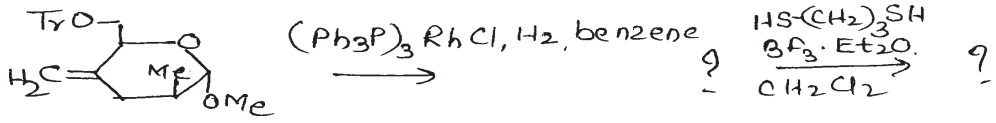


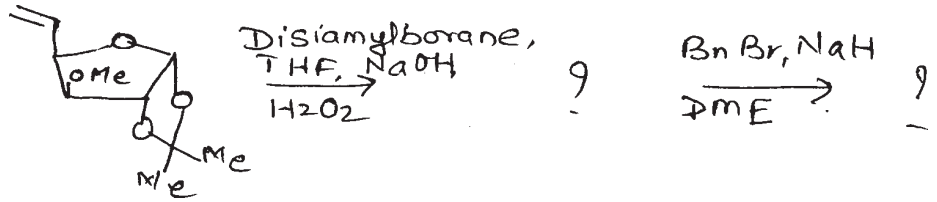
How will you prove the presence of - COOH and cis double bond in the molecule.

b) Predict the products in <u>any three</u> of the following : **[6]**

i) D-mannitol 

ii) 

iii) 

iv) 

Q6) Answer <u>any three</u> of the following: **[12]**

a) Explain the role of chelation and hydrophobic bonding in drug-receptor interactions.

b) Describe the different factors which affect the accessibility of drugs to the active site.

c) What are drugs? What are the characteristics expected of an ideal drug?

d) What is green chemistry? Discuss the need for green chemistry.

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

P827

[3923] - 411

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 481 : Bioanalytical and Forensic Science

(Old and New) (Sem. - 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) What is VHT? Give a method for estimation of lactic acid from milk.

b) Give the analytical method for determination of potassium from Jam.

c) Outline analytical procedure for determination of SO_2 from food sample.

d) Write note on 'Food additives'.

e) A sample of baking powder weighed 0.267 gm and it required 44.5 ml of 0.05 M oxalic acid, when subjected to CO_2 estimation. If the blank titre value is 50ml, calculate % of total CO_2 in sample. (Given Molecular weight of CO_2 = 44).

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

a) State principle for estimation of amylase. Outline analytical procedure for its determination.

b) Discuss the chemistry of Vitamin - A with respect to structure, sources, biological functions and principle of estimation.

c) Describe the method for estimation of caffeine from coffee.

d) Give suitable method for estimation of glucose.

e) A biological sample was analysed for Net Protein utilization, digestability and biological value gave following observations:-

i) Intake nitrogen = 20.2 mg
ii) Faecal nitrogen = 10.7 mg
iii) Endogenous faecal nitrogen = 7.3 mg
iv) Urinary nitrogen = 10.1mg
v) Endogenous urinary nitrogen = 6.8 mg.

Calculate NPU, D and B.V.

P.T.O.

SECTION - II

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

a) State the principle for determination of barbiturates by procedure A. Explain procedure A in detail.

b) How cocaine is isolated from urine sample? Outline procedure for adsorption of drug. How it is eluted?

c) Outline the procedure 'Type A' for isolation and identification of amphetamine.

d) Give the procedure for determination of benzodiazapines.

e) A sample containing barbiturate was analyzed by gas chromatographic method. It gave following observations.

i) Concentration of barbiturate = 2.8 μg.

ii) Peak area of drug in sample = 5.7 min.

iii) Peak area for internal standard = 3.8 min.

iv) Peak area for known drug in sample = 2.9 min.

v) Peak area for internal standard in reference barbiturate solution = 7.7 min.

Calculate concentration of barbiturate in given sample.

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

a) Define the terms:

i) Addict ii) Coca leaf iii) Opium iv) Alcohol

b) Explain the rules under narcotic and psycotropic substances related to cultivation of opium popy and production of opium popy straw.

c) Give the rules related to arrangements required in bonded laboratory.

d) Discuss the process for obtaining rectified spirit from non-bonded laboratory.

e) Explain the process "movement of dutiable goods from one bonded warehouse to another bonded warehouse".

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P828

[3923] - 412

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

ANALYTICAL CHEMISTRY

CH - 490 : Analytical Spectroscopy (Old and 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) ***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 following terms used in instrumental analysis.

i) Dispersive power.

ii) Resolving power.

iii) Period.

b) Enlist the criteria for selection of a solvent in IR spectroscopy and give an account of handling of liquid samples in it.

c) Draw a suitable schematic diagram and explain the instrumentation used in the UV-visible region.

d) A solution that contained two absorbing substances was spectro photometrically determined at two wavelengths in a cell with a 1.00 cm pathlength. The absorbance of the mixture was 0.945 at 580 nm and 0.297 at 395 nm. The molar absorptivities are given in the following table. Calculate the concentration of each component in the mixture.

Component	molar absorptivity	
	580nm	395 nm
1	9874	548
2	455	8374

e) The molar absorptivity of the iron (II) -2, 2′, 2″ - terpyridyl complex is 1.11×10^4 at 522 nm. Calculate the concentration of the complex in a solution which has a percent transmittance 38.5 at 522 nm in a cell with a pathlength of 1.00 cm.

P.T.O.

Q2) Attemp any <u>four</u> of the following: **[20]**

a) What is meant by gas-phase chemiluminescence? Explain the phenomenon with a suitable example.

b) What is Bremsstrahlung? Draw and explain the typical X-ray absorption spectrum.

c) Explain in brief the following phenomenon

i) AES. ii) XPS.

d) Describe the X-ray absorptive edge method used for the quantitative analysis of the sample.

e) Calculate the mass absorptive coefficient of an alloy which consists of 19.5 percent nickel and 30.5 percent copper at the wavelength corresponding to K_α radiation of copper. The mass absorptive coefficient at that wavelength is 49.0 cm^2/g for nickel and 53.0 cm^2/g for copper.

SECTION - II

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

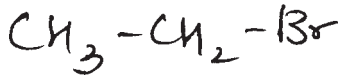
a) What is meant by relaxation? Explain spin-spin and spin-lattice relaxation in NMR.

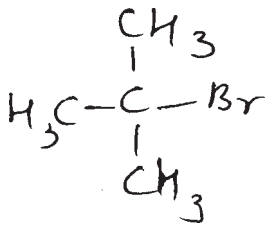
b) What is a chemical shift? Give the scale for measuring chemical shift.

c) Give the classification of coupling interactions.

d) Phenol formaldehyde resins include a class prepared with excess phenol called as novolacs which consists of phenolic nuclei linked by methylene bridges at positions ortho or para to hydroxyl group. Integration of the spectrum gives the ratio of aromatic to methylene protons as 30:18. Calculate the average chain length and average molecular weight of the resin.

e) Predict the nature of NMR spectra of the following compounds.

i) 

ii) 

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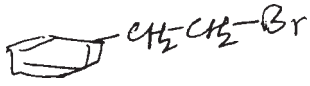
iv) 

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

a) Explain the different ways in which the inductive effect affects the shielding constant.

b) Explain with the help of suitable examples the use of spin label technique in EPR.

c) With the help of suitable example give any two applications of ESR.

d) The difference in chemical shift between α and β protons of naphthalene in dioxane solution has been reported as 14.34 Hz at 40 MHz operating frequency. Express the difference in ppm. Do you expect α or β protons to resonate at lower field? Why?

e) Calculate the relative number of protons in the higher and lower magnetic states when a sample is placed in a 4.69 T field at 20ºC.

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

P829

[3923] - 413
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 491 : Polymer Technology
(Old and New Course) (Sem. - IV)

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 wherever necessary.***

SECTION - I

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

a) Give the salient features of bulk polymerisation.

b) Discuss the mechanism of free radical chain polymerisation.

c) Discuss the kinetics of anionic polymerisation.

d) Write note on Ring-opening polymerisation.

e) Differentiate between the following:

i) Natural polymer and synthetic polymer.

ii) Thermoplastic and Thermosetting polymers.

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

a) Discuss the copolymerisation with suitable examples.

b) Explain the following:

i) Glass transition temperature of polyethylene is –125ºC whereas polyethylene terphathalate is 69ºC.

ii) Polymer obtained by anionic polymerisation are alive.

c) Give method of preparation and uses of the following polymers:

i) Teflon. ii) Phenol-formaldehyde resin.

d) Write note on - Cross linking reactions.

e) What is polymer degradation? Give the brief account of mechanical degradation of polymer.

P.T.O.

SECTION - II

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

a) Describe in detail the cryscopic method for the determination of number average molecular weight of polymers.

b) Give brief account of the electrical properties of polymer.

c) Explain the terms.

i) Impact test. ii) Fatigue test.

iii) Haze. iv) Abrasion resistance.

v) Vapour permiability

d) Describe the characterisation of polymer by Differential Scanning Calorimetry.

e) 0.8321 gms of corboxyl terminated polybutadine was dissolved in Mixture of ethanol and toulene. The Mixture was titrated with 0.1234N alcoholic Potassium hydroxide using phenolphthalein as an indicator. The burette reading recorded was 7.8 ml. Calculate the number average molecular weight of the polymer (Given functionality is 2).

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

a) Write full account of ageing process with suitable examples.

b) Describe in detail the melt-spinning process.

c) What is polymer processing? Describe the foaming process.

d) Explain the term-Reinforcement. Discuss in brief the Spray-up-technique.

e) Calculate number average and weight average molecular weight for the system containing equal number of particles with Molecular weight 10,000, 20,000 and 30,000 respectively.

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

P830

[3923] - 414

M.Sc.

BIOCHEMISTRY

BCH - 470 : Biochemical Endocrinology and Tissue Culture

(Old & New) (Sem. - IV)

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

Instructions to the candidates:

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

SECTION - I

(Biochemical Endocrinology)

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

a) How secretion of thyroid hormone is regulated?

b) Write a note on parathyroid hormone.

c) Describe role of growth hormone on carbohydrate metabolism.

d) What are the primary regulators of mineralocorticoid hormone synthesis? Explain any one.

e) Discuss the mode of action of gastrointestinal hormone with example.

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

a) Write short note on intracellular receptors for hormones.

b) Explain the role of glucagon.

c) Describe the biochemical reaction involved in androgen synthesis.

d) How hormone sensitivity of target cell identified?

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

a) Which two enzymes are critical for catabolism of catecholamines? What is the metabolic product of the sequential action of these two enzymes?

b) Give an account of enkephalins and endorphin.

c) Write a note on Zn-finger.

P.T.O.

SECTION - II

(Tissue Culture)

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

a) What is contact inhibition? Which cell have this property and which cell does not show contact inhibition.

b) Define the terms split ratio, passage number and generation time and give their significance.

c) Give the limitation of micropropagation.

d) What is cell suspension culture? Explain batch and continuous culture.

e) Give the advantages and disadvantages of serum free media.

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

a) What are artificial seeds? How are they produced.

b) What are secondary metabolite? Give techniques of enhancing their production.

c) Write a note on cell repositries.

d) Describe various physical and chemical agents used for sterilization.

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

a) What is organ culture? Explain different methods of it.

b) What are the important properties of isolated protoplast? Give the methods of protoplast isolation.

c) Explain characteristics of transformed cells.

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

P831

[3923] - 415

M.Sc.

BIOCHEMISTRY

BCH - 471 : Fermentation, Enzyme and Food Technology

(Sem. - IV)(Old and 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.***
4) ***Draw neat diagrams wherever necessary.***

SECTION - I

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

a) What are different products that are formed from pyruvate?

b) What are different carbon sources used in fermentation?

c) What is meant by scaling up of fermentation process?

d) How industrially important microorganisms are preserved?

e) What is meant by Batch Culture? Explain with suitable example.

Q2) Discuss in brief (any three): **[15]**

a) Importance of antifoams in fermentation.

b) Filter sterilization.

c) Aeration and agitation.

d) Applications of immobilized enzymes.

e) Chemical methods of effluent treatment.

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

a) How different types of centrifuges are used for product recovery?

b) Explain with suitable example isolation of auxotrophic mutants.

c) How temperature and pH control are important in fermentation processes?

P.T.O.

SECTION - II

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

a) How different enzymes are used in food analysis? Explain with suitable examples.

b) "SCP are unconventional source of good proteins", justify the statement.

c) Why monitoring of food quality is essential? Explain.

d) Write short note on : OCP.

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

a) Discuss in detail the process of preparation of clear and cloudy juice.

b) Explain the role and significance of various food preservatives.

c) Why brown bread is better preferred than white bread? Explain.

d) Explain the principles of food processing.

Q6) Write short notes on (any two). **[10]**

a) Flavouring agents.

b) Sweetners.

c) Food spoilage.

Total No. of Questions : 4] **[Total No. of Pages : 1**

P832

[3923] - 416
M.Sc.
BIOCHEMISTRY
BCH - 472 : Genetic Engineering (New)
Genetic Engineering and Molecular Biochemistry (Old)
(Sem. - IV)

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 the following (any two): **[20]**

a) How maternal effect genes determine polarity in Drosophila embryo by encoding morphogens.

b) Discuss the need for rescue experiment in developmental biology.

c) What are restriction enzymes? Why they are named as restriction endonucleases? Give the role of any five restriction enzymes along with their restriction sites.

Q2) Answer the following (any two): **[20]**

a) What are Ti plasmids? Explain their structure and role in plant genetic engineering.

b) What is cDNA? Describe the procedure to develop cDNA Library of an organism?

c) What is shuttle vector? Give their application.

Q3) Answer the following(any two): **[20]**

a) Discuss the advantages and limitations of Maxum-Gilbert and sangers methods to determine DNA sequence.

b) Genetic engineering is boon to the mankind. Support this statement with suitable examples.

c) Many times viral vectors are preferred over plasmid vectors. Why? Explain with suitable examples.

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

a) Bacteriophage λ genome.

b) Protein engineering.

c) DDRT PCR.

d) Transgenic animals.

e) Microarray.

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

P834

[3923] - 422

M.Sc. - II

DRUG CHEMISTRY

CH - 462 : Chemotherapy

(Old & New Pattern) (Sem. - 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 maximum marks.***

SECTION - I

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

a) Explain with proper examples why antibiotics are generally more selectively toxic than anticancer drugs?

b) Give a brief account of cell wall synthesis and discuss the mechanism of action of β - lactam antibiotics.

c) Give a brief overview of macrolide antibiotics. Explain their mechanism of action. What benefits Roxithromycin & Clarithromycin over Erythromycin.

d) Give a brief account of quinolone antibiotics.

Q2) Answer any two of the following: **[16]**

a) Explain cancer. What are the strategies used to treat cancer. Discuss the benefits of chemotherapy. Explain in brief the role of plant products, endocrine agents and antibiotics in cancer management.

b) How does a nerve impulse travel in a neuron? How does interneuronal transmission takes place? Explain clearly what happens in CNS disorders?

c) Describe Enzyme inhibitors and their role in medicine. Discuss with examples their uses as Anticancer, Antiviral and Antifungal agents.

Q3) Discuss in brief any three of the following and one strategy to treat them.**[9]**

a) Ulcers.

b) Malaria.

c) Epilepsy.

d) AIDS.

P.T.O.

SECTION - II

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

a) Explain the role of endocrine system in maintaining homeostasis. Explain the negative feed back mechanism. What are the functions of Thyroid Hormones? What happens if they are under or oversecreted? How such abnormal secretions therapeutically rectified?

b) Explain in brief any two of the following CVS disorders; discuss the pathophysiological changes and at least one drug to treat them.

i) Myocardial Infarction. ii) Hypertension.

iii) Congestive Heart Failure.

c) Explain how the following group of compounds help in management of diseases (any three).

i) Vasodilators. ii) Anticoagulants.

iii) ATPase inhibitors. iv) β-blockers.

d) Discuss Pain and Inflammation. How do different analgesics and antiinflammatory drugs exhibit their activity.

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

a) What are common viral infections? Explain how Amantidine Ribavarin and Cyclovir act as antivirals.

b) What is diabetes? What is the difference between NIDDM and IDDM? Explain the management NIDDM.

c) Give a brief commentary on the development of carbapenems and carbapenams as antibacterials.

Q6) Discuss the mode of action and uses of the following drugs (any four): **[12]**

a) Pyrazinamide.

b) Lomustine.

c) Clavulanic Acid.

d) Methotrexate.

e) Ketoconazole.

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

P835

[3923] - 423

M.Sc. (Sem. - IV)

DRUG CHEMISTRY

CH - 463 : Drug Design (Old and New 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 two of the following: **[14]**

a) Define the terms proteomics, genomics & Bioinformatics and give their application.

b) Comment on Monoclonal antibodies and their application.

c) How DNA microerips and microarrays are used to know impact of drug action?

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

a) What is regression line of Y on X set up the same for below given data of production in tonns (X) and its price per tonne in thousands rupees (Y) for 8 years.

X -	31.5	21.4	26.4	30.5	37.2	34.8	32	28
Y -	140	150	145	110	115	120	128	132

b) What in standard deviation? Why is it used? Complete the same for following data of height in cms. of 8 students 165, 168, 162, 177, 169, 170, 160, 163.

c) Define correlation, state the different types. Compute Karl Pearson's coefficient of correlation between age (in years) and blood pressure in (mm/Hg) for seven individuals.

Age -	48	50	58	62	65	70	72
B.P.-	120	118	122	123	125	126	128

P.T.O.

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

a) What is combinatorial synthesis and why is it important in pharmaceutical industries? Describe in brief method used for mixed & parallel synthesis.

b) What are receptors? How do they exhibit response on binding of a natural agonist? Explain the working of ion-channel receptors or GPCR.

c) Explain in brief the reasons for designing pro-drugs. Discuss with examples how prodrugs have improved the pharmacokinetic profiles of drugs.

SECTION - II

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

a) Define the term 'Energy Minimisation'. Explain how this technique is central in many of the 'Drug Design' technologies.

b) Discuss the history and development of QSAR by Corwin. Hansch.

c) Explain how the following are calculated/determined for a QSAR analysis

i) Es ii) Π iii) σ iv) optimum log P

d) Explain the various terms & their significance in the standard Molecular Mechanics Force Field. How does MM differ from Quantum Mechanics.

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

a) Give a brief account of 'Topliss' decision tree & Batchwise approach used in QSAR. What benefits it has over the Hansch approach?

b) There are several ligands known to be inhibitors of ACE. There biological activity has been determined. State which technique may be used to identify/develop a new lead from this data set. Justify your approach.

c) Discuss how would you approach to design a drug molecule when the structure of the target is unknown and when the structure of the target is known. Justify your approach.

Q6) Discuss the following in brief (any three): **[10]**

a) 3D QSAR.

b) Bioinformatics in Drug Discovery.

c) Montecarlo Approach.

d) Equation of 'Best Fit' in QSAR.

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

P1039

[3923]-324
M.Sc.
BIOCHEMISTRY
BCH - 375 : Nutrition And Clinical Nutrition
(Old & New) (Sem. - III)

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

Instructions to the candidates:

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

SECTION - I

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

a) Describe in detail the composition of human body.

b) Why the quality of protein is very important rather than its quantity?

c) Classify minerals based on their requirement and add a note on their role in the body.

d) Explain the general process to derive energy from carbohydrate.

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

a) Explain in detail the thermogenic effect of foods.

b) How will you assess the nutritional value / status of foods.

c) Explain the digestion, absorption, transport and storage of carbohydrates in the body.

d) How will you diagnose the different types of nutritional anaemias.

Q3) Write short notes on (any two): **[10]**

a) Food toxins.

b) Starvation.

c) Diabetes.

d) BMR.

P.T.O.

SECTION - II

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

a) Describe acidic and alkaline foods.

b) Give an account on malnutrition and infection.

c) Write in detail the interrelationships between dietary lipids and cholesterol metabolism.

d) Explain in detail the physiological effects and metabolic adaptation during exercise.

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

a) Explain the adverse effects of alcohol and tobacco.

b) What are the effects of germination and sprouting on food quality.

c) What are hallucinogens? Explain the effect of hallucinogens.

d) What is amino acid therapy? How it is useful in various clinical conditions.

Q6) Write short notes on: (any two) **[10]**

a) Dietary fiber.

b) Refining food.

c) Inborn errors of metabolism.

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

P779

[3923] - 101
M.Sc.
PHYSICAL CHEMISTRY
CH - 110 : Physical Chemistry - I
(Sem. - I) (2008 Pattern)

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) Write the Schrodinger's one dimensional and three dimensional wave equation useful to a chemist. Explain the meaning of each term in it.

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

c) Evaluate the degeneracy of a system having energy 101 f where 'f' is the energy spacing factor.

d) Write a note on steam distillation.

e) Explain the zeroth and third laws of thermodynamics. Give their applications.

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

a) Derive Gibbs-Duhem equation and explain its significance.

b) Explain Raoult's and Henry's laws.

c) Derive Clapeyron equation and give its significance.

d) Explain vant Hoff factor and give its significance.

e) Explain the principle of steam distillation. Give its applications.

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

a) The work function of sodium is 1.82 eV. Determine its threshold frequency.

b) the vapour pressure of benzene and toluene at 20°C are 74.7 torr and 22.3 torr respectively. A mixture of the two at 20°C has vapour pressure 46.0 torr. Determine the mole fraction of benzene in

i) Solution

ii) Vapour above the solution.

c) Calculate the number of photons emitted by a mW bulb emanating 700 nm light in one hour.

SECTION - II

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

a) Explain the terms :
   i) Reaction rate.
   ii) Specific rate constant.
   iii) Pseudounimolecular reaction.

b) Using steady state principle, derive Michaelis Menton mechanism for enzyme catalysed reaction.

c) What is steady-state approximation? Justify with the help of consecutive first order reactions.

d) Discuss the mechanism for the reaction between oxygen and hydrogen. Indicate the explosion regions for the reaction with the help of a suitable plot and explain their causes.

e) Elaborate the role of various factors which influence the rate of a reaction in solution state.

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

a) Discuss in detail the diffusion-controlled limits. Write the expression relating diffusion-coefficient with flux of matter.

b) Derive Eyring equation for reaction rate.

c) Explain Stirling's approximation and thermodynamic probability. Using them, obtain the condition for the probability to be maximum.

d) Derive the expression for translational partition function.

e) Define partition function and hence derive the equation $Q = Q_r Q_v Q_t Q_e$.

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

a) A first order reaction is 50% complete in 30 minutes at 27°C and 10 minutes at 47°C. Calculate the reaction rate constant at 27°C and the energy of activation of the reaction in kJ/mole.

b) Calculate the collision frequency when 1g of O_2 is mixed with 0.1g H_2 in one litre container at 27°C [Given : Collision cross section = 0.227 nm^2, $K = 1.38 \times 10^{-16}$ $ergk^{-1}$ At. Wt's of O = 16, H = 1].

c) Calculate the rotational entropy of CO at 298K
   [$I = 14.48 \times 10^{-47}$ kg m^2, $\sigma = 1$].

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

P780

[3923] - 102
M.Sc. (Part - I)
INORGANIC CHEMISTRY
CH - 130 : Inorganic Chemistry - I
(2008 Pattern) (New) (Sem. - I)

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

SECTION - I

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

a) What are the conditions of a mathematical group? Explain them considering an example Abelian group.

b) Draw possible isomers of the complex $Ma_2b_2c_2$. Explain on the basis of symmetry which isomer is optically active.

c) Discuss the symmetry operations of the molecules having following point groups (any two) :

i) C_2h ii) D_3 iii) C_4V

d) Develop stereogram showing general point for the following point groups. Justify your answer.

i) D_4h ii) C_4V

e) Give the general matricess for the following symmetry operations.

i) E ii) i iii) C_n iv) σxy v) Sn

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

a) Fill in the missing entries in the character table given below which is presented in the standard format. The symbols A, B, C and D represent certain symmetry operations and E is identity. Label the irreducible representation with appropriate Müliken symbols.

P.T.O.

	E	2A	B	2C	2D
T_1	1	1	1	1	1
T_2	1	...	1	−1	−1
T_3	1	−1	1	1	−1
T_4	1	−1	1	....	1
T_5	....	0	....	0	0

b) Write out the characters of the representations of the following direct product and determine the set of irreducible representations which comprise them for the point group. Td.

Direct product $T_1 \times E$

Td	E	$8C_3$	$3C_2$	σS_4	$6\sigma d$
A_1	1	1	1	1	1
A_2	1	1	1	−1	−1
E	2	−1	2	0	0
T_1	3	0	−1	1	−1
T_2	3	0	−1	−1	1

c) Using similarity transformation show that 3 planes of symmetry in C_3V point group are mutually conjugate to each other.

C_3V	E	C_3	C_3^2	σV_1	σV_2	σV_3
E	E	C_3	C_3^2	σV_1	σV_2	σV_3
C_3	C_3	C_3^2	E	σV_2	σV_3	σV_1
C_3^2	C_3^2	E	C_3	σV_3	σV_1	σV_2
σV_1	σV_1	σV_3	σV_2	E	C_3^2	C_3
σV_2	σV_2	σV_1	σV_3	C_3	E	C_3^2
σV_3	σV_3	σV_2	σV_1	C_3^2	C_3	E

d) Sketch and describe all the symmetry operations in BrF_5 molecule and classify it into appropriate point group.

e) Explain the term Miller indices and draw (2 1 0), (1 1 1) and (0 0 1) planes in cubic system.

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

a) Find out normalized SALC using projection operator of A_1' irreducible representation on σ_1 of CO_3^{2-} ion.

D_3h	E	$2C_3$	$3C_2$	σh	$2S_3$	$3\sigma V$
A_1'	1	1	1	1	1	1

b) By change of coordinate method give the products of the following symmetry operations in trans $C_2H_2Cl_2$

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

c) Find the reducible representation for which σ bond form the basis in BCl_3 molecule and find out which orbitals from boron atom will be offered for σ bonding. Given character table for D_3h point group

D_3h	E	$2C_3$	$3C_2$	σh	$2S_3$	$3\sigma V$		
A_1'	1	1	1	1	1	1		x^2+y^2,z^2
A_2'	1	1	−1	1	1	−1	Rz	
E'	2	−1	0	2	−1	0	(x,y)	(x^2-y^2,xy)
A_1''	1	1	1	−1	−1	−1		
A_2''	1	1	−1	−1	−1	1	z	
E''	1	−1	0	−2	1	0	R_x R_y	(xz,yz)

SECTION - II

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

a) What do you understand by organometallic compound? Give classification of these compounds with suitable example.

b) Give an account of hydrides of boron.

c) Give characteristic reactions of CO_2.

d) Give an account of oxyacids of phosphorous.

e) Give an account of electron rich compounds.

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

a) Molecular sieves.

b) Phosphazenes.

c) Fullerenes.

d) Interhalogen compounds.

e) Applications of noble gases.

Q6) a) Draw <u>any five</u> structures : **[5]**

i) XeO_3 ii) $[TeCl_4]$

iii) P_4O_{10} iv) B_5H_9

v) S_2F_{10} vi) $[Pt\ Cl\ (PPh_2)_2]_2$.

b) Complete <u>any five</u> reactions : **[5]**

i) $SiF_4 + 2F^- \rightarrow \overset{?}{\text{——}}$.

ii) $B_3N_3H_3Cl_3 + NaBH_4 \rightarrow \overset{?}{\text{——}} + NaCl + BH_3$.

iii) $PCl_5 + n\ NH_4Cl \rightarrow \overset{?}{\text{——}} + n\ HCl$.

iv) $NH_3 + COCl_2 \rightarrow \overset{?}{\text{——}}$.

v) $BeCl_2 + R\ MgCl + (C_2H_5)_2O \rightarrow \overset{?}{\text{——}} + MgCl_2$.

vi) $GeCl_2 + N \equiv C - CH_3 \rightarrow \overset{?}{\text{——}}$.

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

P781

[3923] - 103
M.Sc. - I
ORGANIC CHEMISTRY
CH - 150 : Organic Reaction Mechanism & Stereochemistry
(2008 Pattern) (Sem. - I) (New 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) ***Students admitted 2008 onwards must attempt new pattern (2008 pattern).***

SECTION - I

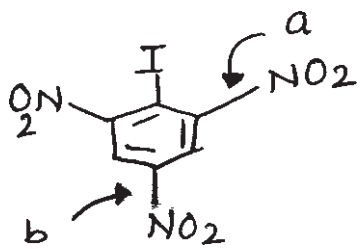
Q1) Attempt any four of the following : **[12]**

a) Compound (A) yields an enhanced ortho-substitution on nitration with benzoyl nitrate whereas (B) reacts normally. Explain.

(A) (B)

b) Acetolysis of 4-methoxybutyl brosylate is ~ 650 times as fast as n-butyl brosylate. Explain.

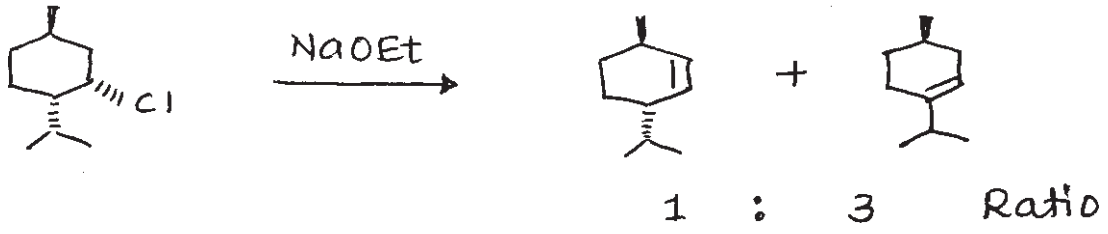
c) In the following compound bond length a is 1.45A° where as b is 1.35A°. Explain.



d) Explain the formation of the product in the following reaction.

P.T.O.

e) Justify the following ratio of the products.



Q2) a) Write short notes on <u>any two</u> of the following : **[8]**

i) EDA complex.

ii) Proton sponges.

iii) E1cb Mechanism.

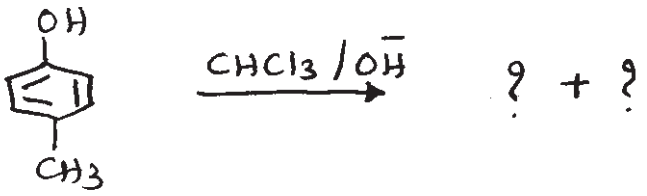
b) Explain the following conversions by giving complete reaction sequence (any two) : **[8]**

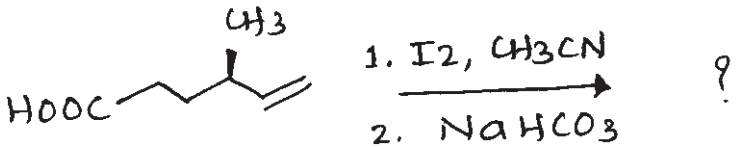
i) Benzene to O-nitroanisole.

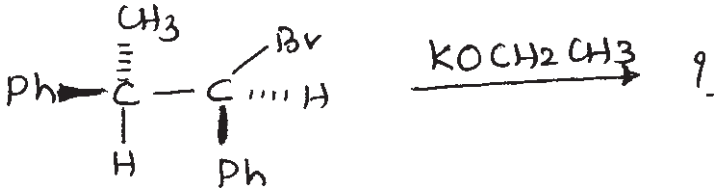
ii) 1-propyne to 2-hexene (cis).

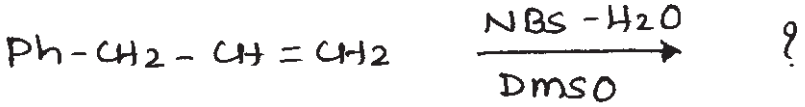
iii) Phenol to m-anisidine.

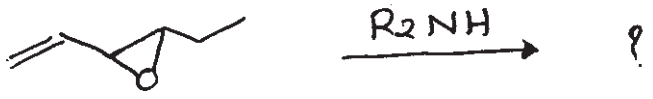
Q3) Predict the product/s and Justify your answer (any four) : **[12]**

a) 

b) 

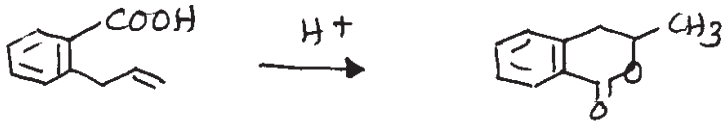
c) 

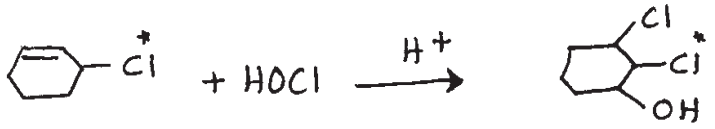
d) 

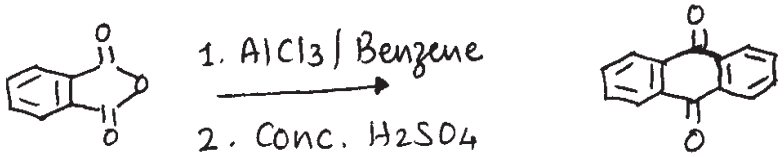
e) 

SECTION - II

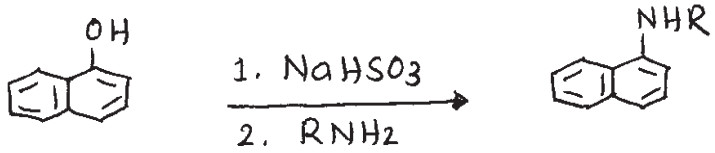
Q4) Suggest mechanism for <u>any four</u> of the following : **[12]**

a) 

b) 

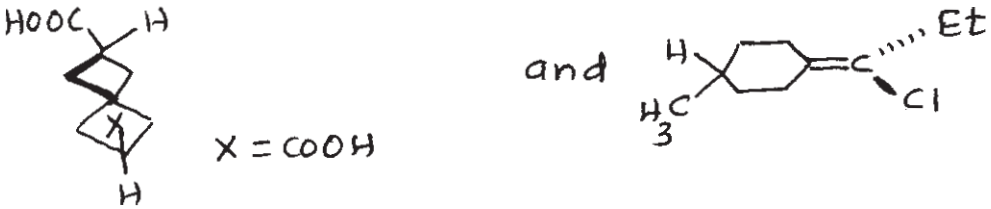
c) 

d) 

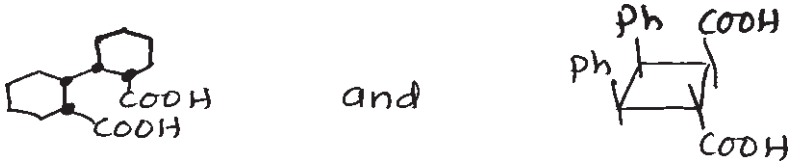
e) 

Q5) Solve the following (any eight) : **[16]**

a) Assign 'R' and 'S' configuration.



b) Which of the following is optically active? Justify.

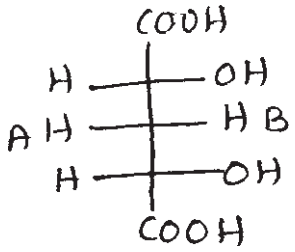


c) State and explain chemoselectivity with suitable example.

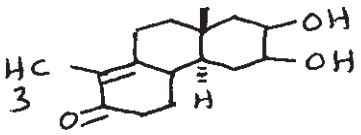
d) 2,6-di-t-butylpyridine is a weaker base than pyridine. Explain.

e) Define atropisomerism with suitable example.

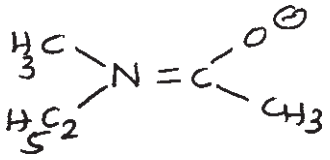
f) Assign PRO 'R' / PRO 'S' to HA and HB



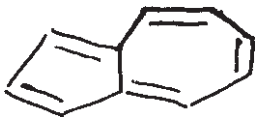
g) Assign E/Z configuration to the following



and



h) Comment on the stability and dipole moment of following compound.



Dipole moment = 0.8 D.

i) What are cryptands? Give one example.

Q6) Attempt <u>any four</u> of the following : **[12]**

a) Anthracene and phenanthrenes undergo many reactions across the 9, 10 positions. Explain.

b) Write a note on Fullerenes.

c) State and explain stereoselective and stereospecific reactions.

d) Explain with example optical activity in helical compounds.

e) What are ambident nucleophiles? Explain.

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

P782

[3923] - 104
M.Sc. (Sem. - I)
BIOCHEMISTRY
BCH - 170 : Biomolecules
(Old & New)

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) Attempt any four of the following : **[10]**

a) With suitable example explain the term anomers.

b) Explain composition of living matter.

c) Explain the term chylomicrons.

d) Give structures of any two sugar acids.

e) Discuss biological importance of buffer.

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

a) Give classification of lipids with suitable example of each class.

b) Write short account on fat soluble vitamins.

c) Comment on pathological changes in lipid levels.

d) Discuss functioning of pH meter.

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

a) Write short account on sugar derivatives.

b) Discuss cyclic structure of monosaccharides.

c) Discuss biological importance of lipids.

d) Discuss properties of water.

P.T.O.

SECTION - II

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

a) Discuss acid base behavior of amino acids.

b) Give structure of tripeptide Glu-Tyr-Trp.

c) Enlist forces stabilizing tertiary structure of proteins.

d) Give biological significance of peptides.

e) What are essential and nonessential amino acids?

f) Explain the term super secondary structure.

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

a) Discuss end group analysis.

b) Discuss classification of amino acids based on polarity of R group.

c) Discuss significance of Ramchandran plot.

d) Discuss structure of hemoglobin.

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

a) Give short account on solid phase synthesis.

b) Discuss α helical structure.

c) Define hydrophobic interactions. Give its role and importance.

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

P783

[3923] - 105
M.Sc. (Sem. - I)
BIOCHEMISTRY
BCH - 171 : Enzymology & Biophysical Techniques
(New) (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
Enzymology

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

a) Derive Michaelis - Menten equation.

b) Aspartate carbamoyl transferase an mild heating loses its allostericity. Explain.

c) Give the metabolic significance of Km.

d) Study of pre-steady state kinetics determines the mechanism of enzyme catalysis. Explain.

e) How purity of an enzyme is judged?

f) Why low specificity is usually associated with proteolytic enzymes?

g) What are the advantages of having the final of multistep metabolic pathway inhibit the enzyme that catalyzes the first step?

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

a) What is the effect of arid-base and covalent catalysis an enzyme certalyzed reaction?

b) What are the salient features of regulatory enzymes.

c) What is enzyme turnover? How it can be correlated with structure and function of an enzyme?

d) What are the application of affinity labelling?

e) How specificity of amino acid side chain modifying agent is achieved?

P.T.O.

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

a) Give an account of the enzymes routinely monitored in liver and cardiac disease.

b) By making the use of Hills equation, how ligand binding sites an oligomeric enzymes are determined.

c) Give the structural aspects of E-coli pyruvate dehydrogenase enzyme system and its regulation.

SECTION - II
Biophysical Techniques

Q4) Explain the following terms (any five) : **[10]**

a) Gradient PAGE.

b) Southern blotting.

c) Native PAGE.

d) Lyophilization.

e) Reverse dialysis.

f) Properties ion exchanger.

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

a) Give the principle working and application of NMR.

b) What is gel chromatography? Give its advantages and applications.

c) Explain the theory and applications of UV visible spectrophotometer.

d) Distinguish between fiber glass filter and Nitrocellulose filter.

e) Give salient features of Mak hydroxyl apetite chromatography.

Q6) Answer the following (any three) : **[15]**

a) Give the principle working and applications of isoelectrofocusing and gradient electrophoresis.

b) Explain the different detector systems which are used in GLC.

c) Give principle and importance of SDS PAGE.

d) Write a note on metal chelate chromatography.

e) Give working and applications of HPLC.

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

P783

[3923] - 105
M.Sc. (Sem. - I)
BIOCHEMISTRY
CH - 171 : Enzymology & Genetics
(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 in bracket on the right hand side indicate full marks.***

SECTION - I
Enzymology

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

a) Give the classification of enzymes. Which criteria is used for classification enzymes?

b) Give detail account of enzyme specifily.

c) How purity of enzyme is judged?

d) What is the significance of Km and Kcat?

e) How enzyme activity is measured? How activity of enzyme is expressed?

f) How change in substrate concentration helps in determination of mechanism enzyme catalysis?

g) Describe the simple experiment that would help to decide whether an enzyme inhibitor was competitive or non-competitive.

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

a) Transform the Michaelis-Menten equation in to lineweaver-Burk equation and show the effect of competitive inhibitor on lineweaver-Burk plot.

b) According to Koshland, Nemethy and filmer, what are the features of regulatory enzymes?

c) In what ways are chymotrypsin, trypsin and elastase similar as catalyst? In what way they differ? What factors in enzyme structure are responsible for these differences.

d) Give the clinical signification of aspartate aminotransferase and alanine aminotransferase.

P.T.O.

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

a) What is the significance of enzyme turnover? How enzyme degradation is measured?

b) Why it is necessary to purify an enzyme? How specific activity, yield and fold purification of enzyme is determined?

c) Chemical modification of aminoacid chains determines the active center of an enzyme. Explain. Why serine 195 of chymotrypsin is super reactive?

SECTION - II
Genetics

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

a) Define mutagens. Describe the mode of action of acridine dye on DNA.

b) With suitable example explain how haploid organism can form parental and nonparental offspring.

c) Describe in brief different types of DNA with special emphasis on the Z type.

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

a) What are lytic and lysogenic bacteriophages? Explain the life cycle of lytic bacteriophage with suitable example.

b) Write a brief account on semiconservative mode of DNA replication.

c) Describe any two suggested transposition models.

d) Describe the degeneracy of the genetic code.

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

a) Conditional mutants.

b) Phenotype.

c) Mutation by base analogese mutagens.

d) Co-dominance.

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

P784

[3923]-106
M.Sc.
BIOCHEMISTRY
BCH - 172 : Microbiology and Cell Biochemistry of Eukaryotes
(Sem. - I) (Old & New)

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

Instructions to the candidates:

1) ***Answer 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
(Microbiology)

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

a) Discuss the contributions of Louis Pasteur and Robert Koch towards microbiolgoy.

b) Why are microorganisms stained? Explain the principle of gram staining.

c) What is meant by Flagella? Explain the structure and arrangement of flagella.

d) Explain the methods of preservation of bacterial culture.

e) How dyes and synthetic detergents control the growth of microorganisms?

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

a) Applications of fluorescence microscopy.

b) Bacterial growth curve.

c) Bacteriophages and their life cycle.

d) Industrial production of Lysine.

e) Process of steam sterilization.

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

a) Write in detail about bacterial cell wall.

b) Enlist chemical agents used for control of microorganisms. Add a note on mode of action of heavy metals.

c) What are different other virulence factors responsible for diseases?

P.T.O.

SECTION - II

(Cell Biochemistry/Cell Biology)

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

a) Give a detailed account on mitochondrial ultrastructure and its metabolic functions.

b) What are stains? Which are the different types? Give examples of specific staining of cells and cell organelles.

c) State principle and explain the technique for subcellular fractionation.

d) Give a comparative account of prokaryotic and eukaryotic cell.

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

a) Structural and functional aspects of xylem and phloem.

b) Describe meiotic event in cell division.

c) Discuss industrial applications of various fungal species.

d) Describe different phases of cell cycle.

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

a) Extracellular matrix : composition and role.

b) Events in cell differentiation.

c) Fertilisation event for human germ cell.

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

P785

[3923] - 201
M.Sc.
PHYSICAL CHEMISTRY
CH - 210 : Physical Chemistry - II
(2008 Pattern) (Sem. - 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

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) Explain the effect of anharmonicity on the vibrational spectra of a diatomic molecule.

b) Discuss the stark effect in the linear and symmetric top molecule.

c) Explain in brief :

i) Morse potential.

ii) Polarizability ellipsoid.

d) What is Raman scattering? Describe the quantum theory of Raman scattering.

e) Explain the factors affecting :

i) Line-width.

ii) Intensity of spectral lines.

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

a) Vibrational coarse structure has three types of intensity patterns. Explain their cause.

b) Describe the band origin and band head in relation to the rotational fine structure of electronic vibration spectra.

c) What is predissociation? Explain predissociation spectra.

d) Write a note on NMR spectroscopy.

e) Discuss the principle of ESR. Explain the factors responsible for the hyperfine structure in the ESR spectra.

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

a) Rotational constant for a molecule is $5.0cm^{-1}$. Find the most populated level at temperature $1327^{o}C$.

b) Predict the form of rotational Raman spectra of a molecule for which $B = 9.997cm^{-1}$, when it is exposed to $29697cm^{-1}$ laser radiation.

c) Compute the relative population of two states of an electron spin in magnetic field of 0.3 T at 300K. ($g = 2$).

SECTION - II

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

a) Derive the relationship between decay constant and half-life period.

b) Explain the separation of isotopes by gaseous diffusion method.

c) Give an account of the two models suggested for the interaction of secondary electrons with solvent molecules in radiolysis.

d) Explain the term LET of radiation. How does it affect the yields of prp's of water?

e) What is a hydrated electron? Give the different methods to obtain the hydrated electron.

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

a) What is design parameter? Give the classification of typical reactors on the basis of different fuel-moderator combinations.

b) Discuss, India's nuclear energy programme.

c) Describe with a suitable example how the surface area of a precipitate can be determined with the help of radioisotopes.

d) How is the power of a lubricant determined using a radioactive isotope?

e) Discuss the use of radiotracers in assessing the volume of blood in patient.

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

a) A radioactive element has half-life period of 24.5 days. Starting with 6.0×10^{-3} kg of the element, how much amount would be decayed in 15 days.

b) A 0.1g gun metal alloy containing 90% Cu was irradiated for one day in a neutron flux 10^{9}n $cm^{-2}s^{-1}$. Calculate the activity after a cooling period of 6 hours. Given : At.wt. of Cu = 63, t½ of ^{64}Cu = 12.7hrs; r = 69.17% neutron capture cross-section = 4.5b.

c) Calculate the mass absorption coefficient of cyclohexane. Density of cyclohexane is $0.779 cm^{3}$ and linear absorption coefficient is $0.0565 cm^{-1}$. Molecular weight of cyclohexane is 84.

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

P786

[3923]-202
M.Sc. - I
CHEMISTRY
CH - 230 : Inorganic Chemistry - II
(2008 Pattern) (Sem. - II)

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 log tables and calculators is allowed.***
6) ***Atomic Numbers Cr = 24, Cu = 29, Co = 27, Mn = 25, Fe = 26, Ni = 28.***

SECTION - I

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

a) Find out the ground state term in the following complexes (any two) :

i) $[Cr\ (H_2O)_6]^{3+}$
ii) $CuCl_4^{2-}$.
iii) $[Co\ (NH_3)_5\ Cl]Cl_2$

b) Prepare a table of microstates for $s^1\ p^1$ configuration and obtain R-S terms for the same. Find out the ground state term.

c) ^3F is the ground state term for d^8 configuration of Ni^{2+} ion. Find out how it loses its degeneracy when $[Ni\ (en)_2]S_2O_3$ complex is formed.

d) Explain the following :

i) FeF_6^{3-} is colourless but $[Fe\ (CN)_6]^{3-}$ is red.

ii) The molar absorptivities for absorption bands in the visible spectra of ML_4 tetrahedral complexes tend to be higher than those of ML_6 octahedral complexes.

e) Calculate degeneracy of following terms/configurations states.

i) $2.^3B_{2g}$.
ii) $p^2.d^3$.
iii) ^4G
iv) $^3T_{1g}$.
v) $(t_{2g})^4\ (eg)^3$.

P.T.O.

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

a) Explain the possible allowed transitions in $[V(H_2O)_6]^{3+}$ complex ion and correlate them in terms of Racah parameter (B) and crystal field splitting parameter Δ_0.

b) Answer the following :

i) A single absorption peak is observed at 9000 cm^{-1} in the electronic spectrum of VCl_4. What will be the value of Δ if the molecule is tetrahedral? Estimate the value of Δ of vanadium (IV) complex in an octahedral environment.

ii) The electronic spectral bands of transition metal compound are broader than those of a lanthanide compound.

c) What is meant by queneling of orbital magnetic moment by the ligand field? Explain with suitable example.

d) Explain selection rules in d - d transitions. How these rules are relaxed? Illustrate with suitable examples.

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

i) $K_3[Fe(CN)_6]$ μ_{eff} = 2.25 B.M.

ii) $[Mn(acac)_3]$ μ_{eff} = 4.86 B.M.

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

a) Construct correlation diagram for $[Ni(NH_3)_6]SO_4$ complex.

Given :

i) R-S terms for free ion system are ^3F, ^1D, ^3P, ^1G and ^1S in the order of increasing energy.

ii) In the weak octahedral field the R-S terms split in to the following group theoretical terms.

1) $^3F \rightarrow {}^3T_{1g} + {}^3T_{2g} + {}^3A_{2g}$

2) $^1D \rightarrow {}^1T_{2g} + {}^1E_g$

3) $^3P \rightarrow {}^3T_{1g}$

4) $^1G \rightarrow {}^1T_{1g} + {}^1T_{2g} + {}^1E_g + {}^1A_{1g}$

5) $^1S \rightarrow {}^1A_{1g}$

OR

a) Write a note on redox spectra.

b) For a complex three absorption bands are observed at 7, 728cm^{-1}, 12,970cm^{-1}. and 24.038cm^{-1}. Calculate Δ_0 and Racah Parameter B. Comment on nature of M-L bond.

SECTION - II

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

a) Describe chelate effect and Irving-William series with respect to complexes.

b) Comment on the intracellular uptake of chromate ion.

c) Explain how does the log K value of metal complexes affect the prefevential binding of different metals with biological ligands.

d) What is bioinorganic chemistry? Mention the functions of various metal ions that are used in biomolecules.

e) Explain the mechanism of action of cis-platin as anticancer drug.

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

a) Classification of metalloproteins.

b) Ferritin.

c) Fe - S cluster compounds.

d) Aminoacids as ligands.

e) Zinc-fingers.

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

a) Oxy-hemoglobin.

b) Siderophores (Enterobactin)

c) $[(O\text{-}Phen)\ Pt\ (en)]^{+2}$

d) Auranofin.

e) 18 crown 6.

f) Uracil.

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 E 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_{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_{4d} :

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

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

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

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

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

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

(*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_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	$A_2+E+T_1+T_2$	$A_1+E+T_1+T_2$

CORRELATION TABLE FOR GROUP 0_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	$2A_u+B_u$

Character Table for (O) rotational group

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

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

P787

[3923]-203
M.Sc. - I
ORGANIC CHEMISTRY
CH - 250 : Synthetic Organic Chemistry and Spectroscopy
(2008 Pattern) (Sem. - II)

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

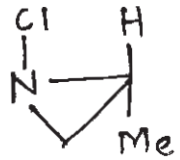
a) Diisopropyl ketone gives addition in presence of MeMgBr. Whereas, it undergoes reduction reaction in presence of $(CH_3)_3$ CMgBr.

b) Why Swern Oxidation is popular and most important.

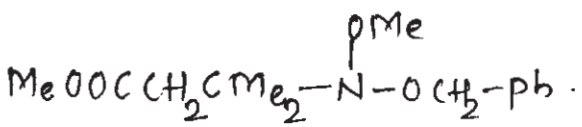
c) Dipole moments of distereoisomeric stilbene dichloride are μ = 1.27D (meso) and μ = 2.75 D (dl). Explain.

d) Nitrogen ylides are less stable than phosphorous ylides. Explain.

e) Comment on the optical activity of compound 'A' and 'B'.



(A)



(B)

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

a) Discuss the effect of dilution on - OH stretching frequency with suitable examples.

b) Use of $NaCNBH_3$ and Bu_3SnH in organic synthesis.

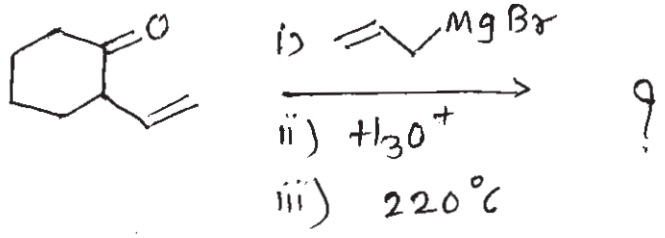
c) Write note on 'Sigmatropic rearrangement'.

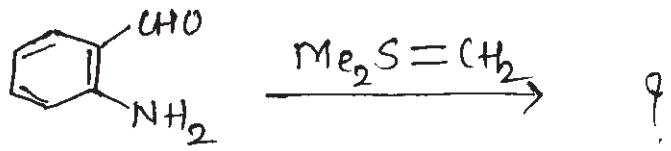
d) Simmon - Smith Reaction. Explain.

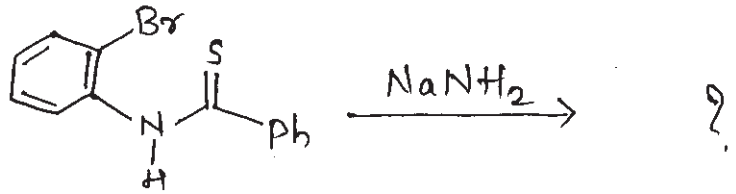
e) Write note on 'Non-Classical Carbocations'.

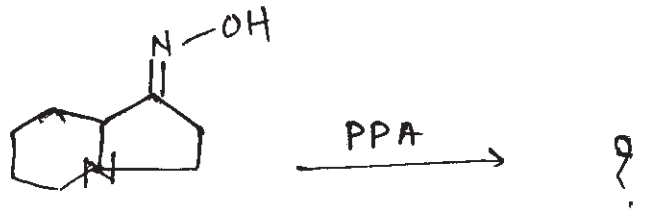
P.T.O.

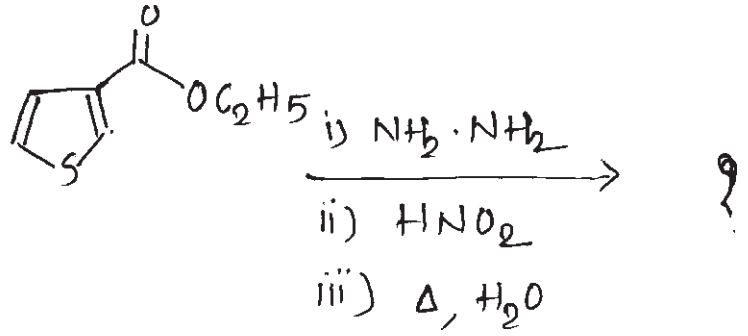
Q3) Predict the product and suggest the mechanism <u>any four</u> : **[12]**

a) 

b) 

c) 

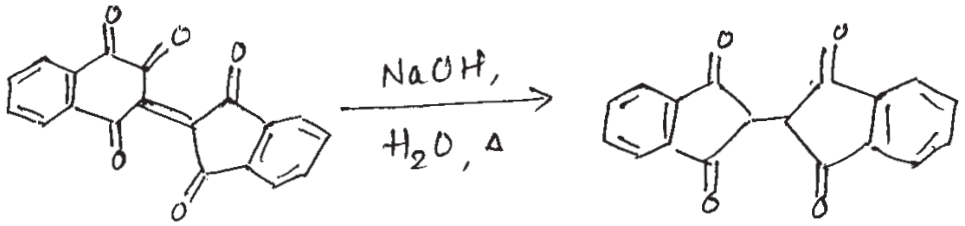
d) 

e) 

SECTION - II

Q4) a) Suggest mechanism for <u>any two</u> of the following : **[6]**

i)



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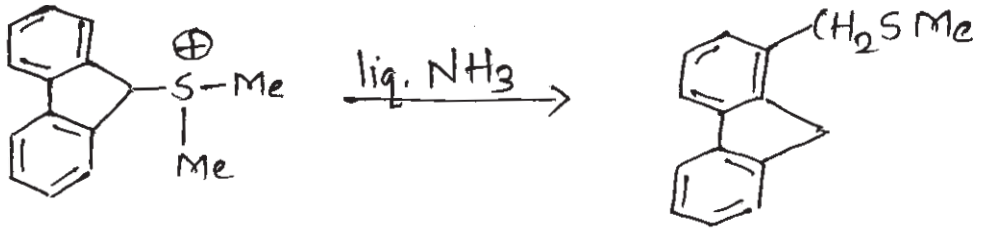

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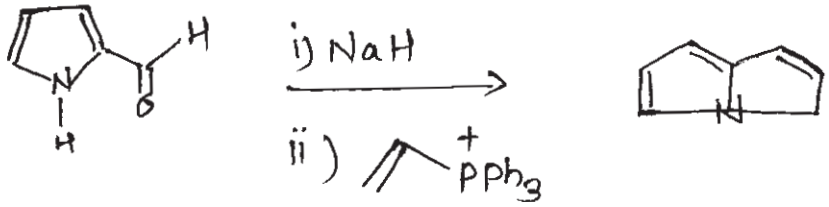
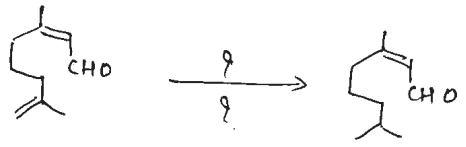


b) Suggest the reagents in following conversions. (any three) : **[6]**

i)



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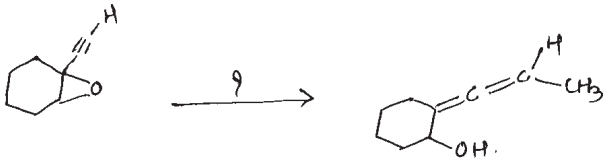

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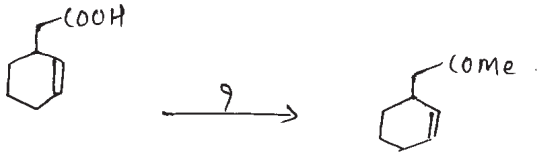

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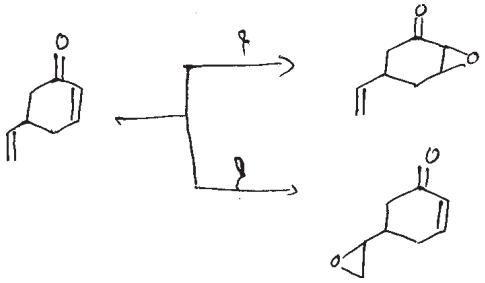
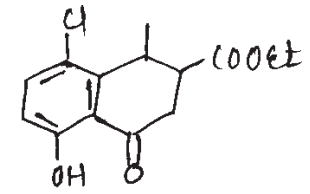
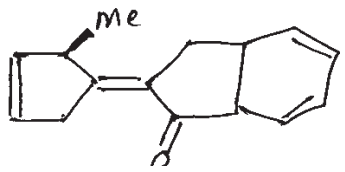


Q5) a) Attempt <u>any four</u> of the following : **[16]**

i) Calculate X_{max} for following :

a) 

b) 

ii) Explain the effect of α -halogen on carbonyl frequency in IR spectra of cyclohexanones.

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

iv) What is mean by fundamental vibrations and overtones.

v) An organic compound with molecular formula C_3H_7NO gives absorption peaks in the region 3413, 3236, 3030, 2899, 1667, 1634 and 1460cm^{-1}. Give the probable structure.

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

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

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

PMR : δ = 1.15 (3H, t, J = 7.5 Hz)

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

4.4 (2H, S)

7.2 (5H, S)

b) M.F. : $C_7H_4O_3NCl$

UV : 255 ($\in$ = 12000)

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

PMR : δ = 8.03 (2H, d, J = 8 Hz)

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

c) M.F : $C_7H_6O_4$

IR : 3238-3053 (broad), 1674, 1604cm^{-1}

PMR : δ : 6.69 (1H, t, J = 8.1 Hz)

7.03 (1H, dd, J = 8.1 and 1.8 Hz)

7.33 (1H, dd, J = 8.1 and 1.8 Hz)

8.77 (1H, S (br), exchangable with D_2O)

9.20 (1H, S (br), exchangable with D_2O)

11.2 (1H, S, D_2O exchangable)

d) MF : $C_7H_{12}O_4$

IR : 1742cm^{-1}

PMR : δ : 2.6 (2H, S)

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

4.16 (4H, q, J = 6.5 Hz)

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P791

[3923] - 301
M.Sc.
PHYSICAL CHEMISTRY
CH - 310 : Quantum Chemistry and Solid State Chemistry
(New) (2008 Pattern) (Sem. - III)

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) State the conditions for a wave function to be acceptable.

b) Find $\left[x, \frac{d}{dx}\right]$.

c) Determine the eigen value of :

i) $\frac{d^2}{dx^2}(3e^{-5x})$ and

ii) $\frac{d^2}{dx^2}(\sin 3x)$

d) Compare the variation method with the perturbation method.

e) Construct the general expression for total energy operator and hence formulate the operator for helium atom. Explain the terms involved.

f) Derive the expression for the first order correction to the wave function for non-degenerate perturbation method.

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

a) Obtain the secular determinants for butadiene and hence sketch the first four molecular orbitals.

b) Explain Huckels 4m + 2 rule for annulenes.

c) Explain how a compound may be classified as aromatic, antiaromatic and nonaromatic on the basis of REPE values.

d) Discuss how Hess and Schaad modified Huckel's theory.

e) Sketch the molecular orbitals for cyclo-butadiene on the basis of HMO theory. Deduce the energies of these orbitals on the basis of secular determinants.

f) Explain the extended Huckel theory and compare it with the Huckel theory.

SECTION - II

Q3) Attempt <u>any three</u> of the following : **[15]**

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

b) Discuss the optical properties of semiconductors.

c) Derive the expression for Schottky defects in a crystal at a given temperature.

d) Define and describe various types of line defects. What is slip?

e) Explain the mechanism of crystal growth from vapour phase.

Q4) Attempt <u>any three</u> of the following : **[15]**

a) Sketch and explain the hysteresis loop observed for the magnetization of an insulator crystal.

b) Explain the thermal properties of a crystal.

c) Stating the types, explain the origin of colour centres in an ionic crystal.

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

e) Discuss the various rate laws for gas-solid reactions.

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

a) How long would it take for Li to penetrate in Ge at 500°C to a 0.6 mm depth? [$D = 10^{-6}$ cm^2 sec^{-1}].

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

c) If the average energy required to create a vacancy in a metal is 1 eV, calculate the ratio of vacancies in the metal at 1000 and 500 K.

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

P792

[3923] - 302
M.Sc.
PHYSICAL CHEMISTRY
CH - 311 : Nuclear and Radiation Chemistry
(New) (2008 Pattern) (Sem. - III)

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
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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) Give classification of nuclear reactors.

b) Explain the terms thermal neutron loss factor, the resonance escape probability and fast fission factor.

c) Discuss in brief the theory of nuclear fission.

d) Describe with suitable example the neutron evaporation and spallation process.

e) Give an account of shell model.

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

a) Describe the sequence of filling the orbits w.r.t. rectangular well potential mode.

b) Describe how surface analysis is carried out using RBS technique.

c) What are the advantages and disadvantages of PIXE technique?

d) What are the postulates of compound nucleus theory? What are its implications?

e) Give classification of nuclear reactions.

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

a) Fission of $^{239}_{94}Pu$ results into $^{108}Pd + ^{129}Xe + 3n$. Find out the energy released during fission.

Given mass of $^{239}Pu = 239.052161$ u

$^{108}Pd = 107.903920$ u

$^{129}Xe = 128.904784$ u

$n = 1.008665$ u

b) Calculate the binding energy of the last two neutrons in ^{37}Cl. Given mass difference between ^{35}Cl & ^{37}Cl is 1.997042 u, mass of n = 1.008665 u.

c) The reaction ^{9}Be (p, n) ^{9}B has threshold energy of 2.059 meV. Find the Q value.

SECTION - II

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

a) Describe the genetic effects of radiation exposure.

b) What are the characteristics of an ideal scintillator? Discuss working of organic scintillator.

c) What is composition of Fricke solution? Explain the reactions involved in the radiolysis of aeriated Fricke solution.

d) What precautions are to be taken while handling radioactivity?

e) Draw and explain the working of surface barrier detector.

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

a) Write a note on Szilard-Chalmer reactions.

b) Describe the characteristics of an aqueous electron.

c) Enlist various personal dosimeters used. Describe any one of them.

d) Write a note on retention in organic compounds.

e) Describe various stages of interactions of radiations with biological cells.

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

a) A radiologist is permitted for a radiation exposure of 0.3 m rem/week. If the dose rate in a laboratory is 5μ rem/h and he has to work for 6 days a week, what is the perday average time he can spend there?

b) Find the recoil energy of an atom with mass number 100 in eV for a 5 meV photon emission.

c) The dose rate at 3m from a γ-source is 100 m rem/h. At what distance will the dose rate be 25 m rem/h.

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

P793

[3923] - 303
M.Sc. (Sem. - III)
PHYSICAL CHEMISTRY
CH - 312 : Advanced Instrumental Methods of Analysis
(2008 Pattern) (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.***
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3.	Planck Constant	h	=	6.626×10^{-27} erg s
			=	6.626×10^{-34} J s
4.	Electronic Charge	e	=	4.803×10^{-10} esu
			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
			=	1.987 cal K^{-1} mol^{-1}
7.	Faraday Constant	F	=	96487 C equiv^{-1}
8.	Speed of light	c	=	2.997×10^{10} cm s^{-1}
			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
11.	Bohr magneton	β_e	=	-9.274×10^{-24} J T^{-1}
12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) Define absorptive edge and explain x-ray absorption with a typical x-ray absorptive spectrum.

b) Discuss briefly SEM and STEM techniques.

c) Draw a neat labelled diagram of wavelength-dispersive instrument used in x-ray fluorescence and name the sources used in it.

d) Describe pulsed neutron activation analysis technique.

e) Discuss the advantages of NAA technique.

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

a) Explain the role of irradiation time and flux of irradiating particle for the required sensitivity in NAA.

b) Describe magnetic mass analyzer used in mass spectrometer.

c) Define hard and soft method of ionization. Explain arc and spark ionization method used in mass spectrometry.

d) With the help of energy level diagram explain the terms, Fermi level, binding energy and work function in solids as used in ESCA.

e) Explain the terms spectral splitting and chemical shift observed in ESCA.

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

a) 0.5 g sample containing 5% tin was irradiated in a neutron flux of 1.5×10^8 n cm^{-2} s^{-1} for one hour. What will be the activity of the sample in dpm at the end of irradiation?
Given : γ = 5.6%, σ = 13.3 b, t½ of ^{125}Sn = 9.5 min.

b) The mass absorption coefficient for Ni measured with a Cu kα line is 49.2 cm^2/g. Calculate the thickness of a nickel foil that was found to transmit 47.8% of the incident power of a beam of Cu kα radiation. The density of Ni is 8.90 g/cm^2.

c) In an ESCA experiment, the Cr kα x-rays (λ = 2.294 Å) caused the ejection of electrons from a calcium compound. The measured kinetic energy, Ek was 1.1 keV. The work function can be taken as 3.2 eV. Calculate the value of the binding energy for these electrons in the calcium atom.

SECTION - II

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

a) Explain gas-phase chemiluminescent titrations with a suitable example.

b) Distinguish between Fluorescence and phosphorescence. What is heavy-atom effect?

c) Describe the sample introduction into the ICP in ICP-AES technique.

d) Draw a neat labelled diagram of an ICP source. What is the detection limit in ICP emission technique?

e) Draw a typical TGA curve and state its general features. What are the most common furnace atmospheres used in Thermogravimetry?

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

a) Explain the application of thermogravimetry to determine the composition of binary mixtures.

b) Discuss briefly about the current-voltage relationship used in coulometry.

c) Explain the application of coulometry to perform neutralization titrations.

d) Discuss the technique of hydrodynamic voltametry.

e) Distinguish between normal pulse and differential pulse voltametric techniques. Which one is preferred for the analysis? Why?

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

a) A constant current of 0.800 A was used to deposit copper at the cathode and oxygen at the anode of an electrolytic cell. Calculate the mass of each product that was formed in 15.2 min, assuming that no other redox reactions occur

[At. wt. of Cu = 63.5].

b) During the forward scan of a triangular wave voltamogram at a disk electrode, a peak current of 25.4 μA was observed at a scan rate of 0.250 v/s. Estimate the peak current at a scan rate of 50.0 mv/s assuming a reversible electrochemical reaction.

c) At what value should the cathode potential be controlled if it is desired to separate silver from 0.005M solution of Cu^{2+} ions?
[Given : $E^{o}_{oxi,}Cu^{2+} = -0.337$ V].

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P794

[3923]-304
M.Sc.
PHYSICAL CHEMISTRY
CH - 314 : Polymer Chemistry
(New) (Optional) (2008 Pattern) (Sem. - III)

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 mechanism of addition polymerization.

b) Define the terms monomer, polymer, degree of polymerization, homo chain polymer and configuration.

c) Derive the rate equation for step polymerization in presence of catalyst.

d) Discuss the secondary bond force in polymers.

e) Discuss the role of Ziegler-Natta catalysis in polymerization.

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

a) What are co-polymers? What are the advantages of copolymers over homopolymers.

b) What is glass transition temperature? Describe the relationship between T_g and T_m.

c) Write a note on block and graft co-polymer.

d) Discuss the elastomer forming properties of polymer.

e) It is almost impossible to obtain 100% crystalline polymer, explain.

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

a) Calculate $\overline{X}_n, \overline{X}_\omega$ and the weight fraction of $\overline{X}_n$ - mers when a step polymerization is 95% complete.

b) Calculate the viscosity of the polymer at C = 0.40 *g/dl*
Huggin's constant = 0.33, K = 1.2×10^{-4}, $\alpha = 0.72$, M = 120000.

c) Three moles of 1, 3 butadiene are co-polymerised with two moles of vinyl chloride, what will be the composition of the polymer formed instantaneously if the monomer reactivity ratio of the two monomers are 8.8 and 0.035 respectively. [Atomic weights : C = 12, H = 1, C1 = 35.5]

SECTION - II

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

a) Describe with neat diagram vapour-phase osmometry method to determine the molecular weight of the polymer.

b) Discuss the use of DTA in analysis of polymer.

c) Describe the effect of radiation exposure on polyethylene.

d) Write a note on X-ray diffraction analysis in polymers.

e) Define viscosity, relative viscosity, reduced viscosity, intrinsic viscosity. Write the emperical relation between intrinsic viscosity and average molecular weight of the polymer.

f) How are the IR spectra useful for the analysis of polymers.

Q5) Attempt <u>any four</u> of the following : **[20]**

a) Explain, how NMR and ESR spectroscopy is useful in analysis of polymer.

b) Discuss the viscous flow phenomenon and it's mechanism in the polymer.

c) Discuss the conduction mechanism in conducting polymers.

d) Describe compression molding with neat diagram.

e) Distinguish between textile and fabric properties of polymers.

f) Write a note on melt spinning.

g) Describe the process of dying fibre.

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P795

[3923]-305
M.Sc.
PHYSICAL CHEMISTRY
CH - 315 : Special Topics in Physical Chemistry (New)
(Sem. - III)

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} $= 8.314$ 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	$= 5.051 \times 10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11 \times 10^{-31}$ kg

P.T.O.

SECTION - I

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

a) Classify sensors according to type of output signals and materials used.

b) Write general applications, functional properties for the three structural properties.

c) Explain the influence of hydrogen and water vapour on the properties of semiconductor ceramics.

d) Write a note on conductimetric sensors.

e) Define the terms, Poison, Michaelis-Menten kinetics, the Hammett acidity function and specific acid catalysis.

f) Explain the dependence of the rate constant for oximation of acetone on pH at 25°C.

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

a) Explain catalysis in gas phase with a suitable example.

b) Discuss catalysis in concentrated strong acid solutions.

c) Write the charge balance for 0.1 M HCN and 0.1 M NaCN.

d) Write proton condition for H_2Se and NaHSe.

e) Calculate pH and concentration of all species for 0.1 M H_3PO_4.
Given: $Ka_1 = 5.89 \times 10^{-3}$, $Ka_2 = 6.1 \times 10^{-8}$, $Ka_3 = 4.78 \times 10^{-13}$.

f) Find the fractions of $H_2C_2O_4$, $HC_2O_4^-$ and $C_2O_4^{2-}$
Given : pH = 11.59, $Ka_1 = 0.053$, $Ka_2 = 5.37 \times 10^{-5}$.

SECTION - II

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

a) Give an account of scanning tunneling microscope.

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

c) Describe briefly pachinko machine.

d) What do you mean by biomimetics? How is it used in under water actuation?

e) What are intelligent gels? Explain.

f) Describe different forms of smart composites.

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

a) What are the applications of nanogels?

b) Differentiate between smart materials and intelligent materials. Describe any one method of preparation of an intelligent composite.

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

d) What are azeotropes? Describe one such system.

e) Give an account of chemical methods of preparing nanoparticles.

f) Describe briefly carbon nanotubes.

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P795

[3923]-305
M.Sc.
PHYSICAL CHEMISTRY
CH - 316 : Environmental Chemistry (Old)
(Sem. - III)

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
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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	$= 5.051 \times 10^{-27}$ 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) Give the classification of air pollutants and discuss the sources of oxides of carbon.

b) Discuss biochemical effects of mercury.

c) Explain how CO_2 and O_3 play an important role in the troposphere and stratosphere respectively.

d) Write a note on atmospheric photo chemistry.

e) What are the effects of NO_x on human health?

f) Discuss hydrological cycle with the help of labelled diagram.

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

a) How does environment get polluted by petroleum hydrocarbons?

b) What are the causes and effects of acid rain?

c) Write a brief note on modified detergents.

d) Discuss briefly the point and non-point sources of water pollution.

e) What are surfactants? Discuss in brief cationic surfactants.

f) Describe chemical examination of water with reference to chloride, sulphate and phosphate.

SECTION - II

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

a) Explain the biotic damage due to thermal pollution.

b) Write two definitions of soil. State the factors affecting soil formation.

c) Discuss the mechanism of polymer degradation by photo sensitizer additives.

d) Describe soil pollution by industrial wastes.

e) What are the sources of thermal pollution? Discuss any one in detail.

f) Discuss the diagnostic tests and treatment of lead poisoning.

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

a) Describe chemical examination of water with reference to mercury, lead and iron.

b) Explain the enzyme inhibition by toxic metals in human beings with suitable examples.

c) Define 'Chemical toxicology'. Classify highly toxic solids with their recommended limit in ppm.

d) Write a note on : Carcinogenic compounds.

e) Explain the following :

i) Thermal noise.
ii) Shot noise.
iii) Partition noise.
iv) Environmental noise.
v) Flicker noise.

f) Discuss the biochemical effects of lead on human beings.

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[3923]-306
M.Sc. - Part - II
INORGANIC CHEMISTRY
CH - 326 : Organometallic Compounds of Transition Metals and Homogeneous Catalysis
(New) (2008 Pattern) (Semester - III)

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

Instructions to the candidates:

1) ***All questions are compulsory & carry equal marks.***
2) ***Figures to the right indicate full marks.***
3) ***Use of log table and calculator are allowed.***
4) ***At.No : Mo = 42***

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

a) Give a brief account of the different methods for the preparation of metal carbonyl compounds.

b) What is EAN rule? Discuss with suitable examples the application of EAN rule in predicting the stability of the organometallic compounds.

c) Write the structures of the products formed in the following reactions, keeping in view the 18 electron rule -

i) $\eta^4 - C_4H_6\ Fe(CO)_3 + HCl \longrightarrow ?$

ii) $(\eta^5 - Cp)_2\ Fe + HBF_4 \longrightarrow ?$

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

e) Explain the typical reactions of $TiCl_2(\eta^5 - C_5H_5)_2$.

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

a) What haptacities are possible for the following ligands.

i) C_2H_4, ii) Cyclopentadienyl,
iii) C_6H_6, iv) Butadiene
v) Cyclo octatetraene.

b) Explain the difference in IR spectra of the following :

i) $M_o(PF_3)_3\ (CO)_3$ Vs. $M_o(PMe_3)_3\ (CO)_3$
ii) $Mn\ C_P\ (CO)_3$ Vs. $MnC_P^*\ (CO)_3$.

c) The variable temperature ^1H *n.m.r* of $[C\eta^5 - C_5H_5)Fe(CO)_2]_2$ shows one sharp signal at +28ºC, while two sharp signals are seen in the ^1H *n.m.r* at – 70ºC.

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

e) Organometallic compounds act as protecting and activating agents for functional groups. Explain.

Q3) Attempt any FOUR of the following : **[20]**

a) Discuss mechanism of hydroformylation reaction of alkene with rhodium catalyst and cobalt catalyst.

b) Discuss in detail production of aldehydes with wacker's process.

c) i) State whether following is true or false and explain your choice – "The Ni–C bond length in nickelocene is longer than the Fe-C bond length in ferrocene."

ii) Using the 18-electron rule, find out the Mo-Mo bond order in $[(\eta^5 - CP)\ Mo(CO)_3]_2$. Draw the possible isomers of the molecule.

d) The $\nu(CO)$ band in the IR spectrum of $[Fe(CO)_4]^{-2}$ is at about 1790 cm^{-1}, whereas for N*i*$(CO)_4$ it is about 2060cm^{-1}. Explain.

e) Draw the structures :

i) Dimeric $Mn_2(CO)_{10}$, ii) $[CO(H)\ (N_2)\ (PPh_3)_2]$

iii) $Cis(CP)_2.Fe_2(CO)_4$, iv) $\mu - CO - [-(\eta^4 - C_4H_4)Fe(CO)]_2$

v) Thiophene chromium tricarbonyl.

Q4) Write notes on any FOUR : **[20]**

a) Applications of the suzuki cross-coupling reaction.

b) Environmental aspects of OMC's.

c) Tertiary phosphine complex of TM's.

d) Metal-nitrosyl compounds.

e) Group V organometallic compounds in Medicine.

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

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[3923] - 308

M.Sc. (Part - II)

INORGANIC CHEMISTRY

CH - 331 : Structural Methods in Inorganic Chemistry

(New) (Sem. - III) (2008 Pattern)

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

Instructions to the candidates:

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

Q1) Attempt any four : **[20]**

a) The cyclic voltamogram of the antibiotic chloraphenicol is recorded in 0.1M acetate solution, with carbon paste electrodes and at a scan rate of 350 mv/sec. Explain the CV and interpret the redox mechanism.

b) Calculate the ESR transitions for methyl radical.

c) Sketch the 'H nmr for $[BH_4]^-$ and $[A1\ H_4]^-$.

d) Write an account on applications of SEM technique in characterization of materials.

e) What are the principles underlying the x-ray diffraction technique? Explain.

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

a) $CrC_2O_4 . 2H_2O$ decomposes in two steps to form Cr_2O_3. Calculate the weight loss for each step and write the decomposition reaction for each step.

b) Using a refractometer with λ = 1.54A° only one reflection from a FCC material is observed when $2\theta = 121°$. What is the interplanar spacing. Find the indices of this reflection.

c) Which of the following transformations are not detected by TGA and why?

i) Loss of moisture
ii) Sublimation
iii) Melting
iv) Softening of polymer
v) Phase transformation
vi) Gas adsorption

P.T.O.

d) Explain with suitable examples how XRD studies is useful in particle size determination.

e) Explain the importance of the following in thermal analysis. : Sample size; furnace atmosphere; particle size; heating rate.

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

a) What are the limitations of NQR?

b) What is meant by 'g' value in ESR? What are the factors affecting 'g' value?

c) Vanadylacetylacetone shows 8 lines in the hyperfine structure of its ESR spectrum. Calculate the spin of ^{51}V nucleus.

d) A powder diffraction pattern was obtained for lead with CuK_{α} radiation ($\lambda = 1.539\ A^{o}$). Calculate the interplanar distance which gives rise to a first order line at $\sin\theta = 0.9210$.

e) Write a account on Applications of thermal methods.

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

a) DSC

b) Kramer degeneracy theorem & Zero field splitting.

c) Spin-spin coupling in NMR.

d) Asymmetry parameter.

e) Photo Electron spectroscopy.

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

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[3923] - 309

M.Sc. (Part - II)

INORGANIC CHEMISTRY

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

(New) (Sem. - III) (2008 Pattern)

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 the functions of cytochrome oxidase?

b) Discuss why increased levels of superoxide dismutase enzymes are observed during anthra cyclenone treatment for cancer chemotherapy.

c) Explain the role of metal clusters in water oxidation.

d) Discuss different types of copper proteins.

e) Explain with suitable examples, how reactivity of perfectionate ion changes with complexing agents.

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

a) Explain the concept of model compounds for metallo - enzymes.

b) Explain the structure and functions of carboxypeptidase.

c) Describe the model compounds of iron-sulphur proteins.

d) Explain the bifunctional binding modes of cis-platin with DNA.

e) Explain what do you mean by "Radiolabelling". Discuss how it is used for antibiotics.

P.T.O.

Q3) Write short notes on (any four) : **[20]**

a) Hydrogenase

b) MRI contrast reagents.

c) Methyl cobalamine cofactor

d) Zinc gene regulatory proteins

e) Catalase

Q4) a) Draw the structures of : **[5]**

i) Azurin

ii) Eithidium bromide

iii) $[Tc\ (PR_2)_4\ X_2]$

iv) Deoxyhaemerythrin

v) $[Cu\ (phen)_2]^+$

b) Answer in short (any five) : **[10]**

i) Mention any four techniques that are used for characterisation of radiopharmaceutical isomers.

ii) Explain the role of Gadolinium complexes in radiopharmaceuticals.

iii) Why transition metals are involved in enzymatic reactions?

iv) What do you mean by iron buffering.

v) Mention any four metal-nucleic acid interactions.

vi) Explain any two reactions of urease.

c) Match the following : **[5]**

A	B
Vit. B_{12}	Catalase
$[Ru\ (bipy)_3]^{2+}$	Alcohol dehydrogenase
Manganese	e^- fransfer
Zinc	reduction of ribose to deoxyribose
Cytochrome	DNA cleavage

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

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[3923] - 310

M.Sc. - II

ORGANIC CHEMISTRY

CH - 350 : Organic Reaction Mechanism

(New - 2008 Pattern) (Sem. - III)

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) : **[12]**

a) Non classical carbocation.

b) Newman's rule of six.

c) NGP by ester and pi bond.

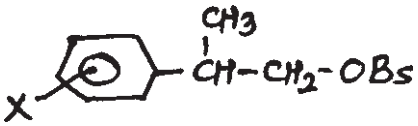
d) Use of FAD & $FADH_2$ in biotransformations.

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

a) The δ constant of -OR is positive at meta and negative at para position.

b) Prove that Hammett equation is a linear free energy relationship.

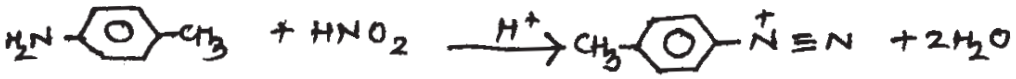
c) Rate of ionisation of series of following compound are more successfully correlated with δ^+ than δ values, explain.



d) Predict the sign of rho(ρ) for the following reactions giving reasons :

i) $ArCOCl + EtOH \longrightarrow ArCOOEt + HCl$

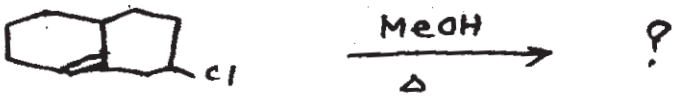
ii) $ArO^- + CH_3I \longrightarrow ArOCH_3 + I^-$

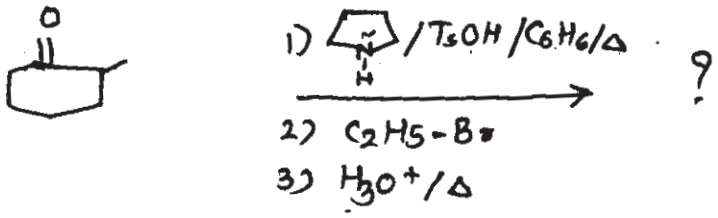
iii) 

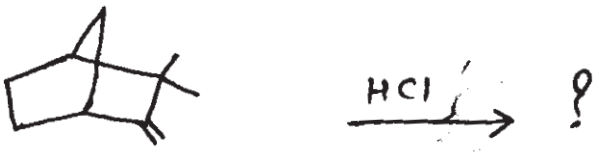
iv) 

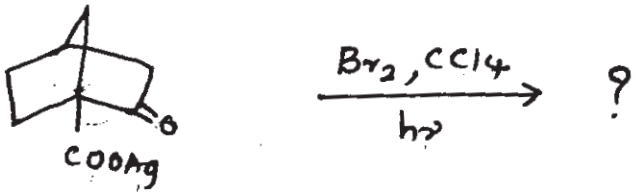
P.T.O.

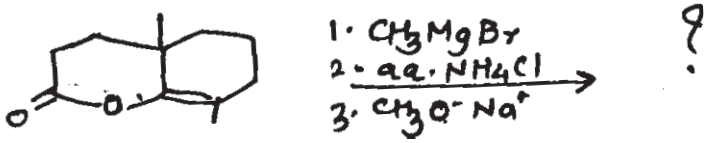
Q3) Predict the product in the following giving mechanism of their formation (Any four) : **[16]**

a) 

b) 

c) 

d) 

e) 

SECTION - II

Q4) Explain <u>any three</u> of the following : **[12]**

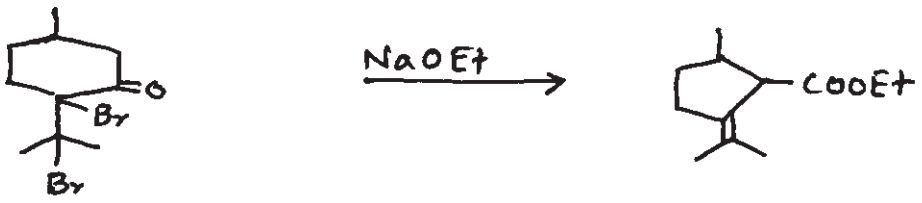
a) Role of Lysine enamine as natures enol equivalent.

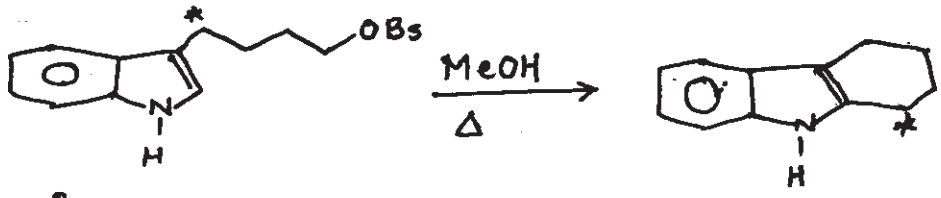
b) Formation of carbenes from tosyl hydrazones.

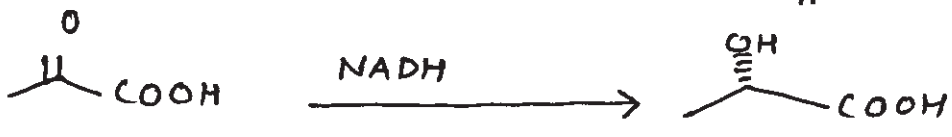
c) Benders strategy to solve the ambiguity in BAC2 mechanism.

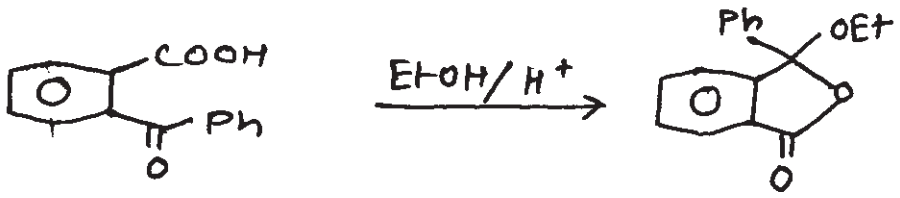
d) 4-methoxy ethyl benzoate hydrolyse rapidly as compared to ethyl benzoate in concentrated sulphuric acid but reverse is true in dilute sulphuric acid.

Q5) Suggest the mechanism for the following (any three) : **[12]**

a) 

b) 

c) 

d) 

Q6) Attempt <u>any four</u> of the following. **[16]**

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

b) Basic hydrolysis of $(PhCH_2)_2$ NCH_2 CHMeCl yields predominantly a primary alcohol, whereas neutral hydrolysis gives a secondary alcohol.

c) Ester hydrolysis by the BAL2 mechanism is practically never observed.

d) Explain the experiment by which it can be proved that Fries rearrangement is intramolecular or intermolecular rearrangement.

e) Explain any two methods of formation of carbene and its cyclopropanation reaction.

✪✡✪✡

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

P801

[3923] - 311

M.Sc. - II

ORGANIC CHEMISTRY

CH - 351 : Spectroscopic Methods in Structure Determination

(2008 Pattern) (Sem. - III)

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.***
4) ***Spectroscopic data tables are not provided.***

SECTION - I

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

a) NMR can be used as a tool to distinguish primary, secondary and tertiary alcohols.

b) The size of cyclic Olefins could be estimated from the vicinal coupling constants.

c) Compared to PMR, the signals in CMR are weak and integrations are not done as in PMR.

d) Double focusing M.S. is preferred to single focusing M.S. for structure determination.

e) Spin decoupling studies can be utilized to simplify a complex PMR spectrum.

Q2) Answer any four of the following : **[16]**

a) Predict the structure from the given spectral data.

M.F. : C_8H_7OCl

UV : 260 nm

IR : 1750 cm^{-1}, 1600, 1500 cm^{-1}

CMR : 26 (q), 128 (d), 129 (d), 135 (s), 140 (s), 177 (s)

MASS : 154/156 (m^+ 3:1), 139/141, 111/113

PMR : 2.5 (S, 3H); 7.3 (d. J = 8Hz); 7.8 (d, J = 8Hz, 2H)

P.T.O.

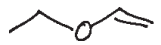
b) Assign the structure.

M.F. : $C_8H_{12}O$

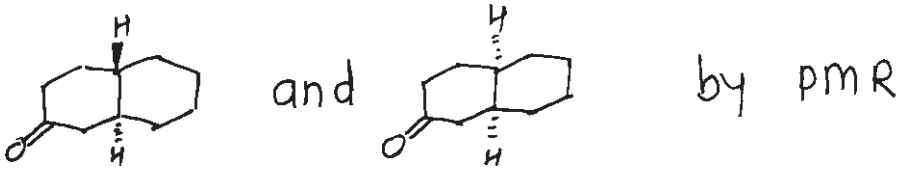
IR : 2740, 1685, 1618 cm^{-1}

CMR : 188.2 (d), 153.4 (s), 152.7 (d), 43.6 (s), 40.8 (t), 30.3 (t), 29.5 (q)

PMR :1.25δ (S, 6H); 1.83 (t, 7Hz, 2H); 2.5 (dt, 7& 2.6 Hz, 2H); 6.78 (t, 2.6 Hz, 1H); 9.82 (S, 1H).

c) Draw the PMR spectra of  indicate the approximate chemical shifts, coupling constants and splitting pattern for the various protons.

d) Distinguish the following pairs by the spectral methods indicated.

i) 

ii) 

e) The COSY and HETCOR spectra of a compound C_4H_8O exhibits the following data

Its CMR (DEPT - 135) show negative peaks. Analyse the data and arrive at a structure.

COSY : $3.8 \rightarrow 1.7$

$1.7 \rightarrow 3.8$

HETCOR : $3.8 \rightarrow 64$

$1.7 \rightarrow 32$

Q3) Discuss any three of the following : **[12]**

a) Principles and applications of nOe.

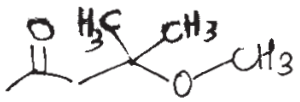
b) Compare CW-NMR verses FT-NMR.

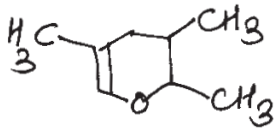
c) Ionisation techniques in mass spectrometry.

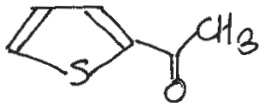
d) Long range coupling.

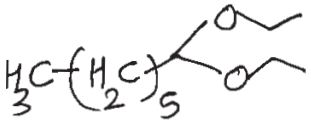
SECTION - II

Q4) a) Explain the genesis of following ions <u>any four</u> : **[8]**

i)  m/z : 130, 115, 100, 73, 43

ii)  m/z = 126, 70, 69, 56, 41

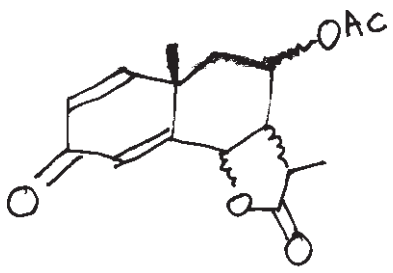
iii)  m/z = 126, 111, 83, 39

iv)  m/z = 103, 143, 75, 47

v)  m/z = 86, 74, 30

b) A compound shows M^+ at 84 and has a base peak at 56, what is its probable molecular formula? It exhibits only one signal in its PMR and CMR at 1.4 and 35 respectively, nothing significant is observed in its IR. Deduce its structure. **[4]**

Q5) a) The PMR spectrum of artemesinin acetate <u>A</u> shows vicinal coupling constants as $J_{6,7} = 11.6$Hz; $J_{8,9\,(ax)} = J_{8,7} = 10.9$ Hz; $J_{7,11} = 1.5$ Hz while its 6 - epimer, 6 - epiartemesinin acetate <u>B</u> shows vicinal coupling constants as $J_{6,7} = 5.7$ Hz; $J_{8,9\,(ax)} = J_{8,7} = 10.5$ Hz; $J_{7,11} = O$ Hz. Determine the structures of <u>A</u> & <u>B</u> with correct stereochemistry at C_6, C_7, C_8 & C_{11}. Explain your answer. **[6]**



A/B

b) Deduce the structure of a compound with molecular formula $C_{10}H_{12}O_2$: which exhibits the following spectral data. **[5]**

IR : 1711 cm^{-1}

PMR : 2.1 (s); 3.6 (s); 3.8 (s); 6.85 (d); 7.1 (d)

Normal CMR	DEPT – 135	DEPT – 90
29 ppm	Positive	No peak
50	Negative	No peak
55	Positive	No peak
114	Positive	Positive
126	No peak	No peak
130	Positive	Positive
159	No peak	No peak
207	No peak	No peak

c) Using the given spectral data deduce, the structure of the compound - Justify your answer. **[5]**

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

IR : 2960, 1680, 1450, 1213, 1003 cm^{-1}

PMR : 1.02. (t, J = 6Hz, 24 mm)

1.75 (m, 16mm)

2.95 (t, J = 6.5 Hz, 16 mm)

7.35 (m, 16 mm)

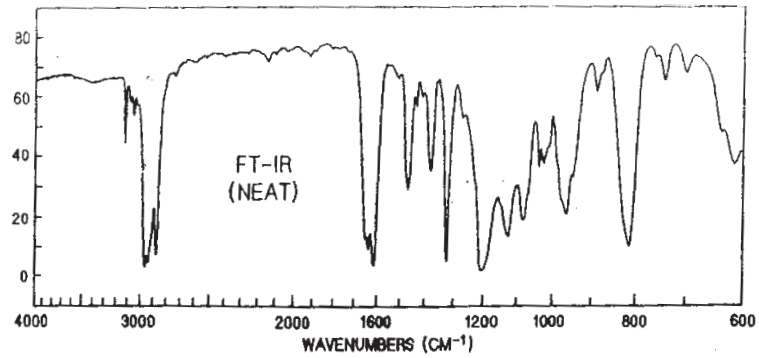
7.45 (m, 8 mm)

8.00 (m, 16 mm)

CMR : 13.8, 17.7, 40.4, 128.0, 128.5, 132.8, 137.0, 200.4

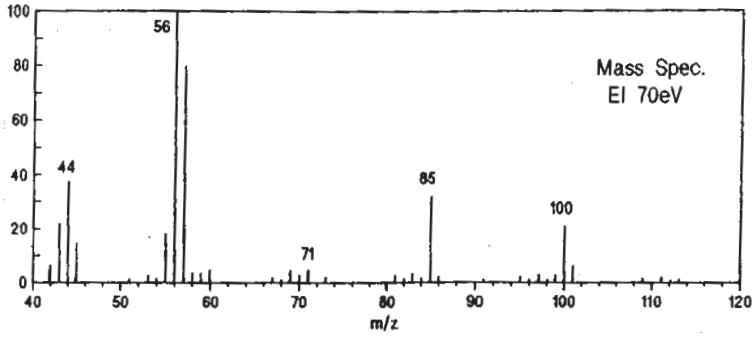
Mass : M^+ (148, 55%), 133 (08), 120 (15), 106 (13), 105 (100), 77 (30)

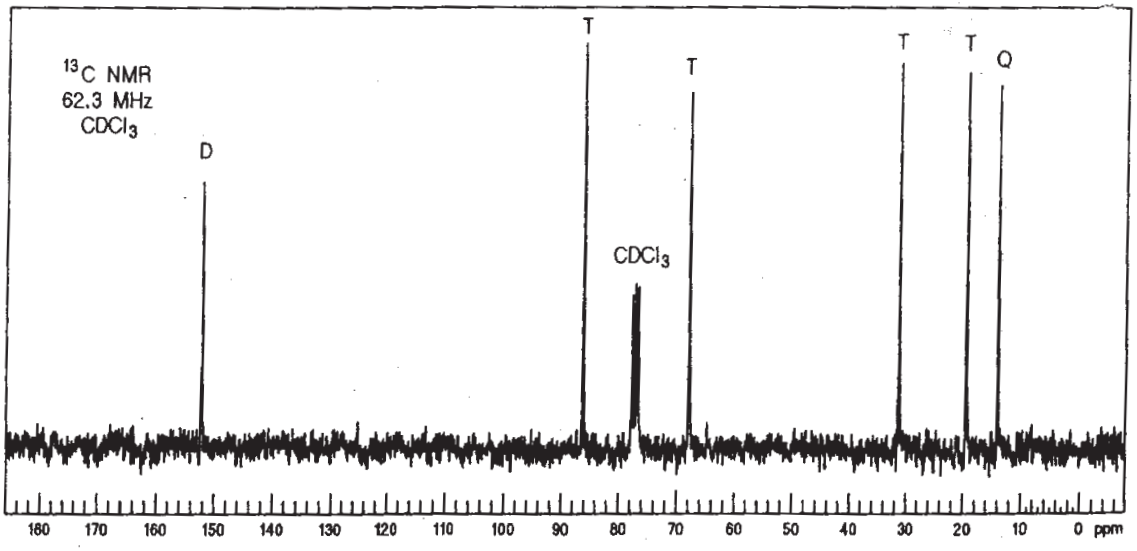
Q6) An unknown compound exhibits the following spectral data. Analyse the spectra and attempt to put these data together and assign a reasonable structure. Justify your assignment. **[12]**

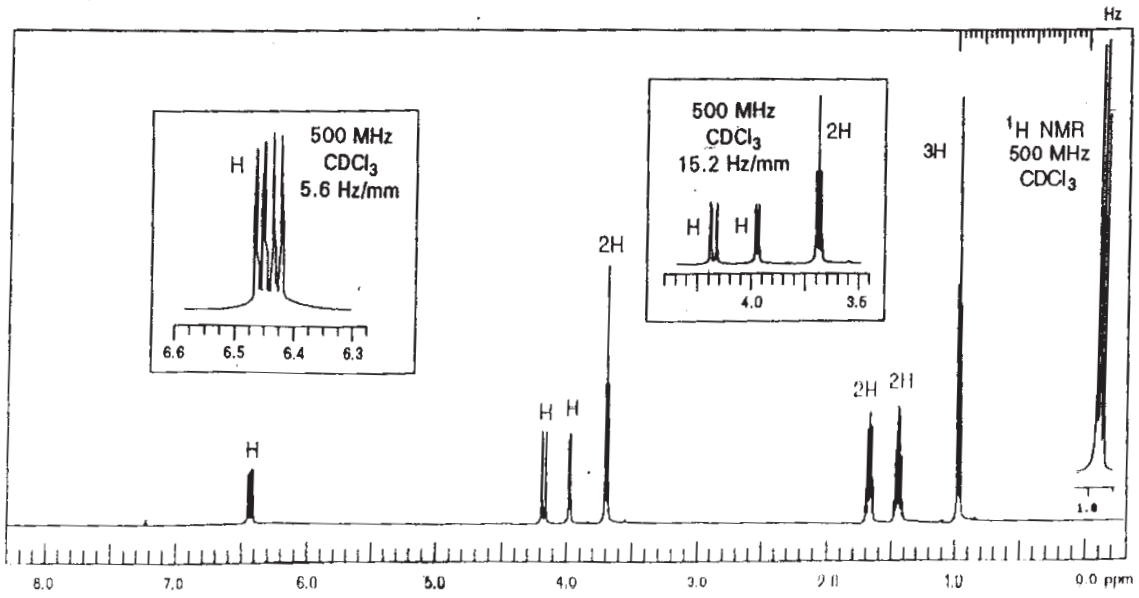


Exact M.S. (EI) = 100.0888

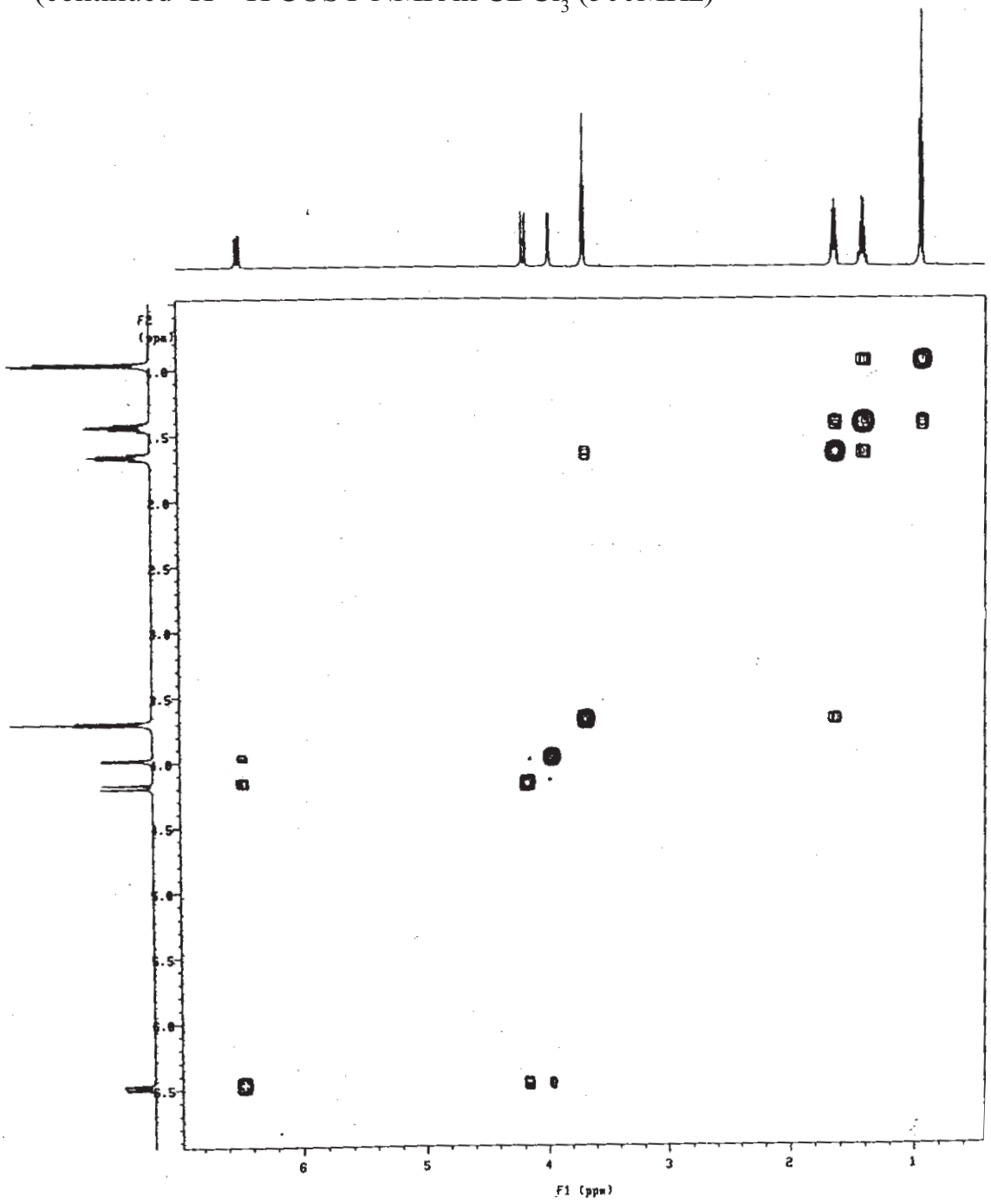
UVλ_{max} = BLANK







(continued $^{1}H - ^{1}H$ COSY NMR in $CDCl_3$ (500MHz)



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

P802

[3923] - 312

M.Sc.

ORGANIC CHEMISTRY

CH - 352 : Organic Stereo Chemistry

(2008 Pattern) (New) (Sem. - III)

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

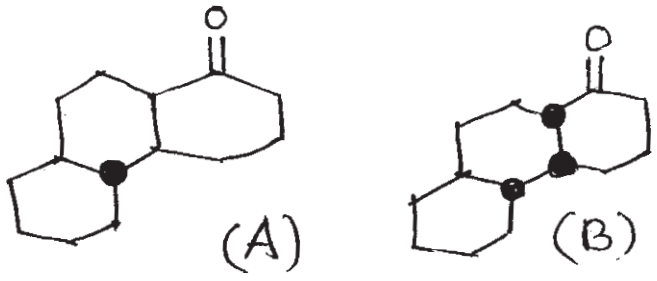
Q1) Answers any four of the following : **[16]**

a) Cis - 4 - hydroxy cyclohexane carboxylic acid lactonize, while the trans isomers does not.

b) Reduction of cyclobutanone by $NaBH_4$ is much easy than reduction of cyclo-octanone by $NaBH_4$. Explain.

c) Cis - decalin is less stable than trans decalin. Explain with stereostructures.

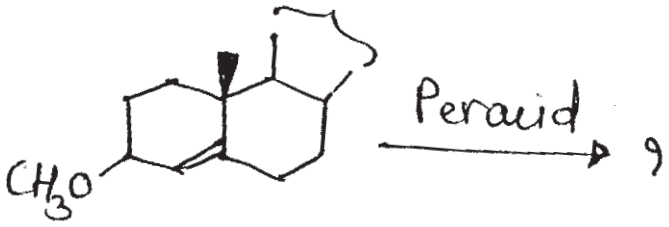
d) Compound 'A' undergoes epimerisation on treatment with base where as 'B' does not. Explain.

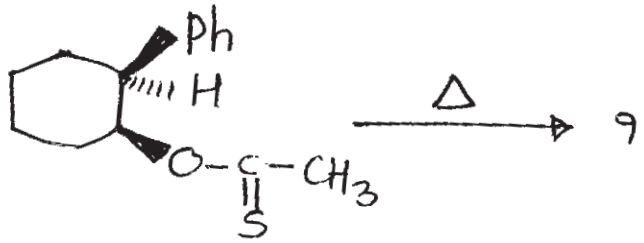


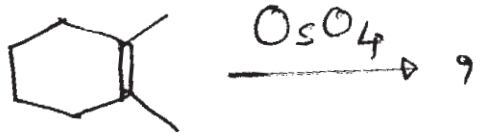
e) Draw structures for Cis - anti - trans and Cis-anti-Cis isomers of perhydrophenanthrene and compare their stabilities comment on their optical activity.

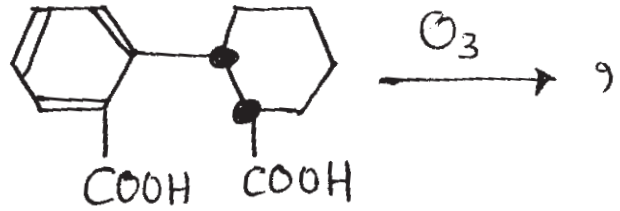
P.T.O.

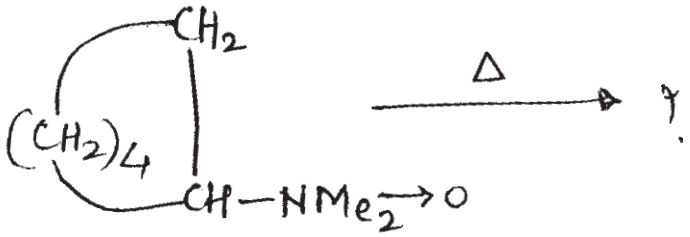
Q2) Predict the product/s in <u>any four</u> of the following and explain stereochemical principles involved. Justify. **[12]**

a) 

b) 

c) 

d) 

e) 

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

a) Estimation of the relative stabilities of Cis and trans - decalin.

b) Sterric assistance in solvolysis to tosylates of cyclohexanols.

c) Reactions of nitrous acid on diastereomers of α-amincyclohexanol.

d) Resolution of alcohols through formation of half ester.

SECTION - II

Q4) Answer the following questions (Any three) : **[12]**

a) Prove that in codeine C_6 - OH and C_{13} - C_{15} bond are trans to each other.

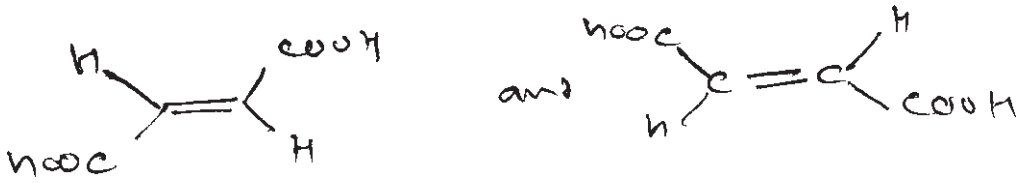
b) What is the stereochemistry of C_3 - vinyl and C_8 - C_9 bond in cinchonine and quinine.

c) Explain the stereochemistry of C_6 & C_{13} in dihydroiso codeine.

d) Give the products obtain in the reaction of enhydrin with diazo methane. How this reaction help to establish lactone ring fusion in enhydrin.

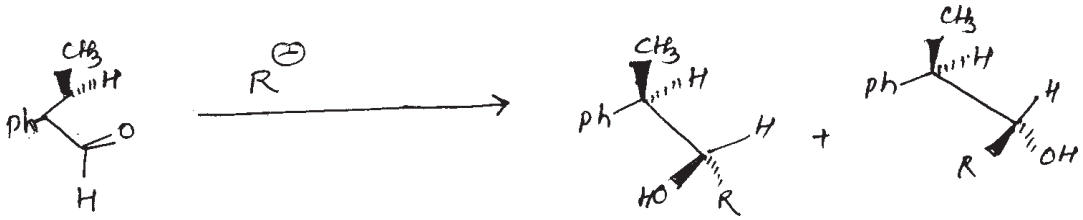
Q5) Attempt <u>any four</u> of the following questions : **[12]**

a) Identify Si and Re focus in the following compounds.



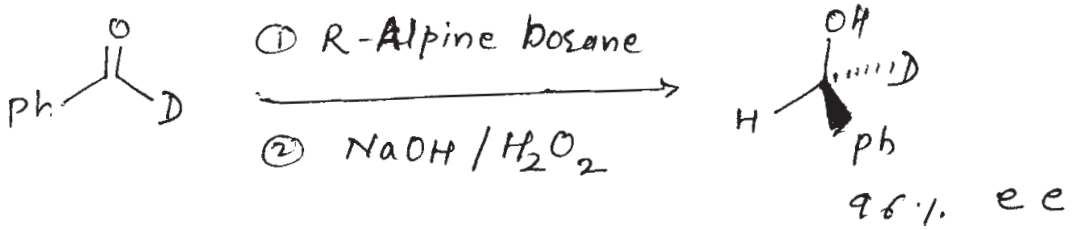
b) Give the structure of organic compound explaining Pro-R and Pro-S configurations of the group attached.

c) Explain the variation in the yields of the products in following reaction.



	Cram	anti Cram
R = CH_3	71	29
R = C_2H_5	96	4
R = C_3H_7	76	24
R = t Bu	98	02

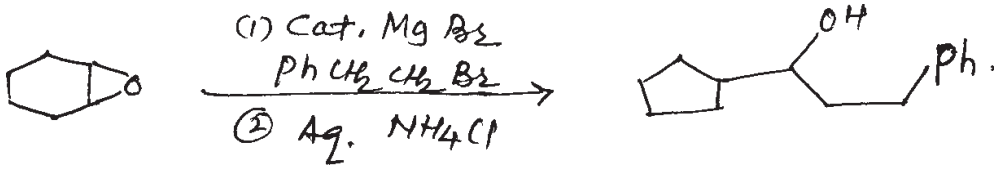
d) Calculate the ee of the R/S isomers obtained in the following reaction provided 'R' isomer is major.



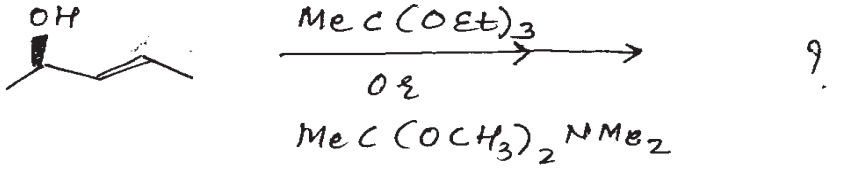
e) Give the comparison between chiral auxillary and catalyst. Give the synthesis of David Evan's auxillary.

Q6) a) Solve <u>any four</u> of the following reactions and explain the stereochemistry and mechanism in details. **[8]**

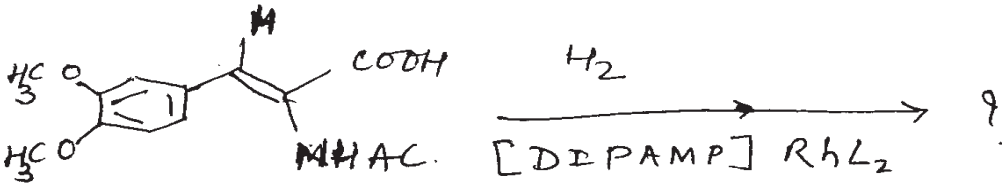
i) Explain the regioselectivity and stereo selectivity observed in the following reaction.



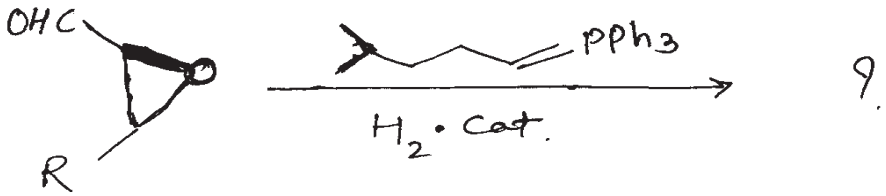
ii)



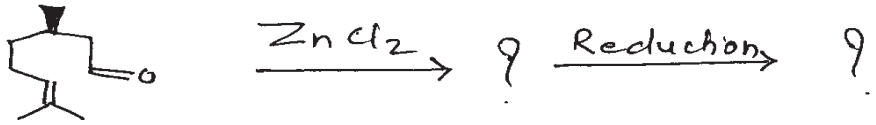
iii)



iv)

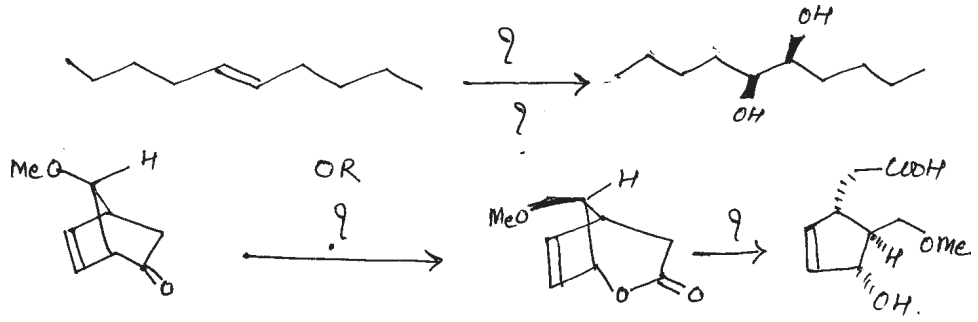


v)

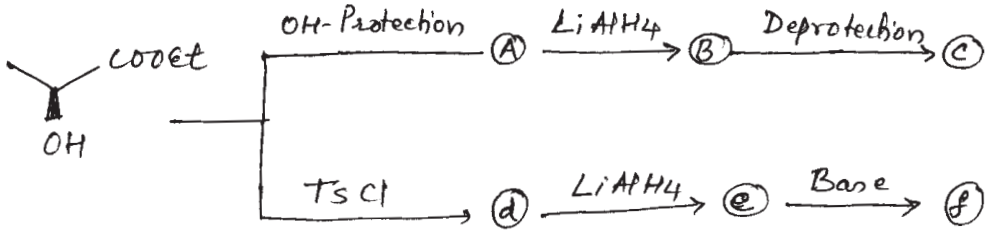


b) Solve the following : **[4]**

Suggest the reagent and give mechanism in the following reaction.



c) Predict the product/s and write stereochemistery of the following reaction. **[4]**



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

P803

[3923] - 313

M.Sc. - II

ORGANIC CHEMISTRY

CH - 353 : Free Radicals, Photochemistry and Pericyclic Reactions & their Applications

(New & Old) (Sem. - III)

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

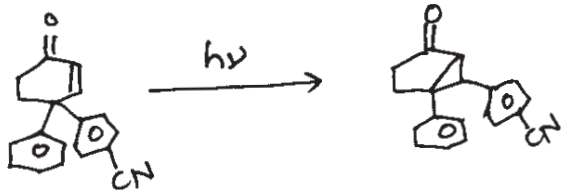
Instructions to the candidates:

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) Suggest suitable mechanism for any four of the following : **[12]**

a)



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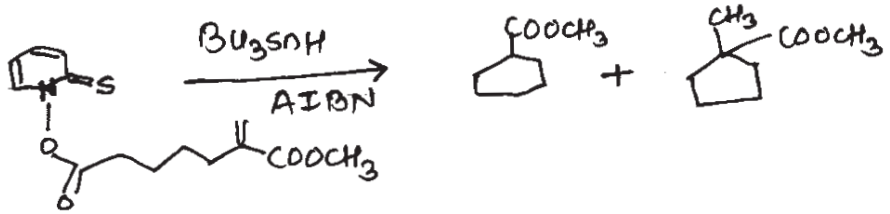

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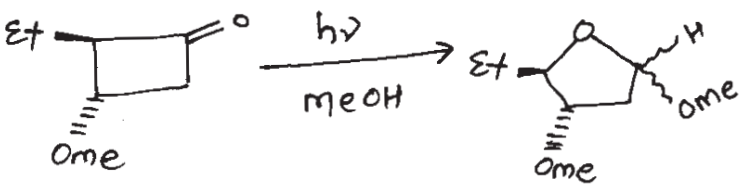

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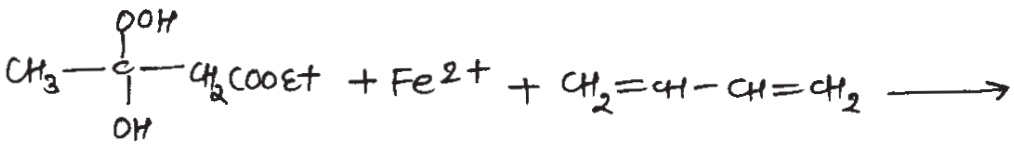
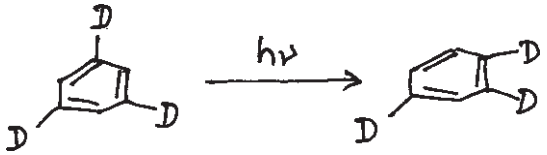


e)

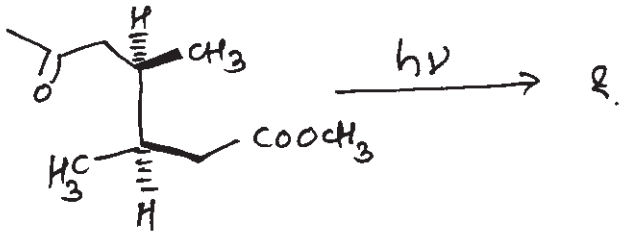


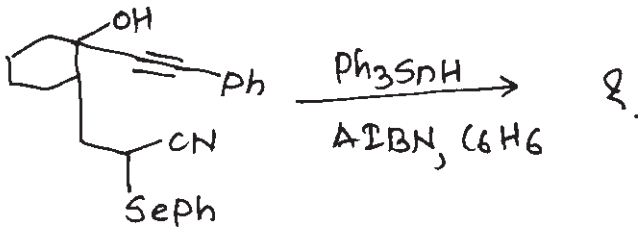
P.T.O.

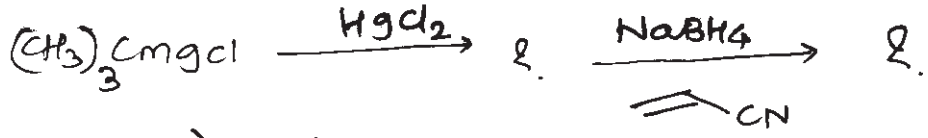
Q2) a) What are antioxidants? Explain their mode of action with suitable examples. **[4]**

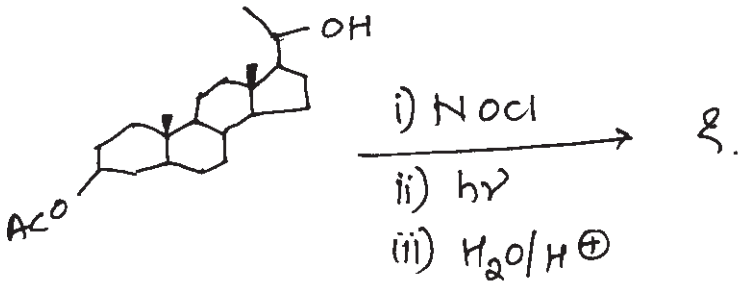
b) Predict the product/s indicating mechanism in <u>any five</u> of the following : **[10]**

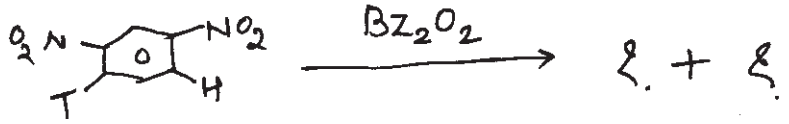
i) 

ii) 

iii) 

iv) 

v) 

vi) 

Q3) a) Explain <u>any two</u> of the following : **[6]**

i) When the erythro form of the deuterated bromide, PhCHD-CHBrPh is treated with NBS, it gives predominantly a meso product.

ii) Decomposition of benzoyl peroxide in damp CCl_4 in presence of elemental iodine gives benzoic acid in quantitative yield.

iii) Photolysis of norbornene in presence of acetophenone mainly shows photodimerisation reaction but its photolysis in presence of benzophenone mainly shows oxetane formation.

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

i) Photoreduction.

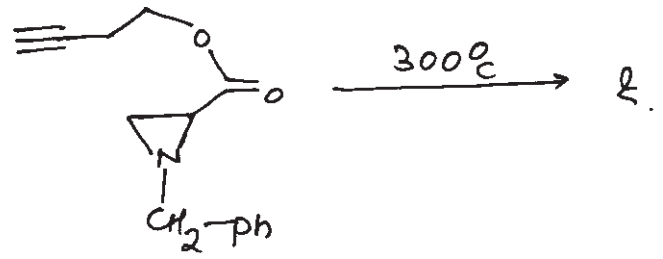
ii) Photorearrangement of 4,4- disubstituted - 2, 5 - cyclohexadienones.

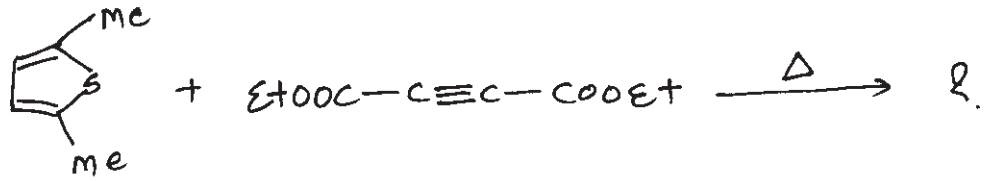
iii) Decomposition of n-Butylhydroperoxide at 85°C.

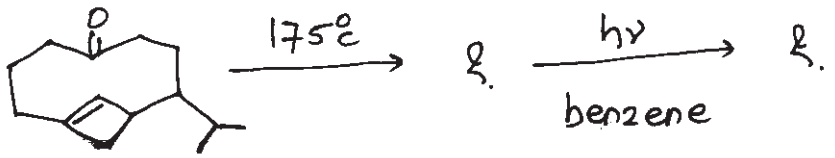
SECTION - II

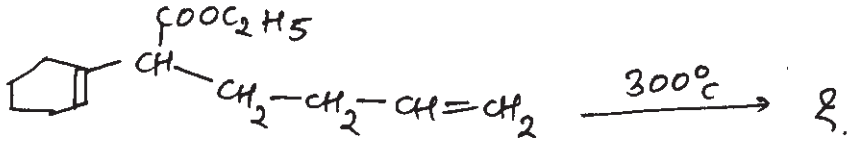
Q4) a) Draw the correlation diagram for con-rotatory opening of 1,3.-cyclohexadiene to 1,3,5-hexatriene and predict whether the reaction will be thermally or photochemically allowed. **[6]**

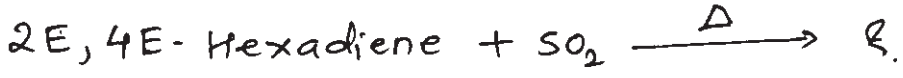
b) Predict the product/s and explain the mechanism for any four of the following : **[8]**

i) 

ii) 

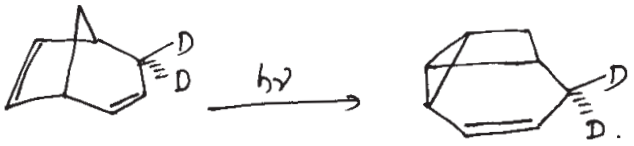
iii) 

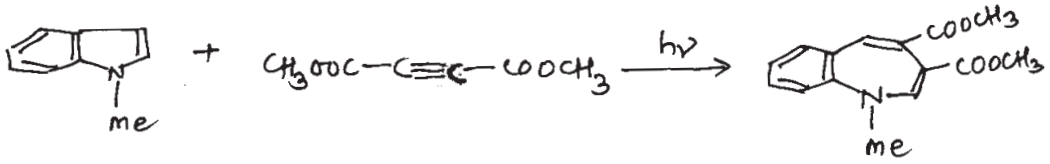
iv) 

v) 

Q5) a) Explain with the help of F_{MO} approach whether supra-antara cycloaddition reaction between allylic anion and butadiene is thermally or photochemically allowed. **[4]**

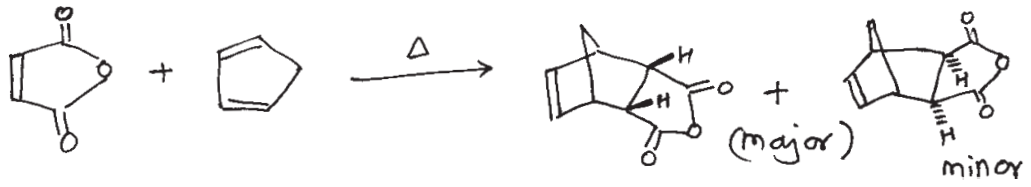
b) Explain the mechanism for <u>any four</u> of the following. **[8]**

i) 

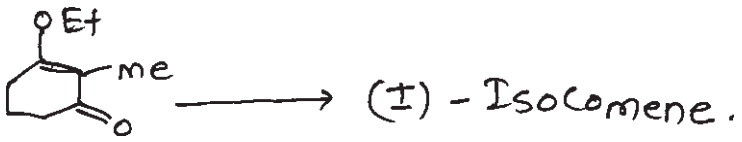
ii) 

iii) 

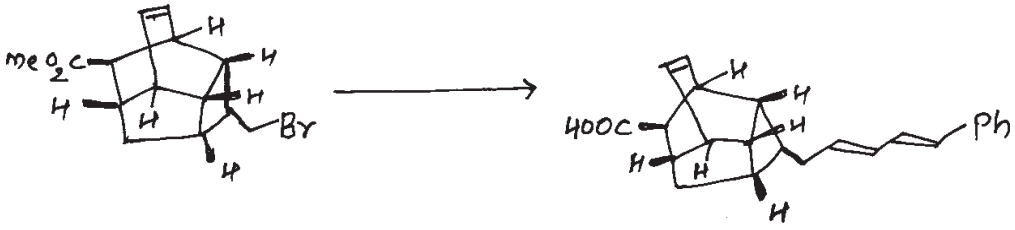
iv) 

v) 

Q6) a) Complete the following synthetic sequence indicating all intermediates and reagents required. **[6]**



b) Complete <u>any two</u> of the following synthetic sequences indicating all intermediates and reagents required. **[8]**

i) 

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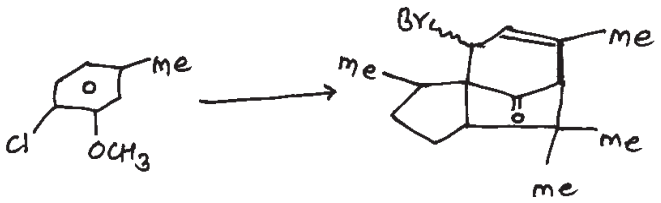
iii) 

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P804

[3923] - 314
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 390 : Electro analytical and Current Analytical Methods in Industries
(New Course) (2008 Pattern) (Sem. - III)

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/calculator (non-programmable) is allowed.***

SECTION - I

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

a) Explain the construction and working of rotating platinum micro-electrode. What are it's advantages over DME?

b) Explain how polarographic technique is useful for qualitative and quantitative analysis.

c) State the principle of electrogravimetric analysis. Explain with a typical example the importance of hydrogen over potential in the electrogravimetric determination of metals.

d) Calculate the diffusion current of Cd^{2+} ion in a solution having concentration 7.1 mM, if drop time was measured at the rate of 3.47 sec. per drop. The mercury flow rate was 1.72 mg per sec.

[Given : diffusion coefficient of $Cd^{2+} = 6.7 \times 10^{-6}$ cm^2 s^{-1}]

e) A sample of copper ore weighing 2.132 g is dissolved in acid and the copper is electrolysed using constant current of 2.00 A at 8.04 min. Calculate the percentage of copper in the ore.

[Given : at. wt. of Cu = 63.54].

P.T.O.

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

a) What is meant by stripping voltammetry? Explain the purpose of the electrodeposition step in stripping analysis.

b) Write a note on coulometric titrations.

c) State the principle of amperometric titrations. Draw and describe the nature of an amperometric titration curve when only titrant is electro active.

d) Constant-current coulometry was used to assay a solution containing iron (II). The assay was performed in a 0.1M cerium-sulfate-sulphuric acid solution. The overall electrode reaction was

$$Ce^{4+} + Fe^{2+} \rightarrow Ce^{3+} + Fe^{3+}$$

At the end point of titration 25 ml sample, a controlled current of 6.43 mA had flowed for 3 min 43 sec. Calculate the concentration of Fe^{2+} in the sample.

e) Estimate the peak current at a scan rate of 25.0 mV/s, for the forward scan of a triangular wave voltamogram at a disk electrode. Peak current of 17.5 μA was observed at a scan rate of 0.825 v/s, assuming a reversible electro-chemical reaction.

SECTION - II

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

a) Give the principle of Neutron Activation Analysis. Discuss in brief the steps involved in neutron activation analysis.

b) Discuss in brief the technique of isotope dilution analysis.

c) Draw a neat, labelled TGA curve. Discuss with suitable example the effect of particle size and furnace atmosphere on the nature of TGA curve.

d) A sample of steel was analysed for it's nickel content. A 0.1g sample was irradiated in a flux of 10^9 ncm^{-2} s^{-1} for 4 hours. The activity measured with 20% efficiency after a cooling period of 1 hour was 7752 cpm.

Find the percentage of Nickel in the sample.

Given : i) Isotopic abundance of ^{64}Ni = 0.91%

ii) Half-life period of ^{65}Ni = 2.52 hours,

iii) Neutron capture cross-section = 1.496,

e) A TG analysis of 10 mg of naturally occuring hydrated copper oxalate losses 3% of it's weight at 250°C by dehydration. Determine the number of water molecules in copper oxalate.
[at. wt. Cu = 63.55, C = 12, O = 16, H = 1].

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

a) Discuss the applications and limitations of radio-reagent methods of analysis.

b) Discuss the principle and technique of radiometric titrations. Draw and describe the nature of radiometric titration curve when only titrant is radioactive.

c) Discuss the applications of turbidimetry and nephelometry.

d) 1.2 ml of a sample solution containing 4.8×10^4 disintegrations / sec. radioactivity due to tritium injected into the blood stream of laboratory animals. After sufficient time of circulation, equilibrium is established, 0.1 ml of blood was found to have an activity of 128 dpm. Calculate the volume of blood in the body of the animal.

e) Estimate the turbidity coefficient of a sample which gave transmittance 54.8% in the 1.00 cm cell path length of sample concentration 78.5 ppm.

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P805

[3923] - 315

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 391 : Environmental and Analysis of Industrial Materials

(2008 Pattern) (New Course) (Sem. - III)

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) Describe the method of determination of nitrogen from a sample of fertilizer.

b) What are colouring constituents in glass? Describe method for determination of any one constituent in the glass.

c) Describe the method of determination of moisture by Karl fischer titration from explosives.

d) What are pigments? Discuss the analytical method for estimation of cr from the sample of pigment.

e) 0.250 gm. sample of fertilizer containing phosphorus as $Ca_3(PO_4)_2$ was disintegrated completely and the solution was diluted to 100 ml. The gravimetric determination of phosphorus using molybdate method gave 0.120 gm. [P_2O_5.24 MoO_3], from an aliquot of 10 ml. Calculate percentage of phosphorus as P_2O_5 and calcium phosphate.

Given : At. wts. : O = 16, P = 31, Ca = 40, Mo = 96.

P.T.O.

Q2) Attempt <u>any four</u> of the following :

a) What are the constituents of face powder? Explain the method of estimation of chloride from the sample of face powder.

b) What is meant by sampling? What are different steps involved in sampling of different materials?

c) What is detergent? How unsulphated and unsulphonated materials are extracted and estimated from it?

d) 1.5 gm. of sample of cosmetic was dissolved in acid and the solution was diluted to 100 ml. 25 ml. aliquot of this solution was analysed for sulphate. It gave 0.150 gm. $BaSO_4$ precipitate. Calculate percentage of sulphate and sulphur from the given sample.
Given : At. wts. : Ba = 137, S = 32, O = 16.

e) 0.3 gm. sample of borosilicate glass was fused with sodium carbonate. The product was converted into boric acid by suitable process. After adding sufficient amount of manitol, whole solution was titrated with 0.05 N NaOH solution using paranitrophenol as an indicator. The titration reading was 20.5 ml. Calculate the percentage of B_2O_3 in the sample.
Given : At. wts. : B = 11, O = 16.

SECTION - II

Q3) Attempt <u>any four</u> of the following :

a) Mention aluminium based alloys. Explain the method of estimation of Aluminium.

b) What are the major constituents of dolomite ore? How are they estimated?

c) Explain the construction and working of electrostatic precipitator.

d) 0.4 gm. sample of steel was disintegrated by acid treatment. The solution was diluted to 100 ml. from 50 ml. of aliquot, iron was removed as $Fe(OH)_3$. From the filtrate, chromium was precipitated as $PbCrO_4$ by using K_2CrO_4. The amount of the $PbCrO_4$ was found to be 0.140 gm. Calculate the percentage of chromium in the sample.
Given : At.wts. : Pb = 207, Cr = 51.99, O = 16.

e) 0.52 gm. sample of ilmenite was fused with potassium per sulphate and the mass was extracted with H_2SO_4 solution. After removal of insoluble matter, the filtrate was diluted to 100 ml. From an aliquot of 50 ml, after removal of iron Ti-cupferron complex was precipitated. After ignition of the precipitate 0.130 gm. of titanium oxide was obtained. Calculate the percentage of TiO_2 and Ti in the sample.
Given : Atomic wts. : Ti = 47.88, O = 16.

Q4) Attempt <u>any four</u> of the following :

a) What is meant by COD? How is it estimated?

b) Write notes on :

i) Anaerobic decomposition.

ii) Cyclone separator.

c) What is sludge? Describe the method of sludge disposal.

d) Explain the method of determination of hexavalent chromium from waste water.

e) Explain generation, hazards and control of CO_x.

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Total No. of Questions : 4] **[Total No. of Pages : 3**

P806

[3923] - 316
M.Sc. - II (Sem. - III)
ANALYTICAL CHEMISTRY
CH - 392 : Advanced Analytical Techniques
(New Course) (2008 Pattern)

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 calculator is allowed.***
5) ***Use of graph paper is allowed.***

SECTION - I

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

a) State and explain Faraday laws of electrolysis. Give their important applications.

b) Explain the term n type and p type semiconductor. Give the method of preparation and applications.

c) Explain the properties of ideal amplifier. Draw the circuit diagram and discuss the working of an amplifier as differentiator and integrator.

d) Write binary equivalent of the decimal numbers 18 and 23 add binary numbers. Convert the answer to a decimal number.

e) Explain the terms :

i) Resistor. ii) Conductance.

iii) Capacitors. iv) Inductors.

v) Transformers.

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

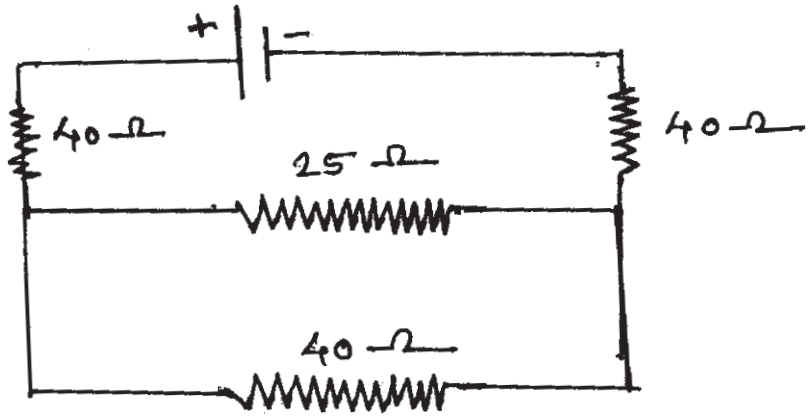
a) Draw schematic diagram of the laboratory information management (LMS 1100) system and explain the function of each component.

b) Write short note on centrifugal force analyzers.

P.T.O.

c) The resistance of the two wires 52 ohms when connected in series and 12 ohms when joined parallel. Calculate the resistance of each wire.

d) Determine the current that & lows through the 25.0 ohms resistance in the following circuit diagram.



e) Draw out line of the major portion of the laboratory computer system and explain the functions each component.

SECTION - II

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

a) Explain the following terms with respect to AAS.
   i) Spectral interference.
   ii) Releasing agent.
   iii) Protective agent.
   iv) Chemical interference.
   v) Ionisation interference.

b) Mention various mass analyser used in atomic mass spectro meter and discuss any one.

c) Describe the principle and mechanism of emission, fluorescence and absorption spectra.

d) Explain Enzyme-linked immunosorbent assay with respect to principle, practical aspects and applications.

e) The soil samples were analysed for the determination of manganese at 280 nm in air acetylene by AAS. The observations are as follows.

Manganese in ppm	Absorbance
0.2	0.0567
0.4	0.1130
0.6	0.1695
0.8	0.2275
1.0	0.2828
Sample	0.1234

Calculate the concentration of manganese in ppm for soil sample.

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

a) Explain the term micronutrients. Explain the procedure for the determination of Zn by mass spectroscopy.

b) Enlist the various evaluation methods used in flame emission technique and discuss any one with example.

c) Explain the role of super critical fluid chromatography as an analytical tool in pharmaceuticals analysis.

d) Describe the principle of single immuno diffusion and double immunodiffusion techniques of analysis. Mention their important applications.

e) 12 ppm solution of lead gives atomic absorption signal of 10% absorption. What is the absorption sensitivity.

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

P807

[3923] - 317

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 380 : Pharmaceutical Analysis

(Sem. - III) (New Course) (2008 Pattern) (Optional)

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

SECTION - I

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

a) What are manufacturing hazards? Explain in detail the "process errors", and microbial contamination.

b) Explain the "Saponification value" and "iodine value". Give in brief the procedure for determination of iodine value for the oil sample.

c) Distinguish between soft capsule and hard capsule. Write an account about the disintegration test for hard capsules.

d) 0.2 g aspirin ($C_9H_8O_4$) sample was dissolved in 25ml distilled water, to which 10ml (0.5M) sodium hydroxide solution was added and mixture was boiled in a water bath for 20 minutes. On cooling, the solution was titrated with 0.5 M hydrochloric acid solution. The burette reading was 5.5 ml. The blank titration reading was 9.9 ml. Determine the percentage of aspirin in the sample.

e) What are identification tests? Explain with suitable examples.

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

a) What are aerosols? How are they prepared? Give advantages and disadvantages of aerosols.

b) Explain the term "limit test". How limit test of lead is carried out for a given pharmaceutical sample?

P.T.O.

c) Explain the term-Ointment and creams. Give classification of ointment bases.

d) What is FDA? How FDA controls the manufacturing of pharmaceutical products in industries?

e) 0.28 g adrenaline ($C_9 H_{13}O_3N$) sample was dissolved in 30 ml glacial acetic acid and solution was titrated with 0.1N acetous perchloric acid using crystal violet indicator. The titration reading was 15 ml. Determine the percentage of adrenaline in the given sample.

SECTION - II

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

a) Describe dry heat sterilization in detail. Give advantages and disadvantages of this method.

b) Give the procedure for determination of trace water content in a pharmaceutical product.

c) Write a procedure for determination of proteolytic activity.

d) From 500 ml saline water bottle, 100 ml saline water was titrated with 0.2 N silver nitrate solution in presence of potassium chromate as an indicator. The burette reading recorded was 40 ml. Calculate the amount of sodium chloride present in the whole sample.

e) 0.525 g ibuprofen ($C_{13}H_{11}O_2$) sample was dissolved in 50 ml alcohol and titrated wish 0.15 N sodium hydroxide solution using phenolphthalein indicator. The titration reading was 18 ml. For neutralisation of 50 ml alcohol, 0.6 ml sodium hydroxide (0.15 N) was required. Determine the percentage of ibuprofen in the given sample.

Q4) Answer any four of the following: **[20]**

a) Explain major steps involved in the development of new drug.

b) Give procedure for determination of ash in ginger. Mention the applications of ash value for vegetable drugs.

c) Describe in detail the microbial assay of antibiotics.

d) Write a brief account of different dosage forms.

e) Short note on - Expiry date fixation.

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

P808

[3923] - 318

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 381 : Medicinal Chemistry

(Old & New Course) (Sem. - III)

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: **[20]**

a) Discuss in brief the development of new procedures followed in drug design.

b) Explain drug receptor interaction.

c) Write the synthetic steps involved in the synthesis of 5-flurouracil/ melphalan.

d) Define the terms:

i) Soft drug.

ii) Inductive effect.

iii) Hormones.

e) Write short note on "Free Wilson analysis".

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

a) Classify cardiovascular drugs with suitable examples.

b) Explain novel drug delivery system.

c) Give the synthesis of chloroquin.

d) Define the terms:

i) Sedatives.

ii) Antipyretics.

iii) Anaesthetics.

e) Write short note on 'Immunological assay'.

P.T.O.

SECTION - II

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

a) What are neoplastic agents? Explain the mode of action of mitotic inhibitors.

b) Explain the term antiinfective agents. Give their general mode of action.

c) Give the synthesis of attenolol and diazepam.

d) What are sulphonamides? Explain the general mode of action.

e) Write short note on 'Biological assay'.

Q4) Answer any four of the following: **[20]**

a) Give a brief account of cancer therapy.

b) Write a brief account of benzodiazapines.

c) Give the synthesis of (any two):

i) Phenytoin.

ii) Sorbitrate.

iii) Streptomycin.

d) Define the terms:

i) Cardiovascular drug.

ii) Anti-anziety drug.

iii) Hypnotics.

e) Write a note on 'Applications of chiral drugs in medicines'.

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

P809

[3923] - 319

M.Sc. (Sem. - III)

BIOCHEMISTRY

BCH - 370 : Molecular Biology

(Old & New)

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 neat labelled diagrams wherever necessary.***

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

a) What are transposons? Give their role in E. Coli.

b) What is origin locus? Give its characteristics.

c) Discuss the role of Rho and add a note on Rho dependent and Rho independent termination of transcription.

d) What will happen if E. Coli are exposed to mild UV radiations? Give biochemical reactions taking place during such exposure.

e) What is high fidelity? How it is achieved in DNA replication process?

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

a) Explain the process of initation, elongation and termination in RNA synthesis.

b) Give the mechanism of activation of amino acid.

c) Describe in detail various DNA repair mechanisms.

Q3) Explain the important role played by following proteins in DNA replication of E. Coli (any four): **[20]**

a) Dna B.

b) DNA Primase.

c) SSB.

d) Gyrase.

e) Dna A.

P.T.O.

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

a) SOS.

b) Detail structure of HIV-1 virus and its genes.

c) Ribozyme.

d) Inhibitors of protein biosynthesis.

e) Role of Sigma and nusA during transcription.

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

P814

[3923]-332
M.Sc.
DRUG CHEMISTRY
CH - 362 : Advanced Analytical Methods
(New) (2008 Pattern) (Sem. - III)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right side 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) $CH_3\ CH_2\ O\ CH = CH_2$ shows a strong peak at m/z 44.

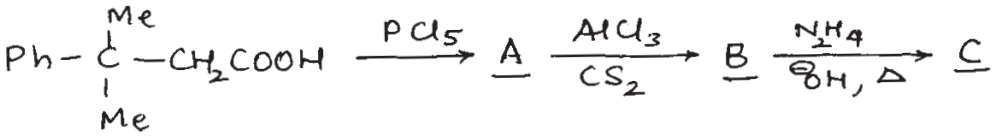
ii) t-Butyl fluoride gives a doublet at 1.4 δ J = 20Hz. On treatment with SbF_5 it gives a singlet at 4.5 δ.

iii) CD_3Cl shows seven lines of unequal intensity in CMR.

iv) In PMR, – OH proton shows a broad singlet in neutral solution while acidified solution shows a sharp singlet.

b) Answer any two of the following : **[6]**

i) Complete the following sequence of reactions and assign the structures for A, B and C.

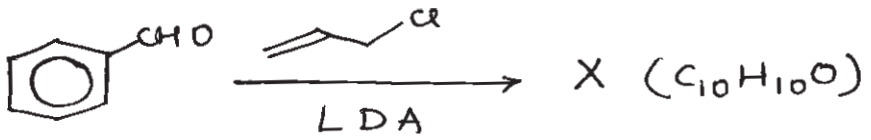


compound C exhibits the following PMR data 1.22(s, 6H); 1.85(t, 7Hz, 2H); 2.83(t, 7Hz, 2H) 7.02(s, 4H).

ii) A compound with mol.formula $C_3H_5ClF_2$ in its PMR shows two triplets one at 1.75 δ and other at 3.63 δ corresponding to three and two protons with J = 7Hz. Assign the structure of the compound.

P.T.O.

iii) Complete the following reaction and identify the product whose spectral data is given below.

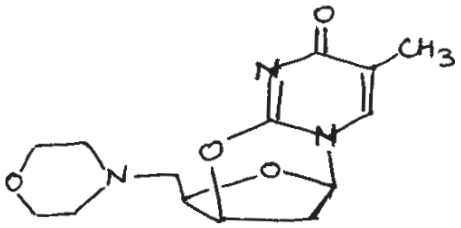


IR : 1496, 1442, 1388, 1250, 1181cm^{-1}

PMR : 3.67(dd, J = 4.1 & 4.5 Hz, 1H); 4.25(d, J = 4.1 Hz, 1H)
5.26(d, J = 10.2Hz, 1H); 5.43(d, J = 16Hz, 1H)
5.66(ddd, J = 4.5, 10.2, 16 Hz, 1H), 7.2 – 7.4(m, 5H)

CMR : 58.8(d) 59.8(d) 121.8(t) 127.7(d) 128.1(d, str.) 128.5(d, str.) 132.2(d) 135.2(s).

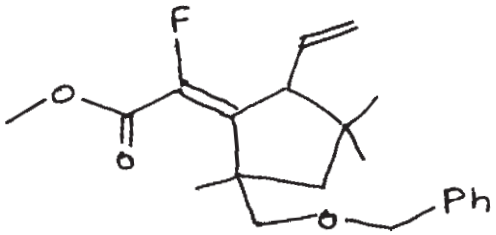
Q2) a) Assign the signals to different carbon atoms in the following compound and justify your assignments. **[5]**



175 (s) 156 (s) 140 (d)
119 (s) 89 (d) 84 (d)
80 (d) 67 (t) 59 (t)
54 (t) 34 (t) 14 (q)

b) Assign the chemical shifts to various protons and comment on the observed coupling constants and spin decoupling experiment. **[8]**

(Note : C - CH_3 and aromatic proton 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, 9 Hz. 1H).

Spin decoupling :	Irradiate at	Change at
	2.88 δ	5.56 into dd (17, 10 Hz)
NOE :	1.82 δ	7% increase at 2.88 δ

c) Answer <u>any one</u> of the following : **[3]**

i) Deduce the structure

M.F. : $C_{10}H_{10}O_3$
IR : 1680, 1602 cm^{-1}
PMR : 3.1(t, 6Hz, 2H); 3.9(s, 3H); 4.5(t, 6Hz, 2H)
6.75(d, 2Hz, 1H); 6.9(dd, 8 & 2Hz, 1H)
8.05(d, 8Hz, 1H)

ii) Assign the structure

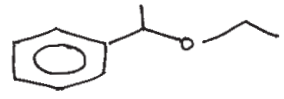
M.F. : $C_8H_{10}O$
CMR : 23(q) 70(d) 125(d) 127(d, strong)
129 (d, strong) 146 (s)

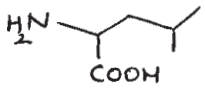
Q3) Write short note on <u>any three</u> of the following : **[12]**

a) Factors affecting chemical shifts in CMR.
b) CW Vs FT NMR.
c) Ionization techniques in mass spectrometry.
d) DEPT experiment.

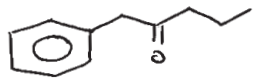
SECTION - II

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

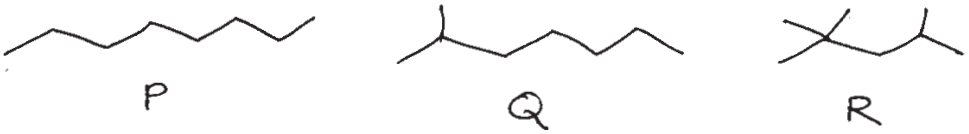
i)  150, 135, 105, 79, 77, 106

ii)  131, 86, 74, 44, 30

iii)  102, 74, 71, 59, 43, 31

iv)  134, 119, 91, 77, 71, 43

b) Mass spectral data for one of the three structures P,Q,R is given below. Identify the structure consistent with the data. **[3]**



Mass : m/e(%) 114(7) 99(12) 71(10) 70(60) 57(50) 43(100) 42(40) 41(28).

Q5) a) Answer <u>any two</u> of the following : **[8]**

i) Explain the factors important in resolution in HPLC. Draw a schematic diagram of HPLC.

ii) Explain :

I) Chiral columns.

II) Reverse phase chromatography.

iii) What are different types of detectors used in GC and their applications.

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

i) Differentiate the following pair by mass spectrometry.

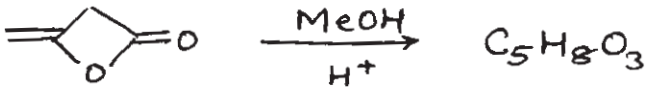
ii) A compound with M.F. $C_8H_4O_3$ shows following signals in CMR. Find the structure.

125 (40) 131 (20) 136 (40) 163 (20)

DEPT 90° : 125 and 136 positive peaks
131 and 163 absent.

DEPT 135° : 125 and 136 positive peaks.

iii) Deduce the structure of the product.



CMR : 203, 170, 62, 39, 22

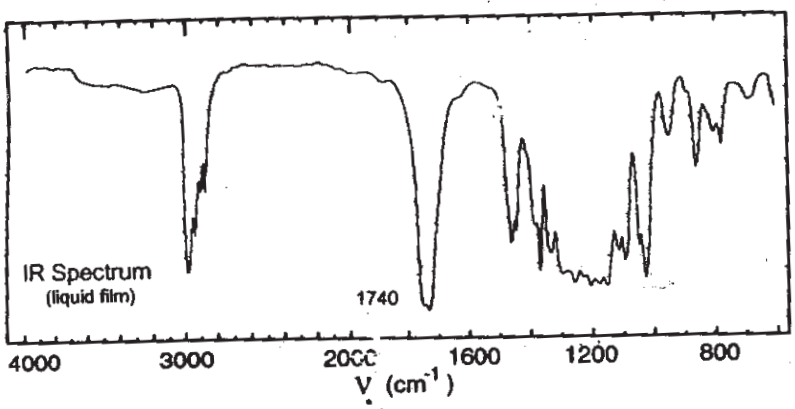
c) A compound with M.F. $C_8H_{11}N$ was insoluble in H_2O and 5% NaOH but soluble in 5% HCl. It reacted with acetylchloride to form a precipitate. Treatment of the compound with benzene sulfonyl chloride, followed by acidification, gave an insoluble product. It shows the following spectral data, deduce its structure. **[4]**

IR : 3354, 1596, 1020, 761, 703 cm^{-1}

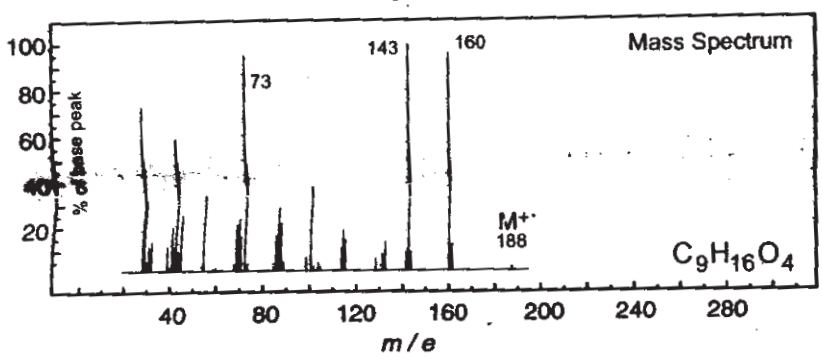
PMR : 7.2(s, 5H); 3.87(q, 6.6 Hz, 1H)
1.83(bs, 2H); 1.2(d, 6.6Hz, 3H)

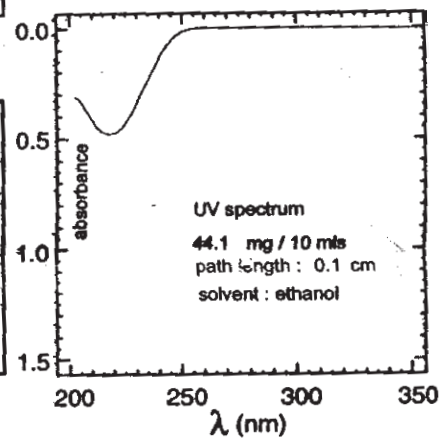
CMR : 148, 128 (str.) 126, 125 (str.) 51, 26

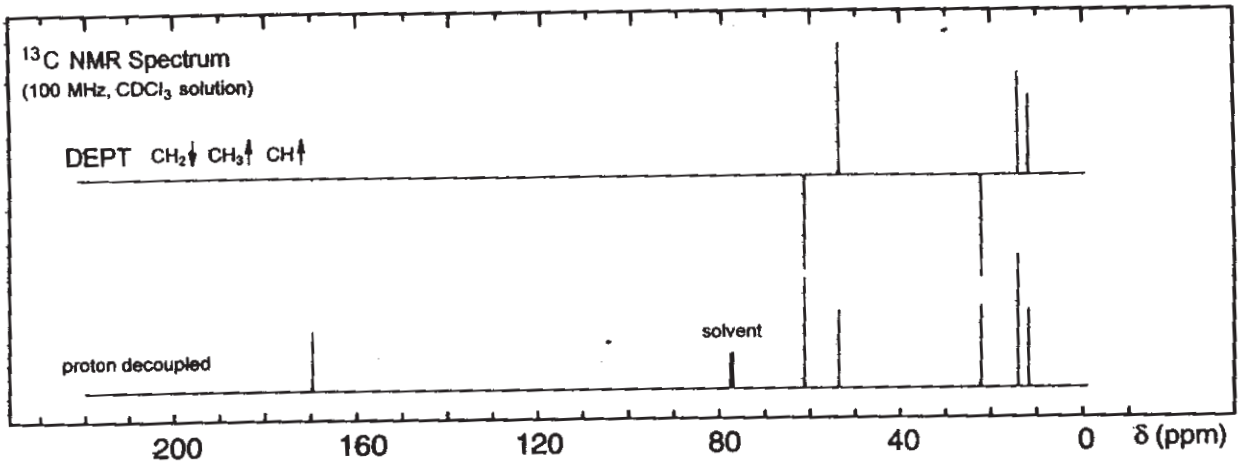
Q6) A compound shows spectral information provided on the next page. Deduce the structure and justify your answer. **[12]**

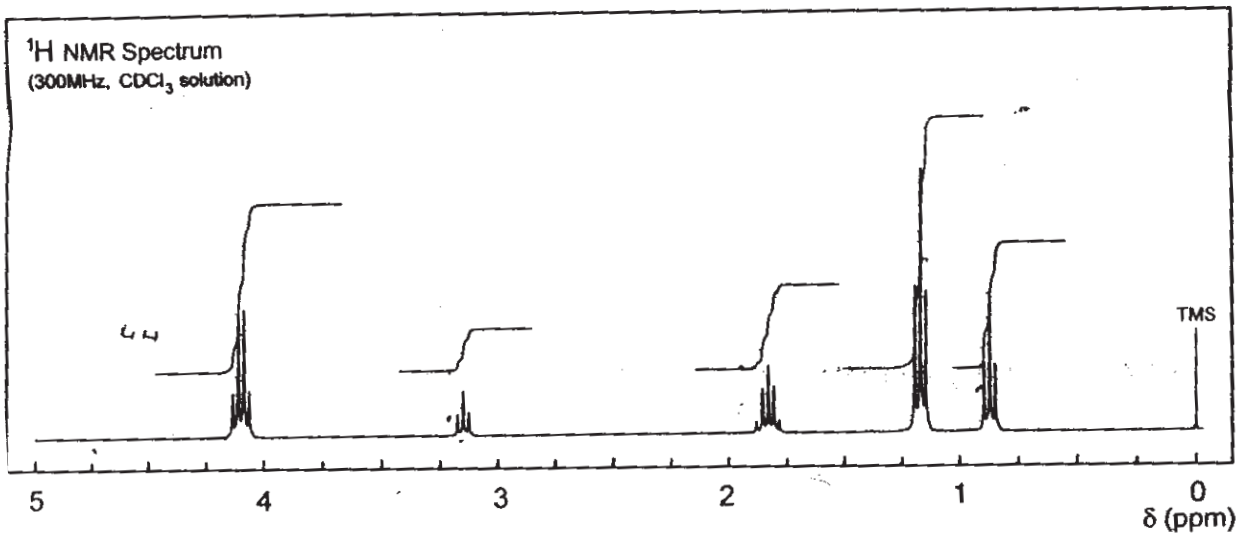


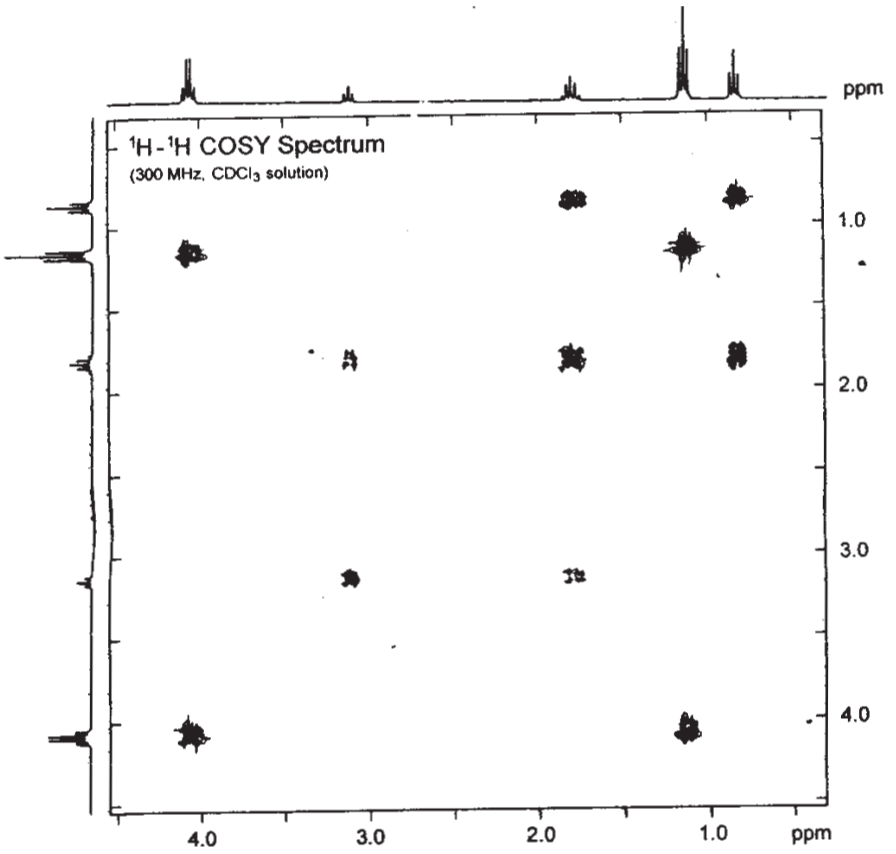
Use the basic spectral data plus the COSY and C-H correlation spectra on the facing page to deduce the structure of this compound.

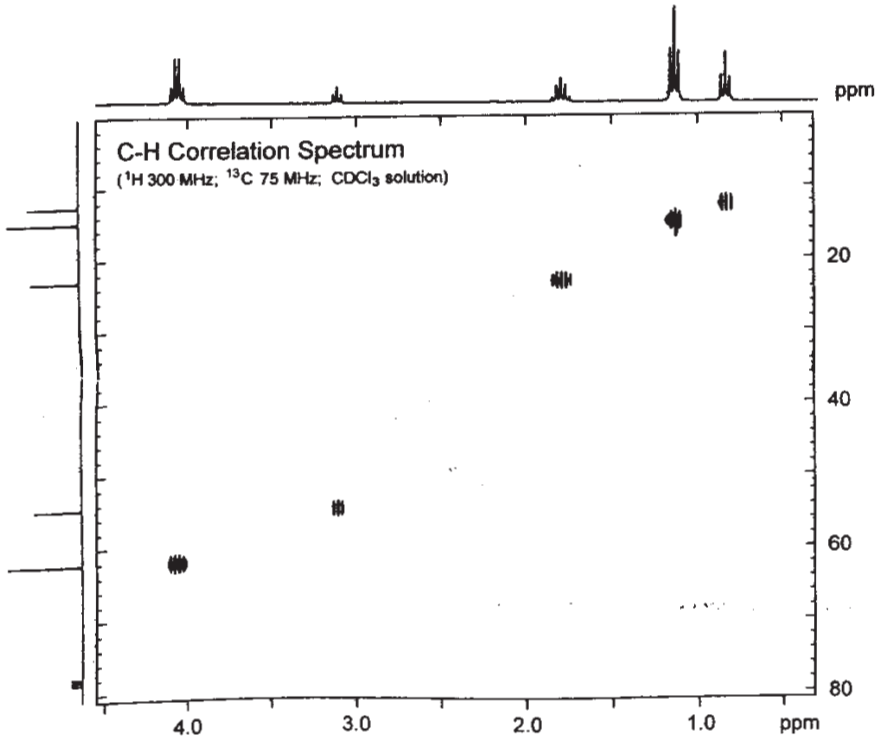









ppm
^{1}H-^{1}H COSY Spectrum
(300 MHz, $CDCl_3$ solution)
1.0
2.0
3.0
4.0
4.0
3.0
2.0
1.0
ppm


ppm
C-H Correlation Spectrum
(^{1}H 300 MHz; ^{13}C 75 MHz; $CDCl_3$ solution)
20
40
60
80
4.0
3.0
2.0
1.0
ppm

☒☒☒☒

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

P814

[3923]-332
M.Sc.
DRUG CHEMISTRY
CH - 362 : Advanced Analytical Methods
(Sem. - III) (Old)

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

Instructions to the candidates:

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

SECTION - I

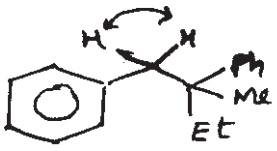
Q1) Explain any four of the following : **[12]**

a) Aromatic protons are desheilded than aliphatic protons.

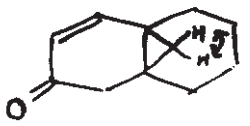
b) DMSO-d_6 shows seven lines of intensities 1 : 3 : 6 : 7 : 6 : 3 : 1 in CMR.

c) Butanone and Butanal can be distinguished by mass spectrometery.

d) The J values for the compounds are as shown below :



14 Hz



4·8 Hz

e) For a given number of nucleii, the CMR signals are 5760 times less intense than PMR signals.

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

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

IR : $1708cm^{-1}$

Mass : 160, 145

CMR : 205 (s, weak) 165 (s, weak) 136 (d) 135 (s, weak) 128 (d) 123 (d) 122 (d) 52 (t) 39 (s) 30 (q, str.)

P.T.O.

b) M.F. : $C_7 H_{14} O_2$

PMR : 1.3(s, 6H) 2.2(s, 3H) 2.5(s, 2H) 3.6(s, 3H)

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

Mass : 43, 73, 100, 115, 130

c) M.F. : $C_{11} H_{14} O_2$

CMR : 13(q) 19(t) 32(t) 64(t) 127(d, str.) 129(d, str.) 131(s, weak) 134(d) 167(s, weak)

d) M.F. : $C_{12} H_{14} O_4$

UV : 220 nm $\in$ = 11000

IR : 1730, 1600, 750cm^{-1}

PMR : 1.25(t, 6Hz, 30mm) 4.28(q,6Hz,20mm) 7.45(dd, 2 & 8Hz, 10mm) 7.65 (dd, 2 & 8Hz, 10mm)

e) M.F. : $C_9 H_{12} O_3 S$

PMR : 7.45(d, 8Hz, 2H) 8.8(d, 8Hz, 2H) 4.1(q, 6Hz, 2H) 2.45(s, 3H) 1.3(t, 6Hz, 3H)

Mass : 200(40) 170(20) 155(60) 107(10) 91(100) 65(30)

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

a) AB and AX spectrum in PMR.

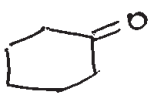
b) Soft Ionization Techniques in Mass spectrometry.

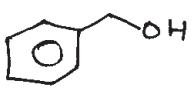
c) HETCOR.

d) Spin-Spin decoupling mechanism.

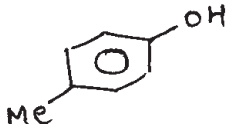
SECTION - II

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

i)  98, 83, 55, 42

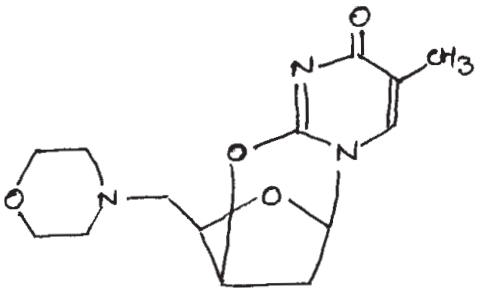
ii)  108, 107, 106, 105, 79, 77

iii) Triethylamine 86, 58, 30

iv)  108, 107, 79, 77

b) A compound $C_5H_{11}ON$ exhibits the following mass spectral data. Analyse the data and arrive at a structure consistent with data 101(0.8) 85(3) 72(19) 59(100) 57(11) 46(38) 43(11) 29(15). **[3]**

Q5) a) Assign the given CMR signals to the various carbons in the given compound. **[8]**



175.9 (s) 156.1 (s) 140 (d)
118.8 (s) 89.4 (d) 84 (d)
80.6 (d) 67.2 (t) 59.1 (t)
54.3 (t) 33.8 (t) 13.6 (q)

b) Answer <u>any two</u> of the following : **[8]**

i) Draw a schematic diagram of GC and explain the various columns used in GC.

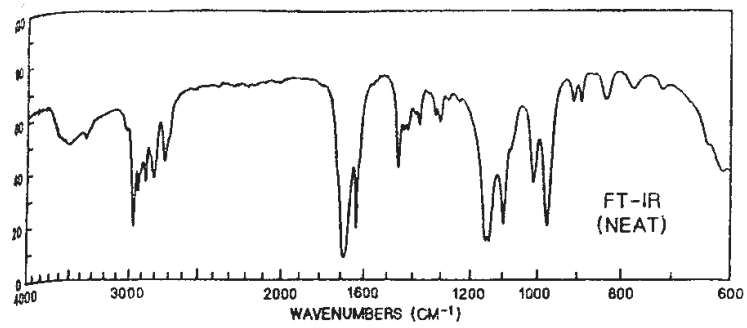
ii) Give the selection criteria of the detector used in HPLC. What are the applications of the RI detector in HPLC.

iii) Explain the terms :

I) Retention time.

II) Gaurd column.

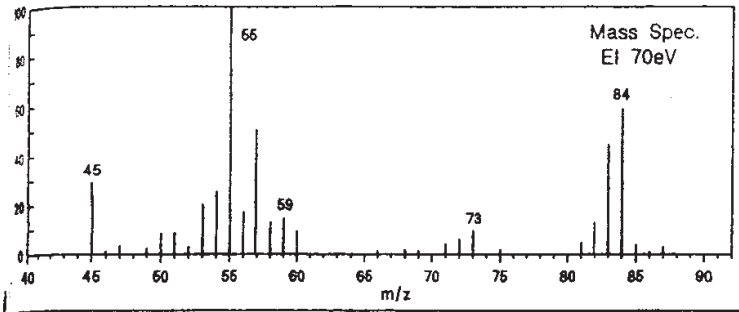
Q6) Deduce the structure of the compound whose spectral information is given on the next page. Justify your answer. **[12]**

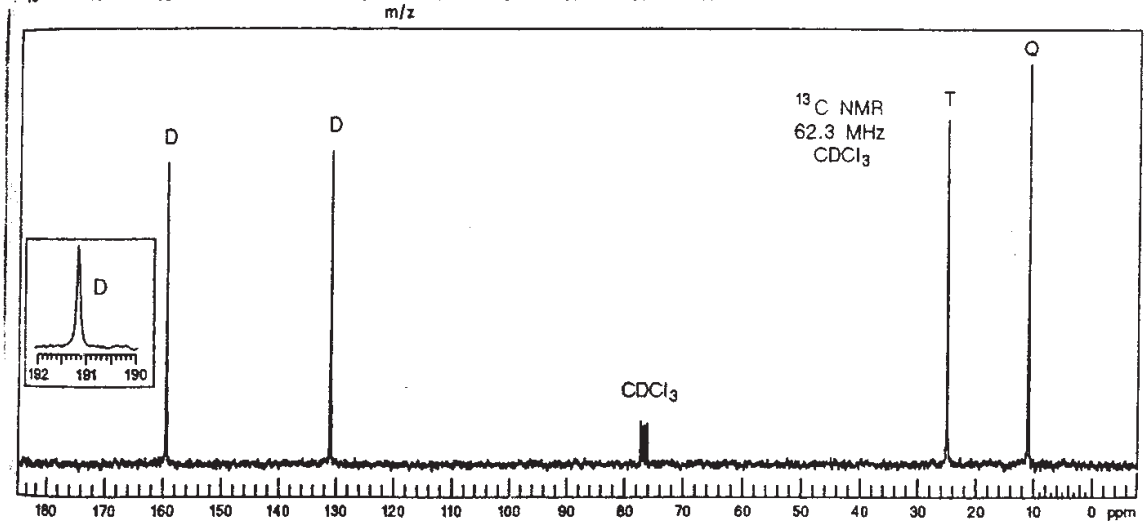


Exact M.S. (EI) = 84.0575

$UV\lambda_{max}$ = 209 (ε = 16,000)
328 (ε = 50)

C, 75% H, 9·5% O, 19%





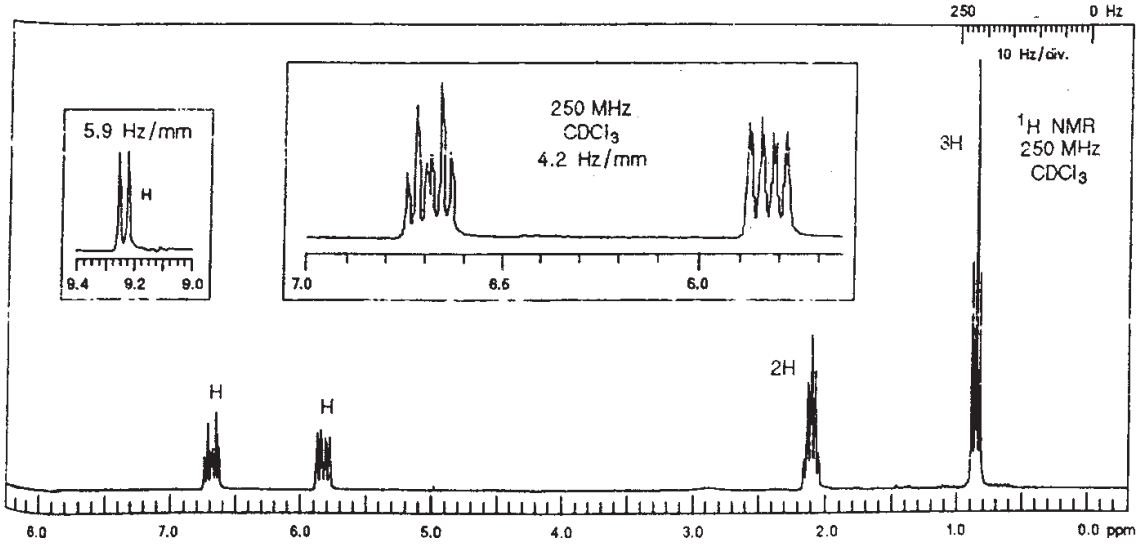


Table 1 : Some characteristic IR data in cm^{-1}. Only approximate values are listed ≡C–H 3300, =C–H 3050, O=C–H 2800, NH 3300, O–H 3600 (free). C≡N 2250, C≡C 2200, C=C 1620-1680. Aromatic 1600 to 1500, C=N 1660. Saturated ketone 1720, Saturated ester 1740, Saturated acids 1720 , Saturated aldehydes 1730. Saturated amides 1650. $CH=CH_2$ 900, and 910, CH=CH (trans) 960. CH=CH–(cis) 690. $C=CH_2$ 890. C=CH 790–840, NO_2 1530 and 1350. Bands for aromatic compounds depend on number of adjacent free aromatic hydrogens : 5 free–690–710 and 730–770, 1 free 860–900, 4 free 735–770, 3 free 750–810, 2 free 770, 800–860 cm^{-1}.

Table 2 : Approximate chemical shifts of methyl, methylene and methine protons in δ values TMS as internal reference.

$C-CH_3$ 0.9; $O-C-CH_3$ 1.4; $C=C-CH_3$ 1.6; $ArCH_3$ 2.3; $O=C-CH_3$ 2.2; $N-CH_3$ 2.3; $S-CH_3$ 2.1; OCH_3–3.3; CH in cyclopropane 0.7, $C=CH_2$ exocyclic 4.6, $C=CH_2$ open chain 5.3, C=CH 5.1, C=CH cyclic 5.3, Ar–H 7 to 9.

$-\underset{\|}{\overset{O}{C}}-CH$ 6.2, $C-CH-\underset{\|}{\overset{O}{C}}$ 5.7

Table 3 : Approximate C^{13} chemical shifts in δ values :

$R-CH_3$, 5–30, $R-CH_2-R$ 25–55, R_3CH 35-70

$-\overset{|}{\underset{|}{C}}-$ (quartenary 30–50) R'_3C-O 57–80.

R_3C-N 60–75, C≡C 75–105, C≡N 110–125.

C=C 100–140, C=N 145–162, Aromatic 115–145.

R–COOR/R–$CONH_2$ 155–180, RCOOH 165–185.

RCHO 185–205, RCOR 190–225.

☒☒☒☒

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

P816

[3923]-334
M.Sc. (Sem. - III)
DRUG CHEMISTRY
CH - 364 : Stereo Chemical Principles and Applications
(2008 Pattern) (New)

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

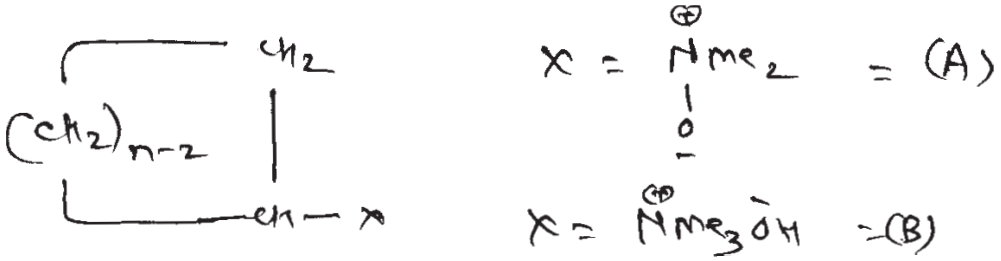
Instructions to the candidates:

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

SECTION - I

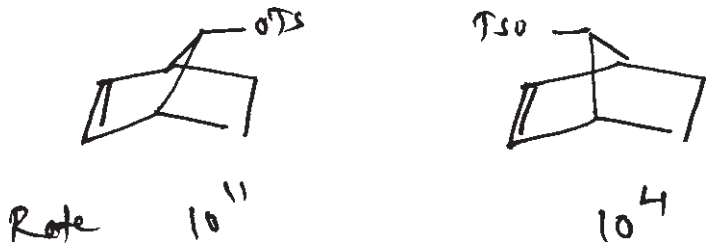
Q1) Answer any four of the following : **[16]**

a) Pyrolysis of compound (A) and (B) gives rise to cycloalkenes, for n = 7, both compounds (A) and (B) gives cis Olefin, where as with n = 9 for both compounds only trans Olefin is obtained with n = 8 compound (A) gives cis Olefin where as (B) give a mixture of cis and trans Olefins.



b) The energy difference between dioxial and diequatorial conformations of menthone is less than that in trans 4-isopropyl-methyl cyclo-hexane.

c) The rate of acetolysis of the following compounds are as follows. Explain.

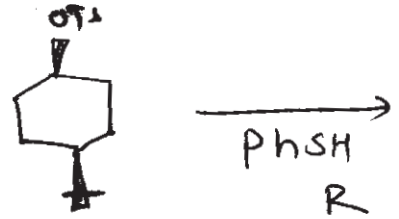


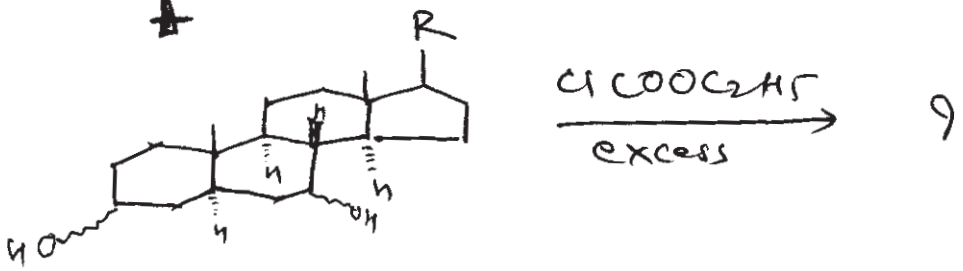
d) Explain why chair-boat interconversion is more focile in cyclohexanone then in cyclohexene.

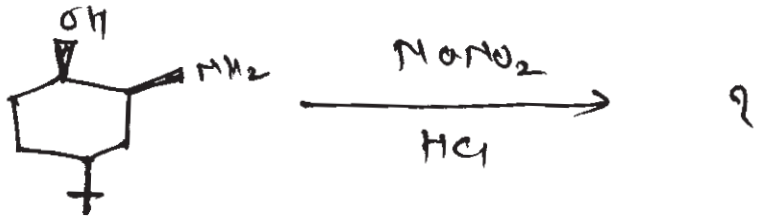
P.T.O.

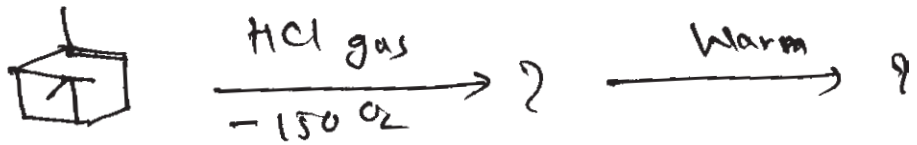
e) Draw the structures of cis-anti-trans and cis-anti-cis isomers of perhydro phenanthrenes and compare their stability and comment on their optical activity.

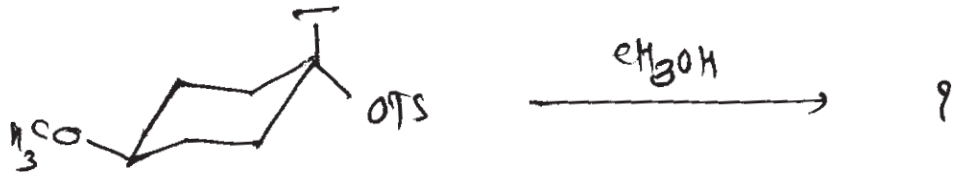
Q2) Predict the product/s in <u>any four</u> of the following and explain the stereo chemical principles involved. Justify. **[12]**

a) 

b) 

c) 

d) 

e) 

Q3) Discuss the following (any three) : **[12]**

a) Concept of I-strain.

b) Relative stabilities of cis and trans decalin.

c) Chromic acid oxidation in cholesterol.

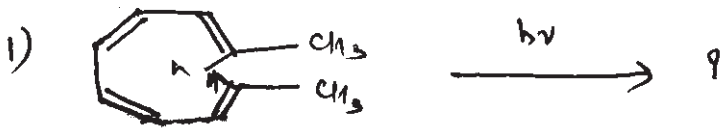
d) Stereochemistry of NGP reactions.

SECTION - II

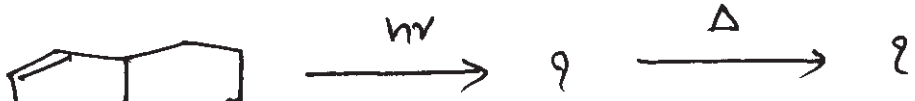
Q4) a) Explain with the help of Mobius and Huckel aromatic transition state approach the [1, 3] shift is thermally or photo chemically allowed process. **[5]**

b) Predict the product/s in any three of the following : **[9]**

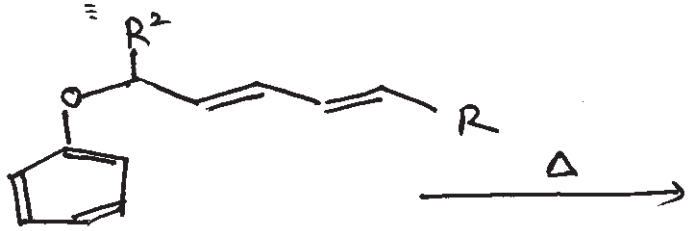
i)



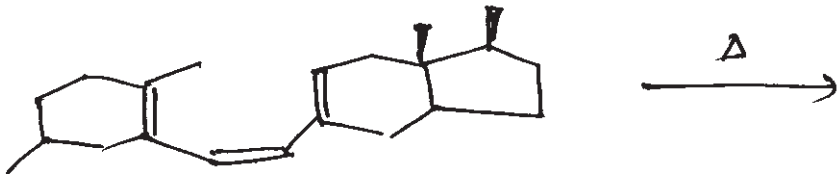
ii)



iii)

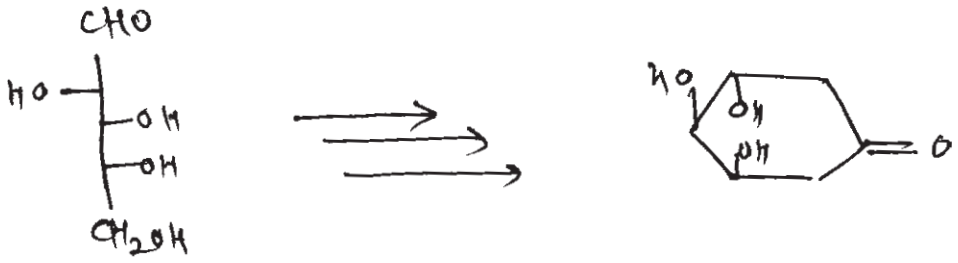


iv)

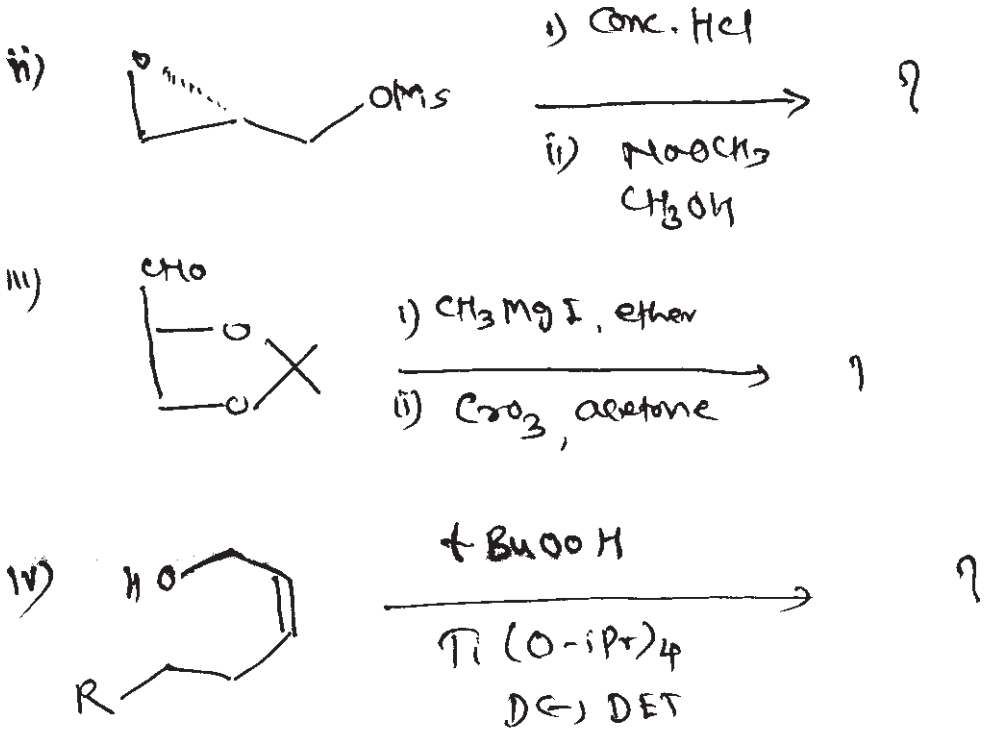


Q5) a) Solve the followings (any three) : **[9]**

i) Complete the following reaction sequence.



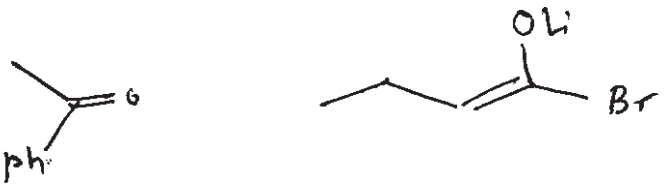
ii) Give the experimental evidence for the ring structure of glucose. Write $^{4}C_{1}$ and $^{1}C_{4}$ conformations for D-Glucose.



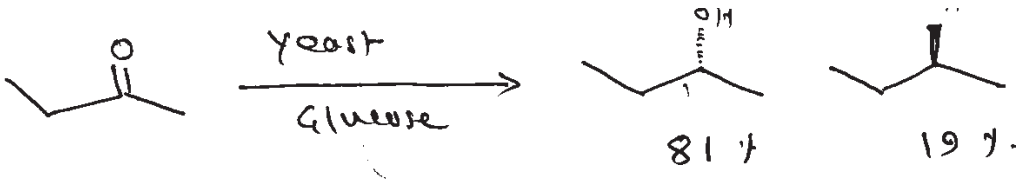
b) Write short note on Chiral auxillary. **[3]**

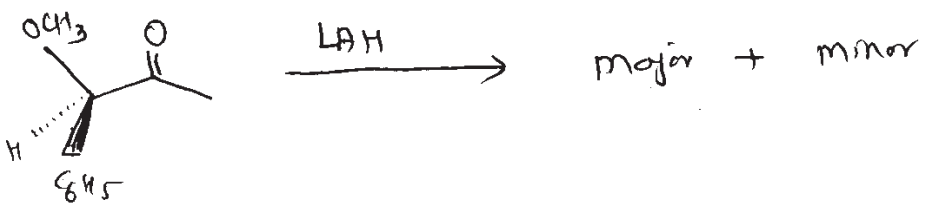
Q6) a) Attempt <u>any two</u> of the following : **[5]**

i) Identify Re and Si faces in the following



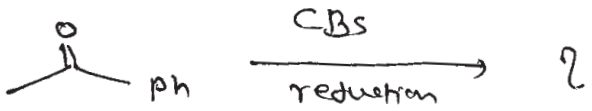
ii) Calculate the diasteriomeric excess in the following reaction products.



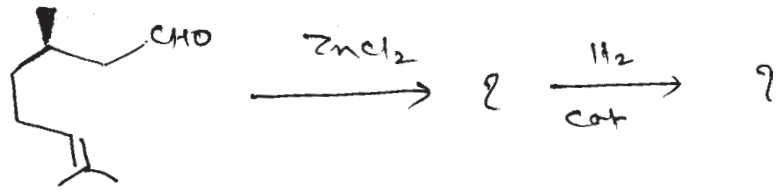
iii) 

b) Predict the product /s in the following reactions. Explain the stereo chemistry & mechanism in detail. (any three) : **[9]**

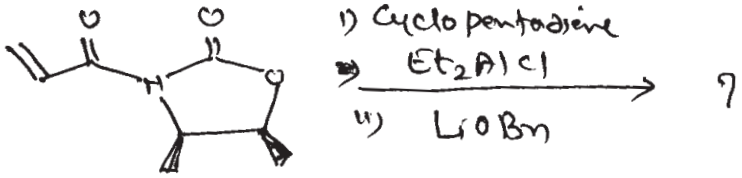
I)



II)



III)



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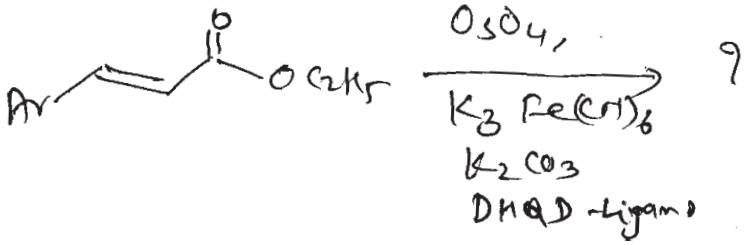

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Total No. of Questions : 6] **[Total No. of Pages : 5**

P816

[3923]-334
M.Sc. (Sem. - III)
DRUG CHEMISTRY
CH - 364 : Stereo Chemical Principles and Applications
(2005 Pattern) (Old)

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

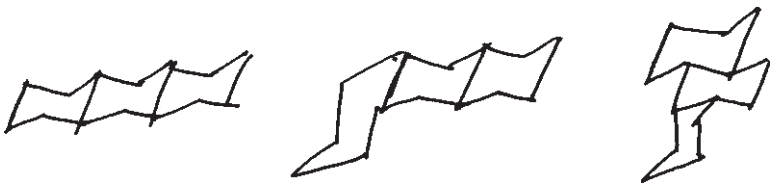
Instructions to the candidates:

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

SECTION - I

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

a) Which of the following conformation is stable? Why? Give their nomenclature.

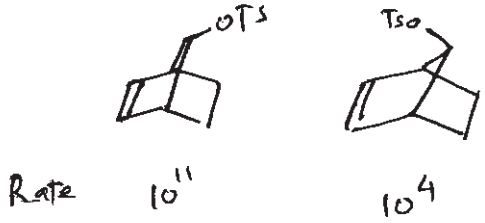


b) 2-α-chlorocholestane-3-β-01 is cyclized to 2,3-β epoxy cholestane several thousand times slowly than 3-α-chloro cholestane-2-β-01.

c) The energy difference between diaxial and diequatorial conformations of menthone is less than that trans-4-isopropyl-methyl cyclohexane.

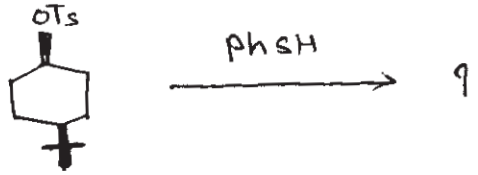
d) Trans-9-methyl decalin is more stable than its cis isomer by 3.35kJ/mol.

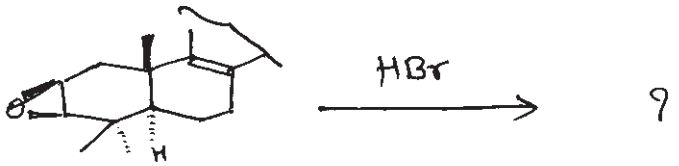
e) Rate of ocetolysis of I and II are 10^{11} and 10^{4}, respectively. Explain.

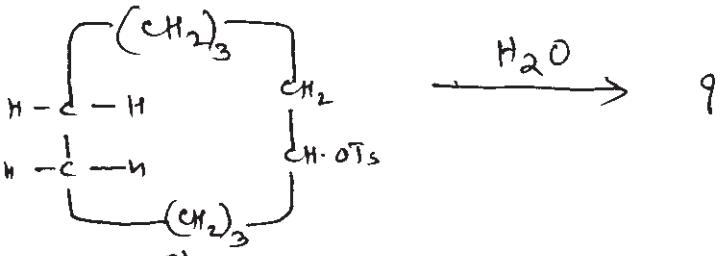


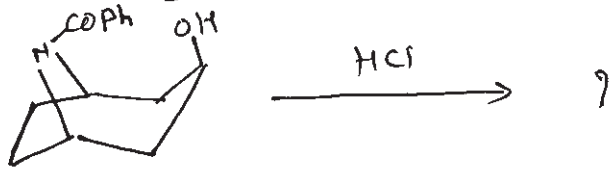
P.T.O.

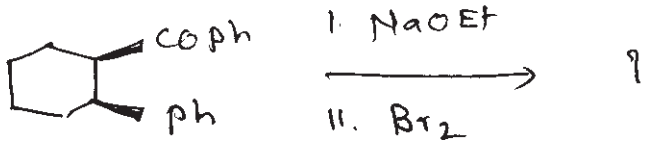
Q2) Predict the product/s in <u>any four</u> of the following and explain the stereochemical principles involved (any four) : **[12]**

i) 

ii) 

iii) 

IV) 

V) 

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

a) Relative stabilities of cis and trans hydrindane.

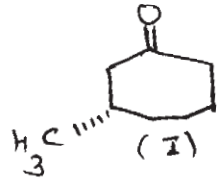
b) Comment on interconversion chair-boat in cyclohexanone.

c) Action of nitrous acid on cis and trans 2-amino cyclohexanol.

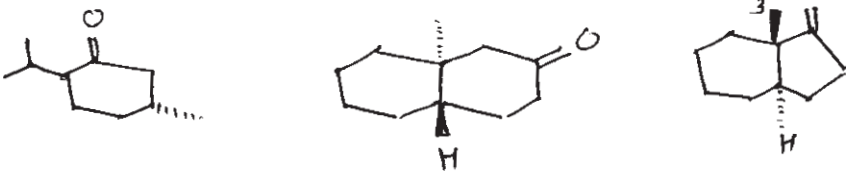
d) Optical activities of trans 1, 2/ trans 1,3/ trans 1, 4-dimethyl cyclohexanes.

SECTION - II

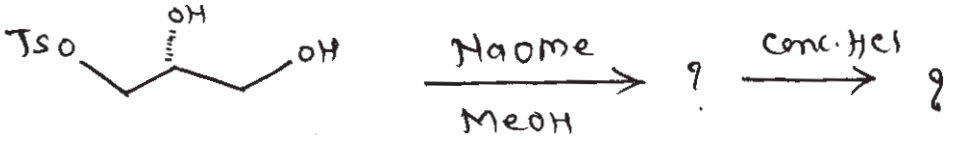
Q4) a) 3-Methylcycloheptanone (I) displays positive cotton effect. Predict the conformation of (I). **[4]**



b) Using octant rule predict the sign of cotton effect (any two) : **[4]**



c) Attempt <u>any one</u> of the following : **[4]**

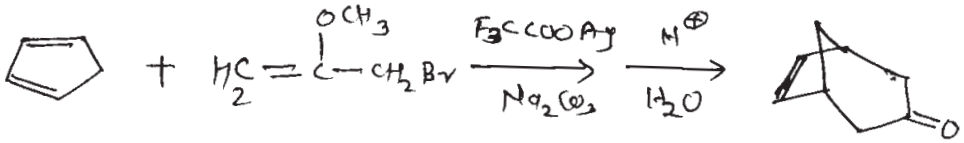
i) 

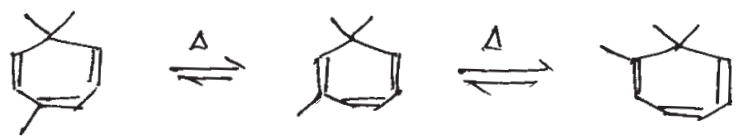
ii) Write Fischer projection of D-Glucose and convert it to β-Glucofuranose structure.

Q5) a) Construct correlation diagram for thermal cyclization of Butadiene → Cyclobutene. Predict allowed process. **[4]**

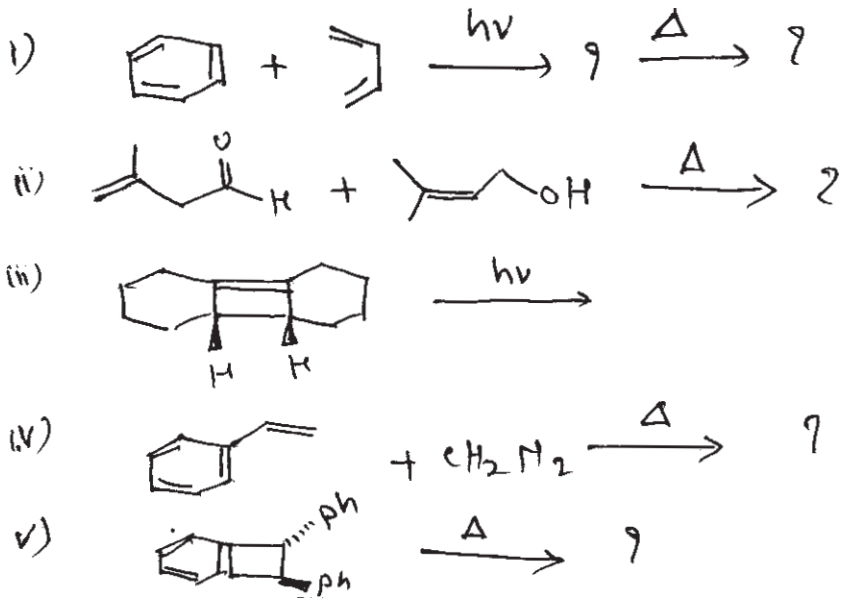
b) Suggest mechanism for <u>any two</u> of the following : **[6]**

i) 

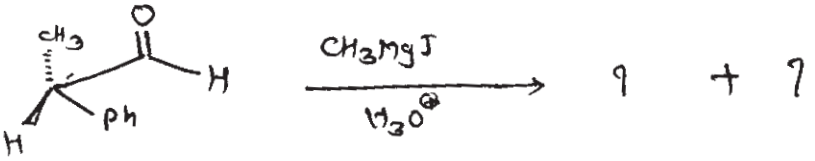
ii) 

iii) 

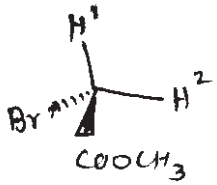
c) Predict the product and analyse the following pericyclic reactions (any three) : **[6]**



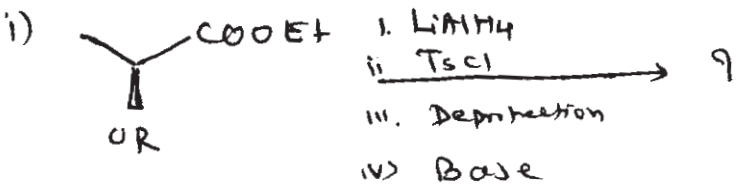
Q6) a) Using Gram's rule rationalize the following reactions. Predict major and minor product. Give mechanism. **[4]**



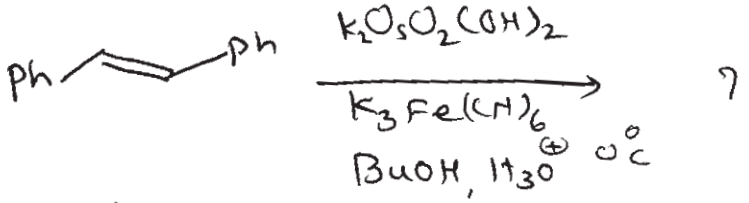
b) Identify Pro-R and Pro-S hydrogen atoms in the following compound. **[2]**



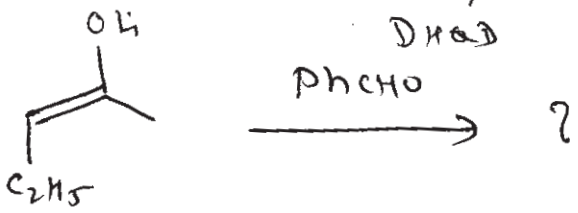
c) Predict the product/s and assign the correct stereochemistry in <u>any three</u> of the following : **[6]**



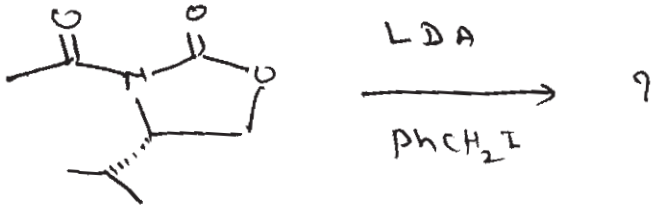
ii)


Ph
Ph
$K_2O_5O_2(OH)_2$
$K_3Fe(CN)_6$
BuOH, $H_3O^{\oplus}$
0°C
?

iii)


OLi
C_2H_5
DHaB
PhCHO
?

iv)


LDA
$PhCH_2I$
?

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

P821

[3923]-405
M.Sc. - II
INORGANIC CHEMISTRY
CH - 430 : Inorganic Polymers and Heterogeneous Catalysis
(Sem. - IV)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Neat diagrams should be drawn wherever necessary.***

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

a) Name three reactions catalysed by zeolites and explain any one in detail.
b) Give an account of P - N compounds.
c) Discuss the bonding in metal clusters.
d) Explain the hydrothermal synthesis of ZSM - 5.
e) Discuss the use of clays as catalysts.

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

a) What is a catalytic converter? Explain its working.
b) "Zeolites are useful as molecular shape selective catalysts". Justify the statement with the help of suitable examples.
c) What are photocatalytic reactors? Explain.
d) Explain the role of semiconductors as catalysts.
e) Discuss the quantitative aspects of adsorption and catalysis.

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

a) Explain the catalytic applications of nanomaterials for environment.
b) What do you understand by phase - transfer catalysis? Explain with the help of suitable examples.
c) Explain the role of zeolites as
   i) Hydrogen transfer catalyst.
   ii) Oxidation catalyst.
d) Explain the volcano diagram for the decomposition of methanoic acid to methanoate.
e) Draw the structure and find out the number of frame work electrons in $[Ni_6(Co)_{12}]^{--}$.

P.T.O.

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

a) Bimetallic nanoparticles.

b) SOD type zeolite.

c) Sodium tripolyphosphates.

d) SN compounds.

e) Surface properties of heterogeneous catalysts.

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

P822

[3923]-406
M.Sc - II
INORGANIC CHEMISTRY
CH - 431 : Material Science
(Sem. - IV)

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

Instructions to the candidates:

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

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

a) What is photoconductivity? Explain the phenomenon of photoconductivity with the help of band energy level diagram.

b) What are nanoparticles? Explain the size dependent properties of nanoparticles.

c) Explain the different types of plots of L vs T in solid state reactions.

d) Explain the different types of superconductors.

e) Explain the atomic model of diffussion. Give the diffussions mechanism in solids.

f) What are three main types of synthetic fibres used to produced fibre - rein forced plastic composite materials?

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

a) Derive the expression $x = \frac{C}{T - \nu c} = \frac{C}{T - \theta}$

b) What are biomaterials? Explain the classification of biomaterials.

c) Explain the working mechanism of n - p - n transistor?

d) What is Hysteresis loop? Saturation magnetisation of FCC iron is 1750 KA / m^2 . Calculate the net magnetic moment per iron atom in the crystal.

Given lattice parameters of BCC iron is 2.87 A°

e) In germanium energy gap is 0.75 ev. What is the wavelength at which it starts absorption of light?

P.T.O.

Q3) Attempt any FOUR of the following: **[20]**

a) What is Luminiscence? Explain the different types of Luminiscence.

b) Explain the peilter and seebeck effect on the basis of energy level diagram of two dissimilar metals.

c) What is the difference between normal and inverse spinel? Give applications of magnetic materials.

d) Explain the synthesis of super conducting materials?

e) Explain the hysteresis loops.

f) With the help of flow sheet explain the solgel process.

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

a) Crystal growth.

b) Schottky and frenkel defect.

c) Flotz zone method for synthesis of pure silicon.

d) The kirkendall effect.

e) Bioactive glass.

f) Macrodefect free cement.

Total No. of Questions : 9] **[Total No. of Pages : 3**

P823

[3923]-407
M.Sc - II
INORGANIC CHEMISTRY
CH - 445 : Inorganic Applications in Industry, Biotechnology and Environmental Chemistry.
(Sem. - IV)

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 indicates full marks.***
5) ***Neat diagrams must be drawn wherever necessary.***
6) ***Use of logarithmic table / calculator is allowed.***

SECTION - I
Applications of Inorganic Materials

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

a) What is meant by the term pigment? Explain the following properties of Inorganic pigment.

i) Colour

ii) Hiding power

iii) Chemical resistance

iv) Ease of wetting.

b) Which type of isomerism are seen in chromium and cobalt complexes of tridentate Azo compounds? Explain any one type of isomerism.

c) Discuss the different processes available for electrodeposition of Zinc.

d) Explain the production and properties of glass fibers for reinforcing plastic resin

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

a) How are redox centers ligand to PVP electrode coating? Explain the effect of increasing the positive potential of the platinum electrode on electro deposition.

b) Explain the microstructure of hardwood.

P.T.O.

c) A piece of wood containing moisture weigh 174.3 gm. and after oven drying a constant weight is 156.5gm what is its percentage moisture content? Justify your answer on the quality of wood.

d) Give in detail production of portland cement.

Q3) Write notes on (any two): **[10]**

a) Yellow pigment.

b) Alloy plating.

c) Phthalocyanins.

SECTION - II

Environmental Chemistry

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

a) Describe how nitrogen can be removed from the waste water by biological treatment.

b) What are maximum contaminant level (MCL) of the safe drinking water act?

c) Will geothermal energy ever be a major source of energy world wide? Explain.

d) Determine PE for waste water that contains 5.0×10^{-7} M Cd^{+2}. Does this waste water favours oxidation or reduction? ($PE^{\circ} = -6.81$)

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

a) List the five provisions of the clean water act (CWA). Which of these are considered the most important?

b) Compare aerobic treatment process with an anerobic treatment process.

c) Mercury (Hg^{+2}) has a $t_{1/2}$ of 6 days. If a person ingests 2mg / day, calculate the steady - state concentration of mercury.

d) Draw a schematic diagram of a phosphoric acid fuel cell (PAFC).

i) What reaction is occurring at the cathode?

ii) What reaction is occurring at the anode?

iii) Show the overall reaction.

Q6) Write notes on (any two). **[10]**

a) Energy from biomass.

b) Electrodialysis.

c) Biorefractory organic pollutant.

SECTION - III
BIOTECHNOLOGY

Q7) Answer any three. **[15]**

a) What is the "Germ theory of diseases"?

b) "Blotechnology is a branches which has developed by the contribution of various branches of science". comment.

c) Explain the effect of PH, concentration and temperature on making of curd.

d) Explain the use of microbes in oil refinery.

Q8) Attempt any three. **[15]**

a) Explain the cycle of methane production using anaerobic bacteria.

b) "Algae" can be used as food as well as fuel". Explain.

c) Discuss the commercial applications of tissue culture.

d) What is recombinant DNA technology? What are its advantages and limitations?

Q9) Write notes on any two. **[10]**

a) Biocalatysts.

b) Gasohols.

c) Living cells - miniature chemical factories.

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

P825

[3923]-409
M.Sc. (Sem. - IV)
ORGANIC CHEMISTRY
CH - 451 : Synthetic Methods in Organic Chemistry
(2008 Pattern) (New 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

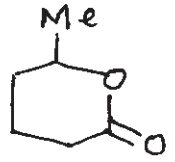
Q1) a) Explain any two of the following : **[6]**

i) Enamines can be used only with reactive alkylating agents.

ii) Phosphonium ylids give alkenes while sulfonium ylids give epoxide with carbonyl compounds. Why?

iii) For boron rearrangements migration preferences are n-alkyl > s-alkyl > t-alkyl.

b) Provide a suitable synthesis using hydroboration strategy as one of the steps. Write all the reagents and intermediate products (any two) : **[6]**

i) 

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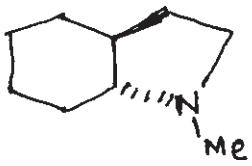
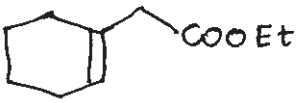
ii) 

from 

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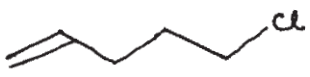
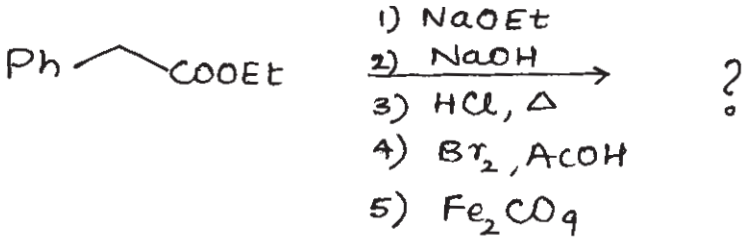
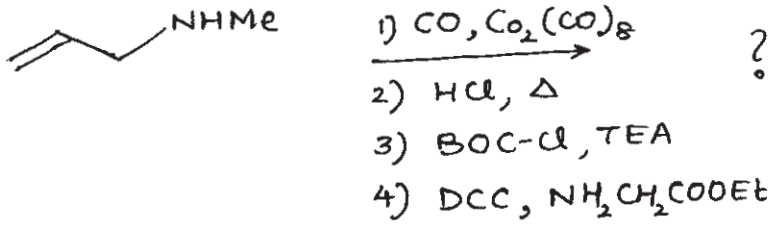
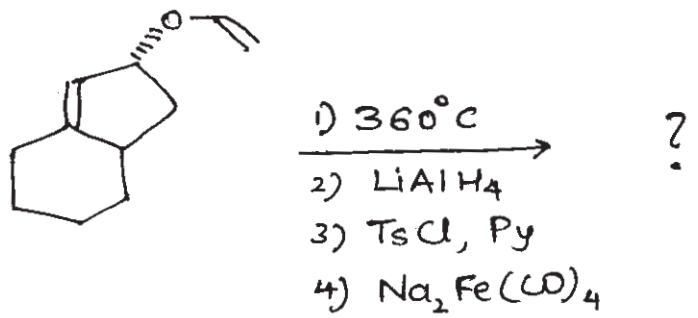
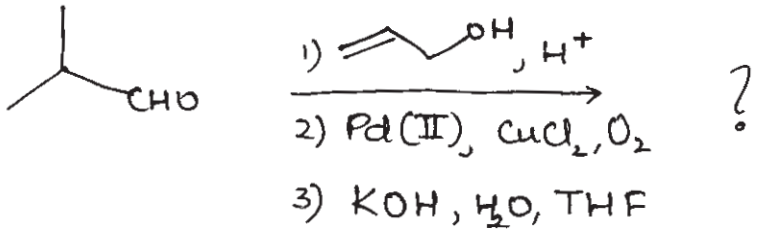
from 

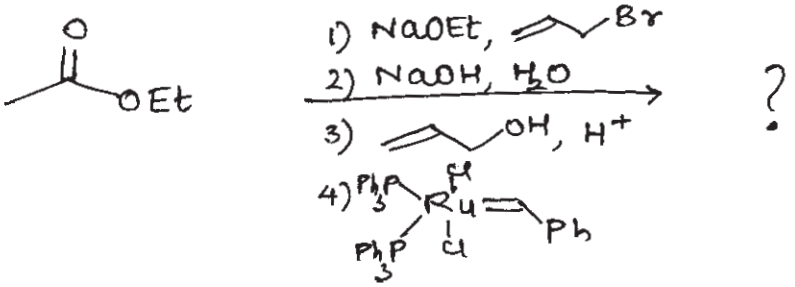
Q2) Predict the products in <u>any four</u> of the following : **[12]**

a) 

b) 

c) 

d) 

e) 

Q3) a) Write short notes on <u>any three</u> of the following : **[9]**

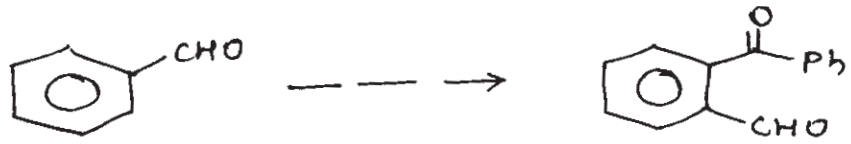
i) Olefin Metathesis.
ii) Chiral organo boranes.
iii) Sulphur compounds used for umpolung of reactivity.
iv) Organo silicons as protecting groups for alcohols.

b) Explain the role of organo nickel compounds in the synthesis of macrocyclic ring compounds. **[3]**

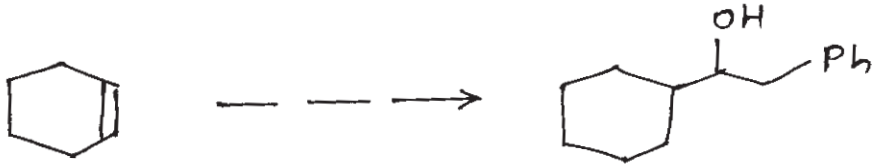
OR

Explain the role of $TiCl_4$ in polymerization reactions.

c) Complete <u>any two</u> of the following transformations. **[4]**

i) 

ii) 

iii) 

SECTION - II

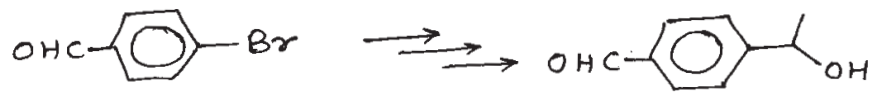
Q4) a) Explain <u>any two</u> of the following : **[6]**

i) Urethane protection of amino group is preferred over amide protection in peptide synthesis.
ii) Reconnection approach is preferred over disconnection approach in 1,6-di-carbonyl compound synthesis.
iii) Convergent synthesis is better then linear synthesis.

b) Explain the use of <u>any two</u> reagents. **[6]**

i) Tris-triphenylphosphine Rhodium chloride.
ii) Tributyl tin hydride.
iii) Dicyclohexyl carbodiimide.

Q5) a) How will you carry out the following conversions? (any two) : **[6]**

i) 

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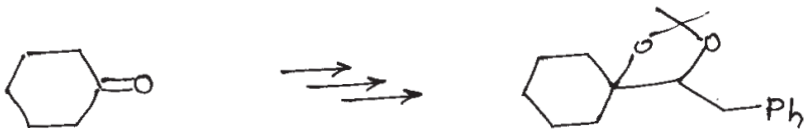
iii) 

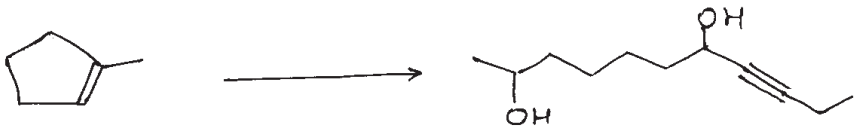
b) Complete the following transformation using the reagents given below. Arrange the reagents in proper order. (any two) : **[6]**

i) 

Reagents : PCC, NaOAc ; H_3O^+ ; DHP, H^+ ; $C_6H_{13}MgBr$; MeOH, H^+.

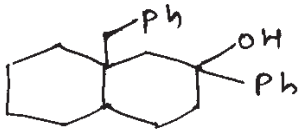
ii) 

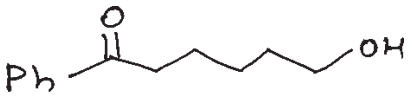
Reagents : TBDMSCl, Py ; NaH, BnBr ; H_2/Pd-C ; MeOH, H^+ ; PCC, NaOAc

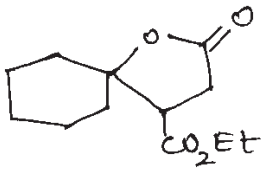
iii) 

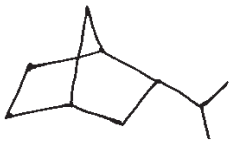
Reagents : AcOH, H_2O ; DHP, H^+ ; ≡, $NaNH_2$; O_3, Me_2S

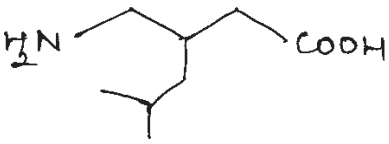
Q6) Using retrosynthetic analysis, suggest a suitable method to synthesize <u>any four</u> of the following : **[16]**

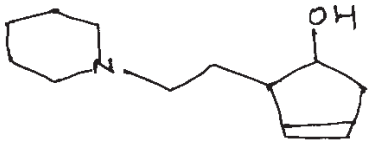
a) 

b) 

c) 

d) 

e) 

f) 

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

P833

[3923] - 421

M.Sc.

DRUG CHEMISTRY

CH - 461 : Synthetic Methods in Organic Chemistry

(Old &New) (Sem. - 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) a) Explain any three of the following: **[9]**

i) TBDMS chloride can be used for selective protection of 5'– hydroxyl group in deoxy-ribonucleosides.

ii) Enamines can be used only with reactive alkylating agents.

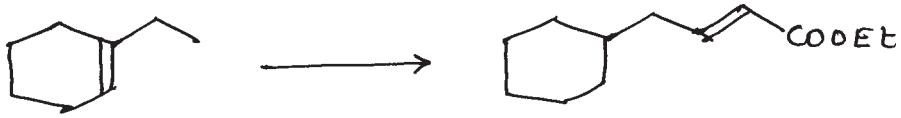
iii) Role of zeiglar-Natta catalyst in polymerization reaction.

iv) Use of Wilkinson catalyst in hydrogenation reaction.

b) Complete any two of the following conversions **[6]**

i) 

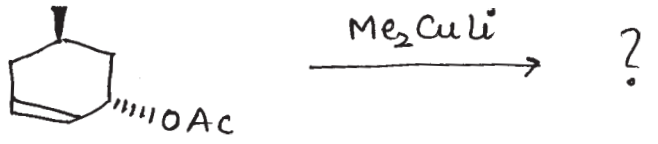
ii) 

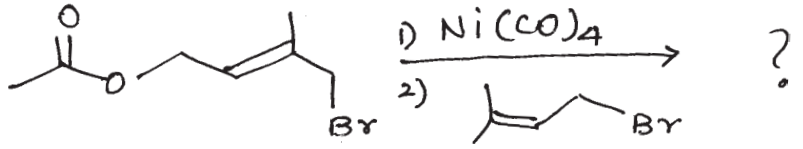
iii) 

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

i) 

P.T.O.

ii) 

iii) 

iv) 

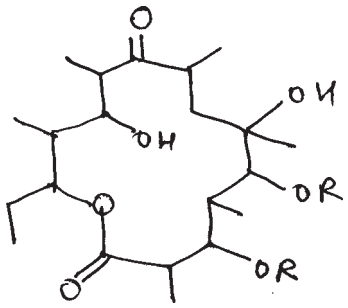
b) Discuss <u>any two</u> of the following: **[6]**

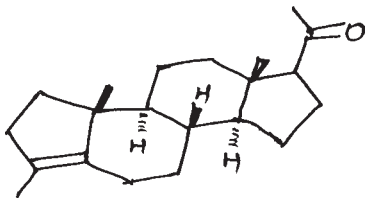
i) Use of pd(o) in Heck reaction.

ii) Use of nitro alkanes in 1, 4-dicarbonyl synthesis.

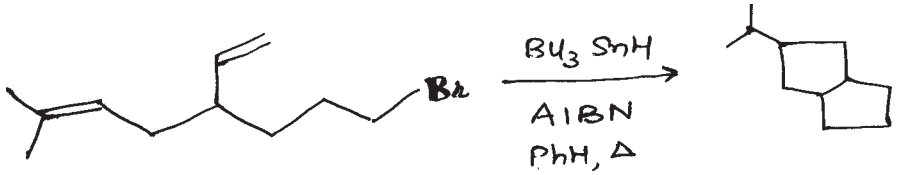
iii) Use of Mannich reaction in the preparation of exo cyclic methylene ketones.

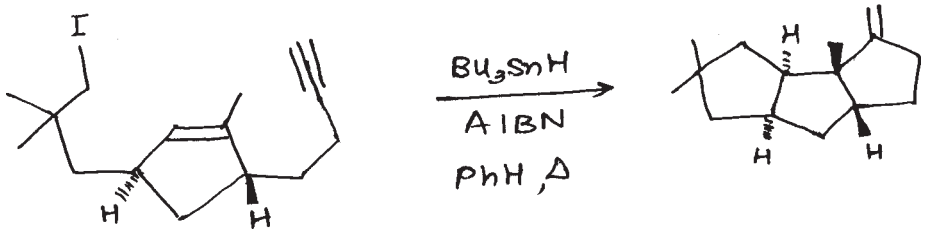
Q3) a) Explain the biomimetic approach to reterosynthesis to obtain <u>any one</u> of the following combounds. **[5]**

i) 

ii) 

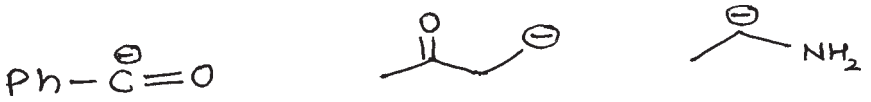
b) Explain the difference in domino reaction and stepwise reaction. Write the steps involved in <u>any one</u> of the following domino reaction.

i) 

ii) 

SECTION - II

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



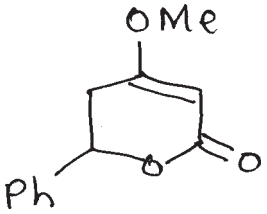
b) Using the method of umpolung carry out <u>any two</u> of the following conversions: **[6]**

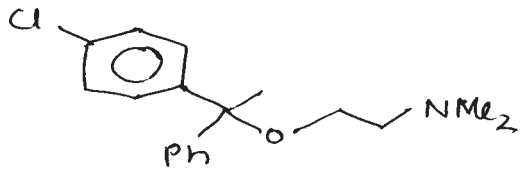
i) 

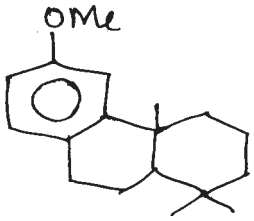
ii) 

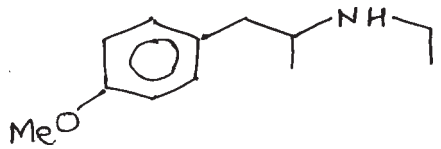
iii) 

Q5) Using reterosynthetic analysis. Suggest a suitable method to synthesize <u>any three</u> of the following: **[12]**

i) 

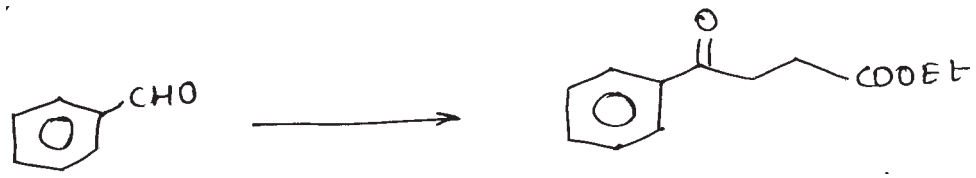
ii) 

iii) 

iv) 

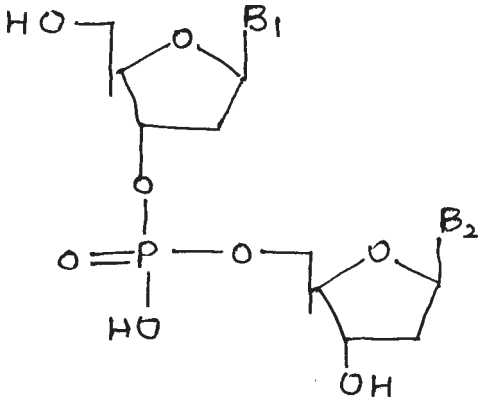
Q6) a) Answer <u>any four</u> of the following: **[12]**

i) Carry out the following conversion using umpolung reaction.



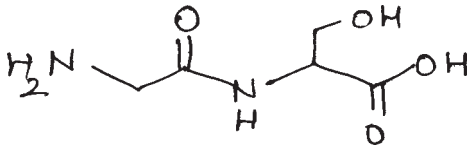
ii) Carry out the following conversion using organo borane chemistry.

iii) Discuss the steps involved in the synthesis of the following dinucleotide.



B_1 & B_2 are bases.

iv) Discuss the steps involved in the synthesis of the following peptide.



v) Carry out the transformation using proper sequence of reagents.

Reagents: DHP, H^+; $C_6H_{13}MgBr$; Me OH, H^+; PCC, Nao AC; H_3o^+

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

i) Advantages of green chemistry with one suitable example.

ii) Advantages of convergent synthesis over linear synthesis.

Total No. of Questions : 12] **[Total No. of Pages : 6**

P844

[3923]-49
M.Sc.
ORGANIC CHEMISTRY
CH - 452 : Pericyclic Reactions, Chiron Approach, Chemotherapy, Medicinal Chemistry, Vitamins, Antibiotics etc.
(2005 Pattern) (Old Course) (Sem. - IV)

Section - I : Pericyclic Reactions, Photo Chemistry and Green Chemistry

Section - II : Medicinal Chemistry

Section - III : Chiron Approach and Newer Methods in Organic Synthesis

Section - IV : Vitamins, Antibiotics and Hormons

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

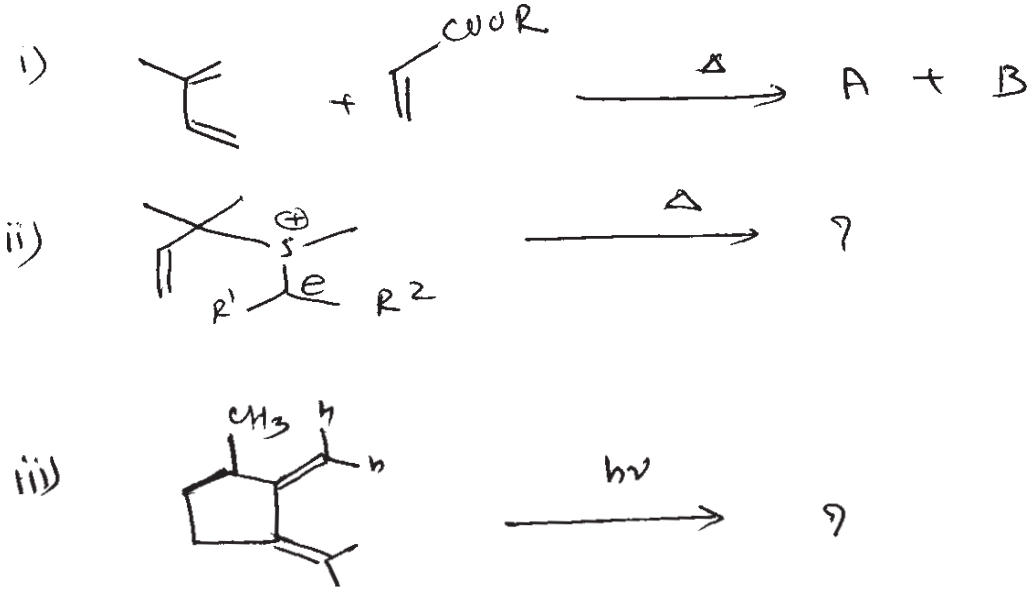
Instructions to the candidates:

1) ***Solve any two sections out of four.***
2) ***All questions are compulsory from both sections.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) a) Construct correlation for $\pi^{2s} + \pi^{2s}$ cycloaddition reaction. Predict wheather reaction is thermally or photochemically allowed. **[6]**

b) Predict the product /(s) of the following reactions. Explain their stereo chemistry and mechanism (any four) : **[8]**



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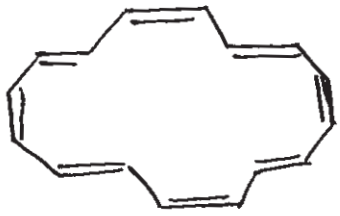
IV)



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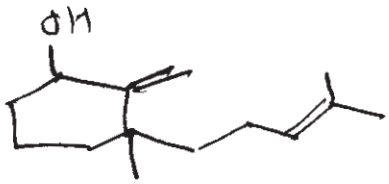
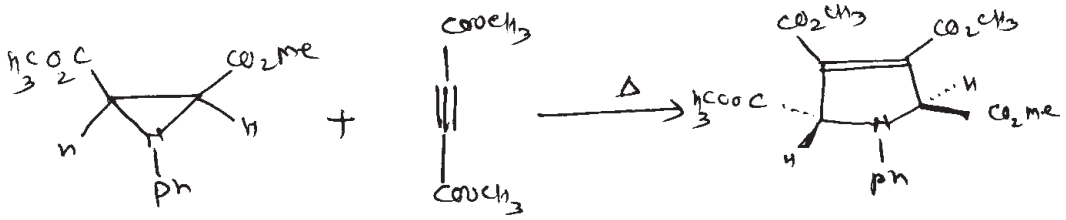


Q2) a) Draw the molecular orbital of pentadienyl system. Comment on their symmetry with respect to C_2 axis of symmetry. **[4]**

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

i)



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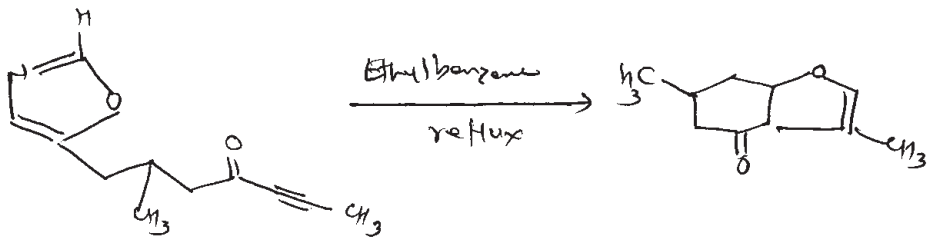
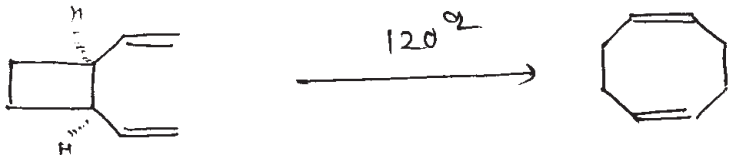
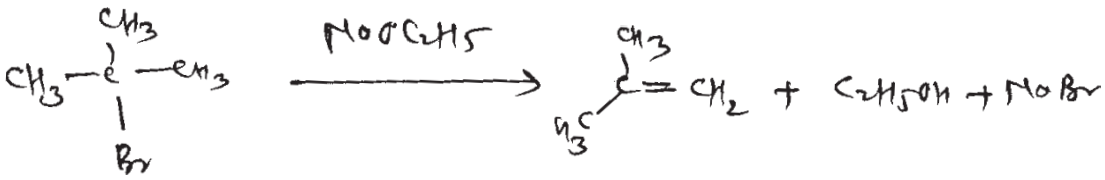


iii)



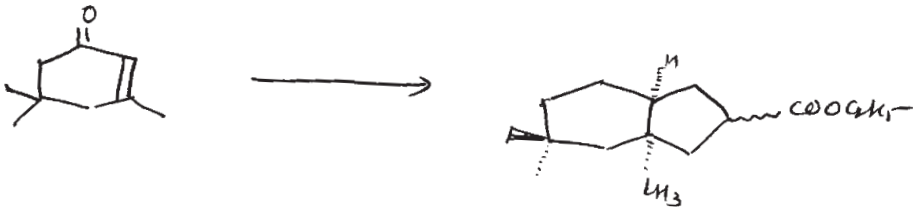
c) Calculate the percentage atom economy in the following reaction. **[4]**



Q3) a) Complete the following synthetic sequence indicating all intermediates and reagents requires (any one) : **[8]**

i)

ii)



b) Explain the importance of [2 + 2] enone-olefin photocycloaddition in the synthesis of natural products with two suitable examples. **[4]**

SECTION - II

Q4) Answer <u>any three</u> of the following : **[12]**

a) What are drugs? How do they exhibit biological response? What are the characteristics expected of an ideal drug?

b) Discuss the mode of action and uses of sulfa drugs with examples.

c) Give a brief commentary on protein synthesis inhibitors used as antibiotics.

d) Explain the following :

i) Pharmacokinetics.
ii) Selective toxicity.

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

i) Discuss in brief the role of alkylating agents as anticancer drugs. Explain their mode of action.
ii) What are antimetabolites. Give a brief commentary on their use as antibiotics, anticancer and antiviral agents.
iii) Discuss how are antibiotics discovered and classified with proper examples.

b) Give a brief account of use of QSAR in drug designing. Explain the Hansch approach. **[6]**

Q6) a) Answer <u>any two</u> of the following : **[8]**

i) Discuss the discovery of penicillin G & the use of semisynthetic penicillins. What are the benefits of Phenoxymethyl penicillin, Ampicillin, Methicillin and Coxacillin over Penicillin G.

ii) Give an account of viral life cycle and the drugs which inhibits these steps with examples.

iii) Discuss in brief :

1) Computer aided drug designing.
2) Drug resistance.

b) Discuss the mode of action and uses of <u>any two</u> of the following : **[4]**

i) Chloroquin.
ii) Duanomycin.
iii) Amphotericin B.

SECTION - III

Q7) a) D – (+) – Glucose is converted by a series of reactions into xylotrimethoxyglutaric acid. Write the sequence of reactions involved and explain how it explains the pyranose structure for glucose. **[4]**

b) What is mutarotation? Explain the mechanism of mutarotation. **[4]**

c) D – (–) erythrose is subjected to kiliani reaction to give two aldopentoses A & B which give following reactions.

i) A, B $\rightarrow$ same osazone.

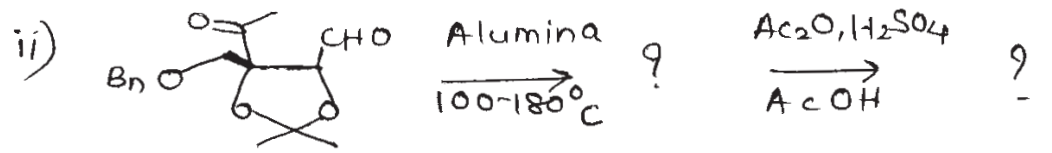
ii) A $\xrightarrow{(O)}$ optically inactive dicarboxylic acid.

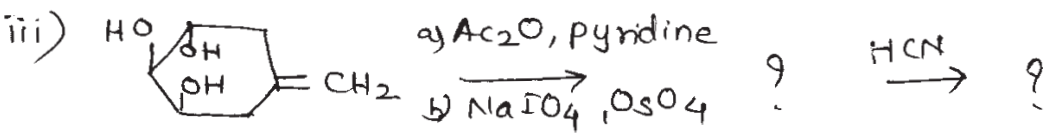
iii) B $\xrightarrow{(O)}$ optically active dicarboxylic acid.

Identify A and B and write the reactions i, ii & iii answered by them. **[4]**

d) Pedict the products in <u>any two</u> of the following. **[4]**

i) 

ii) 

iii) 

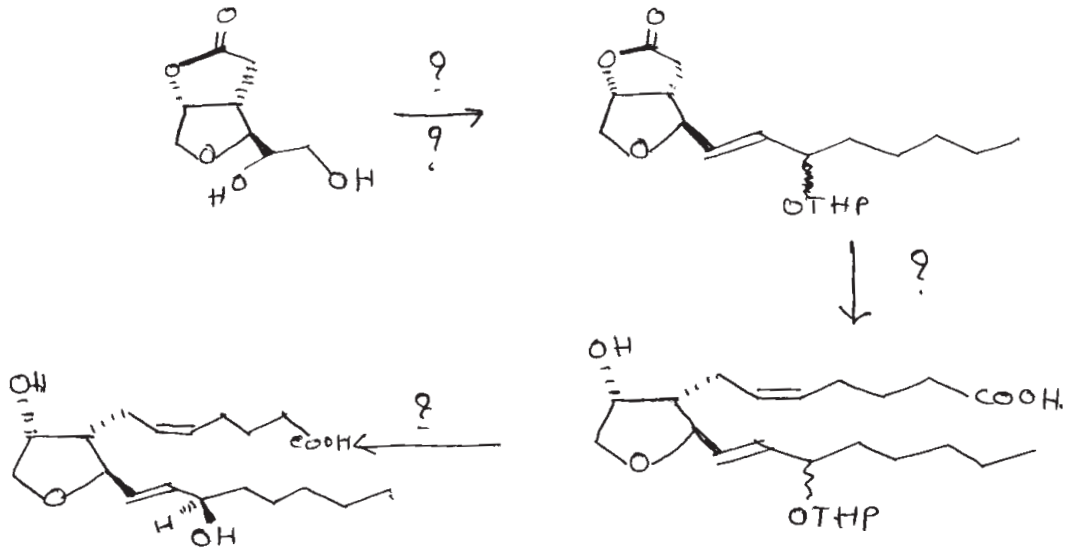
Q8) a) Give retrosynthetic analysis of (–) – multistriatin which is shown below : **[4]**

b) Write short note on <u>any one</u> of the following : **[4]**

i) Rule of five.

ii) Carbohydrates in chiron approach.

c) Write the appropriate reagents in the following course of reactions and rewrite the complete sequence of reactions. **[4]**

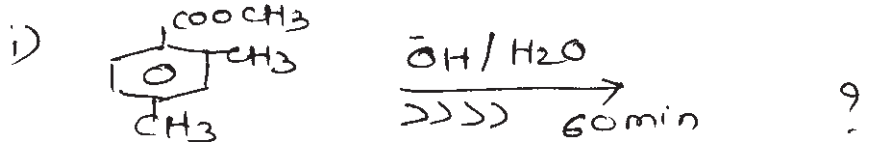


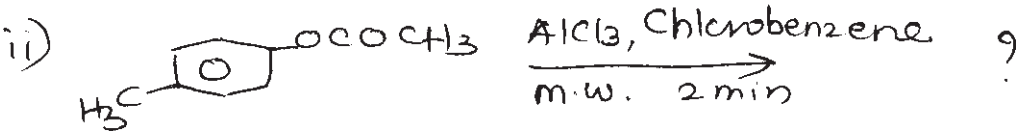
Q9) Answer <u>any three</u> of the following : **[12]**

a) Discuss the advantages and disadvantages of biocatalyst.

b) Explain the phenomenon of cavitation involved in sonochemical reactions.

c) Complete the following sequence of reactions.

i) 

ii) 

d) Discuss the role of polar solvent used in microwave synthesis.

SECTION - IV

Q10) Describe the evidences to establish the presence of the given structural features in <u>any four</u> of the following : **[16]**

a) Presence of tetrahydrothiophene in Biotin.

b) Presence of 1, 4-napthaquinone moiety in vit.K_1.

c) Presence of pyrimidine ring in vitamin B_1.

d) Nature and position of – OH group in estradiol.

e) β-Lactum ring in penicillin.

Q11) Describe the biochemical functions of <u>any three</u> of the following : **[12]**

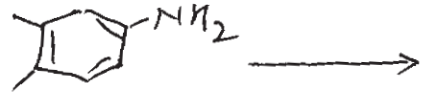
a) Folic acid.

b) Riboflavin.

c) Pyridoxal phosphate.

d) Pantothenic acid.

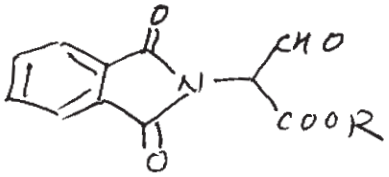
Q12) Complete the sequences in the synthesis of following compounds (any three) : **[12]**

a. 

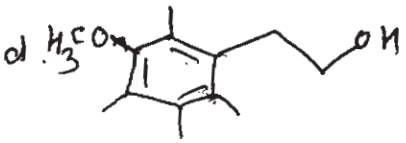
Vitamin B-2

b. 

Estrone

c. 

Penicillin-V

d. 

alpha-tocopherol.

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