

Total No. of Questions : 6]

SEAT No. :

P690

[Total No. of Pages : 2

[4127] - 303
M.Sc. (Sem. - III)
DRUG CHEMISTRY
CH - 363 : Drug Development
(Old & New)

Time :3 Hours]

[Max. Marks :80

Instructions to the candidates:-

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

SECTION - I

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

- a) How will you screen the soil samples for antibiotic producers ?
- b) Describe the process of scale-up for industrial production of antibiotics.
- c) Diagrammatically illustrate the fermentation equipment for aerobic processes.
- d) Explain the antimicrobial assays based on diffusion methods.
- e) Define and explain in short-chemostat and turbidostat.

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

- a) Explain the properties of a substance that makes it immunogenic.
- b) Explain the precipitation techniques for visualization of antigen-antibody interactions.
- c) Diagrammatically illustrate different classes of immunoglobulins.
- d) Explain the mechanism of IgE - mediated anaphylaxis / hypersensitivity.

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

- a) Give a brief commentary on the need for new drugs ? What have been the strategies in drug discovery ?
- b) Discuss the following terms
 - i) Antagonist
 - ii) Institutional Review Board
 - iii) Combinatorial chemistry
 - iv) Analgesic
 - v) Antimicrobials
- c) Why are some drugs more patent than others ? Why do some drugs exhibit side effects ? Explain with examples.

P.T.O.

SECTION - II

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

- a) What is the need of a patent ? Discuss in brief the following with respect to an patent application.
- | | |
|----------------|--------------------------|
| i) Preamble | ii) Claim |
| iii) Invention | iv) Patentable invention |
| v) Prior art | |
- b) What are the dosage forms available. Explain the special characteristics of each form & its need with example.
- c) What are the requirements of a NCE before it can be subjected to clinical trials ? What is the role of FDA in the conduct of clinical trials ? Explain the adjectives of phase I & phase II. How are these conducted ?

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

- a) Explain Bioavailability & Bioequivalence ? How is the bioavailability calculated ? what are the strategies adopted to increase the bioavailability ?
- b) Explain in details the various phases of Rational drug discovery with illustration. What are its benefits over random drug discovery.
- c) Discuss in brief the role of proun development in a pharma industry. What are the characteristics of an ideal industrial process ?
- d) Discuss the following in brief
- | |
|------------------------------------|
| i) Acute & Subacute toxicity |
| ii) Pharmacological assay |
| iii) Pharmacophore identification. |

Q6) Discuss in brief any two of the following **[8]**

- a) Phase I & Phase II metabolism
- b) Pharmacodynamics of drug action
- c) QSAR & drug design.



Total No. of Questions : 6]

SEAT No. :

P691

[Total No. of Pages : 4

[4127] - 304

M.Sc. (Sem. III)

DRUG CHEMISTRY

CH - 364 : Stereo Chemical Principles & Applications

(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

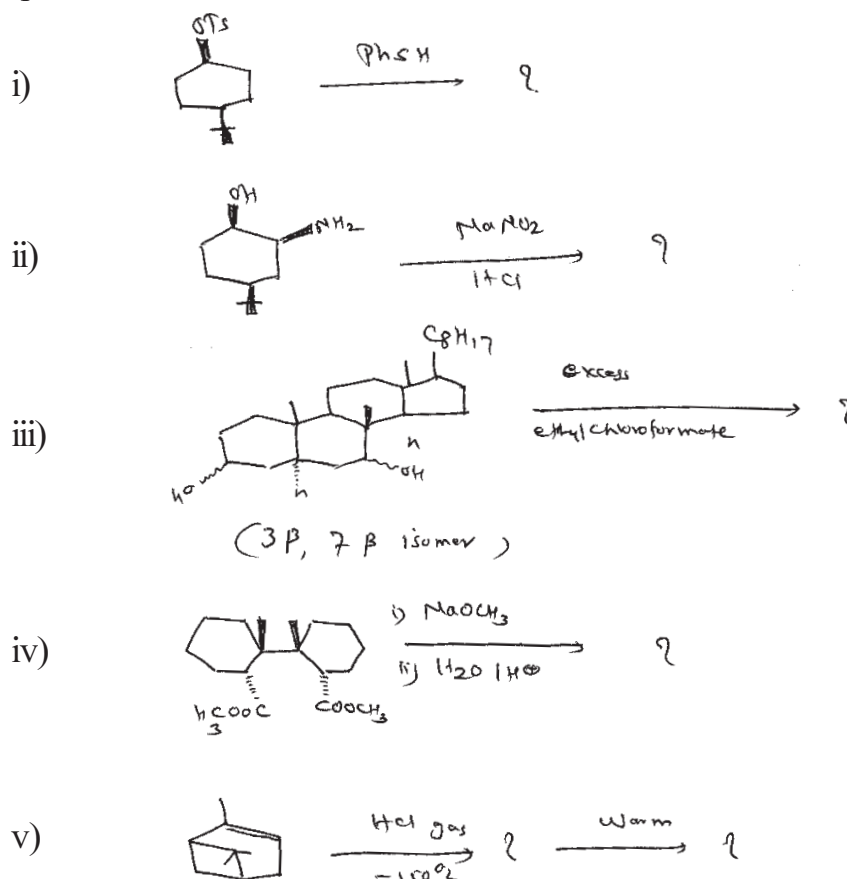
Q1) Answer any four of the following.

[16]

- a) α - Bromocamphor fails to undergo dehydrobromination on treatment with base. Explain
- b) Draw all stereo structures of perhydro phenanthrene. Explain their stability.
- c) Cis - 1, 2 - dibromo cyclohexane undergo elimination to cyclohexene with KI in methanol at 11 times slower rate than trans isomer. Explain.
- d) The β -isomer of hexachlorocyclohexane reacts very slowly with base than any of its isomers. Why ?
- e) Trans 1, 4 - t butyl cyclohexanol is strongly adsorbed on Al_2O_3 than its cis isomer. Explain.

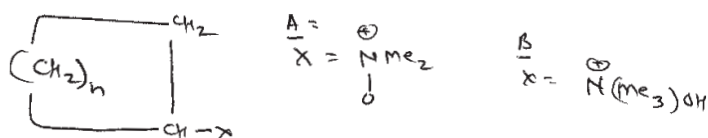
P.T.O.

Q2) Predict the product/s in any four of the following. Explain the Stereo Chemical principles involved. [12]



Q3) Discuss any three of the following. [12]

- Optical activity of cis & trans isomer of 1, 3- dimethyl cyclohexane.
- λ - Alkyl ketore effect.
- Though boat conformation is less stable till few compounds are found in this conformation. Explain the statement with suitable examples.
- Compound A & B an pyrolysis yield the olefin cis / trans olefin depending upon the ring size. Explain the formation of product on the basis of stereo chemistry.



n = 7 A & B- furnish cis olefin

= 9 A & B- furnish trans olefin

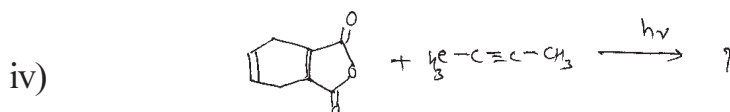
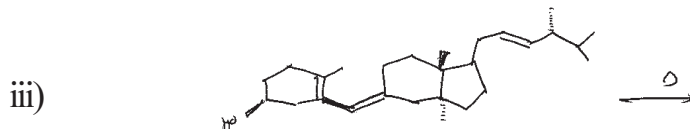
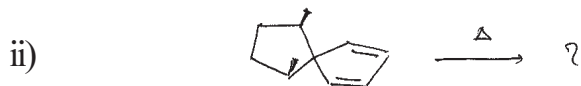
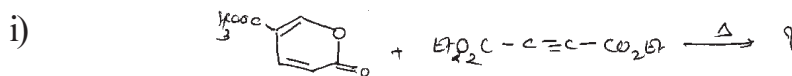
= n = 8 A- furnish cis

B- furnish trans olefin. + cis olefin.

SECTION - II

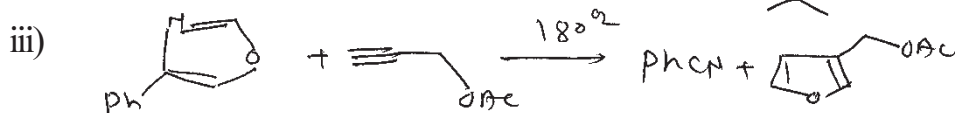
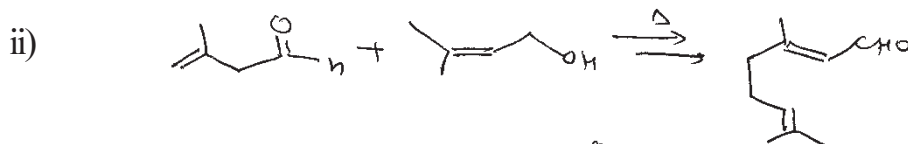
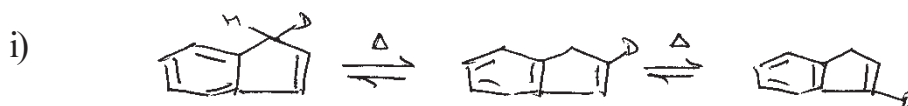
Q4) Answer the following.

a) Predict the product in any three of the following [6]



b) Explain the orientation effects in Diels Alder reaction. [3]

c) Suggest mechanism for any two of the following. [3]

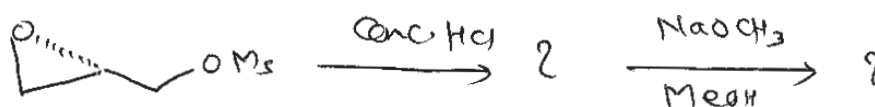


Q5) Answer any four of the following. [16]

i) Draw the chair conformations for α and β -D (+) glucopyranose. Why most naturally occurring glycopyranosires are β - anomer ?

ii) Give the reaction sequence with proper reagent for the conversion of aldohexose to aldopentose.

iii) Complete the following reaction and give mechanism.

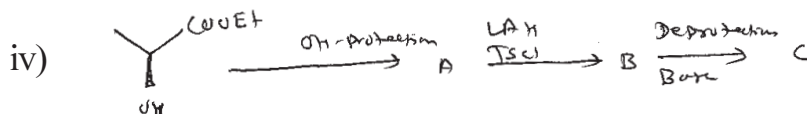
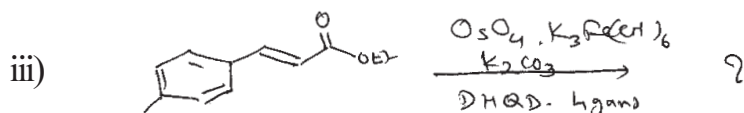
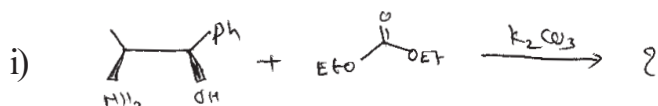




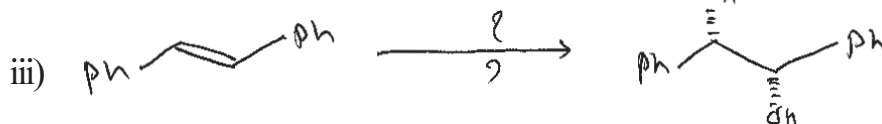
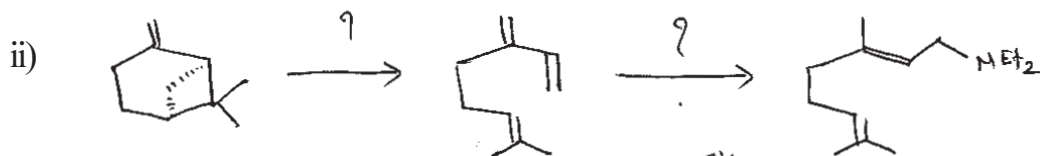
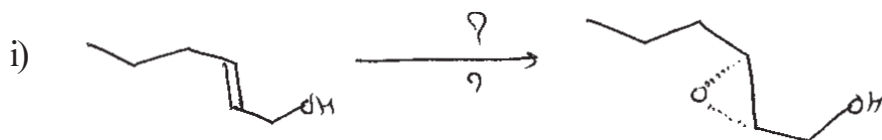
Write the structure of A & B

v) Write short note on anomeric effect.

Q6) a) Predict the product/s and explain the mechanism with stereo chemical principles. (Any three) [6]



b) Suggest reagent & stereo chemistry of the following reactions. (Any two) [6]



Total No. of Questions : 6]

SEAT No. :

P692

[Total No. of Pages : 4

[4127] - 401

M.Sc. (Sem. - IV)

DRUG CHEMISTRY

CH - 461 : Synthetic Methods in Organic Chemistry
(Old & New)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:-

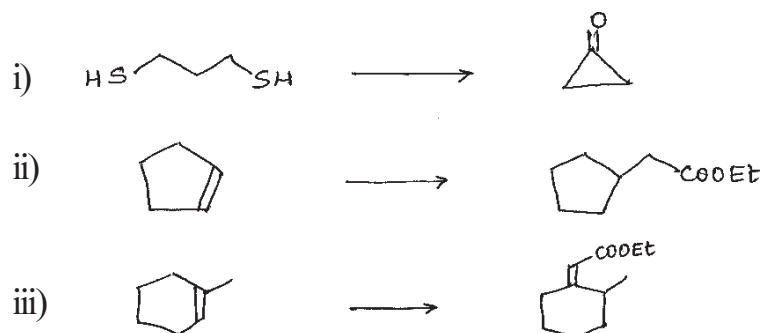
- 1) *All questions are compulsory.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Figures to the right indicate full marks.*

SECTION - I

Q1) a) Explain any Three of the following. **[9]**

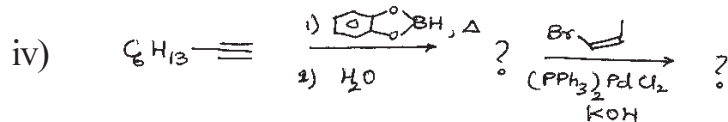
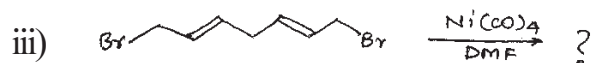
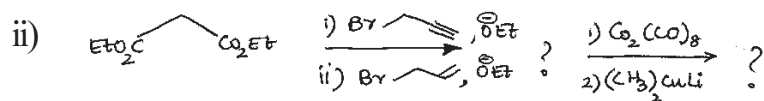
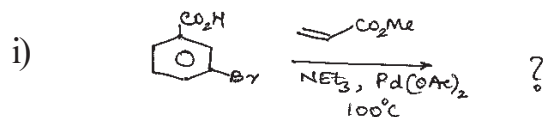
- i) MOM Protection is preferred over methyl protection for - OH group.
- ii) Catechol borane is often employed to prepare alkenyl borane.
- iii) Propenethiol can be used to create β -acylation.
- iv) Advantage of Wittig reaction over Peterson olefination reaction.

b) Complete the following transformation and Justify your answer.
(Any two) **[6]**

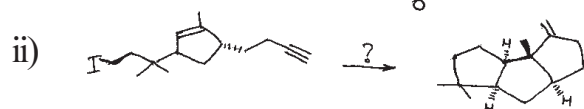
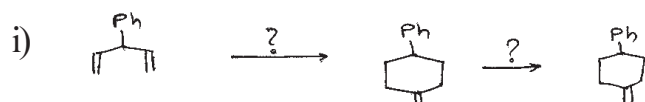


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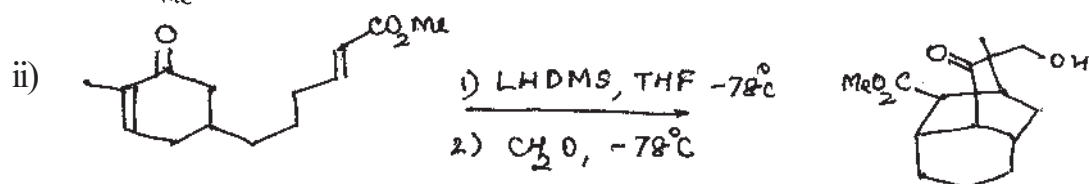
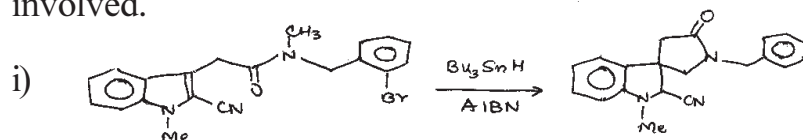
Q2) a) Predict the product in any three of the following. [9]



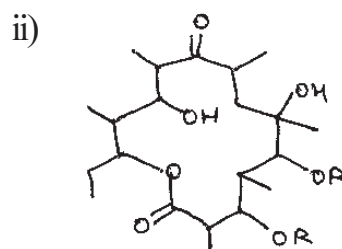
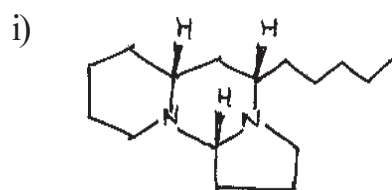
b) Suggest the reagents for accomplishing the following conversions (Any two) [6]



Q3) a) Classify any one of the following Domino reaction and explain the steps involved. [5]

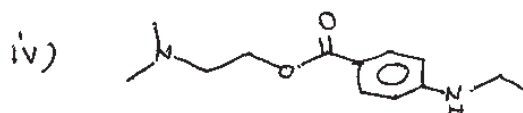
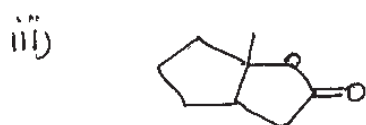
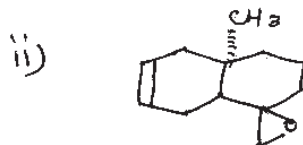
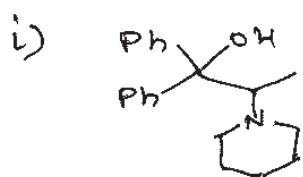


b) What is biomimetic reaction? Explain how this is used to synthesize any one of the following. [5]

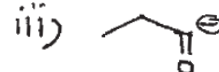


SECTION - II

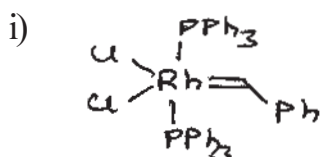
Q4) Using retrosynthetic analysis, suggest a suitable method to synthesize any three of the following. [12]



Q5) a) Give one reaction with reagent for each synthon given below. [6]

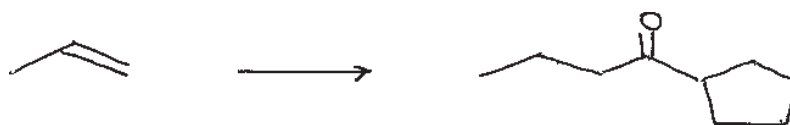


b) Discuss the synthetic utility of any two of the following reagents. [6]

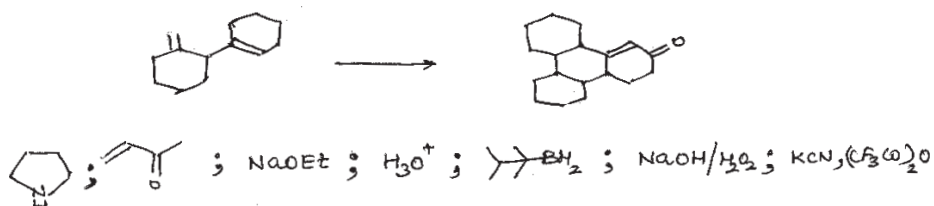


Q6) a) Answer any four of the following. [12]

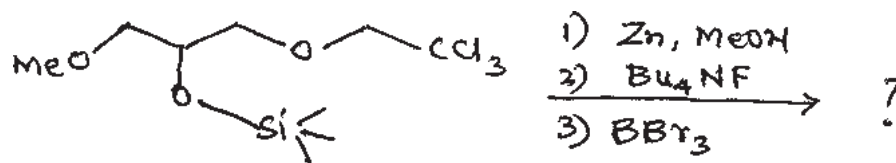
i) Achieve the following conversion using organoborane chemistry.



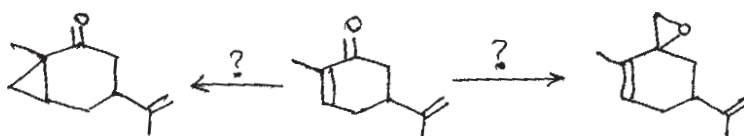
ii) Arrange the reagents given below to achieve the following conversion.



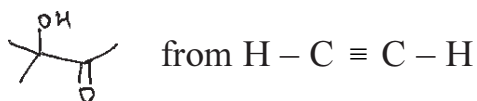
iii) Write the intermediate and the final product for the reaction



iv) Suggest the reagents



v) How will you obtain



b) Give brief account of any one of the following.

[4]

i) Atom economy in green chemistry

ii) Super critical fluids & their use in extraction process.



Total No. of Questions : 6]

SEAT No. :

P693

[Total No. of Pages : 2

[4127] - 402
M.Sc. (Sem. IV)
DRUG CHEMISTRY
CH - 462 : Chemotherapy
(Old & New)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:-

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

SECTION - I

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

- a) Give a brief account of development of semisynthetic penicillins. Explain the benefits in each and every case.
- b) Explain how protein Synthesis is inhibited by the following antibiotics.
 - i) Aminoglycosides
 - ii) Macrolides
- c) What are reasons for the selective toxicity observed in -
 - i) B-lactan antibiotics
 - ii) Fluoroquinolones
 - iii) Sulphonamides
 - iv) Tetracyclines
- d) What is drug resistance. Explain with examples the mechanism of drug resistance and the strategies to combat drug resistance.

Q2) Answer any two of the following **[16]**

- a) What are the common fungal diseases with examples explain how antifungal chemotherapy targets the biochemical pathways.
- b) Discuss in brief biochemical basis and causes of cancer. What are the various therapeutic classes of anticancer drugs. Explain the mechanism of action of cis-platin.
- c) Give a commentary on antimetabolites as anticancer agents. Explain the mechanism of action, biochemical activation for 5- Fluorouracil. Why is it given in combination therapy.

Q3) Discuss in brief any three of the following. **[9]**

- a) Tuberculosis
- b) AIDS
- c) Malaria
- d) Vomitting

P.T.O.

SECTION - II

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

- a) Discuss the organisation and functioning of endocrine system. Explain the feedback mechanisms of hormone release. What is the function of thyroid gland.
- b) Describe in brief the functions of pancreas. What is the role of α , β and D cells. What happens in diabetes. With example explain how oral hypoglycemic agents control the blood sugar level.
- c) Draw a neat diagram of neuron and explain the steps involved in neurotransmission. Explain how this process is affected in depression? Give the strategies to overcome this problem.
- d) Explain in brief any three of the following CVS problems.
 - i) Congestive Heart Failure
 - ii) Myocardial Infarction
 - iii) Angina
 - iv) Stroke

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

- a) How do the following group of drugs help in treating CVS disorders (any two).
 - i) Thrombolytics
 - ii) Ca^{2+} channel blockers
 - iii) β - blockers
 - iv) Vasodilators.
- b) What is pain? Explain the pain pathway and the mechanism of action of common analgesics.
- c) Discuss in brief the need to develop cephalosporins. Give an example each from Ist, IInd and IIIrd generations with their benefits.

Q6) Give the mode of action and uses of the following drugs (any four) **[12]**

- a) Vinblastine
- b) Chloroquin
- c) Ethinyl estradiol
- d) Omeperazole
- e) Acyclovir
- f) Ciprofloxacin



Total No. of Questions : 6]

SEAT No. :

P694

[Total No. of Pages : 2

[4127] - 403
M.Sc. (Sem. IV)
DRUG CHEMISTRY
CH - 463 : Drug Design
(Old & New)

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 two of the following **[12]**

- a) Explain about arithmetic mean, median and mode with formula for discrete data. Also find the same for the data of weight (in kg) of 10 experimental rabbits.

2.5, 3.8, 4.1, 2.0, 3.2, 3.8, 4.0, 3.8, 3.9, 3.1.

- b) Discuss about correlation and regression following data is related to the age of wife (X) and age of husbands (Y) for 8 couples.

X:	22	24	28	35	48	59	68	75
Y:	24	27	29	35	49	62	72	78

Fit a regression equation for Y on X.

- c) A packaging machine is designed for making packets of 200 gms. of washing powder. Test whether the machine is working properly or not at 5% level of significance by taking a sample 200, 199, 198, 201, 194, 198, 199, 193, ($t_7, 0.05 = 2.365$).

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

- a) Explain use of recombinant DNA technology in large scale production of cytokines.
- b) Explain any two of the following
 - i) Eco R1
 - ii) PCR
 - iii) Vector
- c) Explain the concept of personalized medicine giving suitable examples.

P.T.O.

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

- a) Explain in brief the role of membrane bound receptors. Give details of the steps involved in generation of secondary messenger and their role via GPCR.
- b) How are prodrugs better than routine drugs ? What is their design criteria? Explain with examples their benefits.
- c) What are the benefits of solid phase synthesis over homogeneous synthesis ? How does combinatorial chemistry aid in creating libraries of novel compounds. Discuss.

SECTION - II

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

- a) What are various parameters used in QSAR ? How are these obtained for the analysis ? What is meant by equation of best fit ?
- b) Why have computers become popular in drug designing ? Emphasize the role of internet and computer programmes utilised for drug designing.
- c) What are the components of force-field. Explain how this helps in understanding the energy of a system / structure.
- d) Discuss the following.
 - i) Energy minimisation
 - ii) Virtual screening

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

- a) What are the benefits of 3D QSAR over Hansch approach. Explain in brief with examples.
- b) Discuss the following.
 - i) Ab-initio approach
 - ii) Density functional theory
- c) Dihydrofolate reductase inhibitors are known to be very good anticancer, antimalarial and antibacterial drugs. The 3D structure of the enzyme was not known when these drugs were discovered and used. How will you start a drug design programme for novel drugs in any of the above fields or new field based on the 3D structure. Explain your plan of execution Justify it.

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

- a) Utility of data bases and lipinski's rule of five.
- b) Topliss manual method.
- c) St functions of membrane proteins.



Total No. of Questions : 6]

SEAT No. :

P688

[Total No. of Pages : 4

[4127] - 301

M.Sc. (Sem. - III)

DRUG CHEMISTRY

CH - 361 : Chemistry of Heterocycles and Biologically Active Compounds

(Old & New)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates :

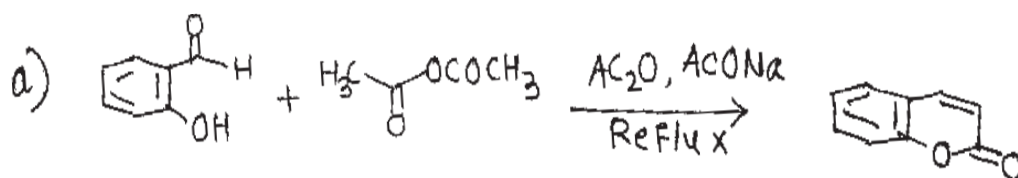
- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Answers to the two sections should be written in separate answer books.

SECTION - I

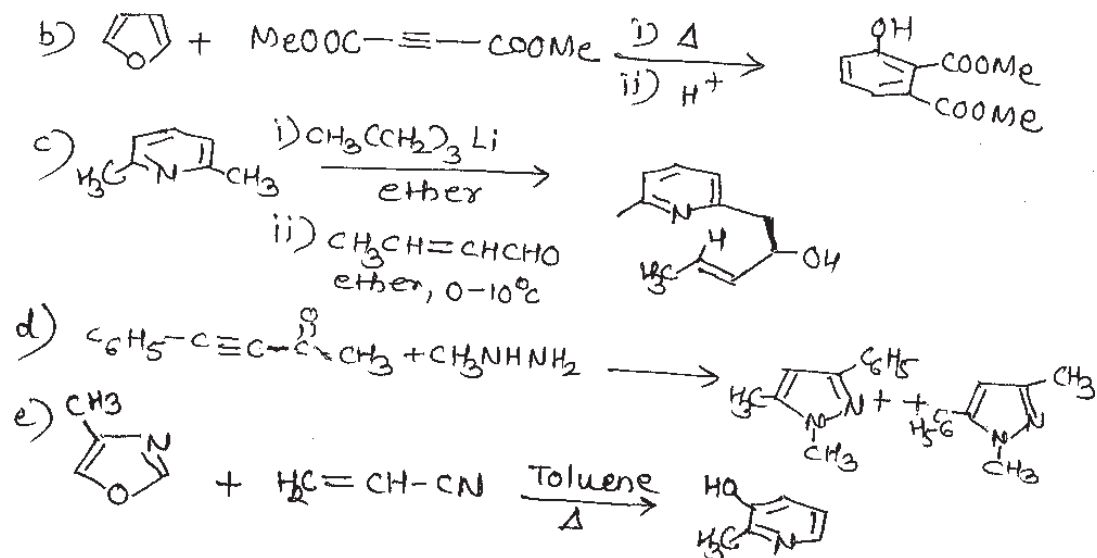
Q1) Explain any four of the following. [12]

- a) 2 - Nitrofurans are less reactive towards acids than furan itself.
- b) 4 - bromopyridine gives two isomeric products on treatment with NaNH_2 in liq. NH_3 , but with NaOMe it gives single product.
- c) Phenyl hydrazine on reaction with 2- methyl cyclohexanone in acidic medium gave isomeric mixture of tetrahydrocarbazole and indoline.
- d) Pyrimidine is resistant to electrophilic substitution as compared to imidazole.
- e) 5- methoxy quinoline is synthesized by Bischler- Napieralski synthesis and not by skraup synthesis.

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



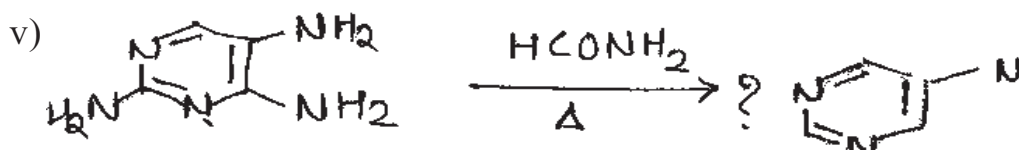
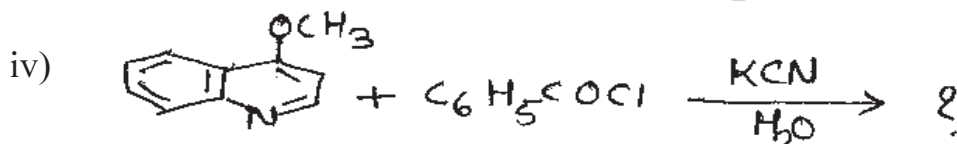
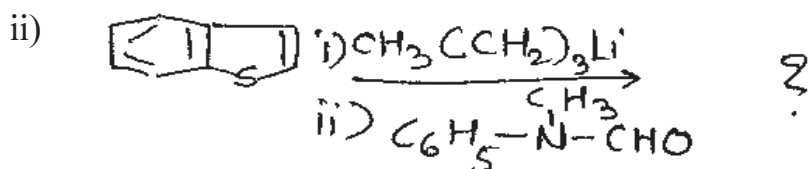
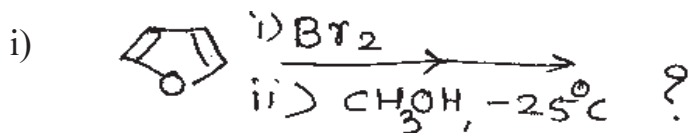
P.T.O.



Q3) a) Write short notes on any two of the following. [7]

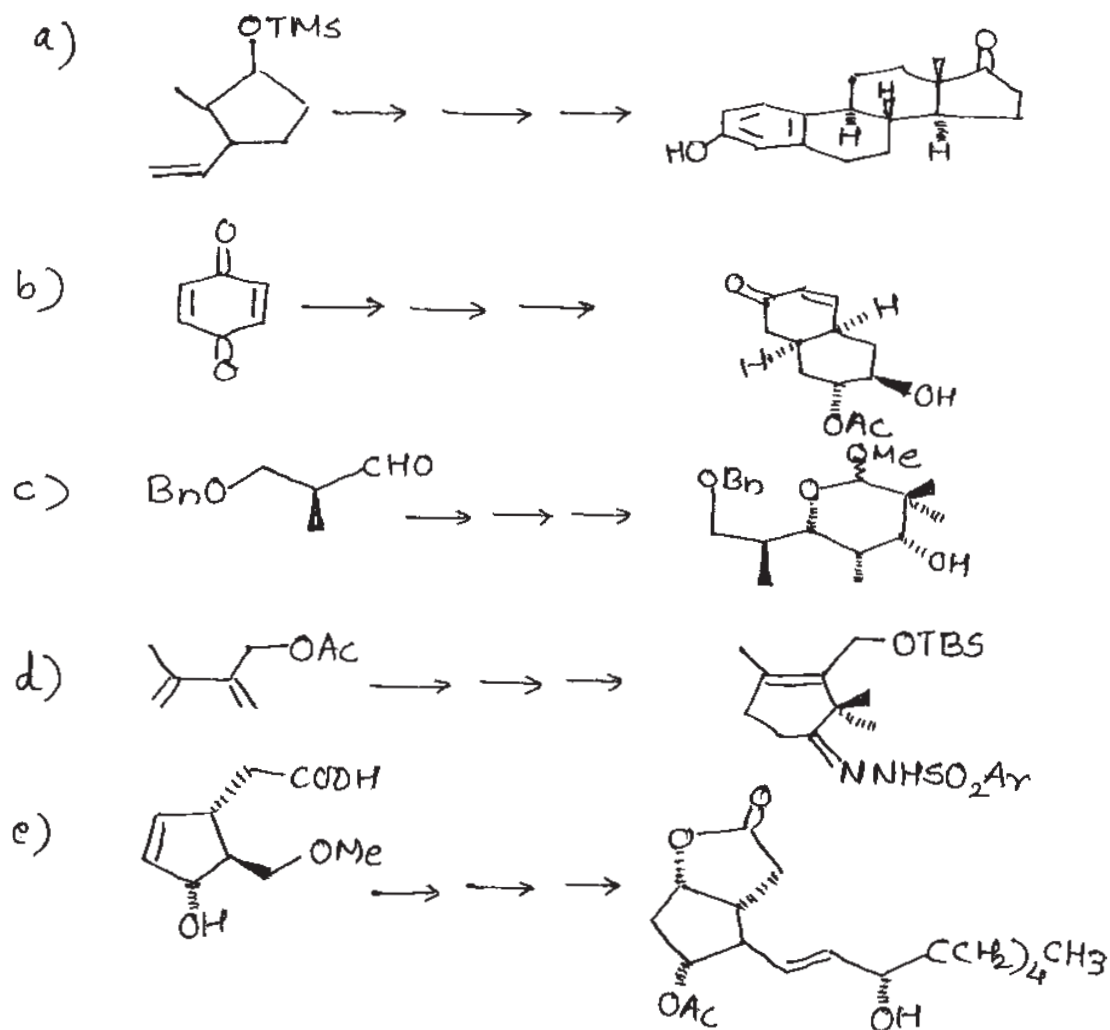
- Pictet-spengler synthesis
- Tschitschibabin Reaction.
- Effect of electron donating and withdrawing groups on electrophilic substitution in thiophene.

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

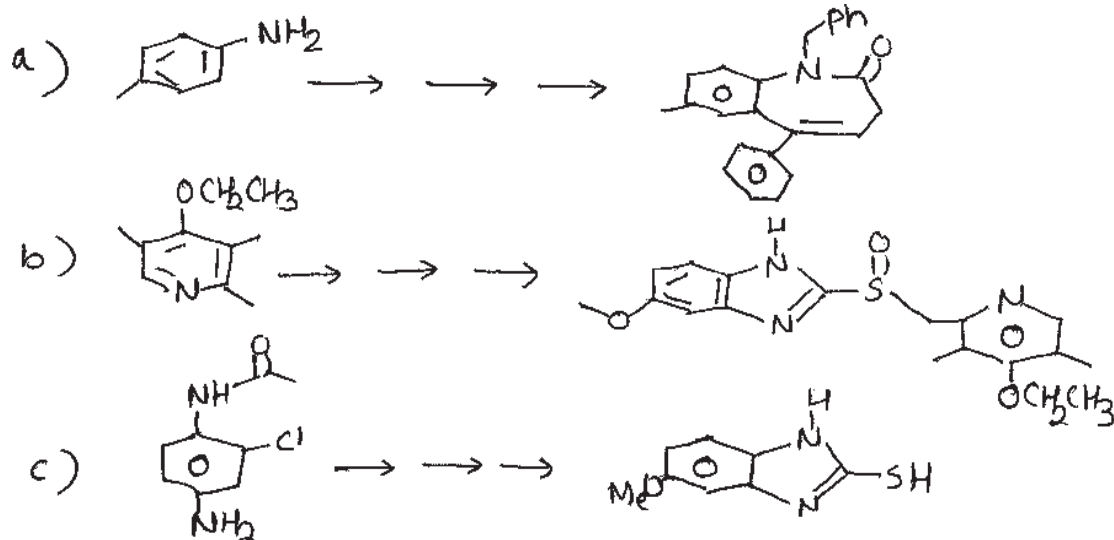


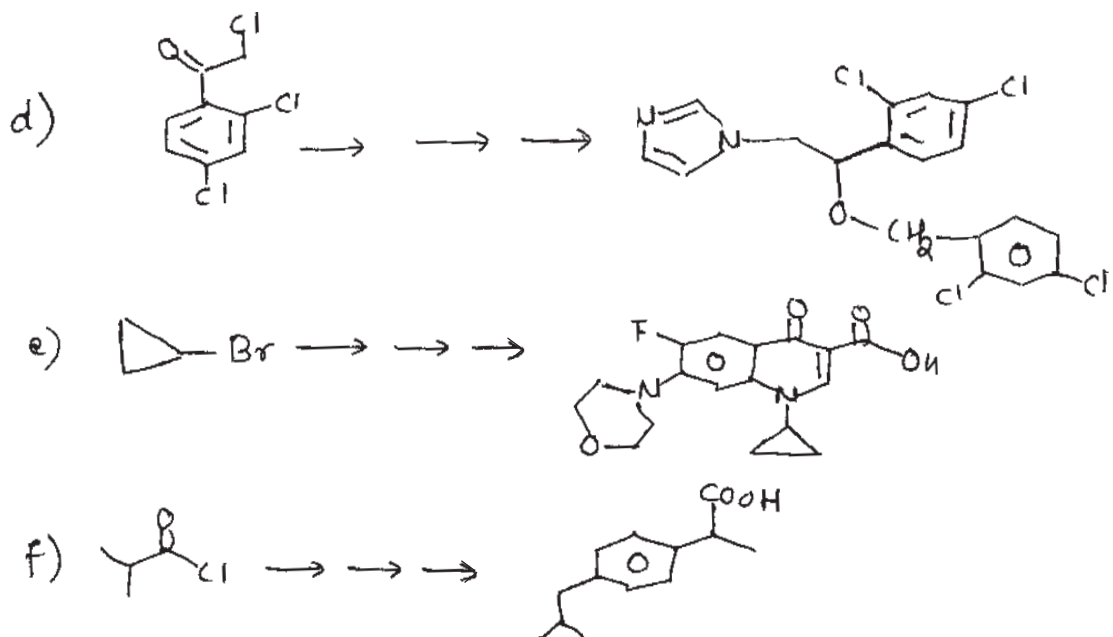
SECTION - II

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

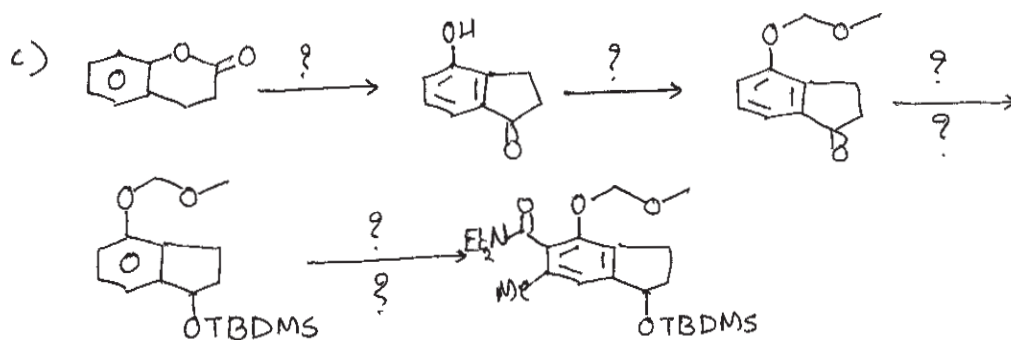
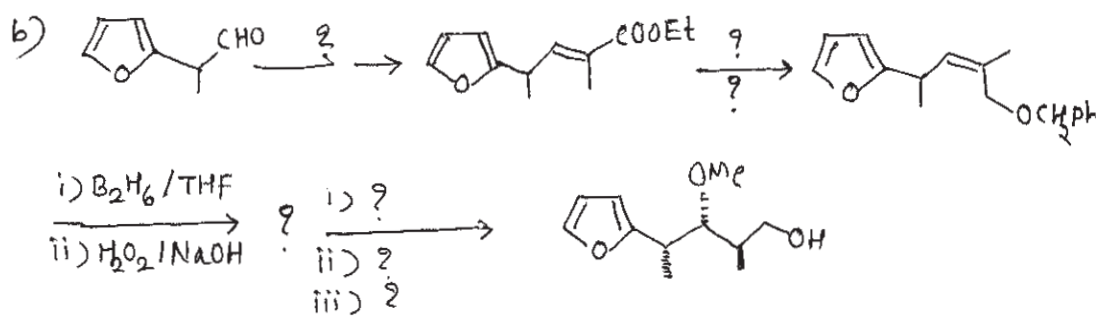
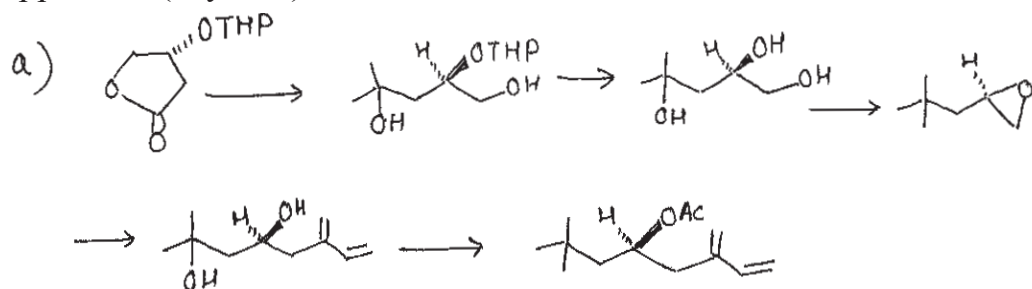


Q5) Discuss the steps involved in the synthesis of following drugs, comment on the reagents used and mechanism involved. (any four). [16]





Q6) Put the missing reagents/intermediates in the following synthesis. Justify your approach. (any two) [9]



Total No. of Questions : 6]

SEAT No. :

P689

[Total No. of Pages : 4

[4127] - 302

M.Sc. (Sem. - III)

DRUG CHEMISTRY

CH - 362 : Advanced Analytical Methods
(Old & New)

Time : 3 Hours]

[Max. Marks : 80

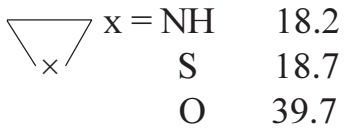
Instructions to the candidates :

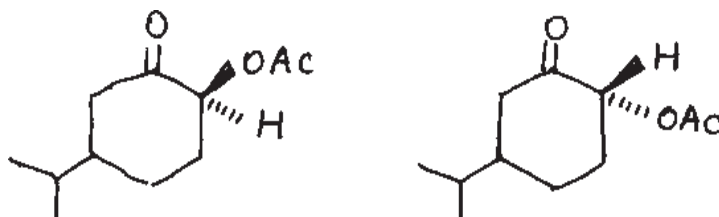
- 1) All questions are compulsory.
- 2) Answers to the two sections should be written in separate answer books.
- 3) Figures to the right side indicate full marks.

SECTION - I

Q1) Answer any four of the following.

[12]

- a) Acetone - d_6 shows seven lines in CMR at 30.2 δ .
- b) Should the α or the β - proton of naphthalene resonate at higher frequency? Why?
- c) Explain the chemical shift observed in the following compounds.
 - i) $\begin{array}{cc} \underline{C} Cl_4 & \underline{C} I_4 \\ 96.7 & - 292.5 \end{array}$
 - ii) 
- d) In oxygenated aliphatic compounds with alkyl groups C_3 or longer, rearrangement peaks occur in MS. Explain.
- e) Distinguish the following pair by PMR.



P.T.O.

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

a) Deduce the structure and comment on the observed coupling constants.

M.F. : C_5H_6O

PMR : 3.1 (dd, 6 & 2Hz, 1H) 3.8 (s, 3H)

4.5 (dd, 15 & 6 Hz, 1H) 6.3 (dd, 15 & 2Hz, 1H)

b) Predict the structure and justify your answer

M.F. : $C_9H_8O_3$

CMR : 115.4, 115.9, 130, 130.0, 144.2, 159.9, 168.1

DEPT 90 : 115.4, 115.9, 130, 144.2, positive

DEPT 135: 115.4, 115.9, 130, 144.2 positive

125.4, 159.9, 168.1, absent

c) Deduce the structure from the given spectral data.

M.F. : $C_8H_9NO_2$

IR : 1745 cm^{-1}

Mass : $165 (M^+)$, 106, 78

CMR : 20 (q) 58 (t) 121 (d) 123 (s) 127 (d) 150 (d) 152 (d) 163 (s)

PMR : 1.3 (t, 7Hz, 3H) 4.0 (q, 7Hz, 2H) 7.4 (dd, 7 & 5Hz, 1H)

8.3 (dt, 7 & 2Hz, 1H) 8.7 (dd, 7 & 2Hz, 1H)

9.2 (d, 2Hz, 1H)

d) An AB quartet appears at 4.1 & 3.9 δ with $J = 8\text{ Hz}$ on a 60 MHz instrument. What will be the line position in Hz on 200 MHz instrument?

e) Deduce the structure & justify your answer

M.F. : $C_9H_8O_4$

IR : $1685, 1766\text{ cm}^{-1}$

CMR : 22 (q) 121 (d, str) 124 (s) 126 (d, str) 158(s) 170(s) 172(s)

PMR : 2.4 (s, 3H) 7.2 (d, 8Hz, 2H) 8.2 (d, 8Hz, 2H) 10.8

(bs, exch. 1H)

Q3) Write short note on any three of the following. **[12]**

a) Application of HETCOR

b) Even electron rule in M.S.

c) A_2 , AB & AX spin systems



d) Nuclear Overhauser Effect

SECTION - II

Q4) a) Answer any two of the following: [8]

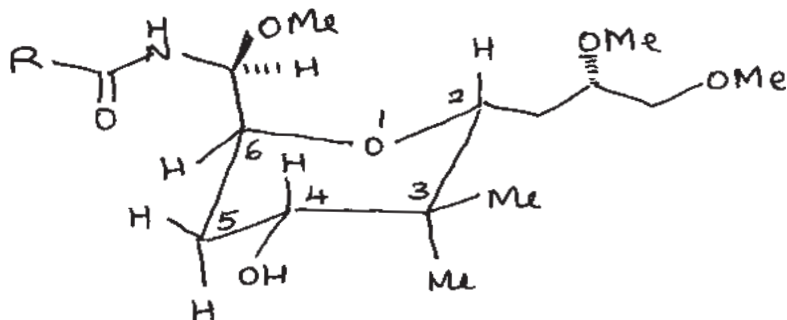
- i) What is FID detector? What are its applications.
- ii) Discuss the various parts of GCMS
- iii) Explain the theory & instrumentation of HPTLC.

b) Write the genesis of any three of the following. [9]

- i)  103, 75, 73, 45
- ii)  97, 82, 68, 41
- iii) Methyl salicylate 152, 121, 120
- iv) 2 - Nitro aniline 138, 121, 92, 80, 65

c) The product of Friedel-Crafts reaction of benzene and ethylene oxide shows a strong peak at $m/e = 92$. Write the fragmentation of the same. [3]

Q5) Assign the proton chemical shift on the numbered carbon atoms using the spin-decoupling experiment. Justify your answer. [8]



1.85 (ddd, 5, 10 & 12 Hz, 1H) 2.1 (ddd, 3, 4 & 12 Hz, 1H)
 3.75 (dd, 4 & 10 Hz, 1H) 3.85 (ddd, 3, 5 & 8 Hz, 1H) 4.0 (dd, 3 & 7 Hz, 1H)

Spin decoupling:

	Irradiation at	Change at
i)	2.1 δ	1.85 (ddd) \rightarrow (dd) 5 & 10 Hz 3.85 (ddd) \rightarrow (dd) 5 & 8 Hz 3.75 (ddd) \rightarrow (d) 10 Hz
ii)	3.85 δ	2.1 (ddd) \rightarrow (dd) 4 & 12 Hz 1.85 (ddd) \rightarrow (dd) 10 & 12 Hz

Total No. of Questions : 4]

SEAT No. :

P653

[Total No. of Pages : 2

[4125] - 309

M.Sc. (Part - II)

INORGANIC CHEMISTRY

CH - 332 : Bio - Inorganic Chemistry : Inorganic Elements in the
Chemistry of life

(2008 Pattern) (Sem. - III)

Time :3 Hours]

[Max. Marks :80

Instructions to the candidates:-

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

Q1) Answer any four :

[20]

- a) Give a brief account of the techniques useful for studying metal - nucleic acid interactions.
- b) Discuss the role of Zn (II) in carbonic anhydrase activity.
- c) Why are citrate formulations of gallium and indium less favored than oxine formulations?
- d) What is the fundamental requirement of a metal centre to participate in redox metallo enzymes? Give examples in support of your answer.
- e) Discuss the chemistry of cobalamins.

Q2) Attempt the following (any four) :

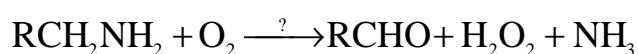
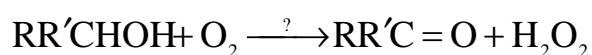
[20]

- a) Discuss and illustrate the principle of Magnetic resonance imaging used in clinical diagnosis.
- b) What are hydrogenases? Explain with the help of suitable examples the mechanism of reactions catalysed by hydrogenases.
- c) Discuss the mechanism of OH radical mediated DNA cleavage.
- d) Compare the therapeutic and diagnostic applications of radiopharmaceuticals.
- e) List the enzymes of copper along with their functions.

P.T.O.

Q3) A) Attempt any five : [15]

- Give correct reason "Cis -platin shows anticancer activity while trans-platin doesn't".
- What are cytochromes? What are their functions?
- Name at least two diseases each caused due to deficiency of copper and zinc.
- Which properties of a radio isotope make it useful for diagnostic purpose?
- Enlist the functions of catalases and peroxidases.
- Write the names of enzymes involved in the following reactions.



B) Match the following : [5]

Coenzyme F - 430

Model of Vit B - 12

Cobaloxime

Nickel

Tc (CNR)₆⁺

DNA cleavage

R_u(bipy)₃

Copper

Haemocyanin

Disproportionation of O₂

Q4) Write notes on (any four) [20]

- Radio labelling on antibodies.
- Redox chemistry involved in DNA cleavage.
- Ureases.
- MRI
- Metal complexes as conformational probes.



Total No. of Questions : 6]

SEAT No. :

P654

[Total No. of Pages : 3

[4125] - 310
M.Sc. - II
ORGANIC CHEMISTRY
CH - 350 : Organic Reaction Mechanism
(Sem. - III) (2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:-

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

SECTION - I

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

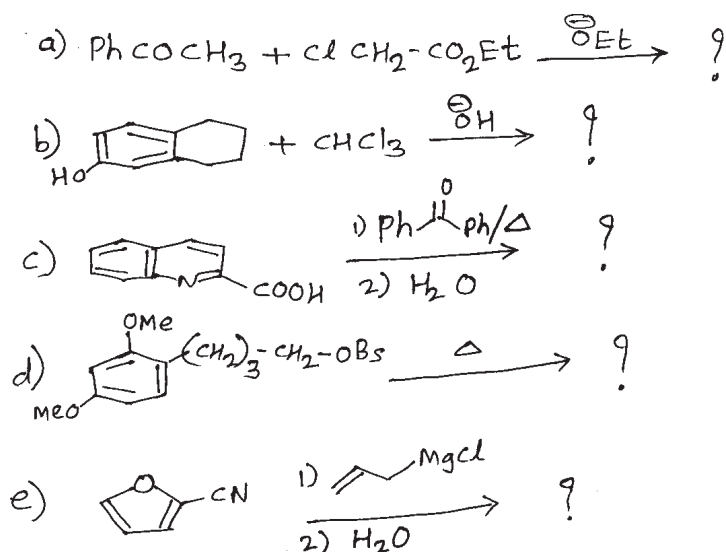
- a) Thiazolium salt $\text{Et}-\overset{\oplus}{\text{N}}\begin{array}{c} \diagup \\ \text{S} \\ \diagdown \end{array}$ acts as catalyst for benzoin condensation.
- b) Predict the sign of rho (ρ) for the following reaction giving reasons.
 - i) $\text{ArCOCl} + \text{EtOH} \longrightarrow \text{ArCOOEt} + \text{HCl}$
 - ii) $\text{Ar}-\text{H} + \text{Br}_2 \longrightarrow \text{ArBr} + \text{HBr}$
- c) From the given data calculate how much faster p - bromobenzyl chloride will solvolyse in water than p - nitrobenzyl chloride.
 $\text{Ar}-\text{CH}_2-\text{Cl} + \text{H}_2\text{O} \longrightarrow \text{Ar}-\text{CH}_2-\text{OH} + \text{HCl} \quad \rho = -1.31$
 $\sigma_{\text{P}}-\text{Br} = 0.23; \sigma_{\text{P}}-\text{NO}_2 = 0.78.$
- d) Explain the significance of σ and ρ .
- e) Pyridine - Z - carboxylic acid decarboxylates faster than its 3-or 4-isomer.

Q2) Write short note on any three of the following : **[12]**

- a) Kinetic isotope effect to determine reaction mechanism.
- b) Zinc carbenoid.
- c) Robinson annulation.
- d) Stetter reagent.

P.T.O.

Q3) Predict the products with mechanism for any four of the following [16]

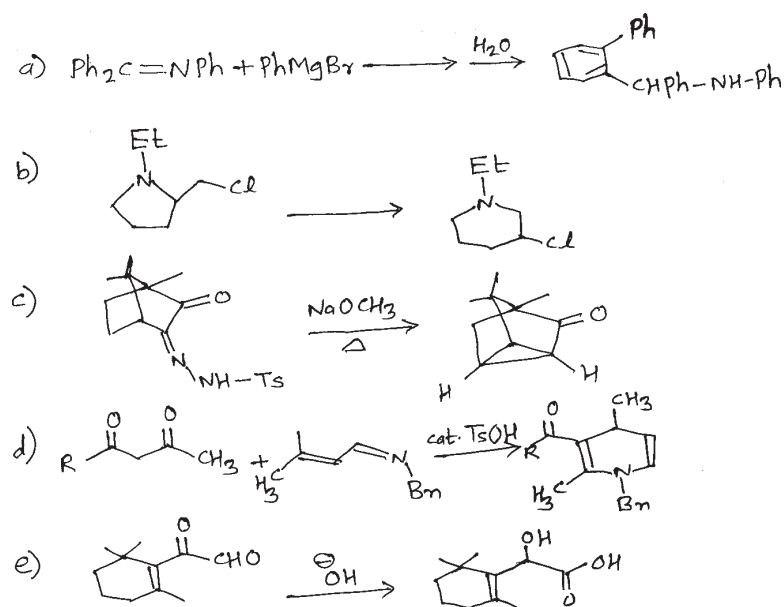


SECTION - II

Q4) Explain any four of the following : [12]

- Hydrolysis of $\text{O}_2\text{N-C}_6\text{H}_4\text{-S-CH}_2\text{-CH}_2\text{-Cl}$ is considerably slower than that of $\text{Et-S-CH}_2\text{-CH}_2\text{-Cl}$.
- The α -methylation of ketones with methyl iodide is much more effectively catalysed by dimethylamine than by trimethylamine.
- Reduction of pyruvic acid by NADH, write full structure of NHDH.
- Any suitable rearrangement involving carbene as intermediate.
- How will you prove the formation of cyclopropanone as a intermediate in favorskii rearrangement.

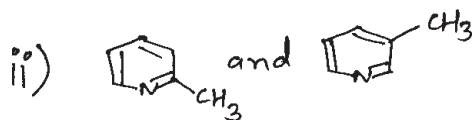
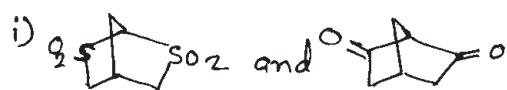
Q5) Suggest the mechanism for any four of the following : [16]



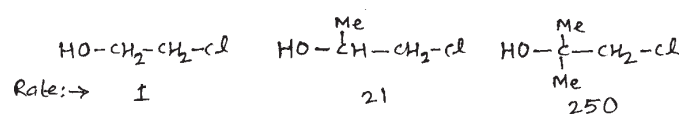
Q6) Answer any four of the following :

[12]

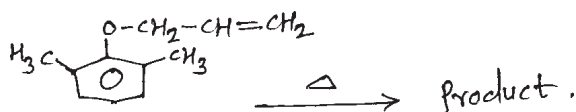
- a) Predict which member in each of the following pair is stronger acid. Justify.



- b) Thio ester hydrolysis occurs more rapidly than ordinary ester hydrolysis.
 c) Epoxide formation is facilitated by alkyl substitution.



- d) Substitution at β - position reduces the rate of hydrolysis in $A_{Ac}2$ mechanism. Explain.
 e) How does the labelling technique help in deducing the reaction mechanism of paraclaisen rearrangement.



[4125] - 311

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

ORGANIC CHEMISTRY

CH - 351 : Spectroscopic Methods in Structure Determination
(2008 Pattern)

Time : 3 Hours]

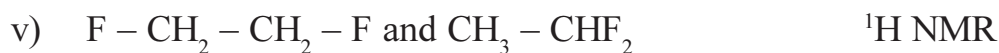
[Max. Marks : 80

Instructions to the candidates:-

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

SECTION - I

Q1) a) Differentiate between the following pairs by using the indicated spectral methods. (any four) [8]



b) Using following spectral data, find the structure of the compound. [4]

M.F. : C₁₃H₁₈N₂O

IR : 1680, 1610, 1510, 730, 690 cm⁻¹.

¹H NMR (δ) : 7.25 (m, 5H),

5.00 (s, 1H, Exchangeable with D₂O),

3.00 (s, 2H),

2.3 (q, J = 6Hz, 2H),

1.1 (t, J = 6Hz, 3H).

Q2) Answer any four of the following :

[16]

a) Deduce the structure.

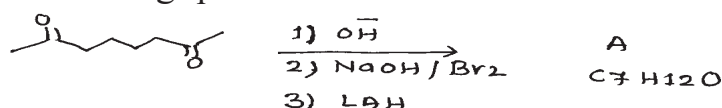
Elemental analysis C = 64.3%, H = 8.8%

IR : 1195, 1670, 1720 cm^{-1}

Mass (m/e) : 114, 99, 86, 69, 41

^1H NMR(δ) : 1.3 (t, J = 7 Hz, 3H), 2.0(d, J = 7Hz, 3H),
4.2 (a, J = 7 Hz, 2H), 5.8(d, J = 16 Hz, 1H),
6.9 (da, J = 7, 16 Hz, 1H).

b) A diketone undergoes following reactions giving a cyclic compound A, which shows following spectral data. Find the structure of the compound A.



UV : Transparent above 210 nm.

IR : 3400 cm^{-1}

PMR : 1.63 δ (s, 3H), 1.7 - 1.8 δ (m, 2H), 2.05 δ
(bs, exchangeable), 2.33 - 2.44 δ (m, 4H), 4.11 δ (s, 2H)

CMR : 13.7 (q), 21.6 (t), 34.2(t), 38.8(t), 89.1(t), 134.3 (s), 135.7 (s).

c) Deduce the structure.

M.F. = $\text{C}_7\text{H}_{14}\text{O}_2$

Mass (m/e) = 130, 115, 100, 73, 43.

CMR : 208 (s), 75(s), 54(t), 50(a), 33(q), 25(q, Strong).

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

d) Deduce the structure.

MF : $\text{C}_5\text{H}_{10}\text{O}_3$

IR : 1728 cm^{-1}

^1H NMR : 2.1 δ (s, 3H), 3.35 δ (s, 6H), 4.6 δ (s, 1H).

CMR : 25, 55, 104, 204.

DEPT 90 : 25, 55, 204, No peak
104 up.

DEPT 135: 204 No peak
25, 55, 104 up

e) Deduce the structure

M.F. : $\text{C}_8\text{H}_{13}\text{NO}_3$

IR : 1690, 1725 cm^{-1}

^1H NMR (δ) ; 4.25 (a, J = 6.7 Hz, 2H),
3.8 (t, J = 7 Hz, 4H)
2.45 (t, J = 7 Hz, 4H),
1.3 (t, J = 6.7 Hz, 3H).

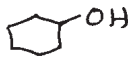
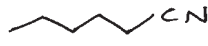

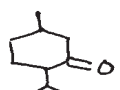
CMR : 207(s), 155(s), 62(t), 43(t), 41(t), 15(q)

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

- Mc - Lafferty - rearrangement.
- Shifts reagents in NMR spectroscopy.
- Importance of DEPT technique in ^{13}C NMR spectroscopy.
- Metastable ions.

SECTION - II

Q4) a) Write the genesis of the ions. (any four) **[12]**

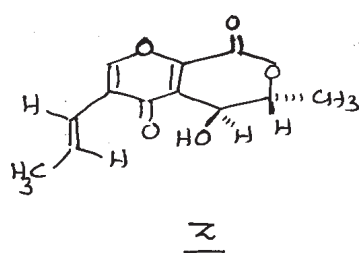
-  100, 99, 57.
- Ethyl isobutyl ether 102, 87, 73
-  97, 82, 68.
-  104, 61, 47.
-  112, 84, 69.

b) Two isomeric methyl ethers with MF. $\text{C}_5\text{H}_{12}\text{O}$ have following mass spectra. Identify which is which. **[4]**

X : 88, 56, 45(100), 41, 29, 27.

Y : 73, 59 (100), 45, 41, 29.

Q5) a) Compound z shows following signals. Assign signals to different protons using decoupling experiments given below. Justify your answer. **[8]**

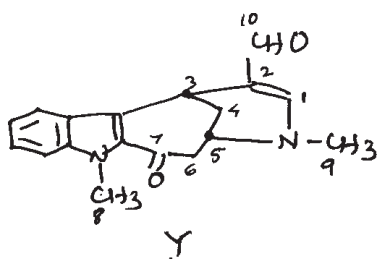


- 1.65 (d, $J = 7\text{Hz}$, 3H),
- 1.97 (dd, $J = 6 \ \& \ 1.5\text{Hz}$, 3H),
- 3.86 (bs, exchangeable, 1H),
- 3.92 (d, $J = 5\text{Hz}$, 1H),
- 4.32 (da, $J = 7 \ \& \ 5\text{Hz}$, 1H),
- 5.87 (d, $J = 2\text{Hz}$, 1H)
- 6.06 (ddq, $J = 16, 2, 1.5 \text{ Hz}$, 1H),
- 6.99 (dq, $J = 6 \ \& \ 16\text{Hz}$, 1H)

Spin decoupling Experiment

- | Irradiation at | Change at |
|----------------|--------------------------------|
| i) 6.06 | 5.87 (s) |
| | 6.99 (a, $J = 6 \text{ Hz}$), |
| | 1.97 (d, $J = 6 \text{ Hz}$). |
| ii) 3.92 | 4.32 (q, $J = 7 \text{ Hz}$). |

- b) Assign the signals to the numbered carbons in the structure y. Justify your answer. [4]



23.9 (s, w), 30.7(t)

41.5 (a), 48(t)

54.4 (d), 125.6(s, w),

153.1 (d), 184.9 (d),

193.6 (s, weak).

- Q6) Deduce the structure of the compound using the spectral information given. Justify your answer. [12]

MASS SPECTRAL DATA

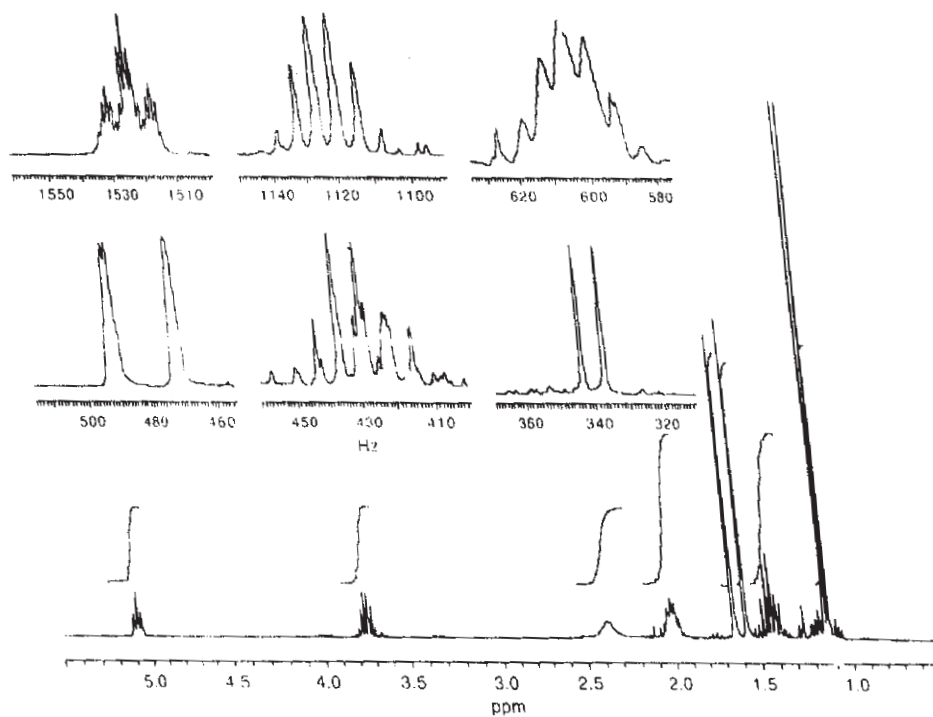
FM (found) = 128.1203

peaks at m/z 128, 113, 110, and 95 (base peak)

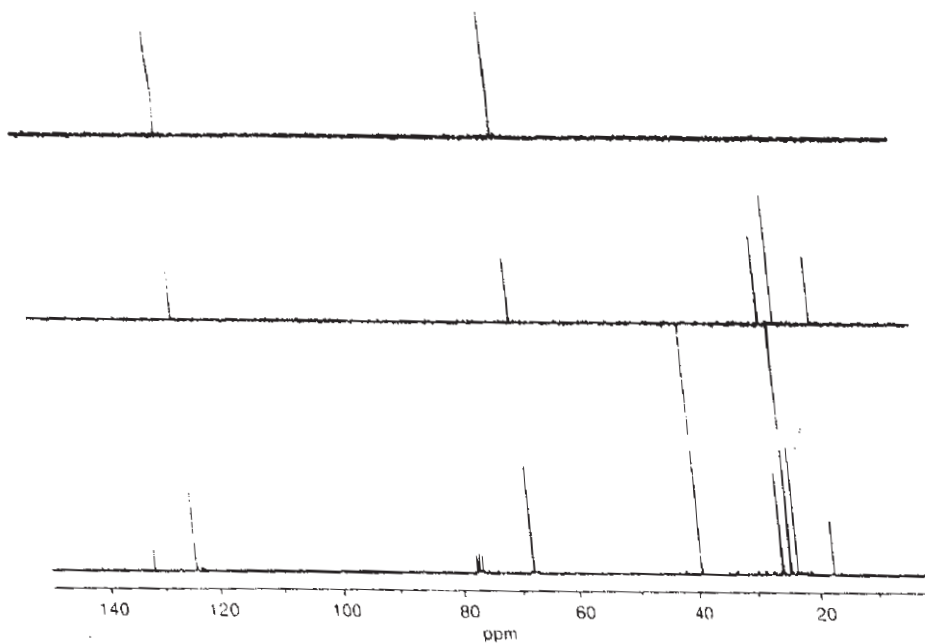
INFRARED DATUM

broad, s at $\approx 3300\text{ cm}^{-1}$

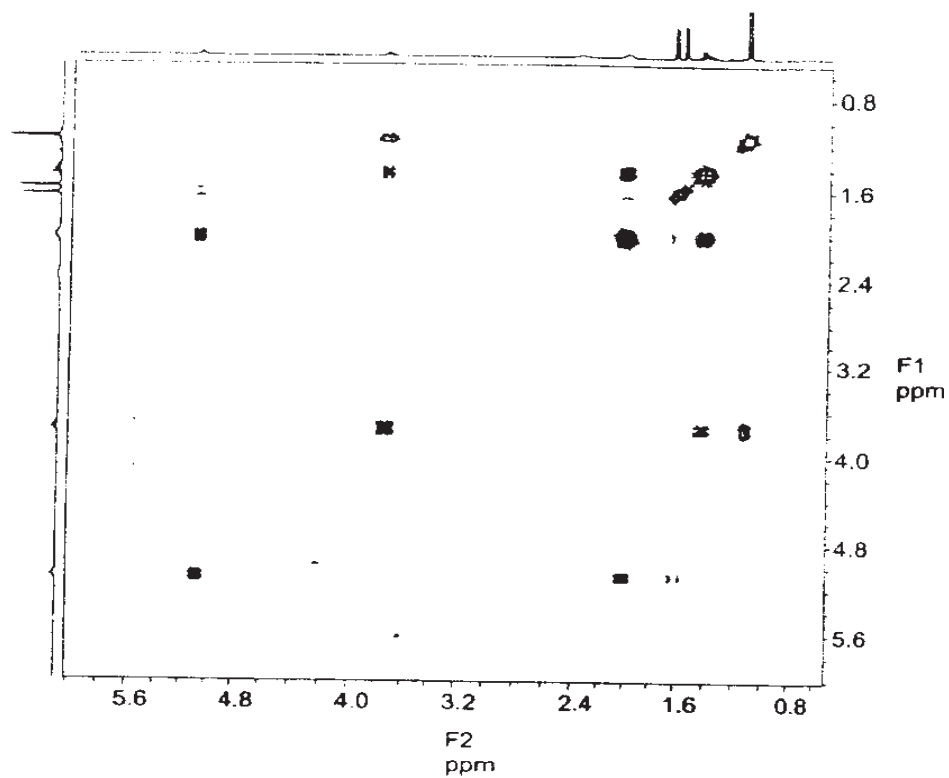
^1H NMR



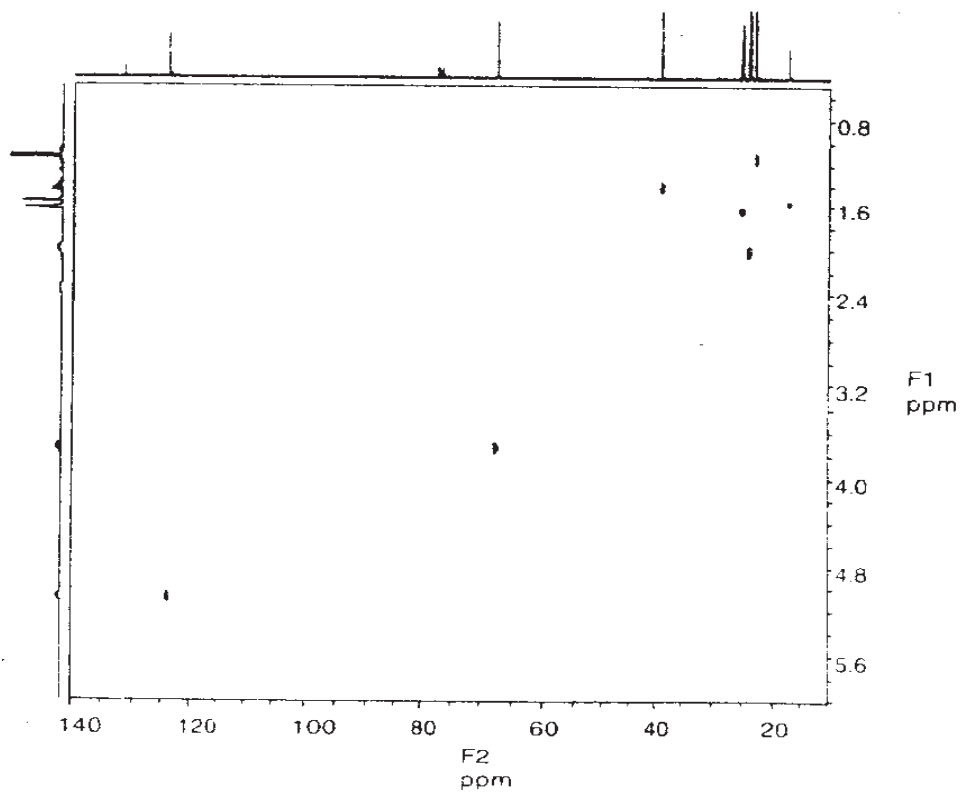
$^{13}\text{C}/\text{DEPT}$



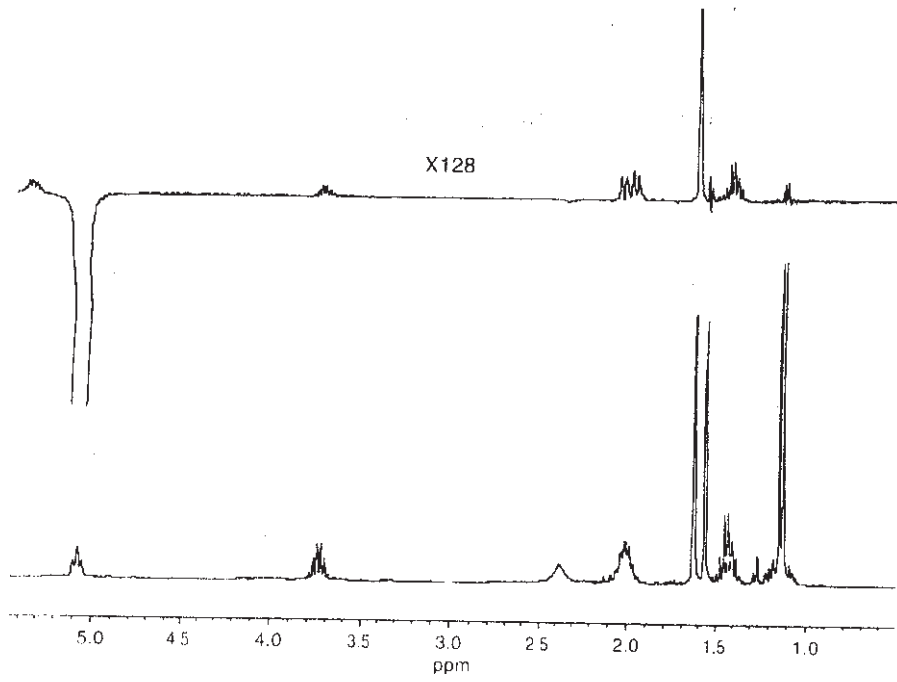
COSY



HETCOR



NOE, DIFFERENCE IRRADIATED at δ 5.08



[4125] - 312
M.Sc. - II
ORGANIC CHEMISTRY
CH - 352 : Organic Stereo Chemistry
(Sem. - III) (2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

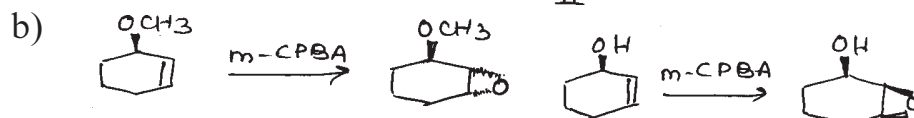
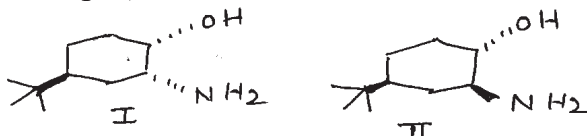
Instructions to the candidates:-

- 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 - IQ1) Answer any four of the following :

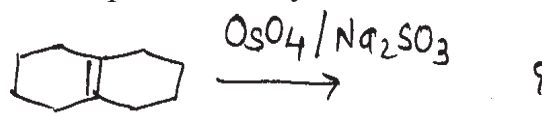
[16]

- a) Write the products when I & II are treated with
- $\text{HNO}_2 / \text{H}^+$



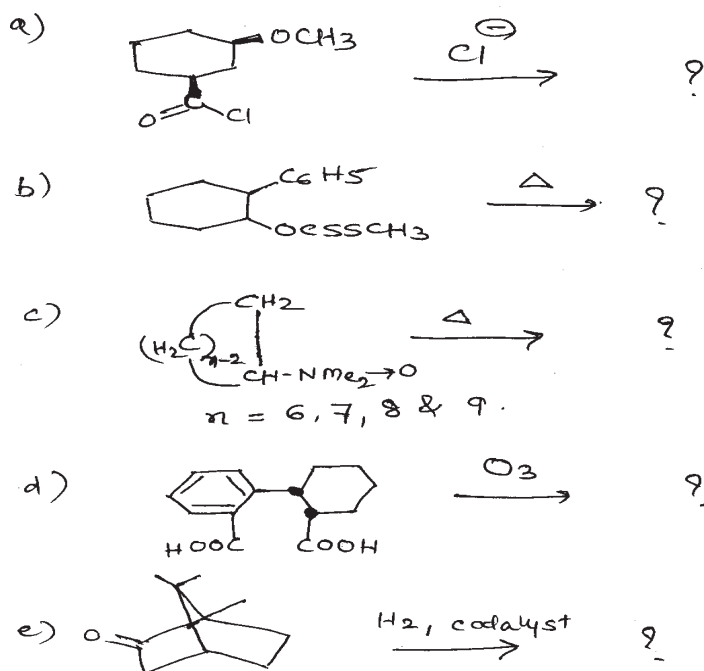
Explain the difference in the stereo chemistry of the product formed in the above set of reactions.

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



- d) Trans - 4 - t - butylcyclohexanol is more strongly adsorbed on alumina than cis isomer. Explain.
- e) Transdecalin is more stable than cis - decalin. Explain. show energy calculations.

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



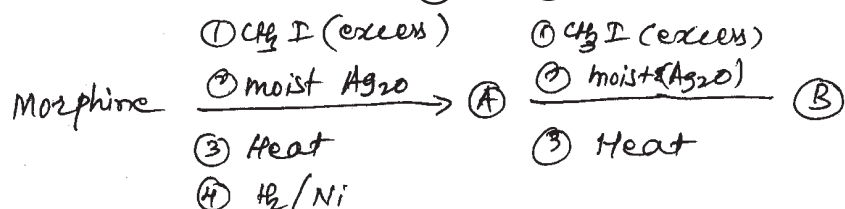
Q3) Attempt any three of the following : [12]

- Write a note on I strain.
- Acetolysis of optically active trans - 3 - chloro - 5 - methylcyclohex - 1 - ene gives racemic mixture of cis and trans acetate. Explain.
- Describe the stability of hydrindanes as a function of temperature. Justify.
- Describe different properties which should be fulfilled by a resolving agent used in resolution by formation of diastereoisomers.

SECTION - II

Q4) Answer the following (any three) [12]

- How relative configuration in codeine at C₅ and C₆ is deduced.
- Draw the stereostructure for (A) and (B) in the following reaction.

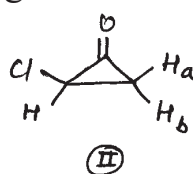
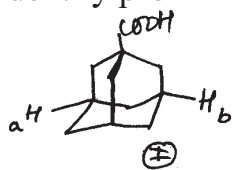


- How will you use NMR spectroscopy and chemical reaction to establish lactone ring fusion to enhyclrin.
- Prove that cinchonidine and cinchonine have different configuration at C₈.

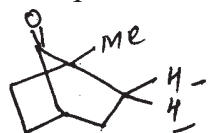
Q5) Attempt the following (any four)

[12]

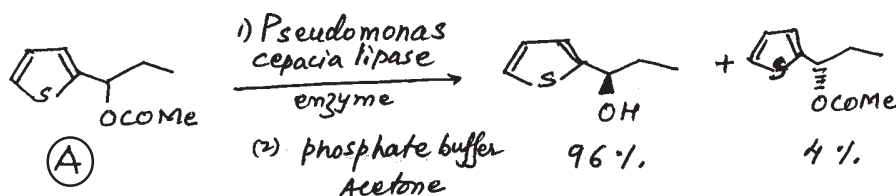
- a) Identify pro - R - and pro - S - hydrogen atoms in the compound I and II.



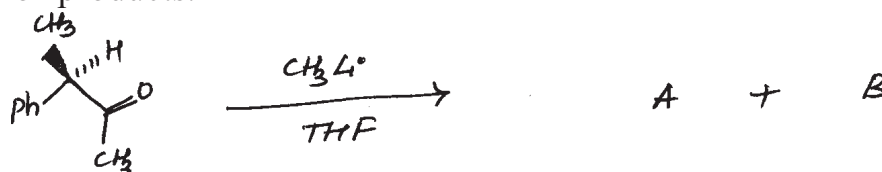
- b) Are the faces of the carbonyl groups in compound A and B are homotopic, enantiotopic and cliastereotopic



- c) Explain the diastereomeric excess and calculate de in the following enzyme catalyses hydrolysis of (A) ester.

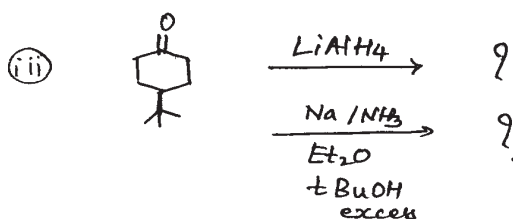
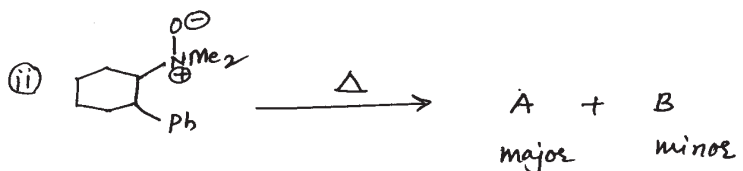
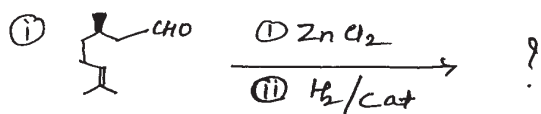


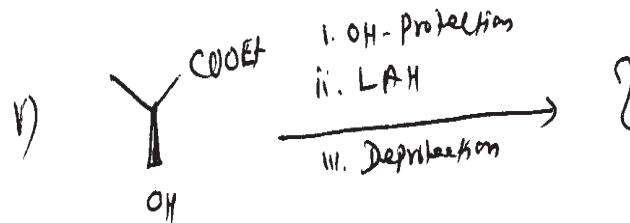
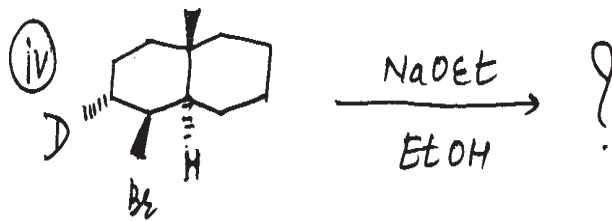
- d) Using Cram's rule rationalise the following reaction, Write major and minor products.



- e) Write a note on "Chiral auxiliary".

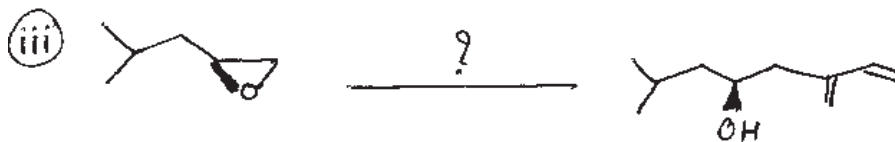
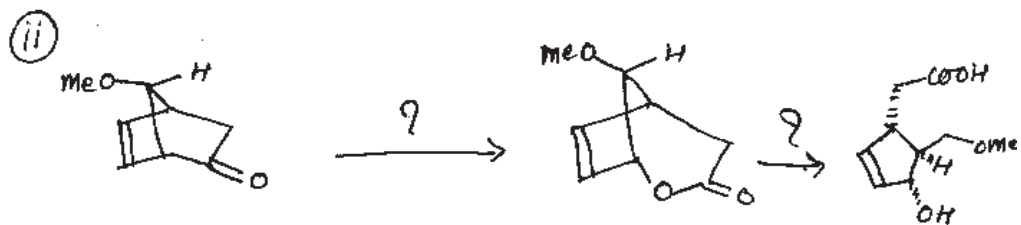
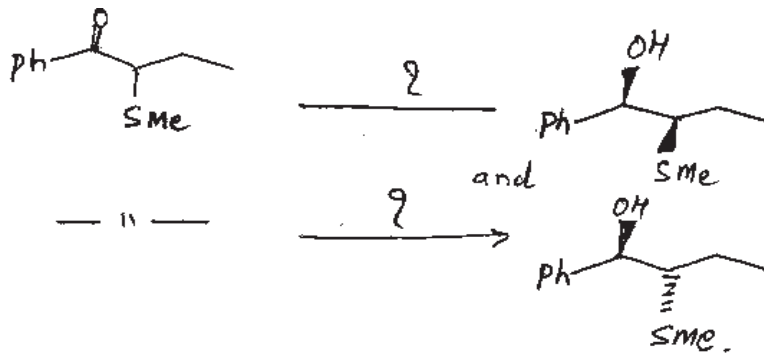
Q6) a) Predict the product/s in the following reactions. Explain the stereochemistry and mechanism in details. (any four) [8]





b) Attempt any two of the following [8]

i) Suggest the reagent/s and stereochemistry of the following reactions.



[4125] - 313

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

ORGANIC CHEMISTRY

CH - 353 : Free Radicals, Photochemistry and Pericyclic
Reactions & their Applications
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:-

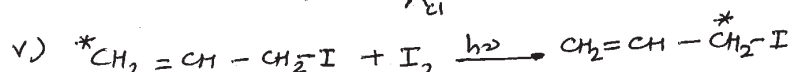
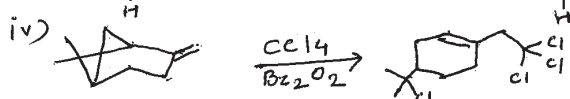
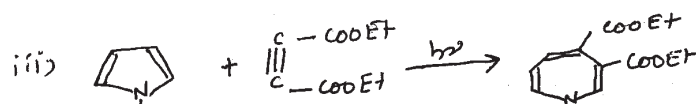
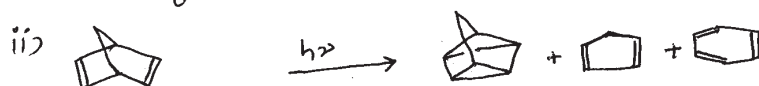
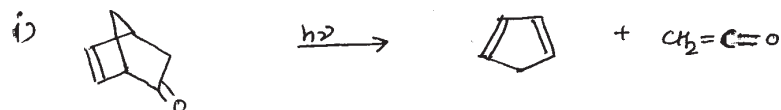
- 1) All questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Answers to the two sections should be written in separate answer books.

SECTION - IQ1) a) Write short notes on any two of the following [8]

- i) Decomposition of diacyl peroxides.
- ii) Photoisomerisation of benzene.
- iii) Norrish type I reaction of saturated cyclic ketones.

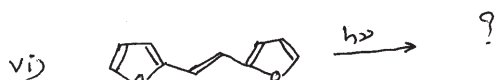
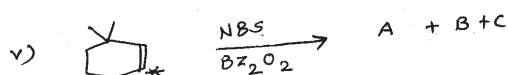
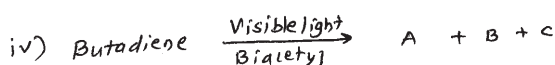
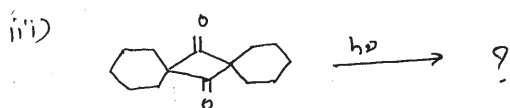
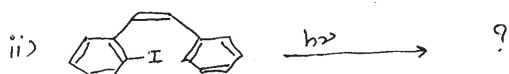
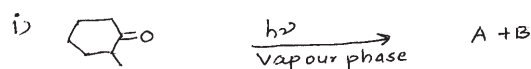
b) Explain any two of the following [6]

- i) 1, 3, 5 - Trimethyl benzene on irradiation. With UV light gives 1,2,4 - trimethyl benzene.
- ii) Synthetic application of Barton reaction.
- iii) Photochemistry of diazo compounds.

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

Q3) a) The peroxy ester $\text{PhCH}=\text{CHCH}_2-\overset{\text{O}}{\parallel}{\text{C}}-\text{O}-\text{O}-\text{CMe}_3$ decomposes about 5000 times as rapidly as t-butyl peroxy acetate. [4]

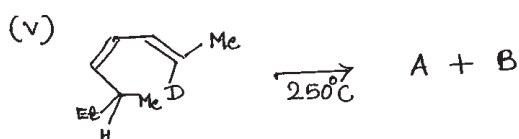
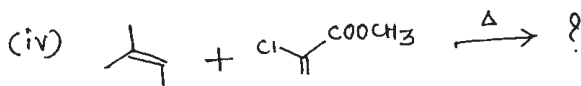
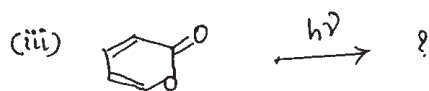
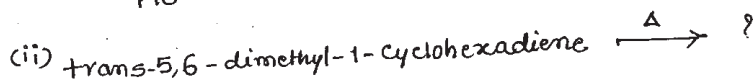
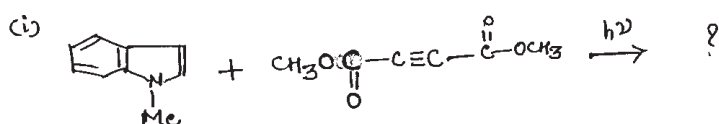
b) Predict the product/s indicating mechanism in any five of the following : [10]



SECTION - II

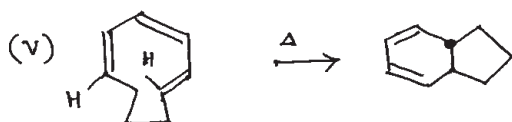
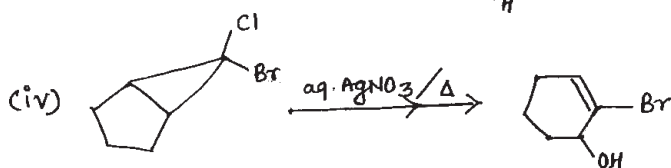
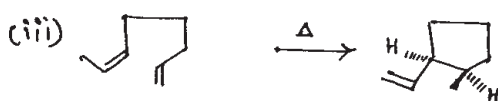
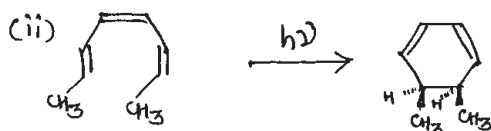
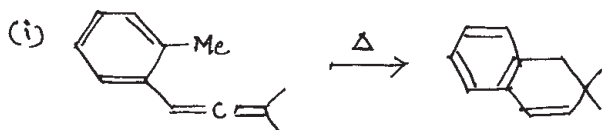
Q4) a) Using PMOs, develop correlation diagram for $(\pi^4\text{S} + \pi^2\text{S})$ cycloaddition reaction. Predict whether the reaction is thermally allowed. [6]

b) Predict the product/s in any four of the following reactions. Explain their stereochemistry and mechanism. [8]

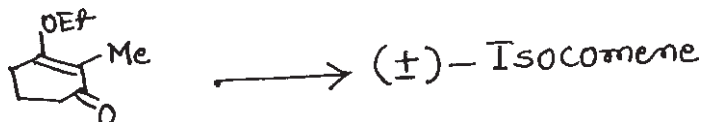


Q5) a) Draw correlation diagram for conrotatory ring closing of allyl carbanion to give cyclopropanyl anion. Justify whether the reaction is thermally allowed. [4]

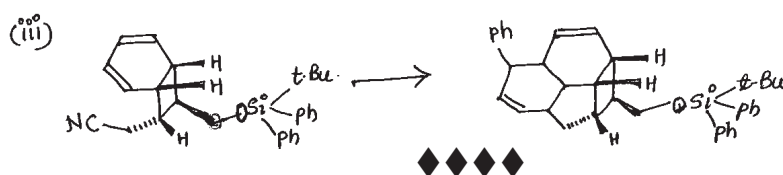
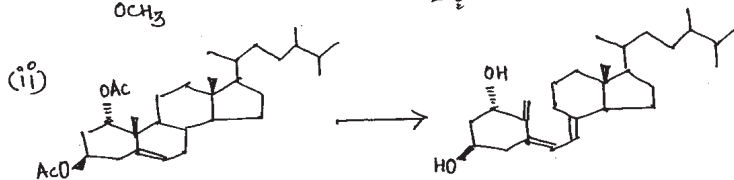
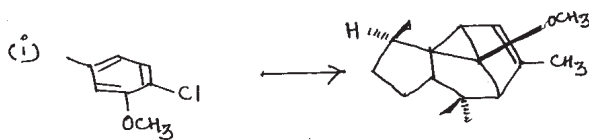
b) Explain mechanism for any four of the following [8]



Q6) a) Outline the synthesis giving reagents required and intermediates involved. [6]



b) Complete any two synthetic sequences mentioning reagents and intermediates formed in steps. [8]



Total No. of Questions : 4]

SEAT No. :

P658

[Total No. of Pages : 3

[4125] - 314
M.Sc. - II (Sem. - III)
ANALYTICAL CHEMISTRY
CH - 390 : Electro Analytical and Current Analytical
Methods in Industries.
(2008 Pattern)

Time :3 Hours]

[Max. Marks :80

Instructions to the candidates:-

- 1) *All questions are compulsory.*
- 2) *Neat diagrams must be drawn wherever necessary.*
- 3) *Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
- 4) *Answers to the two sections should be written in separate books.*

SECTION - I

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

- a) Describe the potential ramp used in square wave polarography. Mention difference between pulse polarography and square wave polarography.
- b) Define Residual current. Why in polarographic analysis it is necessary to remove oxygen from the solution? Explain the method for removal of oxygen.
- c) What are the advantages of DME over a solid micro electrode? Compare the usefulness of DME as a cathode and as a anode.
- d) The diffusion coefficient of oxygen at 25°C in aqueous solution is $2.65 \times 10^{-5} \text{CM}^2\text{S}^{-1}$. A DME with mercury flow rate 1.85 mg per sec and drop time is 3.6 sec per drop. The instantaneous diffusion current of first oxygen was 2.3 μA . Calculate the concentration of dissolved oxygen in water.
- e) The following tabulated data were obtained during the amperometric titration with two indicator electrodes of 25.0 ml solution of iodine with 0.12 m thiosulphate. Calculate the concentration of iodine in the original solution.

Volume of thiosulphate (ml)	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5.0	6.0
Current (μA)	12.0	11.5	11.0	9.0	6.3	0.4	0.3	0.3	0.3	0.3

P.T.O.

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

- a) What is meant by stripping voltametry? What is the purpose of the electrodeposition step in stripping analysis?
- b) Draw the block diagram and explain the working of controlled potential coulometer.
- c) Explain the technique of amperometry. Draw its experimental set - up. Mention its important applications.
- d) The purity of a sample of $\text{Na}_2\text{S}_2\text{O}_3$ was determined by a coulometric redox titration using I^- as a mediator, and I_3^- as a 'titrant'. A sample weighing 0.1342 g is transferred to a 100 ml volumetric flask and diluted to volume with distilled water. A 10.00 ml portion is transferred to an electrochemical cell along with 25 ml of 1M KI, 75 ml of a pH7.0 Phosphate buffer, and several drops of starch indicator solution. Electrolysis at a constant current of 36.45 mA required 221.8 sec to reach the starch indicator end point. Determine the purity of the sample
- e) A sample of nickel ore weighing 3.18 g is dissolved in acid and the nickel is electrolysed using constant current of 2.5 A for 10 min. Calculate the percentage of nickel in the ore.

[Given : Atomic weight of Ni = 58.7]

SECTION - II

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

- a) Give the principle of neutron activation analysis. Discuss the steps involved in NAA.
- b) Discuss the principle of double isotope dilution analysis. Explain how isotope dilution analysis is used to assess the volume of blood in patient.
- c) Discuss the principle and technique of radiometric titration. Draw and describe the nature of radiometric titration curve when only titrant is radioactive.
- d) 100 mg piece of a gold ornament containing 90 percent pure gold was irradiated with thermal neutrons at 2.1×10^{11} neutron per cm^2 per sec. For 2 days producing $^{198}_{\text{Au}}$ ($t_{1/2} = 2.7d.$). Calculate the activity of $^{198}_{\text{Au}}$ in terms of counts per second at the end of irradiation. $^{197}_{\text{Au}}$ is monoisotopic with neutron capture cross section 99b. [Given : $\epsilon = 10\%$].
- e) 10 cm^3 of KCl labelled with ^{36}Cl was titrated with 0.01 M AgNO_3 . Addition of 1 ml of titrant followed by removal of precipitate showed a loss in the activity from 10,000 counts for 5 min to 1500 counts for 2 min. Calculate the amount of KCl in the original solution.

[Given : atomic weights : K = 39.5 and Cl = 35.5]

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

- a) Give the criteria to prefer Turbidometry or Nephelometry as an analytical tool. Describe with suitable example any one application of nephelometry in analytical chemistry.
- b) Explain the differential thermal analysis technique with suitable examples.
- c) Draw a schematic diagram and describe the parts of a modern thermo balance. Give an account of furnace temperature measuring system in thermobalance.
- d) Write a note on Electro chemical sensors.
- e) A TGA curve was obtained for 3.55 mg of calcite sample. The weight loss was 0.85 mg at 950°C by complete decomposition of calcite. Calculate the percentage of CaCO_3 in the calcite sample.
[Given : Atomic weight of Ca = 40, C = 12, O = 16]



Total No. of Questions : 4]

SEAT No. :

P659

[Total No. of Pages : 3

[4125] - 315

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 391 : Environmental and Analysis of Industrial Materials
(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 tables, non - programmable calculator is allowed.*

SECTION - I

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

- a) Describe alkalimetric ammonium molybdophosphate method to estimate phosphorous in the given sample of fertilizer containing phosphorous.
- b) Give an analytical procedure for determination of lead from sample of lead glass.
- c) Explain the term cosmetics. Give the procedure for the estimation of magnesium from cosmetics.
- d) Explain the term propellant and explosive. Describe analytical method for determination of calcium in propellant.
- e) 8.75 gm sample of glass was analysed for barium and lead content by suitable method. It gave 0.840 gm of BaSO₄ and 0.605 gm of PbO₂. Calculate percentage of BaO and pbO in the sample.
[Given : Ba = 137, S = 32, O = 16, pb = 207]

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

- a) What is detergent? Give an analytical method for the determination of iron from detergents.
- b) What are pigments? Discuss the analytical method for estimation of zinc from sample of pigment.
- c) What is sampling? Mention the methods of sampling. Explain the method used for sampling of explosive.

P.T.O.

- d) From 0.250 g of a sample, Calcium was precipitated as calcium oxalate. The solution obtained after dissolution of the precipitate of calcium oxalate required 26 ml of 0.05 N KMnO_4 solution for the titration. Calculate percentage of calcium and calcium oxide.
[Given : At. Wts. Ca = 40, O = 16, C = 12]
- e) 0.4 gm of a sample containing zinc was disintegrated by using acid. The solution was diluted to 100 ml. An aliquot of 25 ml required 14 ml 0.011 M EDTA solution. Calculate the percentage of zinc in the sample.
[Given : At Wts. - $Z_n = 65.33$]

SECTION - II

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

- a) Discuss the method of extraction and estimation of aluminium from bauxite ore sample.
- b) Explain the analytical procedure for estimation of manganese from steel.
- c) Outline the analytical procedure for the determination of any one of the following :
- i) Calcium from Dolomite
 - ii) Copper from brass alloy.
- d) 0.5 g of shipnail brass sample was dissolved in acid. The solution was filtered to separate SnO_2 . The weight of the residue, SnO_2 , was 0.035 gm. The filtrate was used for estimation of pb by suitable method. The weight of the PbSO_4 Obtained was - 0.120 g. Calculate the percentage of Sn and pb in the sample.
[Given : At. wts. O = 16, Sn = 118.7, Pb = 207, S = 32].
- e) A bronze sample weighing 0.3 gm was dissolved by acid. The solution was filtered to separate SnO_2 . The filtrate was diluted to 100 ml. An aliquot of 10 ml required 14 ml of $\text{Na}_2\text{S}_2\text{O}_3$ solution in - iodometric titration. 10 ml of standard 0.025 N $\text{K}_2\text{Cr}_2\text{O}_7$ solution required 12 ml of the same $\text{Na}_2\text{S}_2\text{O}_3$ Solution. Calculate the percentage of copper in the sample.
[Given : At. Wts . Cu = 63.5]

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

- a) Give analytical method for the estimation of cyanide from waste water.
- b) Explain activated sludge process for waste water treatment.

- c) Mention the meaning of following terms :
- i) Aerosol.
 - ii) BOD
 - iii) COD
 - iv) Mist
 - v) Dust
- d) Write note on (any one).
- i) Trickling filtration process for waste water treatment.
 - ii) Settling chambers.
- e) Define sludge. Explain different methods of sludge disposal.



Total No. of Questions : 4]

SEAT No. :

P660

[Total No. of Pages : 2

[4125] - 316
M.Sc. - II (Sem. - III)
ANALYTICAL CHEMISTRY
CH - 392 : Advanced Analytical Techniques
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:-

- 1) Answer to the two sections should be written in separate answer books.*
- 2) All questions are compulsory and carry equal marks.*
- 3) Neat diagrams must be drawn wherever necessary.*
- 4) Use of non - programmable calculator / logarithmic table is allowed.*
- 5) Use of graph paper is allowed.*

SECTION - I

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

- a) State and explain Faraday's law of electrolysis. Give its important applications.
- b) State and explain the principle and working of current and voltage measuring devices with one typical example.
- c) Draw and explain the band structure of conductor, insulator and semiconductor. Mention important applications of semiconductor.
- d) Calculate the binary equivalent of 7497 and the decimal equivalent of 1110001011.
- e) Calculate the output voltage of the transformer with turn ratio 5 : 1 when voltage of 120 V is applied to the primary coil.

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

- a) What is OPAMP? State its important applications.
- b) Describe the role of microprocessor control in AAS.
- c) Write a note on flow injection analyzer.
- d) Draw the configurations of n - type and p - type semiconductors. Give their important properties and mode of action.
- e) Three capacitors 3 μf , 6 μf and 4 μf are connected along with unknown in series across 230 V of d.c. supply, the total capacitance is 1 μf . Calculate the unknown capacitance and voltage across each capacitor.

P.T.O.

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) Explain the internal standard method in AAS with suitable example.
- c) Compare the techniques inductively coupled plasma spectroscopy and direct current plasma emission spectroscopy.
- d) A solution of a sample of plant ash gave a meter reading 40. To solution B and C containing the same quantity of unknown solution 45 and 85 mg/ml of potassium were added, meter reading of 70 and 95 respectively calculate the concentration of potassium in the sample.
- e) Magnesium in blood serum can be determined by AAS. A 5.0 ml serum sample was diluted to 100 ml and its absorbance was found to be 0.125. A standard containing $2 \times 10^{-5}M$ of Mg^{2+} gave the absorbance of 0.187. Calculate the magnesium concentration in milligram percent in sample of blood. [Given : Atomic mass of Mg = 24.0 gm mol⁻¹]

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

- a) Give a comparative account of Atomic mass spectrometry and molecular mass spectrometry.
- b) Explain Enzyme - linked immunosorbent assay with respect to principle, practical aspects and applications.
- c) Describe how the laser enhanced ionisation technique is useful for detection of various gases, liquids and solids.
- d) Define spectrum. Describe in brief the principle and mechanism of emission, fluorescence and absorption spectra.
- e) A 400 mg sample of hair from a young child is digested in HNO_3 - $HClO_4$ and diluted to 25 ml. A 10 ml. aliquot is diluted to 25ml and analysed with a cadmium hollow cathode tube. The absorbance reading is 0.13. To a second 10 ml aliquot 1ml of a 0.400 ppm standard. Cadmium solution is added followed by dilution to 25 ml and analysed for cadmium. The absorbance reading is 0.18. Calculate the cadmium content in the hair sample and compare it with the mean value of 3.3 ppm found for children.



Total No. of Questions : 4]

SEAT No. :

P661

[Total No. of Pages : 2

[4125] - 317
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 380 : Pharmaceutical Analysis
(2008 Pattern) (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.*
- 3) *Use of logarithmic table / non - programmable calculator is allowed.*

SECTION - I

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

- a) Explain process errors and packing errors in pharma industries.
- b) How stability study is used to determine the shelf life of drug?
- c) Give the procedure for photometric determination of haemoglobin.
- d) What is limit test? Explain the procedure for limit test of lead.
- e) 1.12 g of salicylic acid ($C_{10}H_8O$) sample was dissolved in 15 ml ethanol. To this 50 ml of 0.5 m sodium hydroxide solution was added and solution was soiled for 15 minutes. On cooling, excess of alkali was titrated with 0.5 m hydrochloric acid solution using phenol red indicator. The titre reading was 25.0 ml. The blank titration reading was 49.8 ml. Determine the percentage of salicylic acid in the sample.

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

- a) Mention the significance of ash value for vegetable drugs and how water soluble ash in ginger is determined?
- b) How trace water is determined from pharmaceutical preparation?
- c) Describe in detail microbial assay of anepicidin.
- d) Write a note on blood and blood products.
- e) 0.29 g oxyphenbutazone ($C_{19}H_{20}N_2O_3 \cdot H_2O$) sample was dissolved in 25 ml acetone and solution was titrated with 0.1 N sodium hydroxide using bromothymol blue indicator. The titration reading was 7.9 ml. Calculate the percentage of oxyphenbutazone in the sample.

P.T.O.

SECTION - II

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

- a) Describe in detail disintegration test for tablets.
- b) What are aerosols? How are they prepared? Give their advantages.
- c) What are tablets? Give assay of aspirin from APC tablets.
- d) Differentiate between ointments and creams.
- e) 0.59 g ascorbic acid ($C_6H_8O_6$) sample was dissolved in 25 ml water and diluted to 100 ml. 10 ml of this sample solution was titrated with 0.1 N iodine solution using starch indicator. The titration reading was 6.5 ml. Determine the percentage of ascorbic acid in the sample.

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

- a) Explain the role of lubricants, disintegrants and antiadherents in tablet preparation.
- b) Differentiate between solutions and suspensions with suitable examples.
- c) Give an account of gas sterilization of pharmaceutical products.
- d) Explain three phases in the clinical evaluation of investigational new drug (IND)
- e) An accurately weighed sulphadiazine ($C_{10}H_{10}N_4O_2S$) sample, 0.35g; was dissolved in a mixture of 50 ml water and 10 ml concentrated hydrochloric acid. On cooling the solution to 5°C, it was titrated against 0.1 m sodium nitrite solution. The titre reading was 13.5 ml. Calculate the percentage of sulphadiazine in the sample.



Total No. of Questions : 6]

SEAT No. :

P663

[4125]-402

[Total No. of Pages : 3

M.Sc. (Sem. - IV)

PHYSICAL CHEMISTRY

**CH - 411 : Surface and Electro Chemistry
(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) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicates full marks.*
- 5) *Use of logarithmic table/calculator is allowed.*

Physico-Chemical Constants

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

P.T.O.

SECTION - I

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

- a) Write Gibb's equation, explain the terms involved in it and describe any one experimental method for its verification.
- b) Starting from chemical potential of adsorbate, in equilibrium for adsorption and desorption process, derive equation for heat of adsorption.
- c) Describe volumetric method for measurement of adsorption of gas on solid.
- d) Define the terms adsorption isotherm, adsorption isobar and adsorption isoster. Explain Brunauer's five types of characteristic isotherms.
- e) What is floatation? Explain its mechanism.

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

- a) Describe briefly polanyi potential theory of multilayer adsorption.
- b) Discuss modelless method for obtaining pore size distribution in case of porous solids.
- c) Write a short note on heterohomogeneous catalysis.
- d) What are zeolites? Explain with example how they function as molecular sieves?
- e) Give the names of catalyst for following heterogeneous catalysis :
 - i) Hydrogenation
 - ii) Oxidation of butene.
 - iii) hydrocracking
 - iv) Oxychlorination
 - v) Oxidation of ammonia to No.

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

- a) A 0.016 m of an acid solution in benzene is dropped on a water surface, benzene evaporates and acid forms monomolecular film of solid type. What volume of the above solution would be required to cover 500 cm² surface area of water with monomolecular layer of acid? Area covered by single acid molecule is 0.2 nm².
- b) When plotted according to the linear form of the BET equation, data for adsorption of N₂ on carbon kc - 8 at 77 k give an intercept of 0.005 and slope 1.5 (both cc at STP per gram). Calculate specific surface area of adsorbent assuming molecular area of 16Å² for N₂
- c) At 20°C, the surface tension of solution of butyric acid in water, γ can be represented by the equation $\gamma = \gamma_0 - a \ln(1 + bc)$
Where γ_0 is the surface tension of water $a = 13.1$ and $b = 19.60$ are constants. Calculate the excess concentration of 0.2 m/lit solution.

SECTION - II

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

- a) Write Bernal - Fowler equation for heat of solution, explain the terms involved in it.
- b) Assuming the expression for charge density, derive an expression for thickness of ionic atmosphere.
- c) Show graphically the variation of potential drop between two plane parallel electrodes in electrolyte solution. Define absolute ionic mobility and conventional ionic mobility.
- d) Deduce Butler - Volmer equation.
- e) Discuss Helmholtz model of electrical double layer.

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

- a) Discuss the principles involved in the methods of preventing corrosion.
- b) Explain the terms faradic efficiency, voltage efficiency, maximum efficiency and overall efficiency.
- c) What are primary cells? Describe in detail one example of primary cell.
- d) Write a short note on electrosynthesis.
- e) What is passivation? Discuss the general mechanism of passivation.

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

- a) Calculate the value of thickness of ionic atmosphere at 25°C in 0.01 M solution of KBr, dielectric constant of water is 78.54.
- b) If the mobility of the silver ion in aqueous solution at 300 K is $6.4 \times 10^{-8} \text{m}^2 \text{V}^{-1} \text{s}^{-1}$. Calculate
 - i) Diffusion coefficient of silver ion and
 - ii) Its equivalent conductivity.
- c) The following reaction may be made to operate in fuel cell at 300 K.
$$\text{CH}_4 + 2\text{O}_2 \rightleftharpoons \text{CO}_2 + 2\text{H}_2\text{O}(l)$$
$$\Delta H_{300} = -890.4 \text{KJ mol}^{-1}, \Delta G_{300} = -818.0 \text{KJ mol}^{-1}$$
Calculate
 - i) Number of electrons transferred in overall cell reaction.
 - ii) Reversible emf of the cell at 300 K
 - iii) Maximum efficiency of the cell.



Total No. of Questions : 4]

SEAT No. :

P664

[4125]-403

[Total No. of Pages : 3

M.Sc. (Sem. - IV)

PHYSICAL CHEMISTRY

**CH - 414 : Biophysical Chemistry and Related Techniques
(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	= $6.022 \times 10^{23} \text{ mol}^{-1}$
2. Boltzmann Constant	k	= $1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ = $1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	h	= $6.626 \times 10^{-27} \text{ erg s}$ = $6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	e	= $4.803 \times 10^{-10} \text{ esu}$ = $1.602 \times 10^{-19} \text{ C}$
5. 1 eV		= $23.06 \text{ k cal mol}^{-1}$ = $1.602 \times 10^{-12} \text{ erg}$ = $1.602 \times 10^{-19} \text{ J}$ = 8065.5 cm^{-1}
6. Gas Constant	R	= $8.314 \times 10^7 \text{ ergK}^{-1} \text{ mol}^{-1}$ = $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ = $1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	F	= $96487 \text{ C equiv}^{-1}$
8. Speed of light	c	= $2.997 \times 10^{10} \text{ cm s}^{-1}$ = $2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		= $4.184 \times 10^7 \text{ erg}$ = 4.184 J
10. 1 amu		= $1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	= $-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear Magnetron	β_n	= $5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	= $9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION - I

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

- a) Define biological cell. Explain its constituents.
- b) Explain the role of nucleic acids in cell biology.
- c) State the applications of Donnan Membrane Equilibrium.
- d) Write a note on blood buffering system.
- e) Explain the functions of proteins.
- f) Explain the terms 'proteolysis' and 'chaperonins'.

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

- a) Define contour length of a polymer macromolecular chain. Deduce the relation $\bar{R} = \sqrt{\frac{8N}{3\pi}} l$.
- b) Explain the significance of directionality in H bonding.
- c) Explain the importance of the Henderson equation to determine maximum buffering capacity.
- d) Write a note on phosphoanhydride bond in ATP.
- e) Calculate R_{rms} for a polymer having 250 monomer units and 400 nm long.
- f) Explain osmosis and reverse osmosis.

SECTION - II

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

- a) Define the terms :
 - i) Neuron.
 - ii) Nerve
 - iii) Membrane lipids.
 - iv) Membrane proteins and
 - v) Carrier proteins.
- b) Describe the lamellar model to explain the structure of cell membrane.
- c) What is enzyme inhibition? Explain briefly reversible inhibition.
- d) What is a nerve? State its types giving examples.
- e) Derive Michaelis - Menton equation for enzyme catalysis.
- f) Discuss the mechanism of ion transport through cell membrane.

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

- a) Explain the light scattering method for determining the molecular weight of biopolymers.
- b) What is electrophoresis? How is the technique used to determine the molecular weight of proteins?
- c) What are the major applications of optical Rotatory Dispersion.
- d) Write a note on helix - coil transitions.
- e) Discuss the applications of Donnan Membrane equilibrium.
- f) Explain the terms - number - average and weight - average molecular weight of macromolecule.



Total No. of Questions : 4]

SEAT No. :

P666

[Total No. of Pages : 2

[4125] - 405
M.Sc. - II (Sem. - IV)
INORGANIC CHEMISTRY
CH - 430 : Inorganic Solids and Heterogenetics Catalysis
(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) *Draw neat diagrams wherever necessary.*

Q1) Answer the following (any 4) **[20]**

- a) Explain the potential energy curve for adsorption of H₂ on Ni surface.
- b) Write an account on synthesis, properties and structure of hetero polyanions of phosphorus.
- c) Calculate the number of frame work electrons in the compound [Mo₆(Co)₁₆]⁻² and draw its structure.
- d) Giving suitable examples distinguish between polycationic and polyanionic compounds.
- e) "Semiconductor materials play an important role in catalysis". Justify with the help of suitable examples.

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

- a) Explain the role of phosphate linkage in evolution of life.
- b) Explain the importance of zeolites in catalysis. Give examples in support of your answer.
- c) Give examples of polynuclear metal carbonyls. Explain the effect of pyrolysis on these carbonyls.
- d) With the help of suitable examples (at least two) explain the role of nanomaterials in organic synthesis.
- e) Name the important types of reactors used in heterogeneous catalysis and explain working of any one in detail.

P.T.O.

Q3) Attempt the following (any 4)

[20]

- a) Write an account on $(\text{PNCl}_2)_6$.
- b) What do you understand by the term "Supported metal catalyst". Explain their applications.
- c) Comment on the different types of silicates, their structures and tetrahedral coordination.
- d) Complete the following :
 - i) $\text{P}_4\text{H}_{10} + \text{H}_2\text{O} \longrightarrow ?$
 - ii)
 - iii)
 - iv) $\text{Cl}_3\text{B}_3\text{N}_3\text{H}_3 + \text{NaBH}_4 \longrightarrow ?$
 - v)
- e) Draw the following structures.
 - i) $\text{Ir}_4(\text{CO})_{12}$
 - ii) S_4N_4
 - iii) $[\text{NPCl}_2]_5$
 - iv) $[\text{Ta}_6\text{O}_{19}]^{8-}$
 - v) $[\text{Fe}(\text{B}_9\text{C}_2\text{H}_{11})_2]^{2-}$ ~~$\text{SiCl}_4 + \text{P}(\text{OH})_3 + \text{Na}_2\text{HPO}_4 \longrightarrow ?$~~

Q4) Write short notes on : any 4

[20]

- a) Oxyacids of Halogens.
- b) MCM - 41
- c) Nano materials for a clean environment.
- d) Zeiglar Natta Catalyst.
- e) Fischer - Tropsch synthesis.



Total No. of Questions : 6]

SEAT No. :

P662

[4125]-401

[Total No. of Pages : 3

M.Sc. (Sem. - IV)

PHYSICAL CHEMISTRY

**CH - 410 : Molecular Structure and Spectroscopy
(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) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of logarithmic tables/calculator is allowed.*

Physico-Chemical Constants

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5. 1 eV		= $23.06 \text{ k cal mol}^{-1}$ = $1.602 \times 10^{-12} \text{ erg}$ = $1.602 \times 10^{-19} \text{ J}$ = 8065.5 cm^{-1}
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7. Faraday Constant	F	= $96487 \text{ C equiv}^{-1}$
8. Speed of light	c	= $2.997 \times 10^{10} \text{ cm s}^{-1}$ = $2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		= $4.184 \times 10^7 \text{ erg}$ = 4.184 J
10. 1 amu		= $1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	= $-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear Magnetron	β_n	= $5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	= $9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION - I

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

- a) Explain the theory of spin - spin interaction for an A_2 type case. Explain why the two protons in a CH_2 group do not cause splitting of each other's signals.
- b) Discuss the advantages of FT - NMR.
- c) Define the term 'coupling constant' in NMR. Discuss the factors influencing coupling constant.
- d) Write a note on : Use of NMR in medical diagnostics.
- e) Describe the instrumentation used in NQR spectroscopy with a suitable diagram.

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

- a) Explain the working of ESR spectrometer using block diagram.
- b) State the Mc connell equation and discuss its applications.
- c) Distinguish between NMR and ESR spectroscopy.
- d) Discuss the applications of ESR spectroscopy.
- e) Explain the basic principle of PAS.

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

- a) A free electron resonates at 9.8 GHz at a magnetic field strength 0.35 T. At what frequency will resonance occur if the magnetic field is 1.5T?
- b) Differentiate among the following compounds from the ^{19}F spectra at high field.



- c) Predict the nature of ESR spectra of $^{14}NH_3$ and $^{15}NH_3$.

Given :

$$^{14}N, I = 1, A = 20 \text{ G (for } ^{14}N - H)$$

$$^{15}N, I = \frac{1}{2}, A = 6 \text{ G (for } ^{15}N - H)$$

SECTION - II

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

- a) State and explain the principle of X - ray spectroscopy.
- b) Describe the single crystal diffraction method used for investigating the internal structure of crystals.
- c) Define and explain the terms scattering factor and structure factor used in X - ray diffraction.
- d) Discuss the applications of X - ray diffraction.
- e) Explain the principle and experimental arrangement of electron diffraction technique.

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

- a) Discuss the applications of electron diffraction technique.
- b) How is the phenomenon of neutron diffraction experimentally studied?
- c) Define the terms : Pole strength, magnetic yield, gram susceptibility and intensity of magnetization.
- d) Explain the characteristic properties of diamagnetic, paramagnetic and ferromagnetic substances.
- e) Derive the expression for gram susceptibility used in uniform field method.

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

- a) The mass and density of an atom are 63.5 and 8.94 g cm^{-3} respectively. It has an FCC structure. Calculate the radius of an atom.
- b) The density of lysozyme crystals was 1.242 KgL^{-1} . The crystals contained 66% protein. Calculate the mass of dry protein per unit cell.
(Given : The unit cell dimensions of lysozyme crystal in Å are 79, 79 and 38)
- c) Using pascal constants and appropriate constitutive corrections given below, calculate the molar susceptibility of acetic acid.

[Given : Pascal constants in cgs units :

$$C = -6.0 \times 10^{-6}, H = -2.93 \times 10^{-6}$$

$$\text{O}_2(\text{Carboxylate}) = -7.95 \times 10^{-6}]$$



Total No. of Questions : 4]

SEAT No. :

P1565

[Total No. of Pages : 2

[4125] - 318

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 381 : Medicinal Chemistry

(2008 Pattern) (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.*
- 3) *Neat diagrams must be drawn wherever necessary.*

SECTION - I

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

- a) Give a brief account of new procedures followed in drug design.
- b) Write a short note on factors affecting bioactivity.
- c) What is a drug? Classify the drugs on basis of therapeutic action.
- d) Give the history and development of QSAR.
- e) Discuss in detail the Free-Wilson Analysis for evaluation of drugs.

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

- a) What are drug receptors? Discuss the drug receptor interactions.
- b) Write a short note on immunological assay.
- c) Define and explain:
 - i) LD50.
 - ii) Drug absorption.
 - iii) Drug elimination.
 - iv) Pro - drug.
- d) Give a brief account of novel drug delivery system.
- e) Write a short note on 'Molecular modelling'.

P.T.O.

SECTION - II

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

- a) What are hypnotics? Discuss the mode of action of hypnotics.
- b) Give the synthesis of Sorbitrate.
- c) Define and explain:
 - i) Mitotic inhibitors.
 - ii) Chemotherapy.
- d) Discuss the concept of chiral drug with suitable examples.
- e) Give a brief account of recent developments in Cancer therapy.

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

- a) Give the synthesis of any two of the following:
 - i) Quinidine.
 - ii) Amyl nitrate.
 - iii) Ethambutol.
- b) Give a brief account of 'Stereochemical aspects of psychotropic drugs'.
- c) Define the terms :
 - i) Pharmacokinetics.
 - ii) Carcinolytic antibiotics.
 - iii) Sedatives.
- d) With suitable examples discuss the action of CNS depressants.
- e) Write a short note on Serendipity and drug development.



Total No. of Questions : 6]

SEAT No.:

P639

[Total No. of Pages : 3

[4125] - 101
M.Sc. (Sem. - I)
PHYSICAL CHEMISTRY
CH - 110 : Physical Chemistry - 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	=	$6.022 \times 10^{23} \text{ mol}^{-1}$
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7. Faraday Constant	F	=	$96487 \text{ C equiv}^{-1}$
8. Speed of light	c	=	$2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		=	$4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10. 1 amu		=	$1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	=	$-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION - I

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

- a) Write the expression for energy of a particle in a three dimensional box. Explain the degeneracy of energy levels in the cubical box.
- b) Write a note on photoelectric effect. How did it support the quantum theory.
- c) Deduce Vant-Hoff reaction isochore and give its applications.
- d) Explain Raoult's and Henry's laws.
- e) What are isotonic solutions? Deduce a method to determine molecular weight of a polymer by osmotic pressure measurement.

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

- a) What are results of operating $\frac{d}{dx}$ and $\frac{d^2}{dx^2}$ on -
 - i) e^{-ax^2}
 - ii) $\cos bx$
- b) Explain the third law of thermodynamics. Hence, explain determination of absolute entropy of a liquid.
- c) Define and explain the term azeotropes. Give their types and method of separation.
- d) Sketch the phase diagram for the system water. Discuss the various equilibria in the light of clayperon equation.
- e) State and explain the second law of thermodynamics. Obtain an expression for the entropy change in the mixing of two ideal gases.

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

- a) At 25°C the enthalpy and free energy change of a reaction are -54600 cal. and -51250 cal. respectively. Calculate the free energy change at 47°C.
- b) An atom makes a transition from an excited state with a lifetime 10^{-9} s to the ground state and emits a Photon of wavelength 600nm. What is the uncertainty in energy? Find % of uncertainty with respect to ground state.
- c) Calculate the de-Broglie wavelength of an oxygen molecule at room temperature.

SECTION - II

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

- a) Show that in a first order reaction the reactant concentration decreases with time.
- b) Give in brief the characteristic properties to identify chain reactions from other reactions. Also briefly explain the mechanism of the reaction between hydrogen and bromine.
- c) Outline the collision theory of reaction rates for gaseous reaction.
- d) Show how the steady state treatment is used to derive the rate law for an enzyme catalysed reaction.
- e) Explain the flash photolysis technique, for studying fast reactions.

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

- a) Discuss in detail the basic concepts of the transition state theory and derive the expression for the specific reaction rate.
- b) Discuss in detail the diffusion-controlled limits. Write the equation relating diffusion-coefficient and flux of matter.
- c) Derive an expression for Boltzmann distribution law.
- d) Discuss the vibrational contribution to the entropy of a system consisting of diatomic molecule.
- e) Discuss in brief Bose-Einstein statistics.

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

- a) Show that in every first order reaction the time required for 75% reaction is double the time required for 50% reaction.
- b) For the reaction between oxygen and benzene the pre-exponential factor was found to be $1.14 \times 10^{10} \text{ dm}^3 \text{ mol}^{-1} \text{ s}^{-1}$ at 392.2K. Estimate the p-factor for the reaction. Given : $\sigma(\text{O}) = 0.24 \text{ nm}^2$; $\sigma(\text{C}_6\text{H}_6) = 0.88 \text{ nm}^2$. Atomic wt. of H = 1, C = 12.
- c) Calculate the vibrational partition function at 300K and 500K. When vibrational frequency of a diatomic molecule is 1600 cm^{-1} .



Total No. of Questions : 6]

SEAT No.:

P640

[Total No. of Pages : 3

[4125]-102
M.Sc. (Sem. - I)
INORGANIC CHEMISTRY
CH - 130 : Inorganic Chemistry - I
(2008 Pattern) (Part - 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) Sketch and describe all the symmetry operations in XeOF_4 molecule and classify it into appropriate point group.
- b) Assign any two of the following molecules into appropriate point group. Justify it.
 - i) Borazole.
 - ii) Cyclopentadiene.
 - iii) Staggered Ferrocene.
- c) Prove that in any Abelian group each element is in a class by itself.
- d) Using great orthogonality theorem, derive the character table for C_3V point group.
- e) What are the conditions of a mathematical group? Explain them with the help of $\text{cis} [\text{Ni}(\text{en})_2\text{Cl}_2]$ complex.

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

- a) Using matrix multiplication method, find the product of
 - i) $i \times i$
 - ii) $C_2^{(z)} \times \sigma^{(xy)}$

P.T.O.

- b) For the SiCl_4 molecule, find out reducible representation for which sigma bonds form the basis and find out which of the orbitals from the silicon atom will be offered for sigma bonding (character table given below).

T_d	E	$8C_3$	$3C_2$	σS_4	$\sigma \cdot \sigma_d$		
A_1	1	1	1	1	1		$x^2 + y^2 + z^2$
A_2	1	1	1	-1	-1		
E	2	-1	2	0	0		$2z^2 - x^2 - y^2, x^2 - y^2$
T_1	3	0	-1	1	-1	R_x, R_y, R_z	
T_2	3	0	-1	-1	1		xy, xz, yz

- c) 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 T_d .

Direct product $T_2 \times E$

(Character table for T_d point group question no 2b).

- d) Identify the point group and develop stereographic projection for the molecules justify the answer.
- SO_3 .
 - H_3BO_3 .
- e) Find out the normalized SALC using projection operator of Big irreducible representation which operates on σ_1 of the $[\text{AuCl}_4]^-$ complex ion.

D_{4h}	E	$2C_4$	C_2	$2C_2^1$	$2C_2^{11}$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$
B_{1g}	1	-1	1	1	-1	1	-1	1	1	-1

Q3) Attempt Any Two of the following : [10]

- What are Weiss indices? Explain them with the help of suitable example. Draw $(3\ 2\ 1)$ and $(1\ 1\ 1)$ planes in simple cubic system.
- On the basis of symmetry, what is criterion for the molecule to be optically active? Predict the optical activity for the following compounds.
 - 1, 3, 5, 7 tetramethyl cyclooctatetrocene.
 - $[\text{M}(\text{A}-\text{A})_3]$ complex. Justify your answer.
- By schematic representations give the product of the following symmetry operations in B_2H_6 .
 - $C_2^z \times \sigma h^{xy}$
 - $C_2^x \times C_2^z$

SECTION - II

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

- a) Give the characteristic reactions of dihydrogen.
- b) What are crownethers? Explain use of crownethers in separation of alkali metals?
- c) Give an account of electron deficient compounds.
- d) Explain characteristic reactions of PCl_5 .
- e) Give an account of zeolites.

Q5) Write notes on Any Three of the following : **[15]**

- a) Reactions of R-Mgx.
- b) Interhalogen compounds.
- c) Sulphur oxoanions.
- d) Applications of noble gases.
- e) Phosphazenes.

Q6) a) Draw Any Five structures : **[5]**

- i) I_5^- .
- ii) P_4O_{10} .
- iii) $\text{Li}_4(\text{CH}_3)_4$.
- iv) BeF_4^{2-} .
- v) $\text{Al}_2(\text{Ph})_2(\text{Et})_4$
- vi) $\text{H}_3\text{B}_3\text{N}_3\text{Cl}_3$.

b) Complete Any Five reactions : **[5]**

- i) $\text{Na} + \text{C}_{10}\text{H}_8(\text{thf}) \rightarrow ?$
- ii) $4 \text{R}_3\text{SiCl} + \text{LiAlH}_4 \rightarrow ? + \text{LiAlCl}_4$.
- iii) $\text{PCl}_5 + n \text{NH}_4\text{Cl} \rightarrow ? + 4 n \text{HCl}$.
- iv) $\text{PhAsI}_2 + \text{Hg} \rightarrow \dots + \text{Hg}_2\text{I}_2$.
- v) $[\text{HN}(\text{CH}_3)_3\text{Cl}] + \text{LiBH}_4 \rightarrow \dots$
- vi) $\text{SF}_6(\text{g}) + \text{H}_2\text{O} \rightarrow \dots$



Total No. of Questions : 6]

SEAT No.:

P641

[Total No. of Pages : 4

[4125]-103

M.Sc. - I

ORGANIC CHEMISTRY

**CH - 150 : Organic Reaction Mechanism and Stereo Chemistry
(Sem. - I) (2008 Pattern)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

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

SECTION - I

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

- a) Phenalene is acidic enough to react with CH_3OK . Explain.
- b) Tropolylium bromide is ionic compound. Explain.
- c) Why is 2, 6 - dimethyl-N, N-dimethyl aniline is stronger base than N, N-dimethyl aniline?
- d) Electrophilic and nucleophilic substitution reaction of naphthalene preferentially take place at α -position. Explain.
- e) A $\beta\text{-OCH}_3$ group generally retards the hydrolysis of alkyl chloride, but $\beta\text{-SCH}_3$ group accelarates the same. Explain.

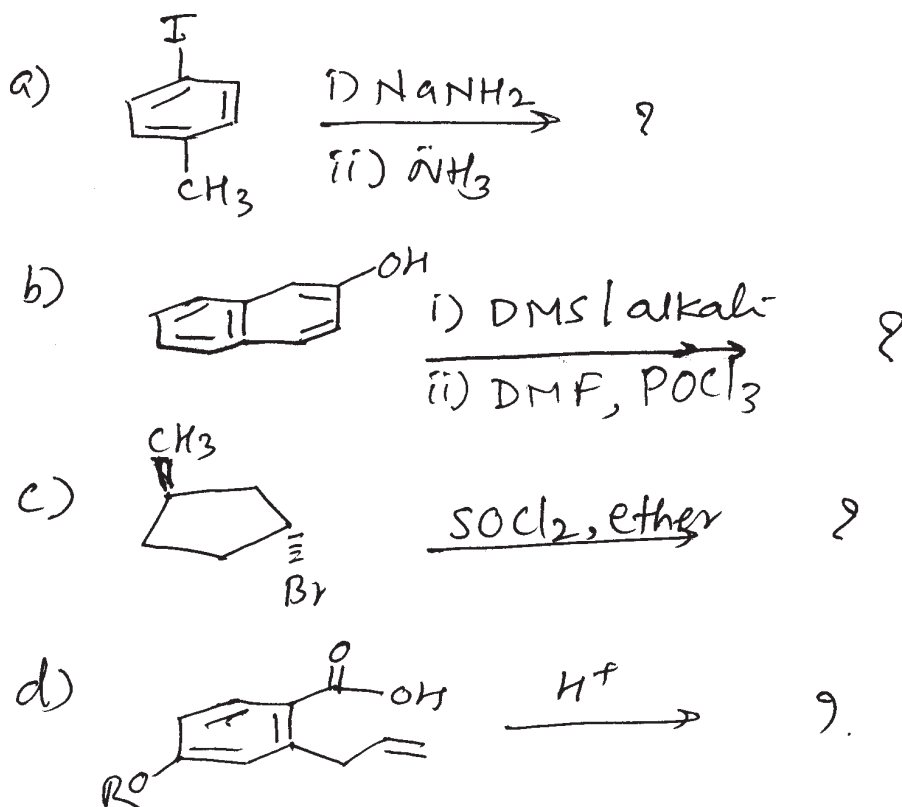
Q2) Write short notes on any three of the following : **[12]**

- a) Inclusion compounds.
- b) Ambident nucleophiles.
- c) Hoffmann and saytzeff's elimination.
- d) Jacobsen reaction.

P.T.O.

Q3) Predict the products with mechanism (any three) :

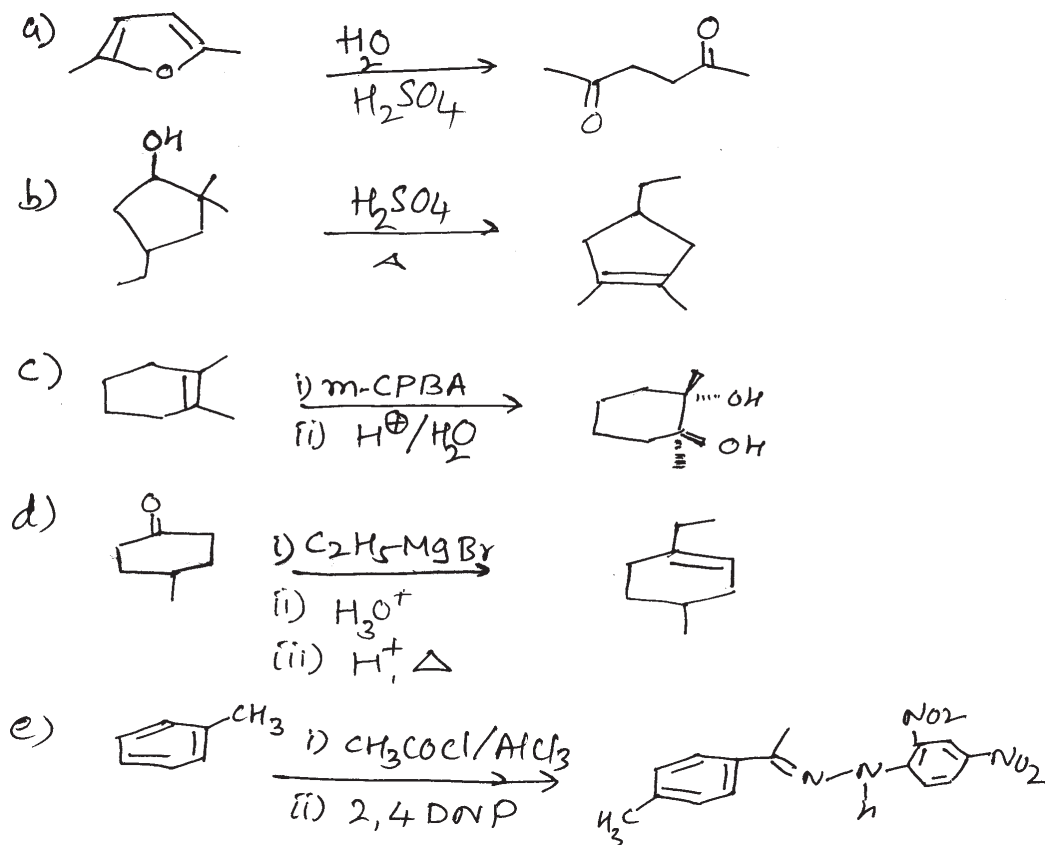
[12]



SECTION - II

Q4) Suggest mechanism for any four of the following :

[12]



Q5) Attempt any four of the following :

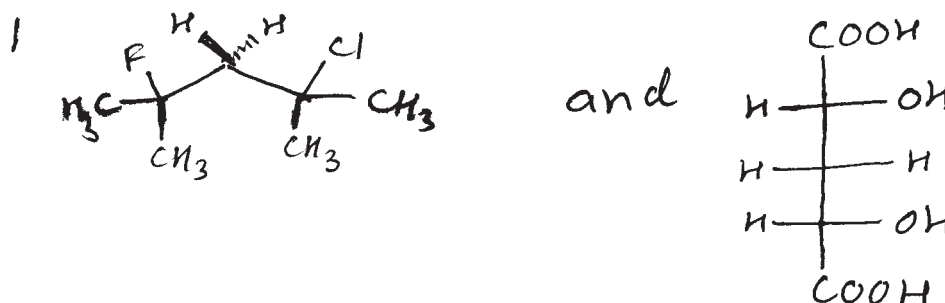
[12]

- Explain stereoselective and stereospecific reactions.
- Nitration of acetanilide gives p-nitro acetanilide as a major product where as nitration of aniline gives m-nitroaniline. Explain.
- Cyclopentadiene reacts with strong base and forms its anion but benzene does not explain.
- Explain, hydroboration-oxidation reaction.
- Give a brief account of nonclassical carbocation.

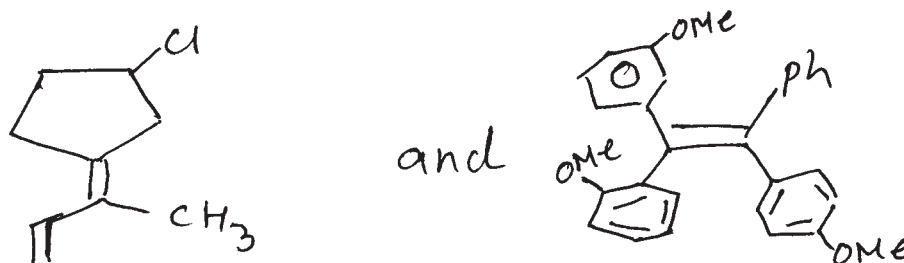
Q6) Attempt any eight of the following :

[16]

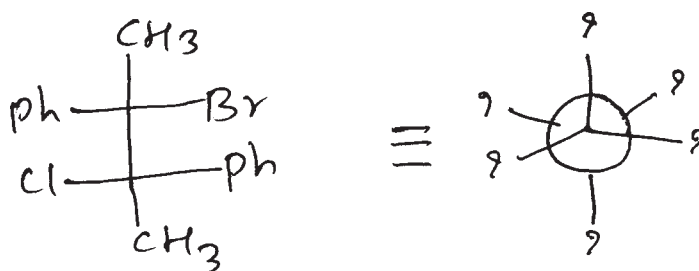
- Assign Pro 'R'/Pro 'S' to the following :



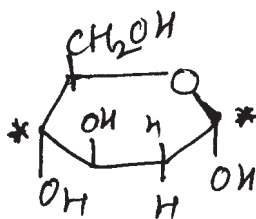
- Assign E/Z configuration of following :



- Convert Fischer to Newmann for the following structure.



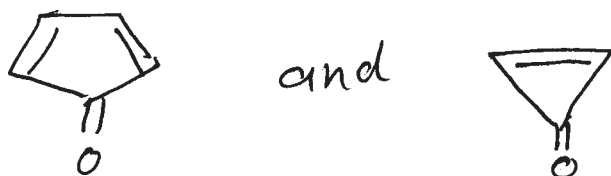
- d) Assign R/S configuration to the following compound.



- e) Maleic acid is stronger acid than fumaric acid in first dissociation but reverse is true in second dissociation. Explain.
- f) Draw the resonance structures for the following :



- g) Comment on stability of following compounds.



- h) For Friedal-Craft acylation reaction of benzene, nitrobenzene can be used as solvent but not toluene. Explain.
- i) Acetylene is stronger acid than ethylene. Explain.

XXXX

Total No. of Questions : 6]

SEAT No.:

P642

[Total No. of Pages : 3

[4125] - 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	=	$6.022 \times 10^{23} \text{ mol}^{-1}$
2. Boltzmann Constant	k	=	$1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ $= 1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	h	=	$6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J S}$
4. Electronic Charge	e	=	$4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5. 1 eV		=	$23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
6. Gas Constant	R	=	$8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	F	=	$96487 \text{ C equiv}^{-1}$
8. Speed of light	c	=	$2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		=	$4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10. 1 amu		=	$1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	=	$-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION - I

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

- a) Outline in brief the factors governing the intensity of spectral lines.
- b) What is Stark effect? Give three uses of it.
- c) Explain the factors affecting the line-width of spectrum.
- d) Compare the infrared and Raman activity of vibrations in H₂O and CO₂.
- e) Explain classical theory of Raman effect.

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

- a) State and explain the rule of mutual exclusion and its converse.
- b) Derive the expression for ν_{\max} . Hence give the method for determination of dissociation energy of a molecule.
- c) State the underlying principle of NMR spectroscopy. What is Larmor precession?
- d) What is predissociation? Explain it by using suitable diagram.
- e) Explain the different ways by which an excited molecule can lose its energy.

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

- a) Reduced mass of HCl molecule is 1.62626×10^{-27} kg and its bond length is 0.1257 nm. Calculate the wavenumber of R (2) and P (2) lines if the fundamental frequency is 2991.3 cm^{-1} .
- b) The rotational constants by analyzing the band spectrum of C₂ molecule is observed at $B_0'' = 1.7527 \text{ cm}^{-1}$ and $B_1'' = 1.6326 \text{ cm}^{-1}$. The band origin is at 19378 cm^{-1} , estimate the position of band head.
- c) Rotational spectrum of D³⁵Cl exhibits lines at 75.15, 85.90, 96.51 and 107.14 cm^{-1} .
 - i) Assign the bands to particular $J'' \rightarrow J'$ transitions and evaluate the bond length for HCl.
 - ii) Obtain centrifugal distortion constant.
- d) The anharmonicity constant for a diatomic molecule is 0.0060. Evaluate the vibrational level that will cause dissociation. (Fundamental vibration frequency = 1640 cm^{-1}).

SECTION - II

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

- a) Describe, construction and working of scintillation counter.
- b) What is hydrated electron? Discuss Hart and Boag's pulse radiolysis experiment to detect hydrated electron.

- c) Describe scavenging of free radicals in water radiolysis.
- d) What are the reactions occurring in radiolysis of Fricke solution and derive expression for $G_{\text{Fe}^{3+}}$.
- e) Describe separation of isotopes by cascade method.

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

- a) Give preparation method for ^{22}Na and ^{35}S isotopes.
- b) What is radio-tracer technique? How is radio-tracer technique used to determine the surface area of precipitate?
- c) Explain critical size of thermal reactor.
- d) Describe, construction and working of fast breeder test reactor (FTBR) at Kalpakkam.
- e) Give an account of nuclear waste management.

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

- a) Calculate the mass absorption coefficient for 1 mer γ -radiations for NaIO_3 . Atomic absorption coefficients for O = 1.69 b/atom, Na = 2.32 b/atom, I = 12.03 b/atom [At.wts, Na = 23, O = 16, I = 127].
- b) 0.1 g of mn sample was irradiated in a neutron flux of 10^7 n/cm²/sec for 30 min. What will be its activity at the end of irradiation if $\gamma = 100\%$, $\sigma = 13.3$ b and $t_{1/2} = 2.58$ h for ^{56}Mn .
- c) Half-life of radon is 3.8 days. After how many days will one twentieth of radon sample be left over?



Total No. of Questions : 6]

SEAT No.:

P643

[Total No. of Pages : 6

[4125]-202
M.Sc. - I (Sem. - II)
INORGANIC CHEMISTRY
CH - 230 : Inorganic Chemistry - II
(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) Neat diagrams must be drawn wherever necessary.*
- 4) Figures to the right indicate full marks.*
- 5) Use of logtables and calculator is allowed.*
- 6) Given : Atomic number; Ni = 28, Co = 27.*

SECTION - I

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

- a) Predict the expected electronic transitions in the following complexes.
 - i) $[\text{Ni}(\text{H}_2\text{O})_6]^{+2}$.
 - ii) $[\text{CoBr}_4]^{-2}$.
- b) Prepare a table of microstates and hence derive the allowed R.S. terms for Nitrogen atom in ground state.
- c) Explain Hund's Rules to determine the ground state term symbols? Arrange the following R.S. terms with increasing order of energy.
 $^1\text{P}, ^4\text{I}, ^6\text{H}, ^6\text{D}, ^3\text{F}, ^3\text{S}$.
- d) Arrange the following transitions in octohedral complex according to increasing intensity.
 - i) $A_{2g} \rightarrow A_{2u}$
 - ii) $A_{2g} \rightarrow A_{1g}$
 - iii) $A_{2u} \rightarrow T_{2g}$
- e) $\text{Ni}^{+z}(\text{oh})$ complex shows 15% increase in its observed magnetic moment value. Calculate spin orbit coupling constant λ for Ni^{+z} ion using following data :
 $Dq = 850\text{cm}^{-1}$.

P.T.O.

Q2) Answer Any Three of the following : [15]

- a) Determine the spin multiplicities of states arising from e_g^2 configuration when infinitely strong octahedral field is relaxed to strong field using Bethe's method of descending symmetry, correlation table and direct product table.
- b) Give the appropriate term symbols for the states with following values of L and S. Also work out possible values of J.
- i) $L = 3, S = 3/2$
ii) $L = 2, S = 3$
- c) Explain non crossing rule with the help of suitable example.
- d) How would you account for the magnetic moment of the following complexes.
- i) $[\text{Ni}(\text{NH}_3)_6]\text{SO}_4 \quad \mu = 2.84 \text{ BM.}$
ii) $\text{K}_2[\text{Ni}(\text{CN})_4] \quad \mu = 0$
- e) For hexa aquo Co(II) complex ion two absorption bands are observed at 16000cm^{-1} and 19417cm^{-1} . Determine the third band with the help of following data. Also calculate crystal field parameter and interelectronic repulsion parameter. Comment on nephelauxetic ratio.
- i) $B = \frac{v_2 + v_3 - 3v_1}{15}$
ii) $10 Dq = v_2 - v_1$
iii) $B_0 = 971 \text{ cm}^{-1}$
iv) $B = 825 \text{ cm}^{-1}$.

Q3) Answer Any Two of the following : [10]

- a) Selection rules in d - d transitions.
b) Factors affecting band width.
c) Nephelauxetic effect and Nephelauxetic Series.

SECTION - II

Q4) Answer Any Three of the following : [15]

- a) Explain the uptake of metal by cell.
b) Discuss the voltage gated channels for Na-transport.
c) What are selected metal ions in biological system? Explain the role of P_t and T_c in medicine.
d) Describe chelate effect and Irving-William series with respect to complexes.

- e) What is bioinorganic chemistry? Show the position of bioessential elements in periodic table. Give reason behind natural selection of these elements.

Q5) Write short notes on Any Three : **[15]**

- a) Hg-Detoxification.
- b) Zinc-finger.
- c) Dioxygen transport.
- d) Michaelis - Menten Model.
- e) Fe-S cluster compound.

Q6) Draw structures of Any Five : **[10]**

- a) Uracil.
- b) Cynocobalmin.
- c) Adenin.
- d) $3\text{Fe} - 4\text{S}$.
- e) Oxyhemoglobin.
- f) $[(\text{O-Phen.}) \text{pt} (\text{en})]^{2+}$.

Character Table for O rotational group

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

Correlation Table for the Group O_h

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

DIRECT PRODUCTS

1. Groups of the form $G \times I$ or $G \times \sigma_2$:

The g, u or $' , "$ additions to the IR symbols in these groups satisfy
 $g \times g = u \times u = g, g \times u = u, 'x' = 'x', 'x'' = 'x'' = 'x'' = 'x''$.

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

For all groups :

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

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 : $A \times E_1 = E_1$ irrespective of the suffix on A.

(b) For all groups except D_{4h}, D_{4d}, S_4 :

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

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

(c) For D_{4h} :

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

irrespective of the suffix on B.

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

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

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 $O_h, O, T_d, D_{2h}, D_6, C_{2v}, C_{2h}, C_{3v}, S_6, D_{3d}, D_{3h}, D_3, C_{3v}, C_{3h}, C_3$:

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

(b) For $D_{4h}, D_4, C_{2v}, C_{4h}, C_4, S_8, D_{2d}$:

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

(c) For D_{4d} :

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

$E_2 \times E_2 = E_3 \times E_3 = A_1 + A_2 + E_4$

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

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

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

$E_1 \times E_3 = B_1 + B_2 + E_4, E_2 \times E_4 = B_1 + B_2 + E_2$

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

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

$$E_1 \times E_2 = E_1 + E_2.$$

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

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

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

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

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

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

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

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

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

6. The complete results for O are :

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



Total No. of Questions : 6]

SEAT No.:

P644

[Total No. of Pages : 4

[4125]-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

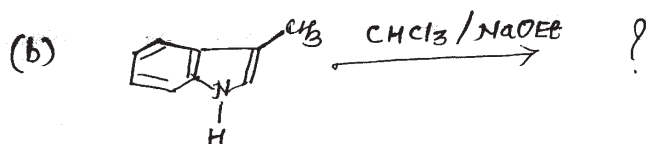
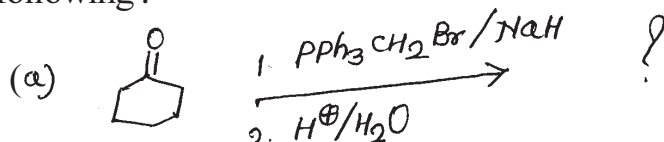
Q1) Explain any four of the following : [16]

- a) N, N-Dimethyl benzamide does not undergo Hoffmann rearrangement whereas benzamide does.
- b) Using suitable spectral technique how will you distinguish intermolecular and intramolecular hydrogen bonding with examples.
- c) Cyclohexene on reaction with O_3O_4 followed by hydrolysis gives Cis-diol whereas with peracid followed by hydrolysis gives trans-diol.
- d) Use of sulfur yield in organic synthesis.
- e) 1, 3-Dimethyl cyclohexane (*a, a*) is unstable whereas 3-hydroxy cyclohexanol (*a, a*) is more stable.

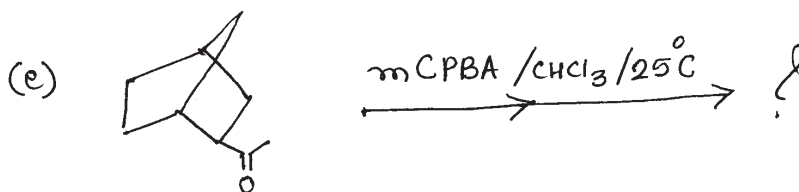
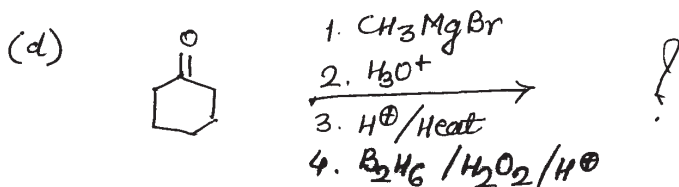
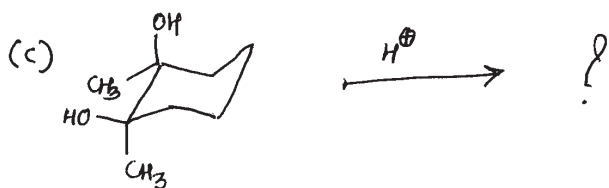
Q2) Write short notes on any three of the following : [12]

- a) Synthesis of primary, secondary and tertiary alcohols from $CH_3-CH-CH_3$.
 $\quad \quad \quad |$
 $\quad \quad \quad MgBr$
- b) Fries rearrangement.
- c) Ozonolysis.
- d) MVP reduction.

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



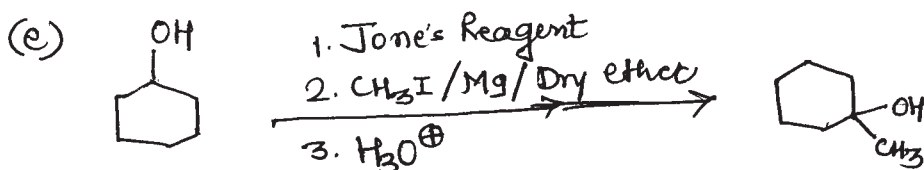
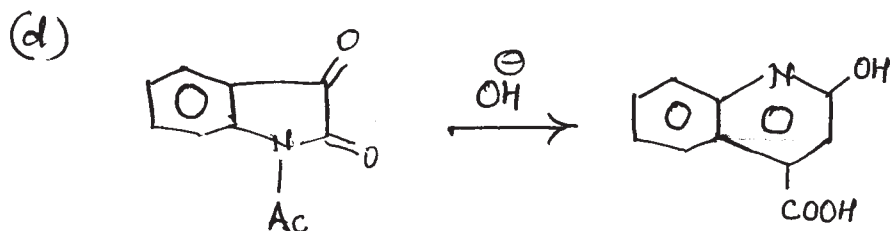
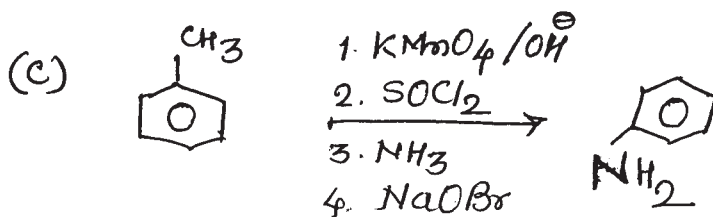
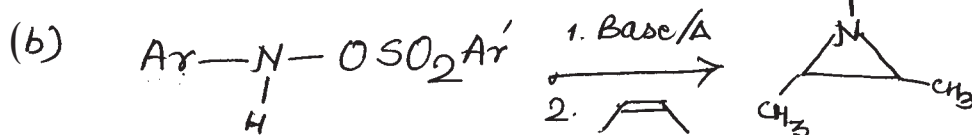
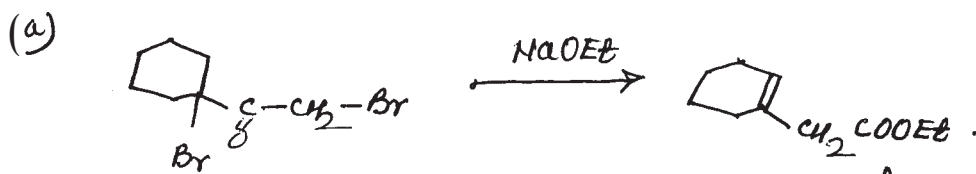
P.T.O.



SECTION - II

Q4) Suggest mechanism for any four of the following :

[12]



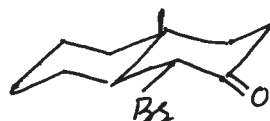
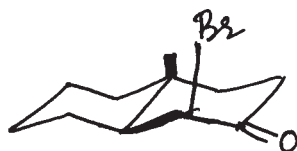
Q5) Attempt any four of the following :

[16]

- a) Calculate the λ_{max} for the following compound.



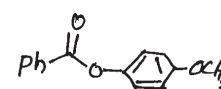
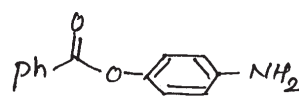
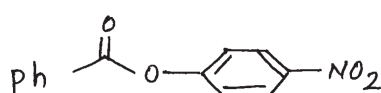
- b) Explain the uv λ_{max} for the following :



λ_{max} 304 nm

279 nm

- c) Arrange the following compounds in decreasing order of carbonyl frequencies.



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



- e) O-Hydroxyacetophenone on methylation shows a blue shift while-P-Hydroxyacetophenone on methylation shows a red shift. Explain.

Q6) Deduce the structure of any three of the following using spectral data and justify your answer.

[12]

- a) M.F. = $C_5H_{11}Br$

UV and IR do not exhibit any significant absorptions.

PMR :

1.02	(d,	6Hz,	24mm)
1.66	(m,		4mm)
1.85	(q,		8mm)
3.4	(t	6Hz,	8mm)

- b) M.F = C_5H_6O

IR = 1600, 1500 cm^{-1}

PMR =

2.3	(s, 3H)	
5.85	(d, 2Hz,	1H)
6.20	(dd, 2 and 1.5 Hz,	1H)
7.2	(d, 1.5Hz,	1H)

- c) M.F. = $C_{12}H_{14}O_4$
 UV = $\lambda_{\max} = 220 \text{ nm}$ ($\epsilon = 11000$)
 IR = 1735, 1600, 1490, 900 cm^{-1}
 PMR = 1.25 (t, 6Hz 30 mm)
 4.25 (q, 6Hz 20 mm)
 7.45 (dd 8 and 2Hz 10 mm)
 7.65 (dd 8 and 2Hz 10 mm)
- d) M.F. = $C_9H_6O_2$
 UV = $\lambda_{\max} = 250 \text{ nm}$ ($\epsilon = 14,000$)
 IR = 3200 – 2500 (Broad), 2200, 1680, 1480 cm^{-1}
 PMR = 7.40 (m, 3H)
 7.70 (dd, 8 and 2Hz, 2H)
 11.2 (m, 1H)

☒☒☒☒

Total No. of Questions : 5]

SEAT No.:

P645

[Total No. of Pages : 3

[4125] - 301
M.Sc. (Sem. - III)
PHYSICAL CHEMISTRY
CH - 310 : Quantum Chemistry and Solid State Chemistry
(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

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

P.T.O.

SECTION - I

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

- a) Explain the properties of Ladder Operators in brief.
- b) The perturbed Hamiltonian \hat{H} is given by relation $\hat{H} = \hat{H}^\circ + \hat{H}'$ where \hat{H}° and \hat{H}' is unperturbed operator and small perturbation operator respectively. Show that if \hat{H} and \hat{H}° are hermitian, \hat{H}' must also be hermitian.
- c) Prove that $\int \phi^* \hat{H} \phi dT \geq E_1$ where the function ϕ is normalized.
- d) State briefly the postulates of quantum mechanics.
- e) Find the term symbols for the following configuration
 - i) $1s^2$ and
 - ii) $1s^2 2s^2 2p^2$.
- f) Show that if $\hat{A} + \hat{B} = \hat{C}$ then $\hat{A} = \hat{C} - \hat{B}$.

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

- a) Deduce the secular equation for benzene and hence sketch the MO energy level diagram.
- b) Explain the basic Hückel approximations. How are these justified?
- c) Show that Hermitian operators have real eigen values.
- d) Explain, why cyclooctatetraene is unstable but its dianion is stable and planar.
- e) Distinguish among the antiaromatic and non aromatic compounds on the basis of REPE values.
- f) Obtain an expression for the energy of the G.S. of H_c atom using the first order perturbation theory.

SECTION - II

Q3) Attempt Any Three of the following : **[15]**

- a) Explain the various mechanism of diffusion in insulator. How is ionic conductivity related to diffusion coefficient?
- b) State and explain the Kirkendall effect.
- c) Discuss the optical properties of semiconductor.
- d) Write a note on p-n junction.
- e) Discuss the dislocation theory of crystal growth.

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

- a) Explain with a suitable example an addition reaction in a solid.
- b) Write a note on Transistors.
- c) How is the parabolic rate law useful in explaining the mechanism of a gas-solid reaction?
- d) Explain the Avrami Erofeyer equation. How it is applied to study the growth kinetics of solid phase decomposition reactions?
- e) What is nucleation? Explain the kinetics of nucleation.

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

- a) Calculate the relaxation time for Cu [At.wt. of Cu = 63.5, density = 8.92g/cc].
- b) If the average energy required to create a vacancy in a metal is 1 ev, calculate, the ratio of vacancies in the metal at 250 and 500K.
- c) How deep will Aluminium penetrate in silicon at 1500°C in one hour?

Given : $\Delta H = 73 \text{ Kcal/mole}$.

$$D_0 = 1.55 \text{ cm}^2/\text{s}.$$



Total No. of Questions : 6]

SEAT No.:

P646

[Total No. of Pages : 3

[4125] - 302
M.Sc. (Sem. - III)
PHYSICAL CHEMISTRY
CH - 311 : Nuclear and Radiation Chemistry
(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

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5. 1 eV		=	$23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
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7. Faraday Constant	F	=	$96487 \text{ C equiv}^{-1}$
8. Speed of light	c	=	$2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
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10. 1 amu		=	$1.673 \times 10^{-27} \text{ kg}$
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12. Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION - I

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

- a) Discuss the Bohr-Wheeler theory of Nuclear Fission.
- b) What are prompt and delayed Neutrons? Explain how they arise?
- c) Derive an expression for infinite medium multiplication factor.
- d) What are thermonuclear reaction. Discuss the mechanism of such reaction occurring on the Sun.
- e) Discuss the discontinuities in nuclear properties with reference to magic numbers, with typical example.

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

- a) Discuss the principle of particle induced 'X' ray emission technique.
- b) Write a note on Breeder-reactor.
- c) Write a note on Cockcraft-Walton accelerator.
- d) Deduce the semiempirical mass equation.
- e) Discuss the charge distribution on the Fission fragments.

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

- a) Calculate the binding energy of the two last neutrons in ^{37}Cl given the mass difference between ^{35}Cl and ^{37}Cl is 1.9970 amu.
- b) In the fission of $^{235}_{92}\text{U}$ the fragments have the mass numbers 90 and 144 what are the primary fragments?
- c) Calculate the no. of uranium atoms that must fission per second if the power generated is 95MW.

Given : Energy released per uranium fission is 3.2×10^{-17} MJ.

SECTION - II

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

- a) Distinguish between intrinsic and extrinsic semiconductor. What are requirements of semiconductor to be good radiation detector.
- b) Give an account of szilard-chalmer's reaction.
- c) What is the role of Cupric-ions in modified ferrous sulphate dosimeter.
- d) How the external radiation hazards can be controlled.
- e) Describe the mechanism of radiation annealing.

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

- a) Explain the terms - G - value, retention, recoil energy and efficiency of detector.
- b) Write a note on “Chernobyl accident”.
- c) Discuss the ICRP recommendation for maximum permissible dose.
- d) Describe the working of any one personal dosimeter.
- e) Discuss the somatic effect of acute radiation exposure.

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

- a) If the linear mass absorption coefficient of Pb is 0.57cm^{-1} . What thickness of lead required to reduced the activity from 10,000 cpm to 6,000 cpm.
- b) When chloroform is exposed to Gamma radiation what is the dose absorbed in 6 hours.
Given (\bar{Z}/A) of frick solution is 0.553 and the dose absorbed by frick solution at the same position is 4.06 Gy/min.
- c) Find out the dose due to 200mci $^{99\text{m}}\text{TC}$ at a distance of 2m.
Given $E_{\gamma} = 140\text{ keV}$.



Total No. of Questions : 6]

SEAT No.:

P647

[Total No. of Pages : 3

[4125] - 303
M.Sc. (Sem. - III)
PHYSICAL CHEMISTRY
CH - 312 : Advanced Instrumental Methods of Analysis
(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.*
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5. 1 eV		=	$23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
6. Gas Constant	R	=	$8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	F	=	$96487 \text{ C equiv}^{-1}$
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11. Bohr magneton	β_e	=	$-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION - I

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

- a) Draw and explain block diagram for apparatus used in x-ray absorption.
- b) Explain the terms absorptive edge, linear absorption coefficient and mass absorptive coefficient and state Beer's law for x-ray absorption.
- c) What is energy dispersive device? Explain briefly gas-ionization detector.
- d) Describe briefly electrochemiluminescence.
- e) With neat labelled diagram describe apparatus for chemiluminescence.

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

- a) Enlist the applications of mass spectrometry.
- b) With neat labelled diagram describe the jet separator used in GCMS.
- c) State and explain various types of cross-sections of nuclear reaction.
- d) Discuss the applications of NAA.
- e) Enlist the various steps involved in radioactivation analysis. Explain briefly postirradiation treatment.

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

- a) Calculate the kinetic energy that a singly charged ion ($z = 1$) will acquire if it is accelerated through a potential of 10^3V in electron bombardment ionic source.
 - i) Does the kinetic energy of ion depend on its mass.
 - ii) Does the velocity of the ion depends on its mass.
- b) Calculate the incident angle at which x-ray from source must strike a analyzing crystal in order to reflect primary radiation ($n = 1$) with wavelength of 0.284nm .
(Given interplanar distance $d = 0.303\text{nm}$).
- c) Calculate geometrical cross section for zinc atom.
Given $R_0 = 1.4 \times 10^{-13}\text{cm}$, atomic weight of $Z_n = 65.37$.

SECTION - II

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

- a) Describe briefly applications of ICP emission spectrometry.
- b) Describe heat flux DSC instrument.
- c) State the principle of inductively coupled plasma atomic emission spectroscopy. Describe sample introduction into the plasma.
- d) What is difference in DTA and DSC. Describe briefly DTA apparatus.
- e) Describe the retarding potential analyser used in ESCA apparatus.

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

- a) With energy level diagram explain the terms.
 - i) Binding energy.
 - ii) Work function.
 - iii) Kinetic energy of ejected electron.
- b) What is voltammetric analysis? Describe different excitation signals used in voltammetry.
- c) Write a note on cyclic voltammetry.
- d) Describe with neat labelled diagram apparatus used for coulometric titrations.
- e) Discuss briefly constant current coulometric analysis.

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

- a) A current of 1.70 A is passed through 300.0ml of 0.16M solution of $ZnSO_4$ for 230S with current efficiency of 90 %. Find out the molarity of Zn^{++} after the deposition of Zn. Assume the volume of solution remain constant during electrolysis.
- b) In an ESCA an electron was found to have a kinetic energy of 1075.0 eV when $MgK\alpha$ source was employed ($\lambda = 0.989nm$). The electron spectrometer had a workfunction of 14.5eV. Calculate the binding energy of emitted electron. What would the kinetic energy have been if an $AlK\alpha$ ($\lambda = 0.834nm$) source had been used.
- c) 1 g sample containing Cu and Ag nitrates were heated in TGA apparatus. The weight of sample recorded at 400°C and 700°C are 0.72g and 0.54g respectively. Calculate percentage of Cu and Ag in given sample.
Given Atomic weights of Ag = 107.87, Cu = 63.54, N = 14, O = 16.0.



Total No. of Questions : 5]

SEAT No.:

P648

[Total No. of Pages : 3

[4125] - 304

M.Sc.

PHYSICAL CHEMISTRY
CH - 314 : Polymer Chemistry
(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.*
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12. Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION - I

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

- a) Distinguish between thermosetting and thermoplastic polymer.
- b) Discuss the secondary bond forces in polymer.
- c) Describe entropy and heat of mixing of polymer solutions.
- d) Derive co-polymer equation for free radical copolymerization.
- e) Define following terms :
 - i) Polymer.
 - ii) Degree of polymerisation.
 - iii) Homochain polymer.
 - iv) Configuration.

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

- a) Why nylon-6 is highly crystalline?
- b) What is glass transition temperature? Describe the method of determination of T_g .
- c) Describe Flory-Krigbaum theory of dilute polymer solution.
- d) Discuss the presence of defects in crystalline polymer.
- e) Explain the instantaneous composition of polymer.

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

- a) Calculate \bar{x}_n , \bar{x}_w and weight fraction of \bar{x}_n -mers when linear step polymerization is 99% complete.
- b) Calculate the viscosity of the polymer at $C = 0.3\text{g/dl}$ [given $M = 1,00,000$, $K = 1 \times 10^{-4}$ $\alpha = 0.80$, Huggines constant = 0.33]
- c) 430g vinyl acetate is copolymerised with 125g vinyl chloride. Calculate the composition of polymer formed instantaneously if the monomer reactivity ratios are 0.23 and 1.68 respectively (Atomic weight of : H = 1, C = 12, O = 16, Cl = 35.5).

SECTION - II

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

- a) Describe the use of TGA technique in the analysis of polymer.
- b) Describe the principle of membrane osmometry.
- c) Write a note on X-ray diffraction in analysis of polymer.
- d) Derive the expression for entropy, enthalpy and free energy of mixing of polymer solutions.
- e) Define : Viscosity, inherent viscosity and intrinsic viscosity.
- f) Describe effect of radiation exposure on polyethylene.

Q5) Attempt Any Four of the following :

[20]

- a) Explain how mechanical properties can be used in physical testing of polymer.
- b) Describe injection molding process with neat diagram.
- c) Discuss the process of vulcanization with suitable example.
- d) Discuss the kinetics and mechanism in block copolymerisation.
- e) Discuss the conduction mechanism in conducting polymers.
- f) Discuss the elastomers forming properties of polymer.

XXXX

Total No. of Questions : 4]

SETA No.:

P649

[Total No. of Pages : 3

[4125] - 305
M.Sc. (Sem. - III)
PHYSICAL CHEMISTRY
CH - 315 : Special Topics in Physical Chemistry
(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	=	$6.022 \times 10^{23} \text{ mol}^{-1}$
2. Boltzmann Constant	k	=	$1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ $= 1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	h	=	$6.626 \times 10^{-27} \text{ erg s}$ $= 6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	e	=	$4.803 \times 10^{-10} \text{ esu}$ $= 1.602 \times 10^{-19} \text{ C}$
5. 1 eV		=	$23.06 \text{ k cal mol}^{-1}$ $= 1.602 \times 10^{-12} \text{ erg}$ $= 1.602 \times 10^{-19} \text{ J}$ $= 8065.5 \text{ cm}^{-1}$
6. Gas Constant	R	=	$8.314 \times 10^7 \text{ erg K}^{-1} \text{ mol}^{-1}$ $= 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ $= 1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	F	=	$96487 \text{ C equiv}^{-1}$
8. Speed of light	c	=	$2.997 \times 10^{10} \text{ cm s}^{-1}$ $= 2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		=	$4.184 \times 10^7 \text{ erg}$ $= 4.184 \text{ J}$
10. 1 amu		=	$1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	=	$-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear magneton	β_n	=	$5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	=	$9.11 \times 10^{-31} \text{ kg}$

P.T.O.

SECTION - I

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

- a) Define Sensor. Draw and explain the block diagram of sensor system.
- b) Discuss the basis of classification of sensors according to the material used and principle of conversion.
- c) Explain the influence of hydrogen and water vapour on the properties of semiconductor ceramics.
- d) Define the poison, Hammett acidity function, specific acid catalysis and Michaelis-Menten Kinetics.
- e) Write a note on : Chemiresistors.
- f) The pH of 0.01M solution of salt of carbonic acid is 7 find the concentration of H_2CO_3 , HCO_3^- and CO_3^{2-} .

Given : - $K_{a_1} = 2.15 \times 10^{-7}$ and $K_{a_2} = 4.69 \times 10^{-11}$.

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

- a) Discuss the catalysis in gas phase with suitable example.
- b) Write proton condition for $\text{H}_2\text{C}_2\text{O}_4$ and NaHS .
- c) Discuss the dependence of the rate constant on pH for oximation of acetone at 25°C.
- d) Draw logarithmic concentration diagram for 0.1M H_2CO_3 .
- e) What are active and passive sensors?
- f) Write the charge balance for 0.1M NaCN and 0.2 M HCN .

SECTION - II

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

- a) Discuss briefly mechanical properties of nanoparticle.
- b) What are intelligent gels? Explain.
- c) What are applications of carbon nanotubes.
- d) Explain the term active smartness with suitable illustration.
- e) What are possible hazards in the use of nano-machines.
- f) Describe different forms of smart composites.

Q4) Attempt any Four of the following :

[20]

- a) Derive and state the limitation of phase rule.
- b) Write a note on steam distillation.
- c) How are the rubber like ceramics prepared? Discuss their applications.
- d) Write a note on constant boiling liquids.
- e) Give an account of Sushi Sensor.
- f) Give an account of chemical methods of preparing nanoparticles.



P649**[4125] - 305****M.Sc. (Sem. - III)****PHYSICAL CHEMISTRY****CH - 316 : Environmental Pollution****(2004 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 tables/calculator is ALLOWED.*
- 5) *Neat diagrams must be drawn WHEREVER necessary.*

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

- a) Explain pathways of pollutants with suitable examples.
- b) Discuss the biochemical effects of lead.
- c) Explain the carbon cycle in the atmosphere.
- d) What are health effect of air pollutants?
- e) Write a note on : atmospheric photochemistry.
- f) Discuss the biochemical effects of DDT.

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

- a) What are causes and effects of acid rain?
- b) How does environment get polluted by petroleum hydrocarbons?
- c) Explain with a suitable diagram biogeochemical cycle.
- d) Write a note on : atmospheric photochemistry.
- e) What are surfactants? Discuss cationic surfactants.
- f) Discuss in detail : the point and non point sources of water pollution.

SECTION - II

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

- a) Write a note on : 'Photochemical Smog'.
- b) Explain the effect of CFC on Ozone layer.
- c) What are the sources of pollutant NO_x ? Explain its biochemical effect.
- d) Define 'soil'. State the factors affecting soil formation.
- e) Discuss the diagnostic tests and treatment of lead poisoning.
- f) Write a note on 'biotic damage due to thermal pollution.

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

- a) What is acidity of water? How it is determined?
- b) Define 'chemical toxicology', classify highly toxic solids with their recommended limit in ppm.
- c) Explain the terms : Thermal noise, partition noise short noise and environmental noise.
- d) What are permissible limit for residual chlorine in water? How it is estimated?
- e) Explain mechanism of toxic chemicals on enzyme with suitable examples.
- f) Discuss the importance of physical examination of water.



Total No. of Questions : 4]

SEAT No.:

P650

[Total No. of Pages : 2

[4125]-306

M.Sc. - II

INORGANIC CHEMISTRY

**CH - 326 : Organometallic Compounds of Transition Metals and
Homogeneous catalysis
(2008 Pattern) (Sem. - III)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

- 1) *All questions are compulsory and carry equal marks.*
- 2) *Figures to the right indicates full marks.*
- 3) *At.No : Fe = 26, Co = 27.*

Q1) Attempt Any Four of the following :

[20]

- a) What are the special features in the bonding of carbonyl ligand to transition metals?
- b) Explain the role of cobalt carbonyl compounds in the hydroformylation reactions.
- c) Explain the bonding in Metal-alkene complexes.
- d) Cobaltocene and nickelocene are readily oxidised as compared to ferrocene. Explain with the help of M.O. diagram.
- e) Explain the typical reactions of Mo (CO)₆.

Q2) Attempt Any Four of the following :

[20]

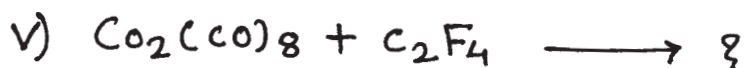
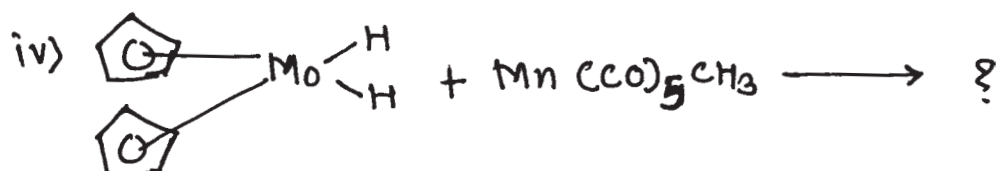
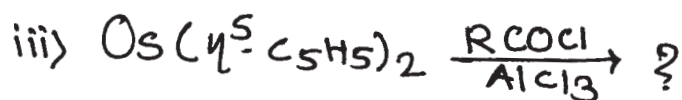
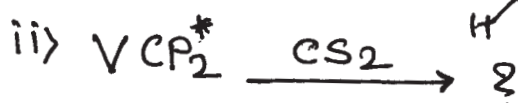
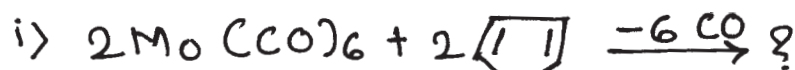
- a) Discuss briefly the possible mechanism for metathesis of propene.
- b) Provide a short account of the preparation and reactions of metal-cyclobutadiene compounds.
- c) Give the preparation and electrophilic substitution reactions of ferrocene.
- d) Discuss the mechanism for oxidation of ethylene to acetaldehyde using palladium catalyst.
- e) Discuss NMR of the following fluxional molecules.
 - i) Fe₂ (CO)₄ (η^5 - C₅H₅)₂ and
 - ii) Fe (CO)₃ (C₈H₈).

P.T.O.

Q3) Attempt Any Four of the following :

[20]

- a) State EAN rule and predict the structure of
- $(\eta^5 - C_5H_5) (\eta^1 - C_5H_5) Fe (CO)_2$ and
 - $CO_2 (CO)_8$ (in hexane and solid).
- b) The variable temperature 1Hnmr $[(\eta^5 - C_5H_5) Fe (CO)_2]_2$ shows one sharp signal at $+ 28^\circ C$, while two sharp signals are seen in the 1Hnmr at $- 70^\circ C$.
- c) Complete the following reactions :



- d) Write an account of application of OMC's in agriculture and horticulture.
- e) Explain the interdependence of Inorganic and organo-metallic materials in the environment.

Q4) a) Write short note on Any Three :

[15]

- Repee's catalyst.
- Metal-Nitrosyl Compounds.
- Gr IV organometallics medicine.
- Tolman's catalytic cycle.

b) Draw the structure :

[5]

- $\mu.CO [(\eta^4 - C_4H_4) Fe (CO)]_2$
- $Ir_4 (CO)_{12}$
- Dimeric $Mn_2 (CO)_{10}$
- $Fe_3 (CO)_{12}$
- $Mo (CO)_3 (\eta^6 - C_7H_8)$



Total No. of Questions : 4]

SEAT No.:

P651

[Total No. of Pages : 2

[4125]-307

M.Sc. - II

INORGANIC CHEMISTRY

**CH - 330 : Co-ordination Chemistry, Magnetism and
Reaction Mechanism
(2008 Pattern) (Sem. - III)**

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

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

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

- a) Draw the crystal field splitting of d orbitals of a central metal ion in symmetric octahedral, tetrahedral and tetragonal complexes.
- b) Explain why $\text{Mn}(\text{CO})_5$ is paramagnetic while $\text{Mn}_2(\text{CO})_{10}$ diamagnetic.
- c) Explain the experimental magnetic moment of the following ions.
 Mn^{3+} $\mu\text{B.m. expt} = \sim 4.9 \text{ B.M.}$
 CO^{2+} $\mu\text{B.m. expt} = 4.1 \text{ to } 5.2 \text{ B.M.}$
Given : atomic no.of Mn = 25 and CO = 27
- d) Write a note on 'High Spin - low spin' equilibria.
- e) Explain why certain Ni (II) complexes show anomalous magnetic moments.

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

- a) What are mixed valence compounds? How they are classified? Why many of them are intensely coloured.
- b) Explain the terms :
 - i) Canting.
 - ii) Antiferromagnetic material.
 - iii) Spin pairing.

P.T.O.

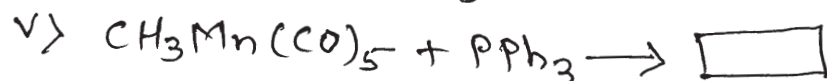
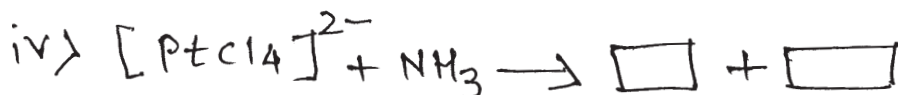
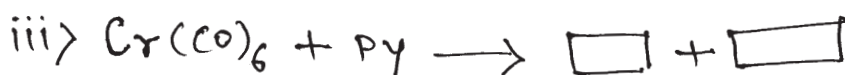
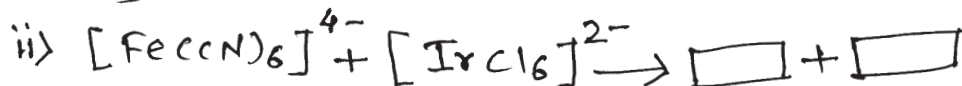
- c) Give the nomenclature for the following molecules.
- $[\text{Rh}(\text{pPh}_3)_2\text{Cl}_2]$
 - $[\text{Pt}(\text{NH}_3)_3\text{Cl}_3]\text{Cl}$
 - $\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$
 - $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$
 - $\text{Pd}(\text{NH}_3)_2(\text{C}_2\text{H}_3\text{O}_2)_2$
- d) What are magnetically diluted and concentrated systems.
- e) Write about super exchange model for an antiferromagnetic interaction.

Q3) Attempt Any Four of the following : **[20]**

- How the solvent plays an important role in substitution reaction of square planar complexes.
- Explain main reaction types with suitable examples.
- Write a note on insertion reactions.
- With the help of 'trans effect' how would you synthesize cis-chloriodobis (pyridine) platinum (II) from K_2PtCl_4 ?
- Explain in brief the various steps involved in photographic process.

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

- Discuss the mechanism of electron transfer reaction with reference to inner-sphere reactions.
- Write a note on oxidative addition reactions.
- Explain the isomerism in $[\text{Co}(\text{en})_2\text{Cl}_2]^+$. Which form is optically active? Why?
- Give in brief an account of π -bonding theory of trans effect.
- Complete the following chemical equations.



☒☒☒☒

Total No. of Questions : 4]

SEAT No.:

P652

[Total No. of Pages : 2

[4125]-308

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

INORGANIC CHEMISTRY

CH - 331 : Structural Methods in Inorganic Chemistry

(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

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

Q1) Answer the following (Any Four) :

[20]

- a) The Mössbauer spectrum of $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ shows a quadrupole doublet while that of $\text{K}_4\text{Fe}(\text{CN})_6$ shows a single line. Explain.
- b) Predict the ESR spectrum of methyl radical.
- c) Explain the process of \bar{e} transitions involved in photoelectron spectroscopy.
- d) What is a shift reagent? How are Lanthanides used as shift reagents in NMR?
- e) The thermogram of a 125.70mg of sample containing $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ (M.W 146.12) and a thermally stable salt had a mass loss Δ_m of 6.98mg at an onset temperature of about 140°C corresponding to vaporization of water. Determine the % age (w/w) of $\text{Ca C}_2\text{O}_4 \text{ H}_2\text{O}$ in the sample.

Q2) Attempt the following (Any Four) :

[20]

- a) Explain the principle of TEM with the ray diagram.
- b) Explain the ESR for NH_2 radical I for $^{14}\text{N} = 1$; I for $^1\text{H} = 1/2$.
- c) Describe the procedure to determine the different redox process using cyclic voltametry.
- d) Discuss the selection rules in ESR and NMR spectroscopy with suitable examples.
- e) Discuss the principles and limitations of NQR.

P.T.O.

Q3) Attempt Any Four :

[20]

- a) Explain in detail the use of X-ray crystallography for determining crystallite size.
- b) Explain the use of NMR spectroscopy for CaCO_3 Equilibrium studies.
- c) What is the effect of furnace atmosphere on the DTA of a substance? Sketch and compare the DTA curve of $\text{CaCO}_3 \cdot \text{H}_2\text{O}$ in air and CO_2 atmosphere.
- d) What is meant by "Isomer Shift" in Mössbauer spectroscopy?
- e) A sample was subjected to X-rays with $\lambda = 1.541 \text{ \AA}$, the diffraction pattern gave the lines at the following 2θ values. With the help of this data index the planes.

2 line no.	$2\theta(^\circ)$
1	65.0
2	59.3
3	45.3
4	37.6
5	32.3

Q4) Write short notes on (Any Four) :

[20]

- a) Differential Scanning Calorimetry.
- b) Auger Electron Spectroscopy.
- c) Zero field splitting.
- d) G-factor.
- e) Factors affecting TG and DTA curves.



Total No. of Questions : 5]

SEAT No. :

P665

[4125]-404

[Total No. of Pages : 3

M.Sc. (Sem. - IV)

PHYSICAL CHEMISTRY

**CH - 415 : Special Topics in Nuclear Radiation Chemistry
(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	= $6.022 \times 10^{23} \text{mol}^{-1}$
2. Boltzmann Constant	k	= $1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ = $1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	h	= $6.626 \times 10^{-27} \text{ erg s}$ = $6.626 \times 10^{-34} \text{ J s}$
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5. 1 eV		= $23.06 \text{ k cal mol}^{-1}$ = $1.602 \times 10^{-12} \text{ erg}$ = $1.602 \times 10^{-19} \text{ J}$ = 8065.5 cm^{-1}
6. Gas Constant	R	= $8.314 \times 10^7 \text{ ergK}^{-1} \text{ mol}^{-1}$ = $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ = $1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	F	= $96487 \text{ C equiv}^{-1}$
8. Speed of light	c	= $2.997 \times 10^{10} \text{ cm s}^{-1}$ = $2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		= $4.184 \times 10^7 \text{ erg}$ = 4.184 J
10. 1 amu		= $1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	= $-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear Magnetron	β_n	= $5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	= $9.11 \times 10^{-31} \text{ kg}$

SECTION - I

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

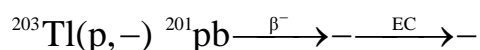
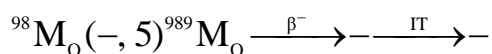
- a) Discuss the general aspects of use of radiopharmaceuticals in diagnosis and therapy of various diseases.
- b) Describe the method of preparation of ^{99m}Tc .
- c) Give an account of positron emission tomography technique.
- d) Write a note on use of ionizing radiation for food preservation.
- e) Describe the method of separation of uranium isotopes.

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

- a) Explain the terms cosmology, nucleosynthesis, meteorite, and p process.
- b) Draw and explain cosmic abundance curve.
- c) Write down the reactions for He, C and Ne burning processes.
- d) Explain how liquid radioactive waste is classified. How this waste is disposed off?
- e) Discuss the various categories of solid waste.

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

- a) Find out the activity of ^{99m}Tc if the activity of loaded ^{99}Mo in technetium generator is 30,00 CPM and ^{99m}Tc is extracted after 6 hours.
Given : $t_{1/2}$ of $^{99}\text{Mo} = 66\text{h}$, $^{99m}\text{Tc} = 6.01\text{h}$, extraction efficiency = 80%.
- b) Find out the thickness of lead required to reduce the activity from 25000 CPM to 10,000 CPM. Given $e^{-\mu} = 0.211$ ble, A of pb = 207, $Z = 82$, density of pb = 11.35 g/cm^3
- c) Complete the following reactions



SECTION - II

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

- a) Describe the radiolysis of aromatic hydrocarbons.
- b) Explain the phenomenon of radiolysis of alkanes.
- c) Explain the principle and technique of radiometric titration curves based on interaction of β - particles with the substance.
- d) Describe the radiometric titration curve for the titration of a mixture of three ions in which ions precipitating first and last are labelled.
- e) Give an account of experimental set up of neutralization reaction using radioactive kryptonates.
- f) What are the various phase separation techniques used in precipitation radiometric titrations? Discuss any one of them in detail.

Q5) Answer any four of the following : **[20]**

- a) State and explain the procedure for the determination of beam energy.
- b) Discuss the chemical problems in purification and isolation of radioactive species during their production.
- c) Write a note on carriers used in nuclear reaction.
- d) Explain competition kinetics with a suitable example.
- e) Define radical scavenging. Explain it with a suitable example.
- f) 20 ml labelled KI were titrated with 0.005 M AgNO_3 radiometrically. Addition of 1 ml of AgNO_3 showed a drop in initial activity from 18,000 counts per 2 min to 8000 CPM. Find the amount of KI in the mixture
Background counts = 50 for 5 min.
(Given : atomic weight of K = 39.1, I = 127, Ag = 108, N = 14, O = 16).



P665**[4025]-404****M.Sc. (Sem. - IV)****PHYSICAL CHEMISTRY****CH - 416 : Special Topics in Physical Chemistry****(2004 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	= $6.022 \times 10^{23} \text{ mol}^{-1}$
2. Boltzmann Constant	k	= $1.38 \times 10^{-16} \text{ erg K}^{-1} \text{ molecule}^{-1}$ = $1.38 \times 10^{-23} \text{ J K}^{-1} \text{ molecule}^{-1}$
3. Planck Constant	h	= $6.626 \times 10^{-27} \text{ erg s}$ = $6.626 \times 10^{-34} \text{ J s}$
4. Electronic Charge	e	= $4.803 \times 10^{-10} \text{ esu}$ = $1.602 \times 10^{-19} \text{ C}$
5. 1 eV		= $23.06 \text{ k cal mol}^{-1}$ = $1.602 \times 10^{-12} \text{ erg}$ = $1.602 \times 10^{-19} \text{ J}$ = 8065.5 cm^{-1}
6. Gas Constant	R	= $8.314 \times 10^7 \text{ ergK}^{-1} \text{ mol}^{-1}$ = $8.314 \text{ J K}^{-1} \text{ mol}^{-1}$ = $1.987 \text{ cal K}^{-1} \text{ mol}^{-1}$
7. Faraday Constant	F	= $96487 \text{ C equiv}^{-1}$
8. Speed of light	c	= $2.997 \times 10^{10} \text{ cm s}^{-1}$ = $2.997 \times 10^8 \text{ m s}^{-1}$
9. 1 cal		= $4.184 \times 10^7 \text{ erg}$ = 4.184 J
10. 1 amu		= $1.673 \times 10^{-27} \text{ kg}$
11. Bohr magneton	β_e	= $-9.274 \times 10^{-24} \text{ J T}^{-1}$
12. Nuclear Magnetron	β_n	= $5.051 \times 10^{-27} \text{ J T}^{-1}$
13. Mass of an electron	m_e	= $9.11 \times 10^{-31} \text{ kg}$

SECTION - I

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

- a) Define 'Sensors'. What are the necessary requirements for conducting electrodes for normal operation of sensors?
- b) Discuss adsorption isotherms used in sensors.
- c) Write a note on biosensors.
- d) Write the proton condition for H_3PO_4 and H_2Se .
- e) Write mass balance on sodium and carbonate in 0.02M NaHCO_3 and charge balance for 0.5 N NaCN .
- f) Draw the logarithmic concentration diagram for 0.1M H_3PO_4
[Given : $\text{PKa}_1 = 2.23$, $\text{PKa}_2 = 7.21$, $\text{PKa}_3 = 12.32$]

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

- a) Discuss the mechanism of general acid - base catalysis.
- b) Explain the catalysis in dilute aqueous solution.
- c) Define the terms :
 - i) Activity
 - ii) Catalyst.
 - iii) Poison and
 - iv) Selectivity of catalyst.
- d) Calculate the pH and concentration of all ionic species for 0.01 M CH_3COONa .
[Given : $K_a = 1.85 \times 10^{-5}$]
- e) Derive the rate expression for Michalis - Menten Kinetics.
- f) Give the mechanism of the phenol - acetone condensation reaction to get bisphenol A.

SECTION - II

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

- a) What are the applications of carbon nanotubes?
- b) Write a note on - nano robot.
- c) Describe any two chemical methods of preparing nano particles.
- d) What are the different techniques used by a submarine to stilt itself?

- e) Discuss the characteristics of passively smart materials.
- f) Explain active smartness with proper illustration.

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

- a) Explain the abnormal changes in properties observed in nano particles as compared to ordinary particles.
- b) Write a note on - smart vibration controllers.
- c) Define functionality. Give examples of monomers that are mono, bi, tri and tetra functional.
- d) With the help of a neat and labelled diagram, describe the working of an electron microscope.
- e) Describe lithographic methods of preparing nanoparticles.
- f) What is the calibration temperature used in thermocouple?
A wattmetre records 100 Nm torque corresponding to 500 watts power.
Calculate the deflection torque to 250 watts power.



Total No. of Questions : 4]

SEAT No.:

P667

[Total No. of Pages : 2

[4125]-406
M.Sc. - II (Sem. - IV)
INORGANIC CHEMISTRY
CH - 431 : Material Science
(2008 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

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

Q1) Attempt Any Four of the following :

[20]

- a) What are nanocomposites? Explain the following properties of nanomaterials.
 - i) Melting point.
 - ii) Density.
 - iii) Specific heat.
 - iv) Magnetic property.
- b) Explain Bardeen-Cooper-Schrieffer theory of super conductivity.
- c) With the help of band energy diagram explain why semi conductors have low electrical conductivity compared to metals.
- d) What is concrete? How is it prepared? Explain the proportions of concrete mixer.
- e) What is the difference between normal and inverse spinel? Give applications of magnetic materials.

Q2) Attempt Any Four :

[20]

- a) Explain the different applications of biomaterials.
- b) Explain sol-gel process.
- c) What is photoluminescence? Explain the different types of luminescence.
- d) Explain the working of p-n-p transistor with the help of band energy diagram.
- e) Derive the expression for curie law.

P.T.O.

Q3) Answer Any Four :

[20]

- a) In an n-type semiconductor, the fermi level lies 0.3ev below the conduction band at room temperature. If the temperature is increased to 330°K find the position of Fermi level. (Given room temperature 300°K).
- b) Calculate the net magnetic moment for Iron atom in crystal structure using the following data :
 - i) Iron has BCC structure.
 - ii) Saturation magnetisation is 1700 kA/m².
 - iii) Lattice parameter 2.87Å.
- c) Calculate the energy gap in 'Si' given that it is transparent to radiation of wavelength greater than 11,000Å.
- d) Calculate the conductivity of specimen if a donor impurity is added to an extent of one part in 10⁸ Ge atom at room temperature.
Given : Avogadro's no : = 6.023 × 10²³ atoms/gm. mole; Atomic weight of Ge = 72.6; Density of Ge = 5.32gm/cc Mobility μ = 3800cm²/v.s.
- e) In Germanium the energy gap is about 0.75ev. What is the wavelength at which germanium starts to absorb light?

Q4) Attempt Any Four of the following :

[20]

- a) Write a short note on Ficks Law of diffusion.
- b) Explain the Meissner effect. Explain what are type I and type II superconductors.
- c) What is Portland Cement? Explain different types of portland cement.
- d) Explain Hysteresis Loop.
- e) Explain the mechanism of crystal growth of Hydration reaction.



Total No. of Questions : 9]

SEAT No.:

P668

[Total No. of Pages : 3

[4125]-407

M.Sc. - II

INORGANIC CHEMISTRY

**CH - 445 : Inorganic Applications in Industry,
Biotechnology and Environmental Chemistry
(2008 Pattern) (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 indicate full marks.*
- 5) *Neat diagram must be drawn wherever necessary.*
- 6) *Use of logarithmic table/calculator is allowed.*

SECTION - I

Inorganic Applications in Industry

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

- a) What type of isomerisms are seen in Cr and Co complexes of tritentate? Azo compounds? Explain any one of them.
- b) Discuss the different processes available for electro-plating of zinc.
- c) What are the main types of synthetic fibers? Explain any one with production and properties.
- d) What are the general properties of pigment? Explain any one of them.

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

- a) "Azo groups are weak donors, but a large number of metal complexes having arylazo ligand are known". Justify the statement with the suitable example.
- b) A piece of wood containing moisture weigh 174.3gm and after oven drying a constant weight is 156.5gm. What is its % moisture content? Justify your answer on the quality of wood.
- c) Comment on the use of polymers in the electroplating industry.
- d) How do pigment size, shape, oilabsorption, bulking value and pigment concentration affect the quality of a pigment coating?

P.T.O.

Q3) Write short notes on Any Two : [10]

- a) Electroplating of tin.
- b) Bronze powder pigment.
- c) Carbon fiber reinforced epoxy resin.

SECTION - II

Environmental Chemistry

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

- a) What is maximum contaminant level (MCL) of the Safe Drinking water Act?
- b) How do you differentiate between active and passive solar heating system?
- c) List the trace element pollution in natural water with sources, effect and significance.
- d) Explain how the detergent and pesticides are responsible for water pollution.

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

- a) Draw a schematic diagram of a Molten Carbonate Fuel Cell (MCFC). Write the reaction that occur at the cathode and anode. Show overall reaction. Describe the molten electrolyte used in this fuel cell.
- b) Name the instrumental method for the determination of Hg, Cd, As, Pb. Explain X-Ray fluorescence (XRF) method for the determination of lead from polluted water.
- c) Describe two way's that phosphate and nitrates are removed in tertiary treatment of sewage.
- d) Define the following :
 - i) Primary and Secondary standards for the safe Drinking Water Act.
 - ii) Analyte.
 - iii) Matrix.
 - iv) Hardness.
 - v) BOD and COD.

Q6) Write short notes on Any Two : [10]

- a) Energy from biomass.
- b) Biorefractory organic pollutant.
- c) Electrodialysis.

SECTION - III

Biotechnology

Q7) Answer Any Three : **[15]**

- a) What is meant by biotechnological manufacturing? What are the safety measures which have to be taken during this?
- b) Comment on the present scenario in biotechnology.
- c) Explain the effect of pH, concentration, temp. on the fermentation of curds.
- d) What is recombinant DNA? What are its advantages and limitations?
- e) Describe the process of beer making.

Q8) Attempt Any Three : **[15]**

- a) What is the role of microbes in oil refineries.
- b) Tissue culture has a great commercial applications. "Explain".
- c) Explain the germ theory of diseases.
- d) Enzymes are active only under special conditions. "Explain".
- e) Explain the important steps in bread making.

Q9) Write short notes Any Two : **[10]**

- a) Fermentation in Biotechnology.
- b) DNA Mapping.
- c) Gasohol.



Total No. of Questions : 6]

SEAT No.:

P669

[Total No. of Pages : 4

[4125]-408

M.Sc. - II

ORGANIC CHEMISTRY

CH - 450 : Chemistry of Natural Products

(2008 Pattern) (Sem. - IV)

Time : 3 Hours]

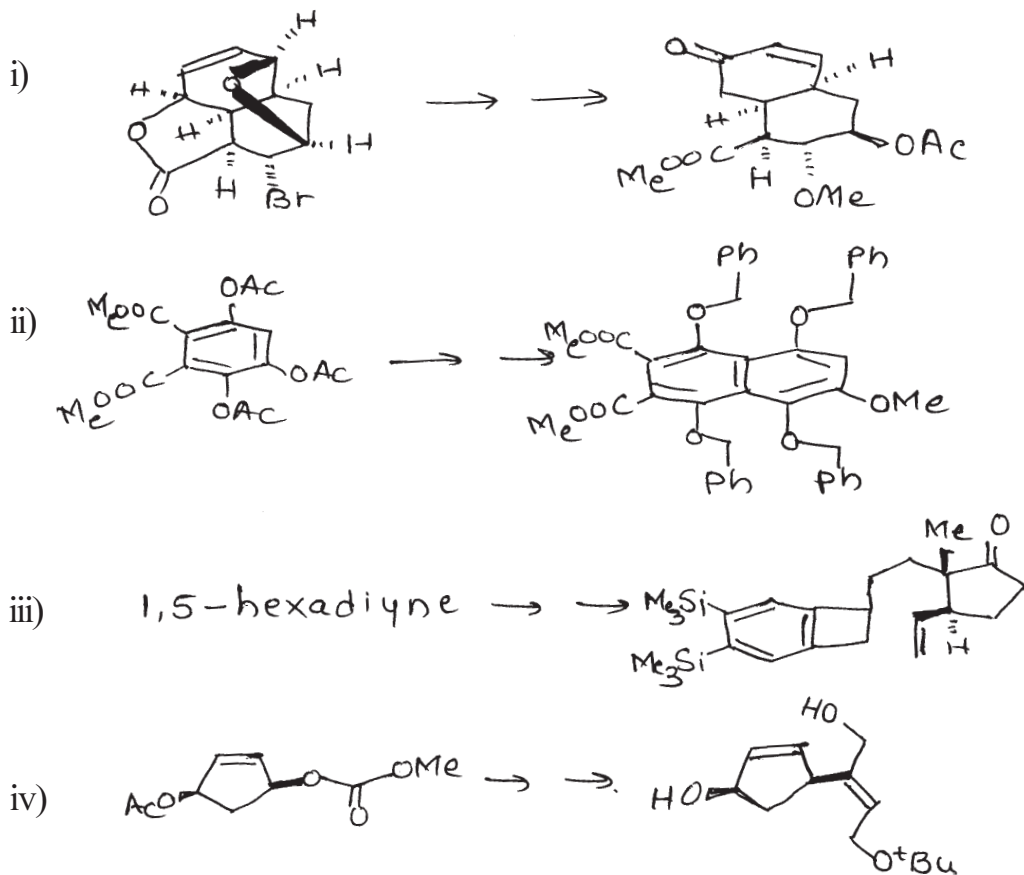
[Max. Marks : 80

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) a) Outline the steps involved in the following synthetic sequences. Indicate the reagents and discuss the mechanism and stereo chemistry involved. (any three) : [12]



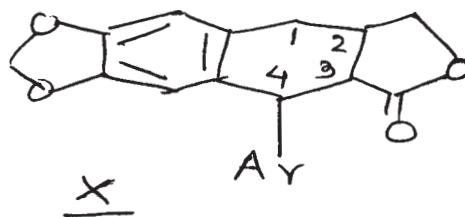
b) Discuss the role of shapiro reaction in the formation of C1-C2 bond in taxol. How it helps to selectively functionalize $\Delta^{14,1}$ double bond. [4]

P.T.O.

Q2) Answer the following (any three) :

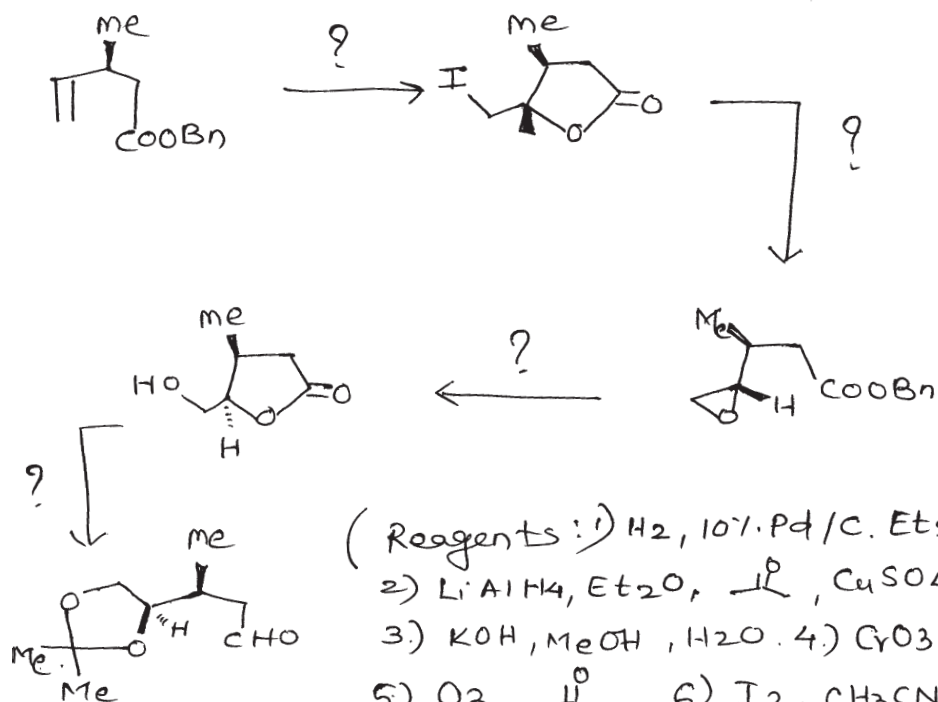
[12]

- How can we detect presence of phenolic-OH group in hydroxycamptothecin? What is the role of NaOD in determination of position of the phenolic-OH group in hydroxycamptothecin?
- Describe the evidences to establish the presence of C-9 methyl group in Hardarcklic acid.
- Give evidences to establish the presence of
 - Pyridone ring structure and
 - Ethyl group on chiral carbon carrying tertiary-OH group in camptothecin.
- Assuming the part structure X for podophyllotoxin, how it was established that -OH is not at C-2, C-3 and C-4 but present at -C-1?



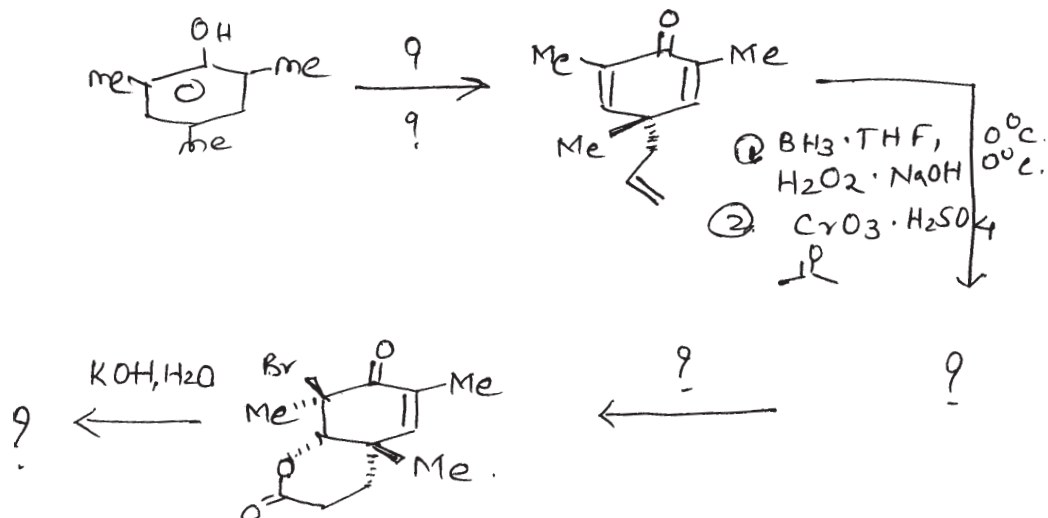
Q3) a) Place the appropriate reagents in the following conversion and rewrite the complete sequence. Explain each step. (Reagents are give below) :

[6]



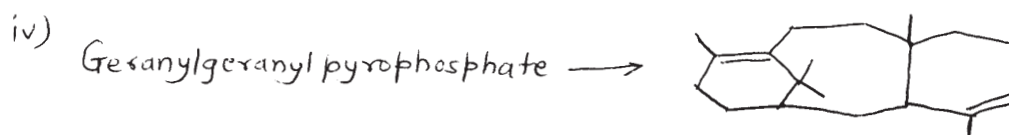
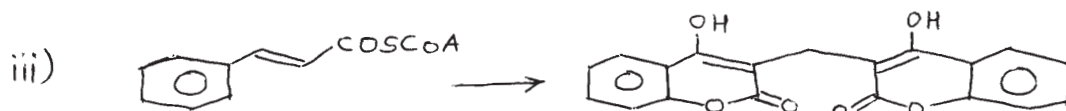
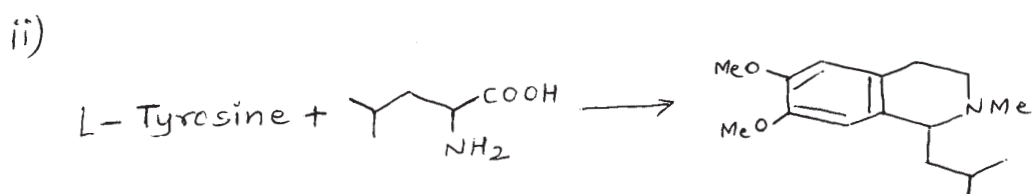
(Reagents : 1) $H_2, 10\% Pd/C, Et_2O$
 2) $LiAlH_4, Et_2O, \text{PhI}^+, CuSO_4$
 3) $KOH, MeOH, H_2O$. 4) $CrO_3, Pyr.HCl$
 5) O_3, PhI^+ , 6) $I_2, CH_3CN, -15^\circ C$,
 7) $BnOK, THF, -20^\circ C$.
 8) $Pb(OAc)_4, Cu(OAc)_2$.)

- b) Complete the following synthesis. Write appropriate intermediates and reagents and explain. [6]



SECTION - II

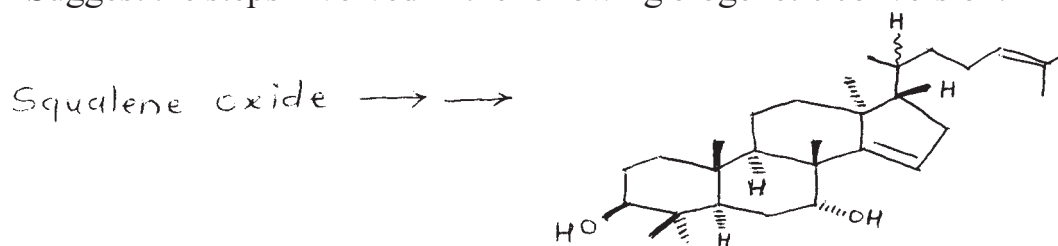
- Q4) a) Explain the importance of Schiff base formation and Mannich reaction in the biosynthesis of alkaloids with two examples. [4]
 b) Suggest biogenetic scheme for any three of the following: [12]



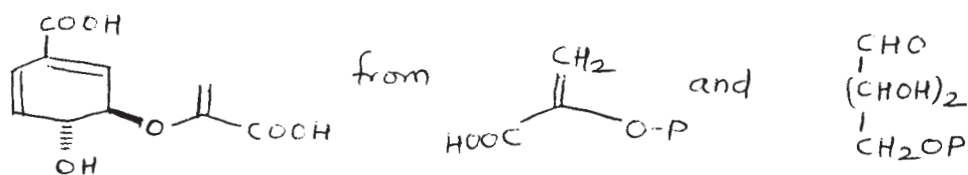
Q5) Answer any two of the following :

[12]

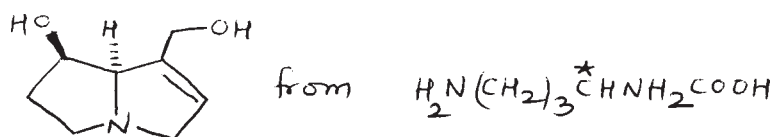
a) Suggest the steps involved in the following biogenetic conversion.



b) Suggest biogenetic pathway for



c) Suggest biogenetic scheme for



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

Q6) a) Suggest the biogenetic pathway for

[6]

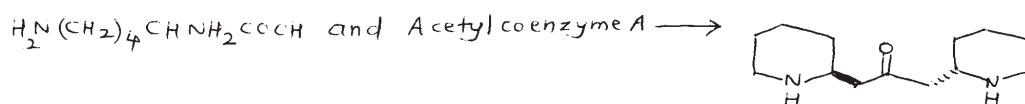


Show the expected positions of label in each step and in the final product. How can we explain the observation that the label is present only in the upper half of the molecule.

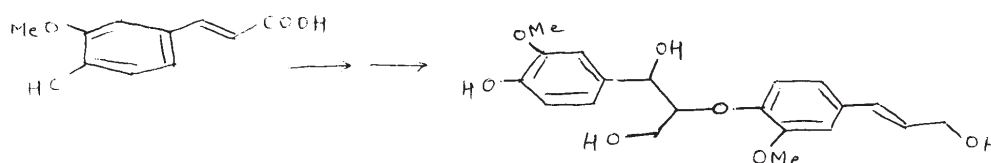
b) Answer any one of the following :

[6]

i) Suggest the steps involved in the following biogenetic conversion.



ii) Write all steps in the following biogenetic conversion.



XXXXX

Total No. of Questions : 6]

SEAT No.:

P670

[Total No. of Pages : 4

[4125]-409

M.Sc. - II

ORGANIC CHEMISTRY

CH - 451 : Synthetics Methods in Organic Chemistry

(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) Explain Any Two of the following : [6]

- a) The importance of protecting groups in organic synthesis with suitable example.
- b) Use of Mannich reaction in preparation of exo-methylene ketones.
- c) Synthetic applications of Collman's reagent in organic synthesis.

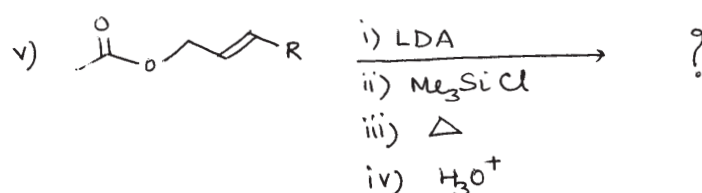
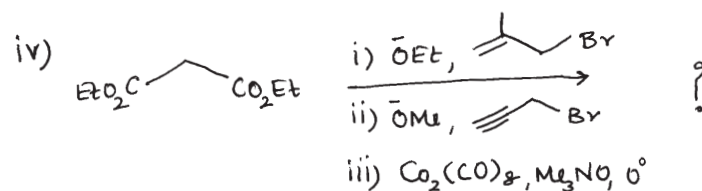
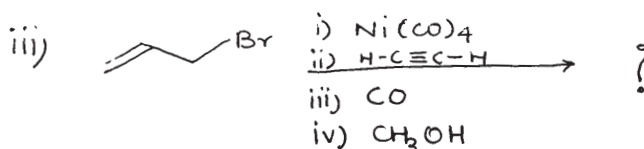
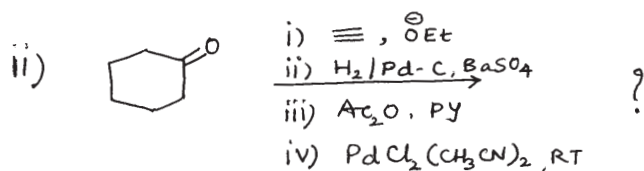
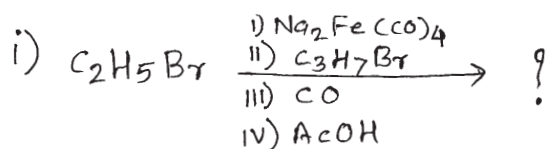
Q2) a) Complete the following conversions by using suitable reagent (Any Two) : [6]



P.T.O.

b) Predict the products in Any Four of the following :

[12]



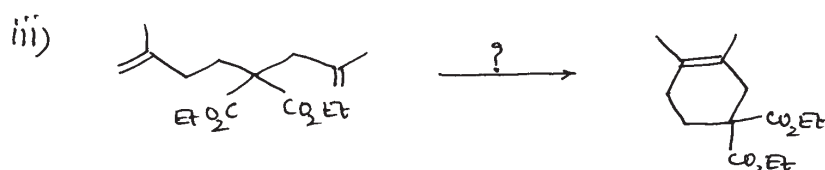
Q3) a) Write short note on Any Two of the following :

[6]

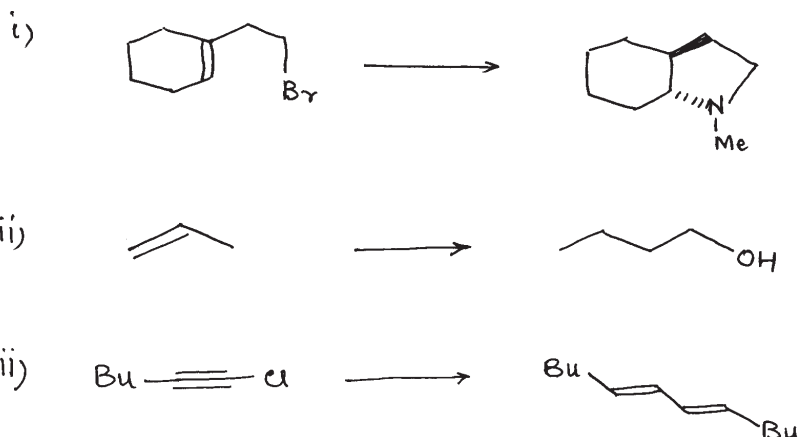
- Chiral Organoboranes.
- Heck reaction.
- Zeigler Natta Catalyst.

b) Write the reagents for the following conversions Any Two :

[4]



c) Provide a suitable synthesis using hydroboration as one of the steps
Any Two : [6]



SECTION - II

Q4) a) Explain Any Two of the following : [6]

- i) Importance of ethyl ethylthiomethyl sulfoxide in the formation of ketones and 1, 4-dicarbonyl compounds.
- ii) BOC is deprotected under acidic conditions while Fmoc under basic conditions.
- iii) Solid phase synthesis of peptides uses peptide linkers.

b) Explain the use of Any Two of the following : [6]

- i) Dicyclohexylcarbodiimide.
- ii) Wilkinson catalyst.
- iii) Benzylidene-bis (tricyclohexyl phosphine) dichloro ruthenium.

Q5) a) Complete the following transformations using the reagents given below.
 Arrange the reagents in proper order Any Two : [6]



KO^tBu ; $HS(CH_2)_3SH, TsOH$; $TsCl$; $nBuLi$; $NaBH_4$;

$Br-CH_2$ (on a benzofuran ring), $aq. HgCl_2$

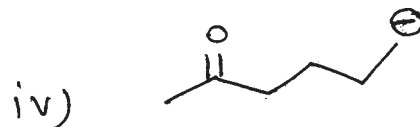
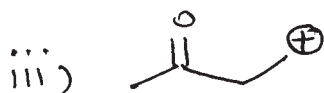


$Me_2S^+CH_3$; H_2O_2/OH^- ; alkene ; $\text{alkene} + BH_2$; $CO, H_2O, 70 atm, 150^\circ C$

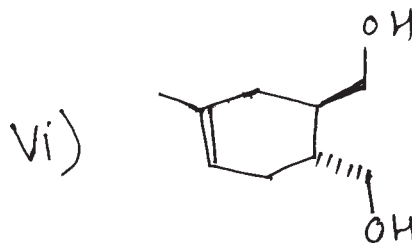
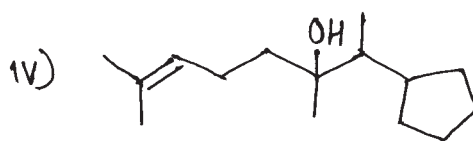
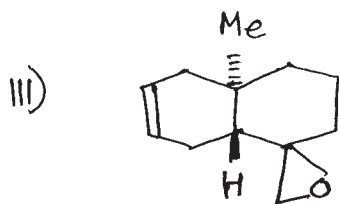
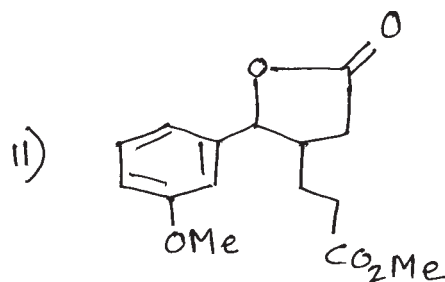
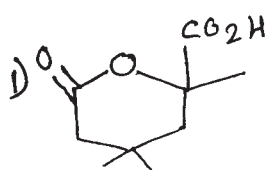


CH_2N_2 ; $NaBH_4$; $EtBr$; $SOCl_2$; KO^tBu ; KCN ; $aq. H_2SO_4$; CH

b) Give the synthetic equivalent of Any Three of the following synthon. Illustrate your answer with one example of each. [6]



Q6) Using retrosynthetic analysis, Suggest suitable method to synthesize of the following Any Four : [16]



XXXXX

Total No. of Questions : 6]

SEAT No.:

P671

[Total No. of Pages : 5

[4125]-410

M.Sc.

ORGANIC CHEMISTRY

CH - 452 : Heterocyclic Chemistry Chiron Approach and Medicinal Chemistry

(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) a) Explain the following Any Three : **[9]**

- i) Furan has lower boiling point than pyrrole.
- ii) 4-chloro-3-nitro pyridine easily hydrolyses in warm water.
- iii) Diazines are highly resistant to electrophilic attack.
- iv) Imidazole is more acidic than Pyrrole.

b) How supramolecular chemistry is different than traditional chemistry? **[3]**

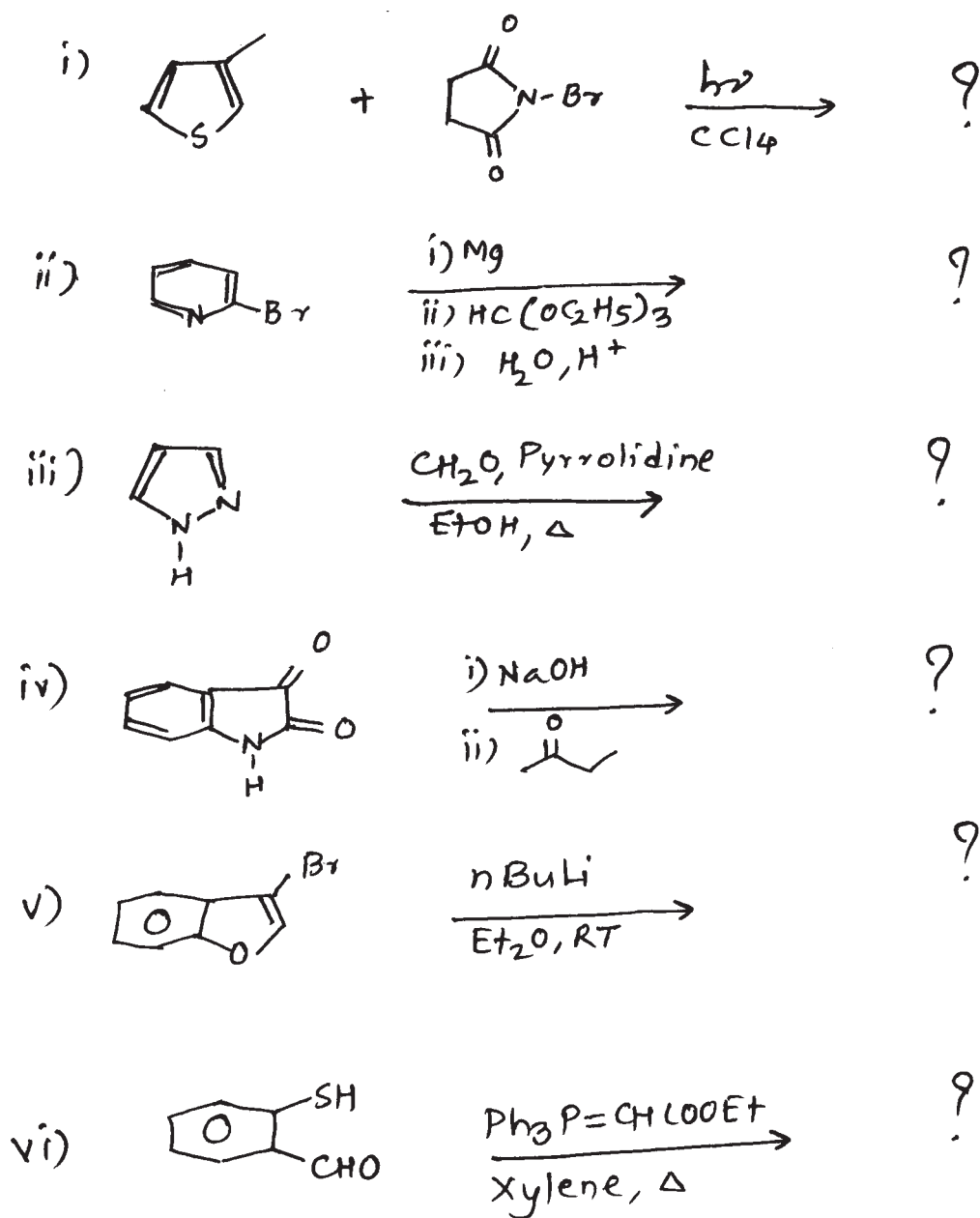
Q2) a) Give the reactions of following reagents with Indole. **[4]**

- i) DMF, POCl₃, 5°C followed by aq. NaOH.
- ii) , PhH, RT.
- iii) NaB (CN) H₃, AcOH, RT.
- iv) Ac₂O, AcOH, heat.

P.T.O.

b) Predict the product/s in Any Five of the following :

[10]

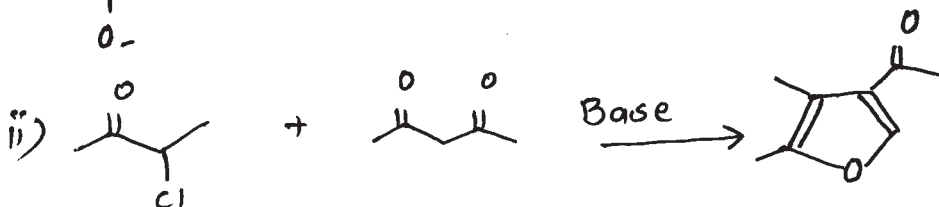
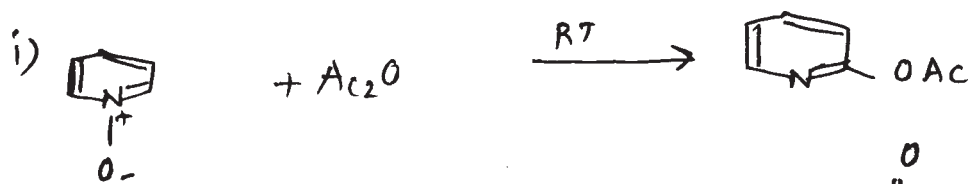


Q3) a) Write notes on Any Two :

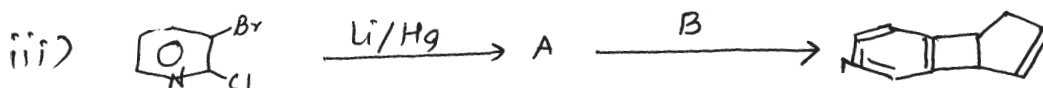
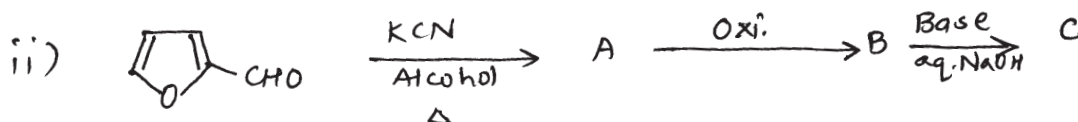
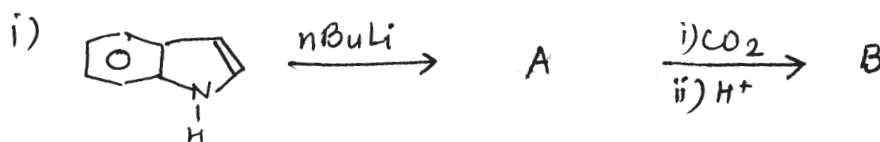
[4]

- Skraup Quinoline Synthesis.
- Paal Knorr thiophene Synthesis.
- Bischler Napierlaski Synthesis.

b) Suggest suitable mechanism for Any Two of the following : [6]



c) Complete the following reaction sequence Any Two : [4]



SECTION - II

Q4) Answer Any Three of the following : [12]

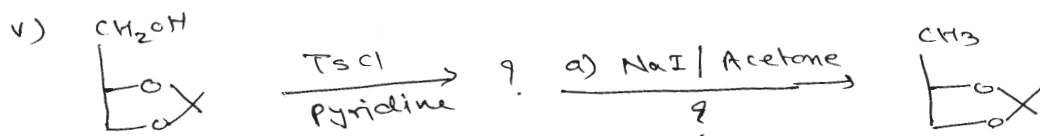
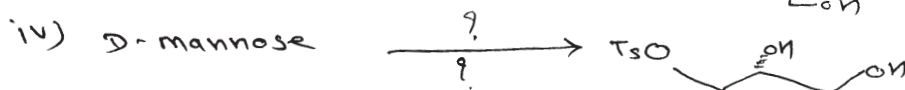
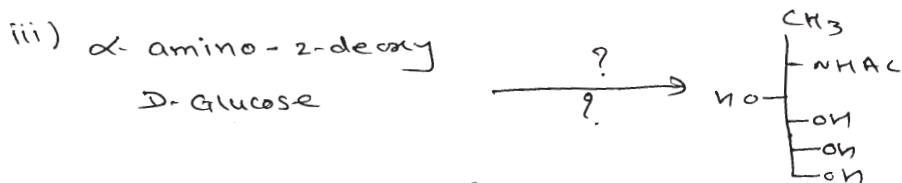
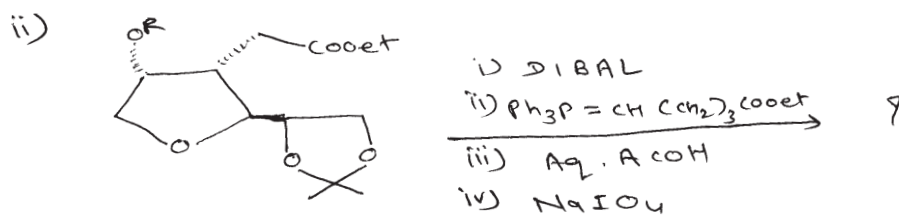
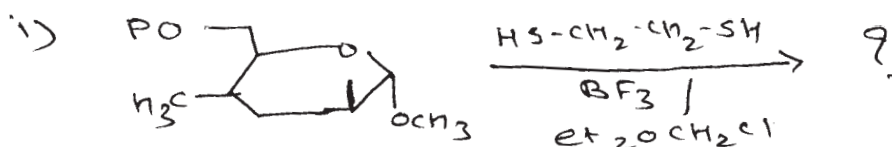
- Two Ruff degradations on an aldohexose give an aldotetrose that is oxidised by HNO_3 to meso-tartaric acid. Give the possible conformations of aldohexose.
- Write the structural formulae of
 - α & β - D - fructo furanose.
 - α & β - D - fructo pyranose.
- Give the $1C_4$ and $4C_1$ conformations in D and L-sugars. Explain the stability of each conformer.

d) Two isomeric compounds A and B having molecular formula $C_6H_{12}O_6$ give following reactions.

- Both A and B form same osazone.
 - Both A and B form penta-o-acetate.
 - A does not get oxidised by Tollen's reagent while B does.
 - Both are sweet in taste and are crystalline.
- Identify A and B and write all the reactions.

Q5) a) Give the retrosynthesis of (-) pentanomycin. [4]

b) Complete the following reaction sequence. Also write the mechanism in each step (Any Four) : [8]

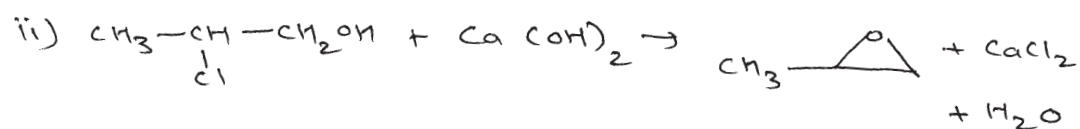
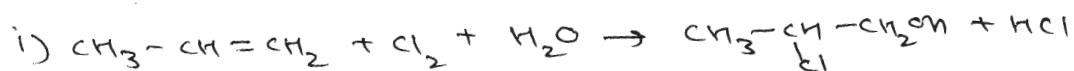


c) Explain the concept of "chiron". [2]

Q6) a) Solve Any Three of the following : **[9]**

- i) Give the theoretical aspects of drug design.
- ii) Explain the elimination of drug from body.
- iii) Write short note on 'Receptor and drug receptor interactions.
- iv) Explain the intermolecular attractive forces involved in solubilization of organic medicine in body.

b) Calculate the atom economy for following reactions. **[5]**



XXXXX

Total No. of Questions : 4]

SEAT No. :

P672

[Total No. of Pages : 2

[4125] - 411

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 481 : Bioanalytical and Forensic Science

(Sem. - IV) (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 table/non-programmable calculator is allowed.

SECTION - I

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

- a) How is starch estimated from flour?
- b) What are micronutrients? Explain with suitable examples.
- c) Explain cryoscopic method for determination of added water in milk.
- d) How is HMF estimated in the sample of honey?
- e) Calculate percentage of lactic acid in given sample of milk, if 10 ml of it required 2.3 ml of 0.01M NaOH solution (Molecular wt. of lactic acid = 90).

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

- a) How is amylase estimated?
- b) Discuss chemistry of vitamin A, with respect to sources, biological functions and principle of estimation.
- c) What are aminoacids? Explain the method for estimation of free aminoacids.
- d) Describe the 'Tanner method' used for estimation of SO₂ from food sample.
- e) A sample of butter weighing 4.98 gm was dissolved in chloroform and treated with KI solution and titrated against 0.01N Na₂S₂O₃. It required 8.4ml of the titrant (corrected titre value). Calculate the peroxide value of the sample.

P.T.O.

SECTION - II

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

- a) Outline the procedure for determination of benzodiazepines.
- b) State principle and give the procedure for determination of barbiturates by 'procedure B'.
- c) Explain the procedure 'Type C' for isolation and identification of amphetamines.
- d) Explain the procedure for isolation of cocaine from urine.
- e) Caffeine is estimated from blood sample by using gas chromatography.

The results of analysis were as follows :

- i) Standard caffeine concentration = 50 µg/ml.
- ii) Peak height of caffeine sample = 65 min.
- iii) Peak height of caffeine in reference standard = 75 min.

Calculate concentration of caffeine in given sample.

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

- a) Define the terms :
 - i) Opium
 - ii) Manufacturer
 - iii) Coca-leaf
 - iv) Psychotropic substance
- b) Explain the rules related to building arrangements in non bonded laboratory.
- c) How are dutiable goods transferred from one bonded warehouse to another bonded warehouse?
- d) Outline the procedure for warehousing of alcoholic preparations.
- e) Write note on 'Illicit Traffic'.



Total No. of Questions : 4]

SEAT No. :

P673

[Total No. of Pages : 2

[4125] - 412
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 490 : Analytical Spectroscopy
(Sem. - IV) (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 table/Non-programmable calculator is allowed.*

SECTION - I

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

- a) What are filters? Distinguish between absorptive and interference filter. Give it's limitations.
- b) What are transducers? Explain with schematic diagram, principle and working of pneumatic detector.
- c) Give the principle of ESCA, with schematic diagram explain essential components of ESCA instrument.
- d) Monochromatic radiation enters the prism at an incident angle 68.2° as measured from the perpendicular to the surface. The refractive index of radiation in air and prism are 1.00 and 1.60 respectively. Calculate the angle at which radiation exist from the prism.
- e) An assay was performed using EMR that has wavelength of 445 nm in methanol. Calculate the velocity, frequency and energy of radiation in methanol (Given : refractive index of methanol = 1.329).

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

- a) Enlist the detectors used for X-ray analysis. Explain any one detector used for X-ray analysis.
- b) What is meant by chemilumin escence? How chemiluminescence is useful in quantitative analysis.

P.T.O.

- c) What is meant by X-ray Fluorescence? With schematic diagram explain energy dispersive X-ray Fluorometer.
- d) State and explain principle of ultraviolet photoelectron spectroscopy. Why is ultraviolet photoelectron spectroscopy not used to study core shell electrons?
- e) A Crystal of topaz was exposed to K_{α} line of copper at 1.542 \AA diffracted at an angle 34.65° relative to the crystalline surface for first order diffraction. Calculate the spacing between the adjacent layers of nuclei in the crystal.

SECTION - II

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

- a) Discuss the quantum theory of NMR spectroscopy.
- b) Write a critical note on 2-D NMR spectroscopy.
- c) Describe with suitable examples the use of NMR technique in kinetic studies.
- d) A compound shows NMR at 240 Hz downfield from TMS peak in spectrometer operating at 60 MHz. Calculate the values of chemical shifts in ppm relative to TMS.
- e) Calculate magnetic field strength required to observe the NMR frequency for ^{19}F at 60 MHz.
(Given : $g_{\text{N}} = 5.257$ and $\beta_{\text{N}} = 5.05 \times 10^{-27} \text{ JT}^{-1}$)

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

- a) Explain how John-Teller effect in copper (II) complex is described in ESR spectroscopy.
- b) Compare the fine splitting, hyperfine splitting and super hyperfine splitting in ESR spectroscopy. Explain the cause of each type of splitting.
- c) Explain the principle of electron microscopy. Distinguish between scanning electron microscope and scanning transmission electron microscope.
- d) Explain the EPR spectrum of DPPH radical.
- e) Calculate the ratio of free electrons in the upper energetic level relative to the number in the lower level at -25°C in the magnetic fields with flux density of 1.49 T
(Given : Bohr Magnetron = $9.273 \times 10^{-24} \text{ JT}^{-1}$).



Total No. of Questions : 4]

SEAT No. :

P674

[Total No. of Pages : 3

[4125] - 413
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 491 : Polymer Technology
(Sem. - IV) (2008 Pattern)

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.

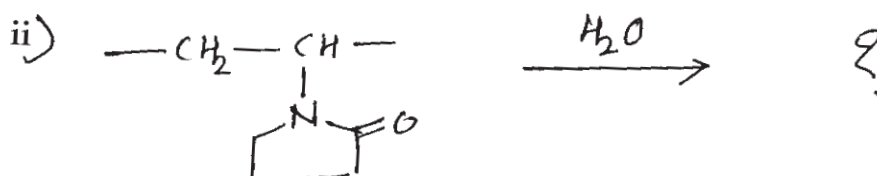
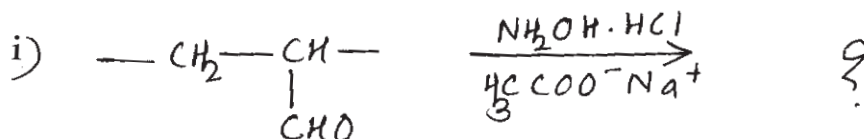
SECTION - I

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

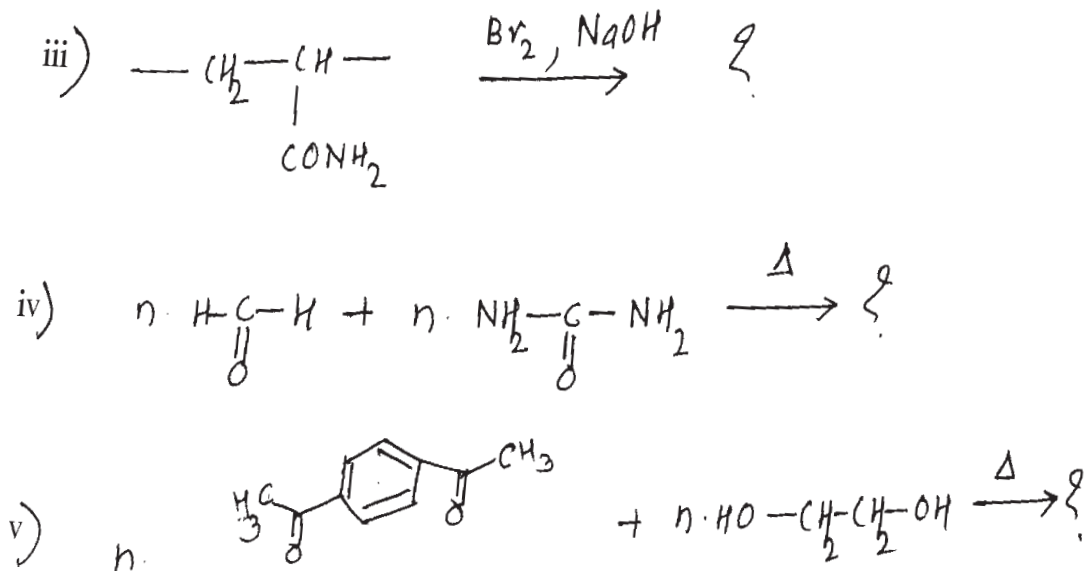
- a) Distinguish between addition and condensation polymerisation.
- b) Classify the polymers on the basis of their origin and structure of main chain.
- c) What are co-polymers? Derive kinetic rate equation for it.
- d) Discuss the effect of radiation on polyethylene.
- e) Write a note on thermal degradation.

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

- a) Write a note on Emulsion polymerisation.
- b) Give method of preparation and uses of
 - i) Teflon
 - ii) Cellophane.
- c) Complete the following reactions.



P.T.O.



- d) Write a note on inhibitors.
- e) 86 gm of vinyl acetate are co-polymerised with 25 gm of vinyl chloride. Calculate the composition of the polymer formed instantaneously if the monomer reactivity ratios of vinyl acetate and vinyl chloride are 0.23 and 1.68 respectively (At. wt. H - 1, C - 12, O - 16, Cl - 35.5).

SECTION - II

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

- a) Explain mechanical properties of polymers with respect to tensile-stress - strain curves and fatigue test.
- b) Write a note on Injection-moulding.
- c) Explain sulphur and non-sulphur vulcanization processes.
- d) Explain the following terms :
 - i) Transmittance
 - ii) Colour
 - iii) Gloss
 - iv) Haze
 - v) Transparency
- e) Equal masses of polymer molecules with $M_1 = 10,000$ and $M_2 = 1,00,000$ are mixed. Calculate \overline{M}_n and \overline{M}_w .

Q4) Attempt any four of the following :

[20]

- a) Describe the dielectric strength and dissipation factor with respect to polymers.
- b) Explain with a neat diagram vapour phase osmometry method for determination of molecular weight of polymer.
- c) Discuss briefly the functions of the following after treatments :
 - i) Scouring
 - ii) Lubrication
 - iii) Sizing
- d) Explain sol-gel and describe the steps involved in preparation of sol-gel.
- e) The intrinsic viscosity for a polymethylacrylate is $275.5 \text{ cm}^3/\text{g}$. Calculate the concentration of polymethylacrylate in benzene solution with relative viscosity 1.999.



Total No. of Questions : 6]

SEAT No. :

P675

[Total No. of Pages : 2

[4126] - 101
M.Sc. (Sem. - I)
BIOCHEMISTRY
BCH - 170 : Biomolecules
(2010 & 2008)

Time :3Hours]

[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 five of the following: **[15]**

- a) Derive Henderson - Hasselbalch equation and write note on buffers.
- b) Write note on isomeric forms of glucose.
- c) Why Sucrose does not answer Benedict's test.
- d) What are fat soluble vitamins? Give their biological importance.
- e) Differentiate between oxidative and hydrolytic rancidity.
- f) How are biologically important macromolecules formed from their monomeric subunits? Give suitable example.

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

- a) Give structures of
 - i) Deoxy Sugar
 - ii) Amino sugar
 - iii) Fatty acid
 - iv) Homodisaccharide
 - v) Sphingolipids.
- b) Discuss the features of different classes of lipids with examples.
- c) What are coenzymes? List out coenzyme forms of B complex vitamins with their significance.
- d) Discuss the reactions of glucose that lead to formation of various sugar acids.

P.T.O.

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

- a) Classify lipoproteins based on density and give their significance.
- b) Write note on properties of amphipathic lipids.
- c) Differentiate between reducing and non reducing sugars.

SECTION - II

Q4) Attempt the following (any five) [15]

- a) Discuss reactions of Lysine & proline with ninhydrin reagent.
- b) Differentiate between α helix & β pleated structures of proteins.
- c) Why aminoacids are referred as ampholytes.
- d) What is role of carboxypeptidase in end group analysis.
- e) Write note on features of peptide bond.
- f) Differentiate between monomeric and oligomeric proteins.

Q5) Attempt the following (any three) [15]

- a) Classify amino acids based on R group.
- b) Elaborate on steps involved in β amino acid sequencing.
- c) Discuss features of Ramchandran plot.
- d) Explain the titration curve of aminoacids with non polar R group.

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

- a) Classify proteins based on composition.
- b) Write note on super secondary structure.
- c) Explain the steps involved in synthesis of oligopeptides by solid phase method.



Total No. of Questions : 6]

SEAT No. :

P676

[Total No. of Pages : 2

[4126] - 102
M.Sc. (Sem. - I)
BIOCHEMISTRY
BCH - 171 : Enzymology and Biophysical Techniques
(2010 Pattern and 2008 Pattern)

Time :3Hours]

[Max. Marks :80

Instructions to the candidates:-

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

SECTION - I

(Enzymology)

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

- a) How do the difference in specificity of chymotrypsin and other related protease arise?
- b) Discuss the acid-base catalysis.
- c) How activity of glycogen phosphorylase is controlled?
- d) Discuss ubiquitin mediated protein degradation.

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

- a) MWC model.
- b) Chemical modification of amino acid side chain.
- c) Proximity and orientation effect.
- d) Pyruvate dehydrogenase complex.
- e) Pre-steady state kinetics.

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

- a) Non competitive inhibition.
- b) Lineweaver-Burk plot.
- c) Coenzymes.

P.T.O.

SECTION - II
(Biophysical Techniques)

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

- a) How will you detect the renaturation stage of DNA using spectrophotometer? Explain with suitable example.
- b) What is the main advantage of slab gels over column gels for PAGE?
- c) What is relation between theoretical plates N , length of the column L ; and the height equivalent of a theoretical plate, H ?
- d) How hydroxyapatite chromatography separate ss DNA from ds DNA?
- e) Distinguish between fiberglass filters and nitrocellulose filters.
- f) Give the applications of spectroscopy.

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

- a) What are the applications of purified enzymes? How purity of an enzyme is judged?
- b) Write a note on 2D electrophoresis.
- c) Explain the process of reverse dialysis and give its applications.
- d) Describe the various techniques used to determine the Molecular weight of a peptide.

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

- a) Define:
 - i) Void Volume.
 - ii) Total capacity of an ion exchanger.
 - iii) Available capacity.
 - iv) Mesh size.
 - v) Reporter group.
- b) Describe any one application of agarose gel electrophoresis.
- c) Differentiate partition and adsorption chromatography.



Total No. of Questions : 6]

SEAT No. :

P677

[Total No. of Pages : 2

[4126] - 103

M.Sc. (Sem. - I)

BIOCHEMISTRY

**BCH - 172 : Microbiology and Cell Biochemistry of Eukaryotes
(2010 Pattern)**

Time :3Hours]

[Max. Marks :80

Instructions to the candidates:-

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

SECTION - I

(Microbiology)

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

- a) Why penicillin is more effective against Gram +ve than Gram –ve bacteria.
- b) What is the mode of action of alcohol as antimicrobial agent?
- c) Explain in detail Endotoxins.
- d) Discuss in detail Koch's Postulates.
- e) Discuss in detail Bright field and dark field microscopy with applications.

Q2) Explain the following: (any three) [15]

- a) Differential staining.
- b) Bacterial growth curve.
- c) Lysine production.
- d) Viral multiplication cycle.
- e) Moist heat sterilization.

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

- a) Define Auto trophs, heterotrophs, Lithotrophs, Phototrophs and Chemotrophs.
- b) Shape and arrangements of bacteria.
- c) Exotoxins.

P.T.O.

SECTION - II

(Cell Biochemistry of Eukaryotes)

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

- a) Describe the different events occurring in different phases of mitosis.
- b) Discuss industrial applications of various fungi.
- c) Explain the composition and role of extracellular matrix.
- d) Write note on: functional and biochemical maturation of tissues.

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

- a) State principle and explain the technique for subcellular fractionation.
- b) Explain in detail the ultrastructure of chloroplast.
- c) Give the functions of Golgi apparatus.
- d) Define fertilization? Explain the different physiological and biochemical events occur during it.

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

- a) Give the significance of meiosis.
- b) Structure of cell membrane.
- c) Cell-cell reorganization in plants.



Total No. of Questions : 6]

P677

[Total No. of Pages : 2

[4126] - 103
M.Sc. (Sem. - I)
BIOCHEMISTRY
BCH - 172 : Cell Biochemistry(2008 Pattern)

Time :3Hours]

[Max. Marks :80

Instructions to the candidates:-

- 1) Answers to both the sections should be written in separate answer books.*
- 2) Figures to the right indicate full marks.*

SECTION - I

Q1) Explain any three of the following: [15]

- a) Contributions of Louis Pasteur and Edward Jenner.
- b) Electron microscopy and its limitations.
- c) Capsule and pili.
- d) Maintenance & preservation of pure culture.
- e) Replication of the animal virus, Herpes simplex virus.

Q2) Answer the following: (any three) [15]

- a) What is the mode of action of UV light?
- b) What are the different methods used for quantitative measurement of growth? How viable cells are measured?
- c) Discuss industrial production of alcohol.
- d) How dyes and heavy metals are useful in controlling growth of microbes?
- e) Discuss the mode of action of diphtheria and cholera toxins.

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

- a) Colony characteristics of bacteria.
- b) Phenol coefficient.
- c) Classification of viruses.

P.T.O.

SECTION - II

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

- a) Give detailed account on prokaryotic cell organization.
- b) Describe structure and function of chloroplast.
- c) Explain prophase of first meiotic cell division.
- d) Give the composition of extracellular matrix.

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

- a) What is the role of golgi vesicles in the formation of plasmamembrane.
- b) Add a note on Lysosome and Peroxisome.
- c) Describe cell aggregation in sponges.
- d) What is organogenesis? Explain the process.

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

- a) Xylem and Phloem.
- b) Density gradient centrifugation.
- c) Marker enzymes.



Total No. of Questions : 6]

SEAT No. :

P678

[Total No. of Pages : 2

[4126] - 201
M.Sc. (Sem. - II)
BIOCHEMISTRY
BCH - 270 : Bioenergetics and Metabolism
(2010 & 2008 Pattern)

Time :3Hours]

[Max. Marks :80

Instructions to the candidates:-

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

SECTION - I

Q1) Answer any Five of the following:

[5 × 3 = 15]

- a) Draw the structure of ATP and list out its significance.
- b) Differentiate between C₃ and C₄ pathway in plants.
- c) Show the entry of sugars other than glucose into glycolysis and give their significance.
- d) What are uncouplers? How do they affect ETC and ATP synthesis in mitochondria?
- e) Define gluconeogenesis. List out the gluconeogenic precursors.
- f) Write note on the defective enzymes that lead to disorders in glycogen metabolism.

Q2) Answer any Three of the following:

[3 × 5 = 15]

- a) Discuss the oxidation of glucose via pentose phosphate pathway and give its significance.
- b) Explain in detail the regulation of glycogenesis and glycogenolysis in presence of glucagon.
- c) Outline the sequence of reactions in anaerobic glycolysis with energetics.
- d) Elaborate on the pathway that leads to formation of glucuronate and Ascorbic acid.

P.T.O.

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

- a) Glyoxylate pathway and its significance.
- b) Photosynthetic pigments.
- c) Electron carriers of mitochondrial ETC.

SECTION - II

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

- a) How are adenine and guanine nucleotides synthesised from Inosine monophosphate?
- b) Give the clinical features of phenylketonuria and gout.
- c) What are ketonebodies? How are they synthesised in liver?
- d) Differentiate between α , β and ω oxidation of fattyacids and give their significance.
- e) Define transamination and deamination reactions and give their significance.
- f) Show the entry of propionylCoA obtained from odd number fatty acids into TCA cycle.

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

- a) Outline the biosynthesis of fattyacids with the help of fatty acid synthase complex.
- b) Discuss the biosynthesis of aromatic aminoacids.
- c) Elaborate on Pyrimidine degradation.
- d) Discuss β -Oxidation of Palmitic acid with energetics.

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

- a) ALT and AST.
- b) Biosynthesis of triglycerides.
- c) Glutathione biosynthesis.



Total No. of Questions : 4]

SEAT No. :

P679

[Total No. of Pages : 2

[4126] - 202
M.Sc. (Sem. - II)
BIOCHEMISTRY
BCH - 271 : Techniques for Characterization of Biomolecules
(2010 Pattern) (New)

Time :3Hours]

[Max. Marks :80

Instructions to the candidates:-

- 1) *All questions are compulsory.*
- 2) *Figures to the right indicate full marks.*

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

- a) Explain the theory of sedimentation. Distinguish between analytical and preparative ultracentrifugation.
- b) ORD and CD are manifestation of the same phenomenon. Justify.
- c) Enlist any five empirical rules for interpreting fluorescence spectra of protein.
- d) Give the principle and working of ESR.
- e) How will you measure partial specific volume by using pycnometer?

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

- a) How will you differentiate the generation of biosensors on the basis of redox reactions?
- b) Give the principle and applications of NMR spectroscopy.
- c) Describe the theory of LCMS. Enumerate the applications of LCMS.

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

- a) Explain the phenomenon of fluorescence.
- b) Write a note on atomic absorption spectroscopy.
- c) Explain the effect of concentration and charge on sedimentation velocity.
- d) Which transducer system is suitable for development of urea biosensor? Why?
- e) What is autoradiography? What are its applications?

P.T.O.

Q4) Answer any four of the following:

[20]

- a) What is circular dichroism techniques? Explain its usefulness in structural analysis of proteins.
- b) Write a note on X-ray diffraction.
- c) Explain the measurement of radioactivity by liquid scintillation counting.
- d) What is the effect of addition of ethidium bromide on viscosity of DNA?
- e) Describe the types of radiations used in Biochemistry.



Total No. of Questions : 6]

P679

[Total No. of Pages : 2

[4126] - 202
M.Sc. (Sem. - II)
BIOCHEMISTRY
BCH - 271 : Biophysical Techniques
(2008 Pattern) (Old)

Time :3Hours]

[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 three of the following: **[15]**

- a) Describe a typical spectrophotometer and explain the empirical rules for interpretation of absorption spectra of biological molecules.
- b) Describe the maximum Gilbert procedure of DNA sequencing.
- c) Discuss the steps involved in Southern blotting for transfer and hybridization of DNA molecule.
- d) Differentiate between thin layer chromatography and thin layer gel (filtration) chromatography.

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

- a) Explain the process of dialysis and give its applications.
- b) Draw the schematic diagram of UV-VIS spectrometer and explain the instrumentation.
- c) Describe any four commercially available matrix-ligand systems for affinity chromatography.
- d) Explain in brief the theory of electrophoresis. Give the types and explain DISC PAGE.

P.T.O.

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

- a) How are individual amino acids from a mixture separated by amino acid analyzer.
- b) Write a note on DNA cellulose chromatography.
- c) What are fiber glass filters? Explain any one application in detail.

SECTION - II

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

- a) What are the factors that affect sedimentation velocity. Describe any one in detail.
- b) Distinguish boundary and band sedimentation.
- c) Discuss various types of viscometer used in biochemistry.
- d) Write in brief free radicals in water.

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

- a) Write a note on autoradiography.
- b) What are gamma counters? Give their uses.
- c) What is partial specific volume? Add a note on mechanical Oscillator technique.
- d) Explain diagrammatically the sedimentation of associating and dissociating system.

Q6) Write short notes on: (Any two) [10]

- a) Radiolysis of water.
- b) Background noise quenching.
- c) Diffusion coefficient.



Total No. of Questions : 6]

SEAT No. :

P680

[Total No. of Pages : 2

[4126] - 203

M.Sc. (Sem. - II)

BIOCHEMISTRY

BCH - 273 : Membrane Biochemistry and Genetics (2010)

Membrane Biochemistry & Nucleic acids (2008)

Time :3Hours]

[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) Features of fluid - mosaic model of biological membranes.
- b) Liposomes and planar bilayer structure for membrane studies.
- c) Valinomycin - a transport antibiotic.
- d) Freeze fracture technique and its significance.

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

- a) Chemiosmotic hypothesis - mechanism.
- b) Acetyl choline receptor channel.
- c) Active transport of sodium and potassium simultaneously.
- d) Glucose transporters in erythrocytes.

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

- a) ATP - ADP exchanger system.
- b) Types of different modes of penetration of antibiotics across cell membranes.
- c) Receptor mediated endocytosis mechanism with proper example.

P.T.O.

SECTION - II
Genetics (New) Nucleic Acids (Old)

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

- a) Discuss the significance of phages and cosmids as cloning vehicles.
- b) Elaborate on one gene one cistron hypothesis.
- c) Explain regulation of lac operon in bacteria.
- d) Enlist the salient features of genetic code.

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

- a) Elaborate on Avery, Macleod and McCarty experiment and its interpretations.
- b) Give the significance of use of radioisotopes in proving semiconservative replication of DNA.
- c) Enlist the salient features of Watson and Crick model of DNA.
- d) Comment on conjugation in bacteria.

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

- a) Nearest neighbour analysis.
- b) Mendelian law of inheritance.
- c) Teratogenesis.



Total No. of Questions : 4]

SEAT No. :

P681

[Total No. of Pages : 2

[4126] - 301
M.Sc. (Sem. - III)
BIOCHEMISTRY
BCH - 370 : Molecular Biology
(2010 & 2008)

Time :3Hours]

[Max. Marks :80

Instructions to the candidates:-

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

Q1) Answer any four of the following:

[20]

- a) Which are the various events that are taking place before DNA replication in prokaryotes.
- b) What is high fidelity? How it is achieved in DNA replication process.
- c) Distinguish between adeno-and retroviruses.
- d) Justify the statement “for survival of E.coli recombination of DNA is essential”
- e) Explain a typical gene expression by flow sheet diagram.

Q2) Answer any two of the following:

[20]

- a) Describe in detail the molecular structure of RNA polymerase of E.coli.
- b) Explain the ultrastructure of Nucleosome and state how it is organized into 30 nm fibre.
- c) Why protein degradation is essential? Explain degradation of proteins by ubiquitin pathway.

P.T.O.

Q3) Explain the important role played by following proteins: **[20]**

- a) Rho protein.
- b) eIF₂.
- c) Ribonuclease P.
- d) Rec A.
- e) Dna B.

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

- a) SOS.
- b) Clover leaf model of tRNA.
- c) Base excision repair mechanism.
- d) Differentiate between prokaryotic and eukaryotic ribosome.
- e) Detail structural organization of HIV - 1 and its genes.



Total No. of Questions : 6]

SEAT No. :

P682

[Total No. of Pages : 2

[4126] - 302

M.Sc.

BIOCHEMISTRY

BCH - 371 : Medical Biochemistry and Immunology

(Sem. - III) (2010 and 2008 Pattern)

Time :3Hours]

[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

(Medical Biochemistry)

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

- a) Define Carcinogens. Discuss the mechanism of carcinogenesis.
- b) What are abnormal hemoglobins? Elaborate on the molecular basis of sickle - cell Anaemia.
- c) What are isoenzymes? Elaborate on the role of these enzymes in the diagnosis of myocardial infarction.
- d) Explain in detail the composition of blood.

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

- a) Describe the mechanism by which aggregating platelets and damaged tissue initiate the formation of thrombus.
- b) What are antibiotics? Explain the mechanism of action of streptomycin and tetracycline at the molecular level.
- c) Discuss the role of hydrolytic enzymes of lysosomes.
- d) Elaborate on the normal composition of Cerebrospinal fluid.

P.T.O.

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

- a) Hallucinogens.
- b) Cellular components of blood.
- c) Fibrinolysis.

SECTION - II
(Immunology)

Q4) Answer Any Three of the following: **[3 × 5 = 15]**

- a) Differentiate between cell mediated immunity and humoral immunity.
- b) Elaborate on the steps involved in producing monoclonal antibodies.
- c) Explain the principle, procedure and uses of competitive ELISA technique.
- d) Describe the structural features of Immunoglobulin G and list out its functions.

Q5) Answer Any Three of the following: **[3 × 5 = 15]**

- a) What are live and attenuated vaccines? Explain the principle of Vaccination.
- b) Differentiate between Innate and Acquired Immunity with suitable examples.
- c) Elaborate on the cascade of proteolytic reactions that leads to activation of complement system.
- d) Discuss the etiology and development of AIDS.

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

- a) Anaphylaxis.
- b) Principle of Immunofluorescence and uses.
- c) Blood group substances.



Total No. of Questions : 4]

SEAT No. :

P683

[Total No. of Pages : 2

[4126] - 303
M.Sc. (Sem. - III)
BIOCHEMISTRY
BCH - 372 : Neurochemistry
(2010 Pattern)

Time :3Hours]

[Max. Marks :80

Instructions to the candidates:-

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

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

- a) Explain in detail the chemical composition of brain.
- b) Write a note on spinal cord.
- c) Describe the organization of ANS. Explain in brief how ANS coordinates PNS?
- d) How neural proteins mediate physiological and biochemical response?
- e) Which environmental factors affect the development of CNS.

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

- a) Describe the ultra structure, function and ion selectivity of acetylcholine receptor.
- b) What are neurotransmitters. Describe in detail the synthesis, storage and uptake of neurotransmitters.
- c) Explain how sound generates potential on hair cell.

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

- a) Describe the properties of an electrical synapse, the way impulses are transmitted and the advantages of an electrical synapsis.
- b) Humans can discriminate between many different tastes. What are the mechanisms that make this possible?

P.T.O.

- c) Compare ion gated channels with voltage gated and chemical gated channels. What features do they have in common? What differences can you describe.

Q4) Attempt any four of the following:

[20]

- a) Write a note on blood-brain barrier.
- b) Explain the role of cAMP in detail.
- c) Which are the proteins involved in learning and memory process.
- d) Describe the carbohydrate and lipid metabolism in brain.
- e) Write a note on GABA receptor.



P683

[4126] - 303

M.Sc. (Sem. - III)

BIOCHEMISTRY

BCH - 372 : Signal Transduction Pathways (2008 Pattern)

Membrane Biochemistry and Specialised Tissues (2004 Pattern)

Time :3Hours]

[Max. Marks :80

Instructions to the candidates:-

- 1) *All questions are compulsory.*
- 2) *Answers to the two sections should be written in separate answer books.*
- 3) *Figures to the right indicate full marks.*
- 4) *Candidates of old course should attempt membrane Biochemistry as Section I and Section I of new course as section II.*

SECTION - I

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

- a) Describe in detail the acceptable sliding filament modes of muscle contraction.
- b) Describe in detail the events in visual excitation.
- c) Explain the term: depolarization, hypopolarization and hyperpolarization.

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

- a) Describe the organization and functional parts of the cells within various taste buds.
- b) Write a short note on contractile proteins in cells other than muscle filaments.
- c) Explain the structure, function and mechanism of action of acetylcholinesterase.
- d) Write a short account on turnover and regulation of neuropeptides.

Q3) Write short notes on (any three) [15]

- a) Structure of eye.
- b) Chemotaxis.
- c) Nerve poisons.
- d) Molecular organization of thick and thin filaments.

P.T.O.

SECTION - II

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

- a) Describe in detail the neuroanatomy of central nervous system.
- b) How carbohydrates, proteins, lipid and amino acids are metabolized in brain.

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

- a) Give the Mechanism of acetylcholine.
- b) How are the nervous and endocrine systems coordinated.
- c) Give the metabolism of any two neurotransmitters.
- d) Explain morphology and anatomy of brain.

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

- a) Blood brain barrier.
- b) Sensory modalities and perception.
- c) Calcium signaling.
- d) Cerebrospinal fluid.

SECTION - I

(Membrane Biochemistry)

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

- a) Discuss the mode of transport of drugs in bacterial cell.
- b) What is photo-transferase system.
- c) Describe the structural features and mechanism of $\text{Na}^+ - \text{K}^+ - \text{ATPase}$.
- d) Write a short note on gap junctions.

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

- a) Explain how different drugs cross the membrane barrier.
- b) Write short note on ATP/ADP exchanger.
- c) Give short account on bacterial toxins.
- d) What is osmoregulation.

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

- a) Membrane asymmetry.
- b) Protein targeting.
- c) Glycosylation of membrane.
- d) Virus membrane receptor.



Total No. of Questions : 4]

SEAT No. :

P684

[Total No. of Pages : 2

[4126] - 304

M.Sc. (Sem. - III)

BIOCHEMISTRY

BCH - 373 : Biochemical Toxicology

(2010 & 2008)

Time :3Hours]

[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 neccessary.*

Q1) Answer any four of the following:

[20]

- a) Which experiments are performed to build up the toxicological profile of the chemical?
- b) Give the various mechanisms of cell injury caused by various toxicants.
- c) Biologic diversity is responsible for selective toxicity of toxicants. Explain.
- d) Explain with examples the additive, synergistic and potentiation effects.
- e) What do you understand the terms safety and risk? Under which circumstances the risk is taken?
- f) How soil and water pollutants are degraded?

Q2) Attempt any four of the following:

[20]

- a) Explain the mechanism and manifestations of allergic reactions.
- b) Explain with suitable example the process of bioactivation.
- c) Discuss the biochemical reactions involved in cararyl biotransformation.
- d) Give details of anti toxic effects caused by organophosphorous insecticide in toxication.
- e) Explain the mechanism of reaction catalyzed by glutathione-s-transferase.
- f) Give mechanism of toxic effects caused by amphibian toxins.

P.T.O.

Q3) Answer any four of the following:

[20]

- a) What are toxic effects of alcohol and methanol?
- b) How teratogenic potential of toxic agent is evaluated?
- c) Give the forensic applications of toxicology.
- d) Distinguish between
 - i) immediate and delayed toxicity.
 - ii) reversible and irreversible toxicity.
- e) What are the toxic effects of DDT? Explain the pathogenesis of these effects.
- f) Explain the mechanism of epoxide hydrolase during xenobiotic biotransformation.

Q4) Give the pathogenesis and clinical symptoms of any five of the following: **[20]**

- a) Delayed neurotoxicity by organophosphorous insecticides.
- b) Fatty liver and liver cirrhosis.
- c) Silicosis and asbestosis.
- d) Micromercurialism.
- e) Renal dysfunction due to lead.
- f) Skeletal system effects a hypertension due to cadmium.
- g) Chronic obstruction pulmonary disease due to cadmium.



P684

[4126] - 304
M.Sc. (Sem. - III)
BIOCHEMISTRY
BCH - 373 : Recent trends in Biochemistry and Toxicology
(2004)

Time :3Hours]

[Max. Marks :80

Instructions to the candidates:

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

SECTION - I

(Recent Trends in Biochemistry)

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

- a) Explain the theory of ORD and give its application.
- b) Explain the rules used to interpret fluorescence spectrum.
- c) Discuss the intellectual right protection.
- d) Describe the techniques used for studying protein folding pathway.

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

- a) How the fluidity of the interior of the erythrocyte membrane is studied by ESR spectroscopy.
- b) How fish freshness is determined by amperometric biosensor.
- c) Give the principle and working of NMR.
- d) Give the application of CD.

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

- a) MALDI.
- b) Patent and patenting.
- c) LCMS.

P.T.O.

SECTION - II

(Toxicology)

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

- a) Distinguish between
 - i) immediate and delayed toxicity.
 - ii) venomous and poisonous animals.
- b) Explain the biotransformation pathway of benzene leading to cellular injury.
- c) Explain the mechanism of biotransformation catalyzed by sulfotransferase.
- d) What are the forensic applications of toxicology?
- e) Biologic diversity plays an important role in selective toxicity of toxicants. Explain.
- f) Explain the reactions involved in carbonyl biotransformation.
- g) In toxication of carbon tetrachloride and ethionine decreases the circulating lipoprotein levels. Justify.

Q5) Give the pathogenesis and clinical manifestations of any three of the following; **[15]**

- a) Cholestasis by various chemical agents.
- b) Chronic pulmonary obstructive disease by cadmium.
- c) Liver cirrhosis.
- d) Renal dysfunction by mercury.
- e) Cardiovascular disease and hypertension by cadmium.

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

- a) Which of the main toxicological studies are performed to build up the toxicological profile of toxic agent?
- b) What is the overall impact of DDT on ecosystem?
- c) What are the components of snake venom?



Total No. of Questions : 6]

SEAT No. :

P685

[Total No. of Pages : 3

[4126] - 401

M.Sc. (Sem. - IV)

BIOCHEMISTRY

BCH - 470 : Biochemical Endocrinology and Tissue Culture(2008 & 2004)

Biochemical Endocrinology and Plant biochemistry (2010)

Time :3Hours]

[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.*
- 4) *Answers to the two sections should be written on separate answer books.*

SECTION - I

(Biochemical Endocrinology)

Q1) Answer Any three of the following: [15]

- a) Discuss the biosynthesis of thyroid hormones.
- b) What are the hormones secreted by the neurohypophysis? What are their respective functions?
- c) Which enzymes are required for adrenal steroidogenesis? Explain their involvement in the shuttling of precursors between mitochondria and the endoplasmic reticulum.
- d) Discuss the role of Insulin and Glucagon in regulation of blood sugar levels.

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

- a) List out the hormones of gastro intestinal tract and give their significance.
- b) Elaborate the role of calcium and phosphoinositide system in signal transduction.
- c) What are prostaglandins? Write note on their biological functions.
- d) Discuss the mechanism of steroid hormones in regulation of gene expression.

P.T.O.

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

- a) Write a note on growth factors.
- b) Discuss how the negative - feedback mechanism helps to maintain proper balances of hormones in the blood.
- c) What defines a cell or tissue as a “target” for hormonal action?

SECTION - II
Tissue Culture (Old)

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

- a) What are the basic requirements of media used in plant tissue culture.
- b) Explain the principle and working of ideal plant Tissue Culture Laboratory.
- c) Describe the somatic cell hybridization technique.
- d) Explain the importance of secondary metabolites.
- e) Explain somatic embryogenesis.

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

- a) Describe the preparation of media and sterilization techniques used in animal tissue culture.
- b) What is synthetic media? Give its advantage and disadvantage with suitable example.
- c) Give the characteristics of transformed cells.
- d) Discuss the various methods of cell preservation.
- e) What is cell line? Give its application.

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

- a) Tissue banking.
- b) Callus culture.
- c) Heterocaryons.
- d) Micropropagation.

SECTION - II
Plant Biochemistry (New)

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

- a) Oxygenase activity of Rubisco.
- b) C₄ pathway.
- c) Biosynthesis of starch.
- d) Role of nitrogen as plant nutrient.
- e) Function of cytokinins.

Q5) Explain the following: (any three) [15]

- a) Isolation of protoplast.
- b) Cryopreservation.
- c) Nitrogenase system.
- d) Flavoroids.
- e) Role of iron and manganese on plant growth.

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

- a) Alkaloids.
- b) Preparation of explants.
- c) Z-scheme of photosynthesis.



Total No. of Questions : 6]

SEAT No. :

P686

[Total No. of Pages : 2

[4126] - 402

M.Sc. (Sem. - IV)

BIOCHEMISTRY

**BCH - 471 : Fermentation and Enzyme Technology and Food
Technology (2010 & 2008)**

Time :3Hours]

[Max. Marks :80

Instructions to the candidates:-

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

SECTION - I

(Fermentation and Enzyme Technology)

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

- a) What is meant by fed batch culture?
- b) How microorganisms are isolated by enrichment culture technique?
- c) What are the basic requirements for expression of foreign DNA in microorganisms?
- d) What are the different carbon sources used in fermentation?
- e) Discuss biological method of effluent treatment.

Q2) Explain in detail: (any three) **[15]**

- a) Discuss in brief the range of fermentation processes.
- b) Effect of inhibitors on fermentation process.
- c) Media sterilization.
- d) Development of inoculum for yeast processes.
- e) Role of agitation in fermentation.

P.T.O.

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

- a) Use of centrifugation in product recovery.
- b) Isolation of intracellular products.
- c) Aseptic transfer of inoculum.

SECTION - II
(Food Technology)

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

- a) What are Primary feedstock? Give their importance.
- b) Discuss the role of enzymes in food processing with suitable examples.
- c) What are genetically modified foods? Give their uses.
- d) Write note on natural and synthetic syrups.

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

- a) What are flavouring agents? Why are they essential in food industry.
- b) Monitoring of food quality is essential - Comment.
- c) Give the various methods of food preservation.
- d) Elaborate on various types of food additives.

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

- a) Single cell protein.
- b) Foods of animal and plant origin.
- c) Role of trypsin in meat tenderisation.



Total No. of Questions : 4]

SEAT No. :

P687

[Total No. of Pages : 2

[4126] - 403

M.Sc. (Sem. - IV)

BIOCHEMISTRY

BCH - 472 : Genetic Engineering (2010 & 2008)

Time :3Hours]

[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) Discuss the advantages and limitations of Maxam-Gilbert and Sanger's methods to determine DNA sequence.
- b) What is microarray? Explain in detailed and give its importance in relation to developmental molecular biology.
- c) Give the protocol to develop cDNA library of *E.coli* and give its significance.

Q2) Answer the following (any two) **[20]**

- a) Explain the importance of various protein gradients that are formed after fertilization.
- b) Discuss the need for rescue experiment in developmental biology.
- c) What are Ti plasmids? Explain their structure and role in plant genetic engineering.

Q3) Answer the following (any two) **[20]**

- a) What is in vitro mutagenesis? Describe in detail single primer extension method and discuss its deficiencies.
- b) Discuss the applications of genetic engineering in medicine and agriculture.
- c) What is cosmid? Give its applications in genetic engineering.

P.T.O.

Q4) Write short notes (any four)

[20]

- a) Restriction mapping.
- b) RFLPs.
- c) Immunological techniques.
- d) Southern blotting.
- e) SV₄₀.

