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

P937 **[3723]-205**

M.Sc.
BIOCHEMISTRY
BCH-271 : Biophysical Techniques
(Old & New)

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

Instructions to the candidates:

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

SECTION - I

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

a) Write short note on hydrophobic chromatography.

b) List out the applications of molecular sieve chromatography.

c) Give the principle and application of isoelectric focussing.

d) Why Polyethylene glycol is used in reverse dialysis? Give the significance of the technique.

e) How are proteins eluted from affinity chromatography column?

f) Write note on the low governing spectrophotometry.

g) Differentiate between fibre glass filter and nitrocellulose filter.

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

a) Discuss the principle, procedure and application of Ion exchange chromatography.

b) Elaborate on the principle and application of Native PAGE and SDS-PAGE.

c) Differentiate between partition and adsorption chromatography with examples.

P.T.O.

d) Explain the procedure to separate DNA fragments by agarose gel electrophoresis.

e) Describe Western blotting technique and give its significance.

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

a) What is DNA finger printing? Give its uses.

b) How do you calculate the R_f values of separated amino acids in paper chromatography? Give its significance.

c) Why lyophilisation technique is used during protein purification studies?

d) List out two important staining procedures for proteins separated by PAGE and give its significance.

e) What are the advantages of TLC when compared to paper chromatography?

f) Give the principle of metal chelate chromatography.

g) List out the detection systems used in Gas-liquid chromatography and give their uses.

SECTION - II

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

a) What are the factors that affect sedimentation velocity?

b) What is the effect of X ray irradiation on sedimentation pattern of DNA?

c) How will you measure viscosity by Ostwald's viscometer?

d) How will you proceed for identification of buried tyrosine in an hypothetical protein by radioactivity?

e) What are the techniques that are used for placing sample and nuclear emulsion in contact?

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

a) Gamma ray detection.

b) Nuclear emulsions used in autoradiography.

c) Measurement of partial specific volume by Mechanical oscillator technique.

d) Applications of airfuge.

e) Sedimentation of DNA at alkaline pH.

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

a) Separation of Individual strands of DNA by sedimentation.

b) Measurement of viscoelasticity of DNA.

c) What is meant by partial specific volume? Explain suitable method for its measurement.

❐❐❐

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

P938

[3723] - 206
M.Sc.
BIOCHEMISTRY
BCH - 273: Membrane Biochemistry & Nucleic Acid
(Old & New)

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

Instructions to the candidates:

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

SECTION - I

(Membrane Biochemistry)

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

a) Characteristic features of biomembranes.

b) Proton gradient coupled to ATP synthesis.

c) Liposome in membrane studies and its applications.

d) Structure and role of gramicidin - A.

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

a) Mechanism of acetyl choline receptor channel.

b) Gap junctions and physiological significance.

c) Osmoregulation through membrane transport.

d) Structural features of sodium - potassium pump.

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

a) Structure and role of nuclear pore complex.

b) Calcium pump.

c) Modes of penetration of bacterial membrane by an antibiotic.

P.T.O.

(_____)

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

a) Describe in detail how nearest neighbour analysis is carried out and why it is done.

b) Describe in detail the genetic disorders caused due to chromosomal mutations.

c) Explain how mapping of E.Coli chromosome is carried out? Give the significance of chromosome mapping.

d) What is plasmid and cosmid? Differentiate between them and give their applications.

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

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

b) Describe the various evidences that prove DNA as a genetic material.

c) What is transformation? Explain in detail the mechanism of bacterial transformation.

d) How will you select and isolate the bacterial auxotrophs.

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

a) Complementation test.

b) Significance of tetrad analysis in fungi.

c) Use of bacteriophages in genetic studies.

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

P892

[3723] - 3

M.Sc.

DRUG CHEMISTRY

CH - 251 : Synthetic Organic Chemistry & Spectroscopy

(Old Course) (Sem. - II) (2005 Pattern)

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

Instructions to the candidates :

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

SECTION - I

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

a) Triethyl phospline is prefered than triphenyl phosphine is Wittig reaction.

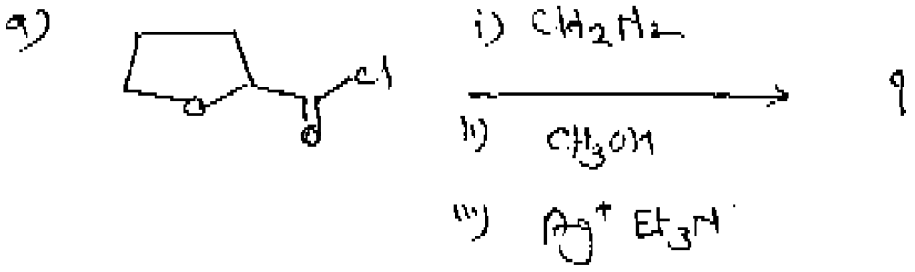
b) 1,3-Butadiene on reaction with bromine at low temperature give 1,2-dibromobutane, while at high temperature it give 1, 4 - dibromobutane.

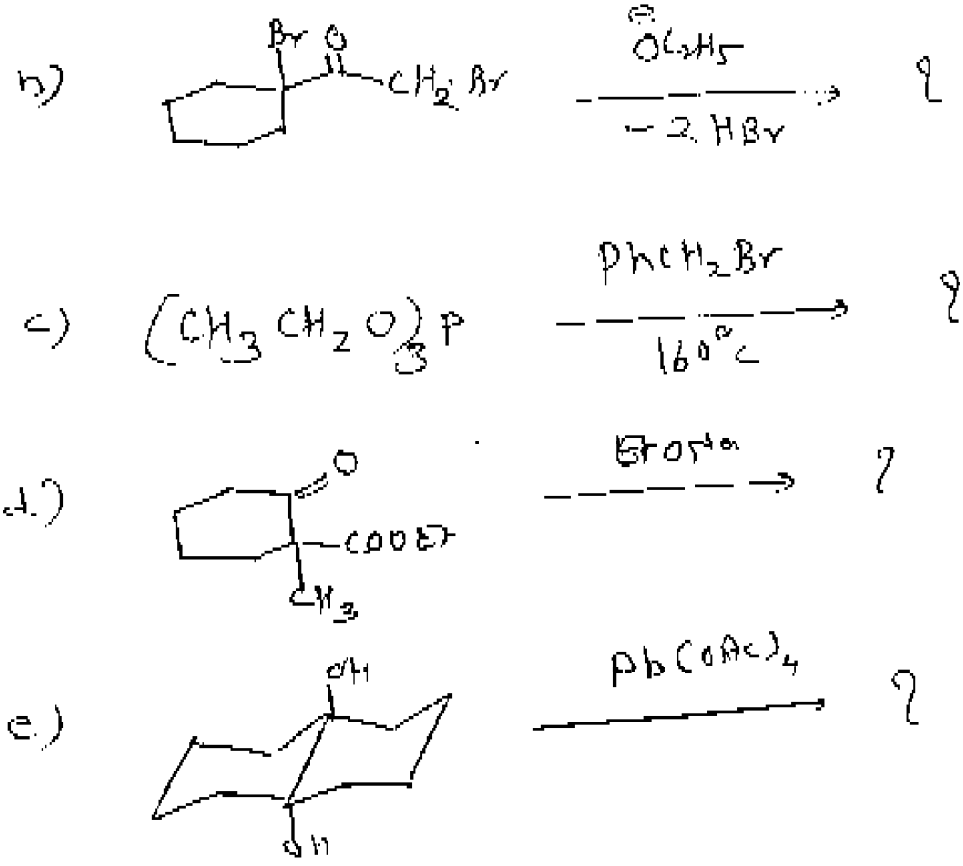
c) Cyclohexene furnish different products on treatment with Osmium tetraoxide and perocids.

d) $ACNH_2$ or $\underset{\underset{CH_3}{|}}{ACNH}$ will undergo Hoffmann rearrangement readily. Justify.

e) m-Nitroaniline is yellowish in colour while its acetyl derivative is colourless. Explain.

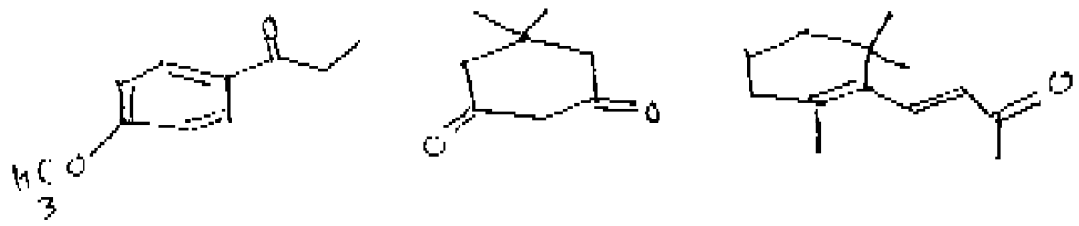
Q2) Predict the products and suggest the mechanism for <u>any Four</u> of the following : **[12]**





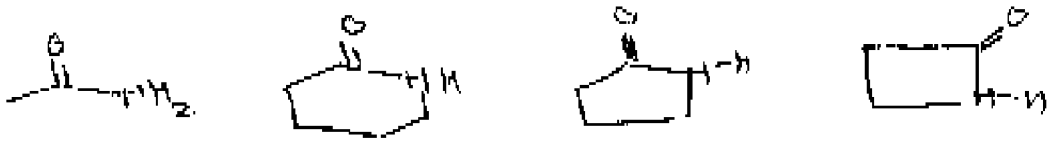
Q3) Answer the followings: **[12]**

a) Calculate λ_{max}.

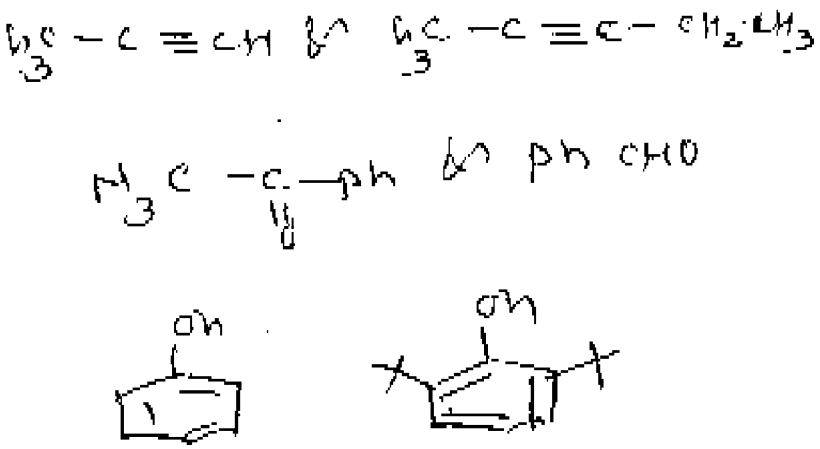


b) Distinguish between the following pairs by UV & IR:

c) Arrange the following compounds is the decreasing order of their carbonyl frequencies justify.



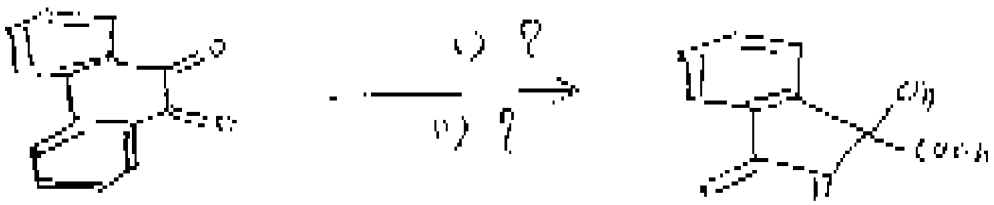
d) Distinguish between following pairs by using IR spectroscopy.



SECTION - II

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

a) Suggest mechanism for following reaction. How will you monitor the reaction by IR spectroscopy.

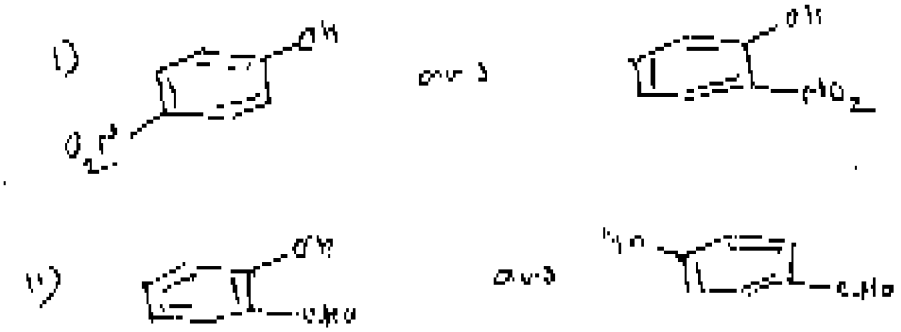


b) Explain why TMS is used as internal standard for NMR spectroscopy.

c) A compound M.F. $C_6H_{10}O$ shows positive lodoform test. The IR of this compound shows a peak at 1690 cm^{-1} and UV shows absorption at 240 nm. Suggests probable structure for the given compound.

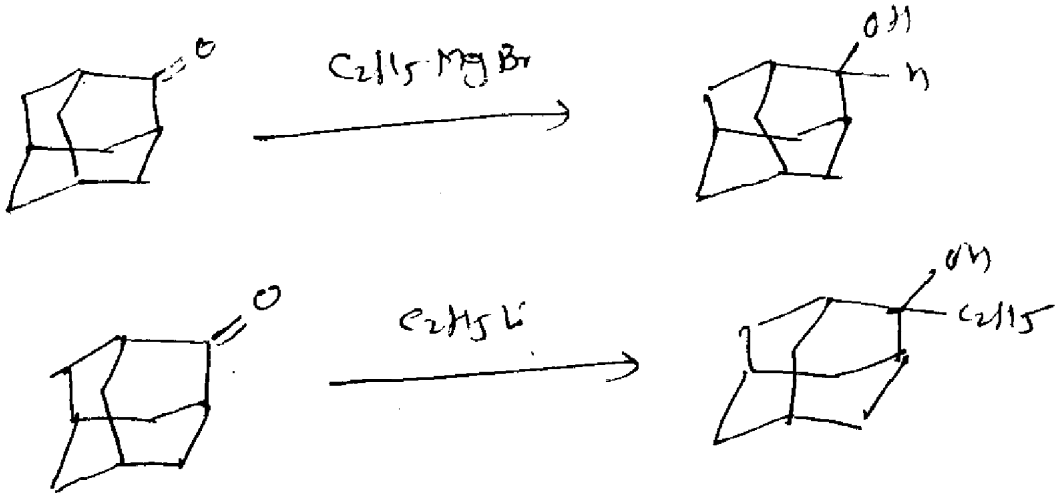
d) Indicates the number lines expected for each of the following underlined protons

e) How will you distinguish the following pairs by IR and NMR.



Q5) Answer <u>Any three</u> the following: **[12]**

a) Explain following reactions.



b) Write short note on:

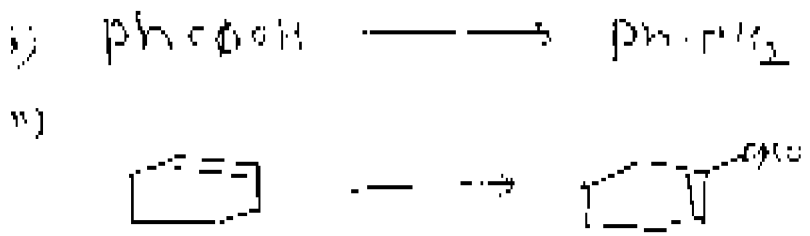
Lithium dialkyl Copper as alkylating agent.

c) P-Me $C_6H_4COOCH_3$ is hydrolyzed more rapidly then $PhCOOCH_3$ in conc. H_2SO_4, but the reverse is true in dil. H_2SO_4.

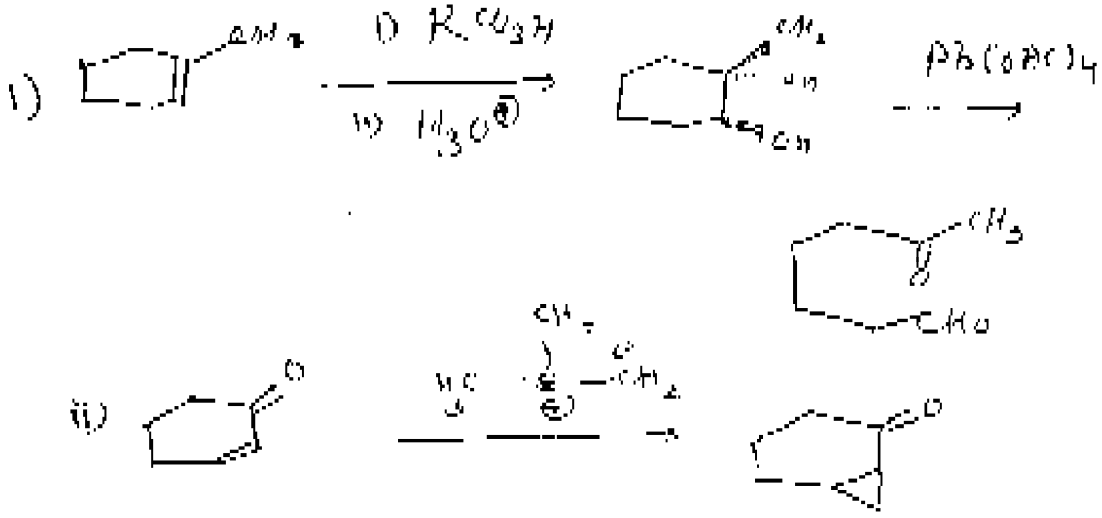
d) B-Hydroxyester cannot be prepared by Grignard Reagent but can be prepared by organozinc compound.

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

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



b) Suggest mechanism for the following coversions.



c) Explain the effect of solvent polarity on UV absorption.

d) Explain the following $\nu_{C=O}$ stretching frequency.

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

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M.Sc.

ORGANIC CHEMISTRY

CH-351 : Spectroscopic Methods in Structure Determination

(2008 Pattern)

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

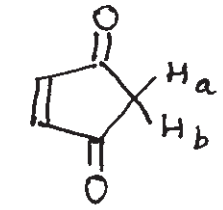
Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***
4) ***Spectroscopic data : 1R, PMR, CMR is not provided.***

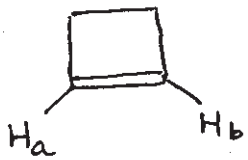
SECTION - I

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

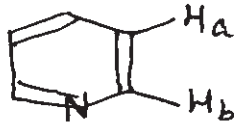
a) The J values for the following compounds are as shown in their PMR.



J_{ab} = 21·5 Hz



J_{ab} = 3 Hz



J_{ab} = 5 Hz

b) Aromatic solvents could be used to resolve the ^1H NMR Spectrum.

c) In oxygenated aliphatic compounds with alkyl groups C_3 or longer, rearrangement peaks occur in M.S.

d) Tetrasubstituted carbon atoms shows weak peaks in CMR.

e) CW spectroscopy is not used for ^{13}C NMR spectroscopy.

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

a) Predict the structure from the given spectral data :

M.F. : C_5H_8O
1R : 1705, 1635, 2750 cm^{-1}
PMR : 1.1 (t, J = 7 Hz, 3H); 2.2 (dq, J = 7 & 4 Hz, 2H)
5.9 (dd, J = 13 & 6 Hz, 1H); 6.78 (dt, J = 13 & 4 Hz, 1H)
9.35 (d, J = 6 Hz, 1 H)

b) Assign the structure :

M.F. : $C_9H_9NO_3$
CMR : 41.3(t), 127.2 (d)*, 128.2 (d)* 131.3 (d)
133.9(s), 166.6 (s), 171.2 (s)
* Strong signals
Mass : 179(M^+), 135, 105, 77, 51

P.T.O.

c) Predict the structure :

M.F. : $C_9H_{11}NO$

IR : 2842, 2720, 1661 cm^{-1}

PMR : 3.1 (s, 24 mm); 6.7 (d, J = 7.5 Hz, 8 mm)
7.72 (d, J = 7.5 Hz, 7.9 mm); 9.75 (s, 3.8 mm)

d) Assign the structure

IR : 1715 cm^{-1}

Mass : 128(M^+, 3%); 85(10%), 72(40%), 43(100%)

e) Predict the structure and justify your answer :

M.F. : $C_9H_8O_3$

CMR : 115.4, 115.9, 125.4, 130.0, 144.2, 159.9, 168.1.

DEPT 135: 115.4, 115.9, 130, 144.2, up
125.4, 159.9, 1681.1 absent

DEPT 90 : 115.4, 115.9, 130, 144.2 up

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

a) Strategies employed to improve M^+ intensity in MS.

b) Application of COSY in NMR interpretation.

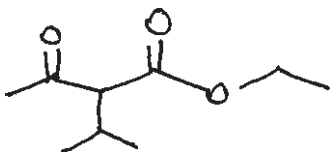
c) Long range coupling in PMR.

d) Factors affecting chemical shift in CMR.

SECTION - II

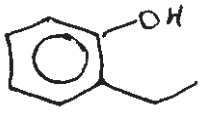
Q4) a) Explain the genesis of the following ions <u>any four</u> : **[8]**

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

ii)  172, 130, 115, 87, 43

iii) Ph-$NHCOCH_2COCH_3$ 177, 119, 93, 92, 43

iv) $CH_3CH_2CH_2CH_2CH_2CN$ 97, 96, 54, 41, 27

v)  122, 107, 121, 104, 77

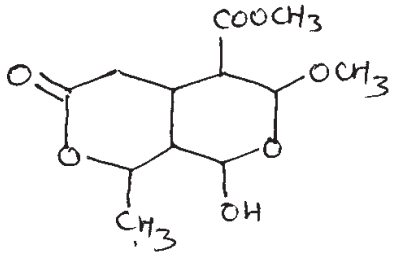
b) Mass spectral data for the isomeric octanes; n-Octane, 2-methylheptane and 2, 2, 4 - trimethyl pentane are given below. Identify which is which?

X (m/e, %) : 114(9), 100(2), 99(2), 85(13), 71(8)
57(17), 56(9), 43(100), 29(9)

Y (m/e, %) : 99(3), 57(100), 56(22), 43(15)

Z (m/e, %) : 114(7), 99(12), 71(10), 70(16), 57(50)
43(100), 42(40), 41(28). **[4]**

Q5) a) Assign the following signals to the various protons in compound X. Based on the J values assign the stereochemistry to the chiral centers. Justify your assignments. **[8]**

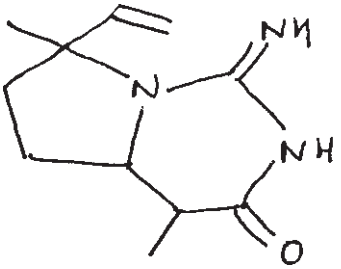


X

^{1}H NMR : 1·75 (ddd, J = 10, 10, 3Hz, 1H)
2·54 (dd, J = 17, 12 Hz, 1H)
2·59 (dd, J = 10, 8 Hz, 1H)
2·49 (dd, J = 17, 5 Hz, 1H)
3·00 (dddd, J = 12, 10, 10, 5 Hz, 1H)
4·52 (dq, J = 10, 7 Hz, 1H)
5·48 (d, J = 8Hz, 1H)
5·88 (d, J = 3Hz, 1H)

Note : Methyl and - OH proton signals are not given.

b) Assign the chemical shifts to various Carbon atoms. **[4]**

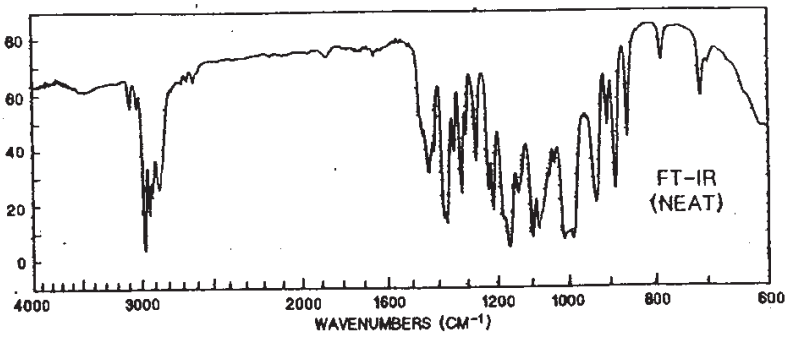


11·5, 20·6, 29·9, 40·7
42·3, 63·1, 65·1, 116·1
142·5, 158·5, 179·8

c) The unknown compound having intense molecular ion peak at m/e = 172 and also M + 2 of same intensity. It has following spectral data. Deduce the structure.

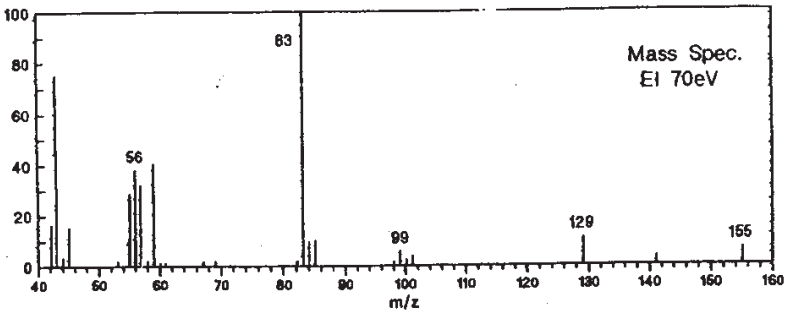
IR : 3500 cm^{-1}.
PMR : 5.2 (s, 1H); 6.8 (d, J = 8Hz, 2H)
7.3 (d, J = 8Hz, 2H);
CMR : 116, 118, 135, 155. **[4]**

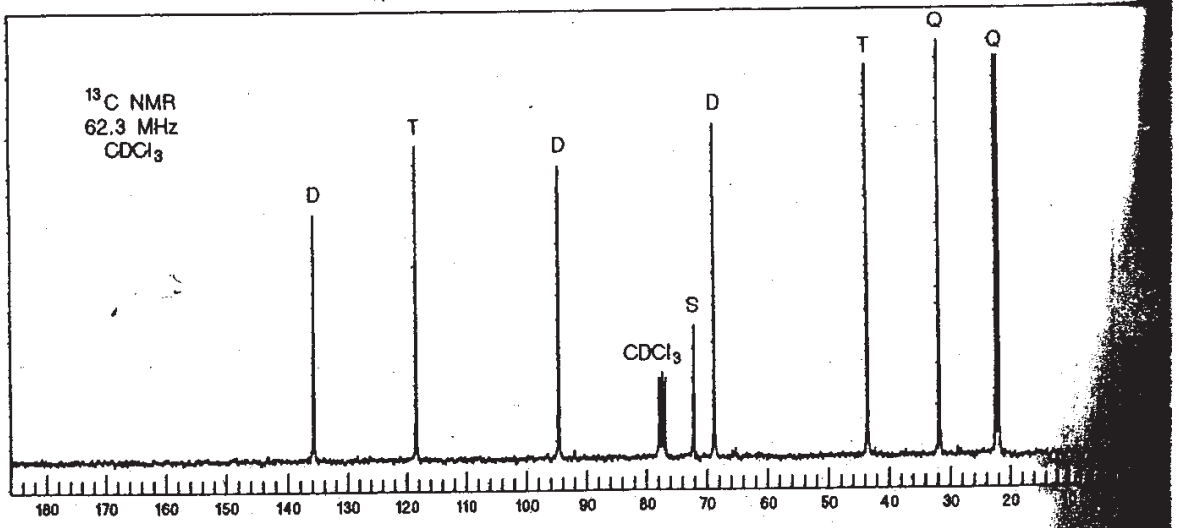
Q6) A compound exhibits the following spectral properties on the attached sheets. Suggest the structure for the compound and explain the spectral data. **[12]**

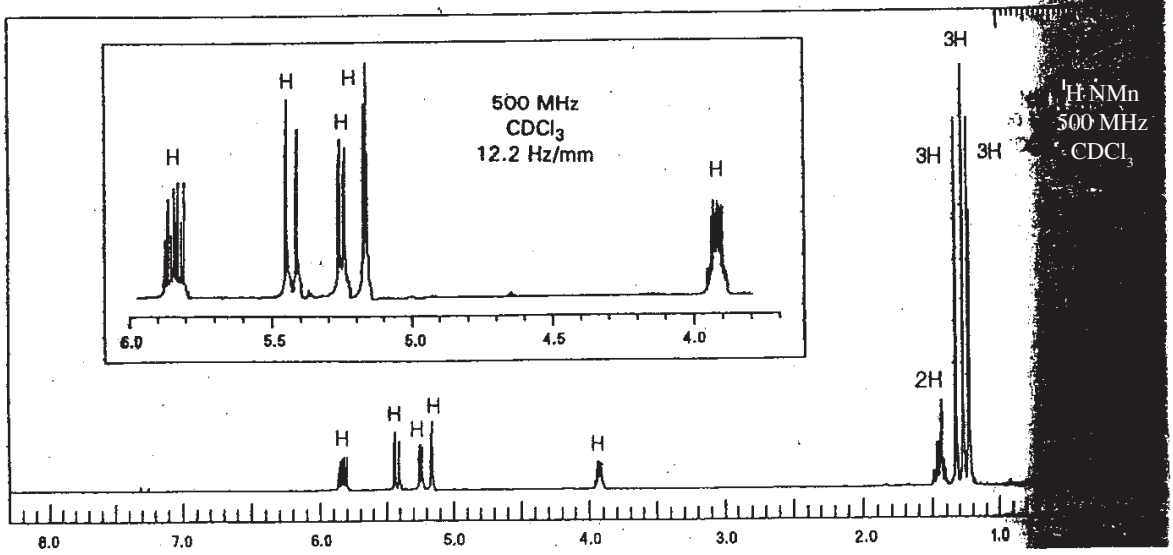


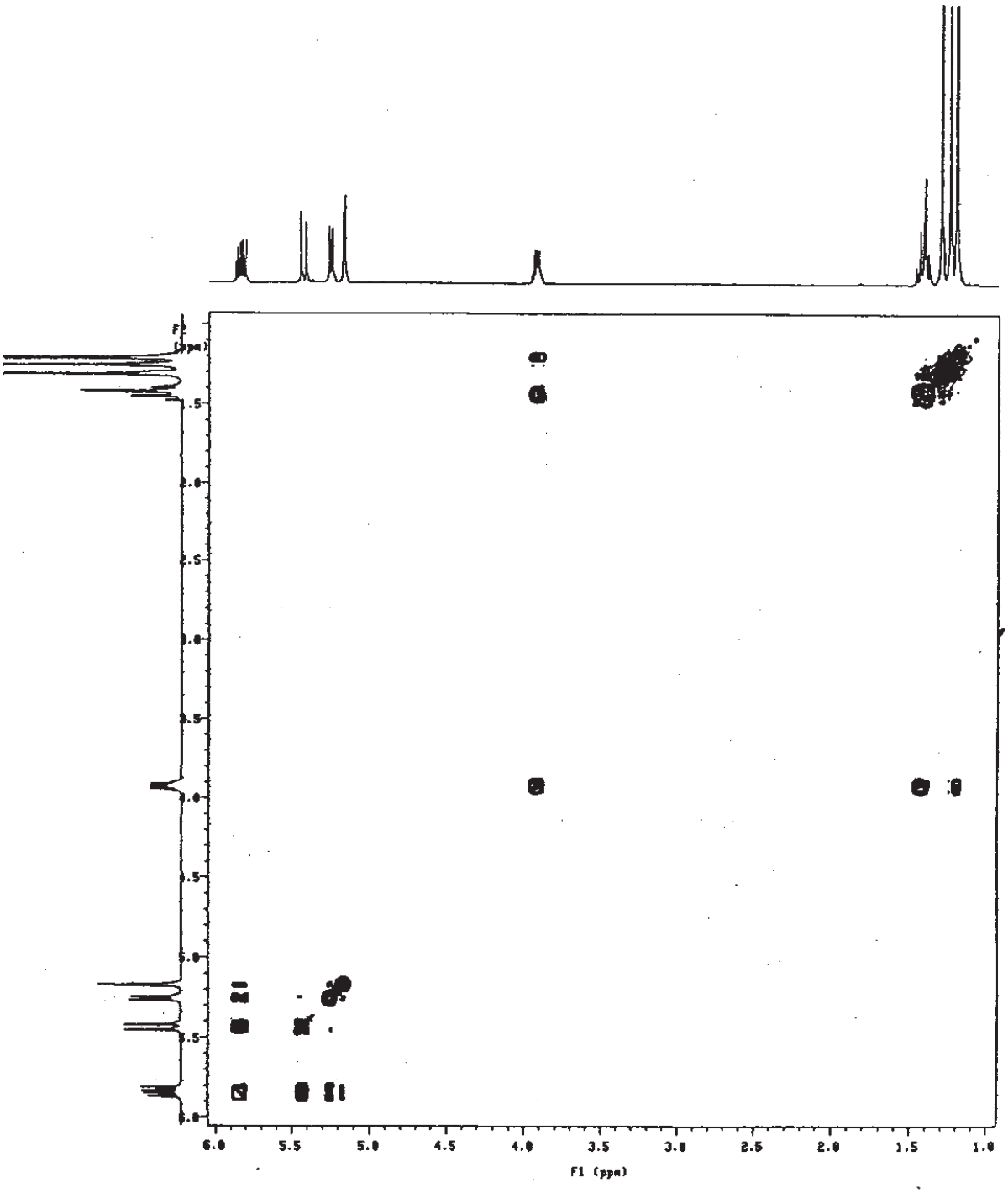
Exact M.S. (EI) = 156.1150

UVλ_{max} = BLANK








6.0
5.5
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
F1 (ppm)

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

P951 **[3723] - 313**

M.Sc. - II

Organic Chemistry

CH - 353 : Free Radicals, Photochemistry and Pericyclic Reactions

(2008 Pattern)

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

Instructions to the candidates :

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

SECTION - I

Q1) a) Write short notes on any two of the following: **[8]**

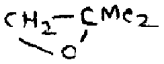
i) Photoenolisation.

ii) Photorearrangement of 4, 4 - disubstituted cyclohexenones.

iii) Distinguishing factors between homolytic and heterolytic reactions.

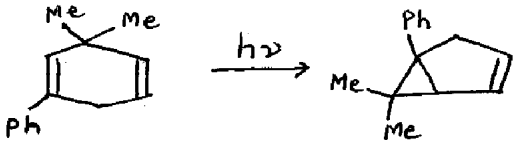
b) Explain any two of the following: **[6]**

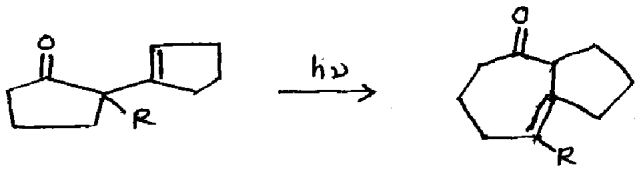
i) When 2, 6 - ditert - butylphenol, a colourless solid, reacts with alkylperoxy radicals, a red dimeric product is formed. Suggest a structure for this dimer and provide a mechanism for its formation.

ii) Decomposition of di-t-butylperoxide in the pure liquid state yields large quantities of isobutylene oxide  in addition to tert-butanol, acetone and methane.

iii) 4 - Dimethylaminobenzophenone undergoes very slow photoreduction in isopropanol, but when it is acidified with HCl, it is photoreduced at a faster rate.

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

i) 

ii) 

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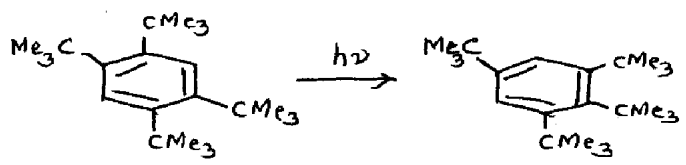
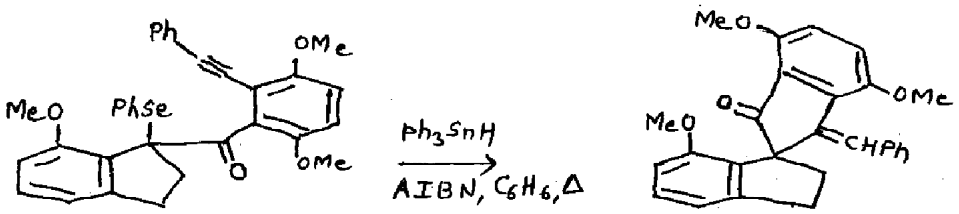
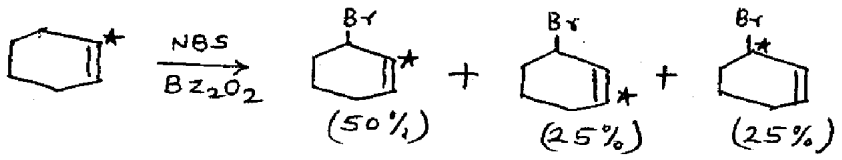
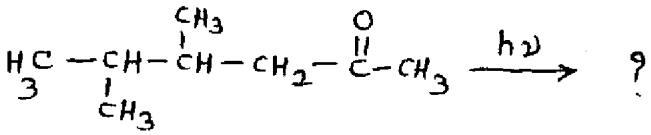
iii) 

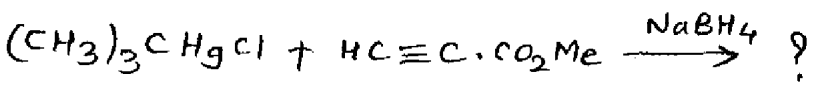
iv) 

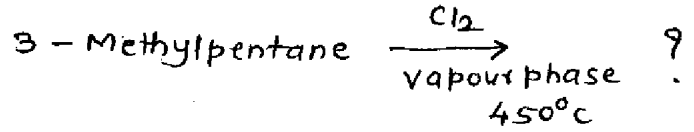
v) 

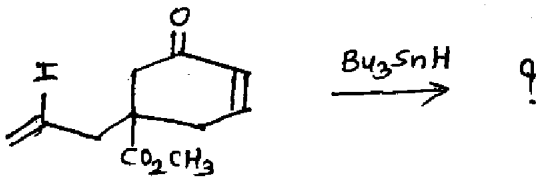
Q3) a) What are inhibitors for autoxidation? Give examples and explain their mode of action. **[4]**

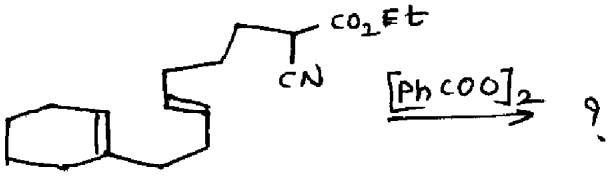
b) Predict the product/s indicating mechanism in any five of the following: **[10]**

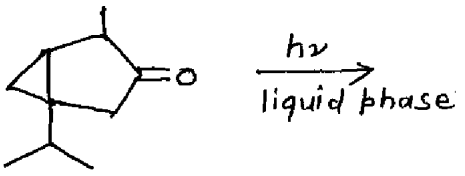
i) 

ii) 

iii) 

iv) 

v) 

vi) 

SECTION - II

Q4) a) Derive the structures of compounds A, B, C, D all with molecular formula C_8H_{16} obtained as shown below. **[4]**

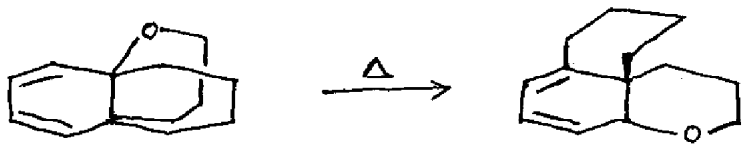
i) Cis - 2 - butene $\xrightarrow{h\nu}$ A + B

ii) Trans - 2 - butene $\xrightarrow{h\nu}$ B + C

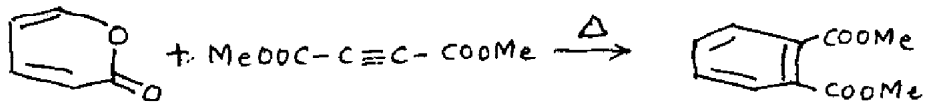
iii) Trans - 2- butene + Cis - 2 - butene $\xrightarrow{h\nu}$ A + B + C + D.

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

i)



ii)



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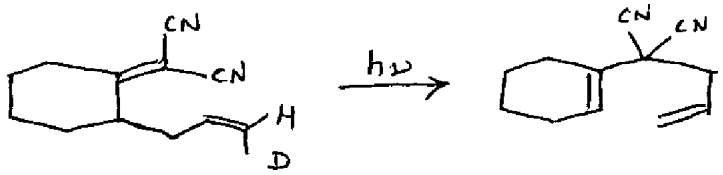
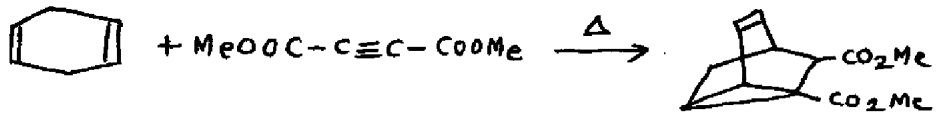
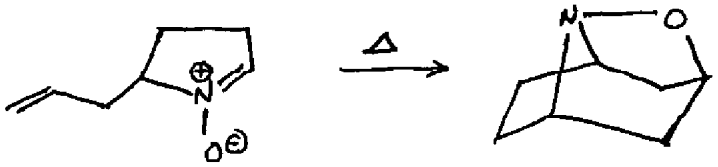


Indicate the position of 'D' in the product.

iv)

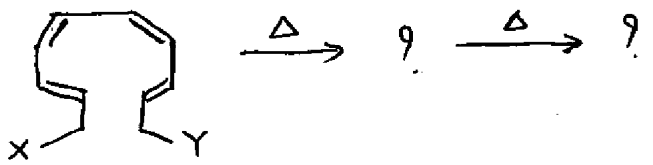


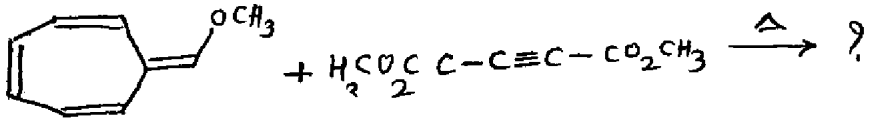
v)



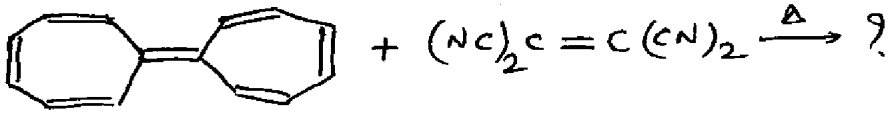
Q5) a) Explain with the help of correlation diagram whether the disrotatory opening of 1, 3 - cyclohexadiene to give 1, 3, 5 - hexatriene is allowed in ground state or in the excited state. **[6]**

b) Predict the products in any four of the following and explain the mechanism. **[8]**

i) 

ii) 

iii) 

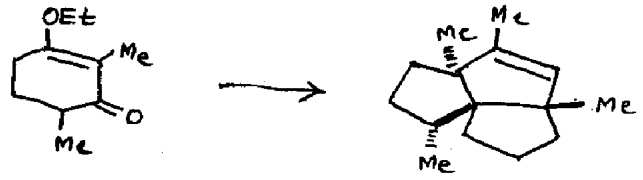
iv) 

v) 1-phenyl-3-(p-Tolyl)propene + EtO2C-N=N-CO2Et $\xrightarrow{\Delta}$?

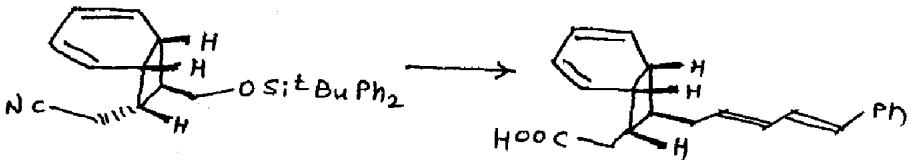
Q6) a) Discuss in detail the synthesis of (±) α - cedrene using meta - arene olefin cycloaddition. **[6]**

b) Complete any two of the following synthetic sequences indicating all intermediates and reagents required. **[8]**

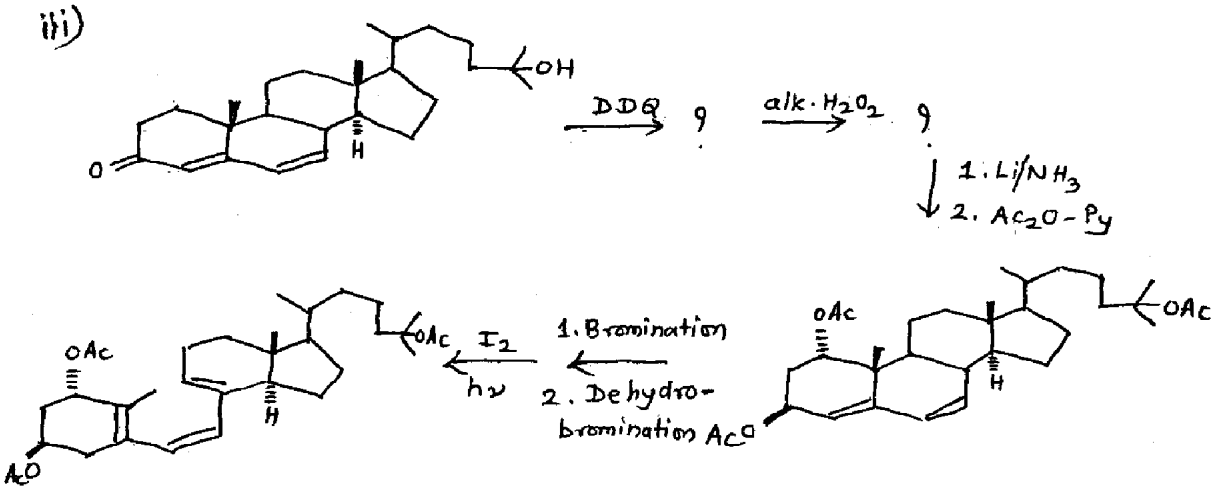
i)



ii)



iii)



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

P952

[3723] - 314

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 390: Electro analytical and Current Analytical Methods in Industries

(New Course)

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

Instructions to the candidates:

1) ***Answers to the two sections should be written in separate answer books.***
2) ***All questions are complsory and carry equal marks.***
3) ***Neat diagrams must be drwn wherever necessary.***
4) ***Use of logrithmic tables / calculator non - programmable is allowed.***

---

1) Attempt any four of the following:

a) Distinguish between differential pulse polorography and square - wave poarography.

b) Define residual current. Why in polarographic analysis is it necessary to remove of oxygen.

c) Rescribe the electrogravimetric method for estimation of copper from brass sample.

d) Determine helf - wave potetial (E1/2) of Ag / $AgNO_3$ electrode having electrode potential - 2.420 V at 25^0 C, the current generated by the rate of mass transport by diffusion is 2.28 μ A. [Given : Cathodic diffusion current = 14.25 μ A]

e) During the forward scan of a tringular wave valtammogram at a disc electrode, a peak current of 25.4 μ A was observed at a scan rate of 0.250 V / S. Estimate the peak current at a scan rate of 50.0 m V/S, assuming a reversible electrochemical reaction.

P.T.O.

2) Attempt any four of the following:

a) What is meant by stripping voltammetry? What is the purpose of the electrodeposition step in stripping analysis?

b) Explain the principle of comerometric titrations. how amperometric technique used in the successive determination of holides in a mixture?

c) What are nanomaterials? Explain it's general applications.

d) Potassium ferrocynanide (n = 1) has a diffusion coefficient of 6.5×10^{-6} cm^2/s during it's oxidation in 0.1 M Kcl. At a scan rate of 100 mv/s the anodic peak current for the oxidation of unknown solution of potossium ferrocyanide. [Given: the electrode area of disk electrode = 015 cm^2]

e) Ditterntial pulse polarography was used with the standerd addition technique to assay an aqueous solution of nitrobenzene which is a reducible organic polutant. From the results recorded in the following table. determine the pollutant concentration in the sample.

Added Concentration (m M)	0	01	02	03	0.4
Peak current (μA)	2.51	4.16	5.75	7.42	9.10

SECTION - II

3) Attempt any four of the following:

a) Explain the principle of activation analysis. Give advantages and limitations of neutron activation analysis.

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) Outline the analytical and explain the analytical procedure for the determination of any two of the following.

i) Calcium freo dolomite.

ii) Iron from bauxite.

iii) Copper from brass alloy.

d) 0.240 g of bauxite are was disintegrated for analysis of aluminium by fusion with Na_2O_2. The mass was extracted with dill. HCI and was diluted to 100 ml. From 50 ml aliquot aluminum was precipitated by using 8 hydroxyquinoline when 0.860 g precipitate of complex was obtained. Calculate the percentage of aluminium in the sample. (Given: At wts. Al =26.98. N = 14, O = 13.99).

e) 0. 240 g borosilicate glass was fused with sodium carbonate and the melt was converted into boric acid by suitable method. To the whole solution sufficient amount of mannitol was added and it was titrated with 0.12 N NaOH solution using paranitrophenol indicater. The titration reading was 24.8 ml. Calculate percentage of $B_2 O_3$ in the sample. (Given: At, wts B = 10.81, 0 = 15.99)

4) Attempt <u>any four</u> of the following:

a) Give analytical method for the estimation of organic from waste water.

b) Explain activated sludge process for waste water treatment.

c) How SOx is generated. Give it's hazardous effect on material .How is it controlled?

d) Mention the meaning of the following terms.

i) Aerosole.

ii) Dust.

iii) Suspended particulate matter.

iv) BOD.

v) Mist.

e) Write short note on <u>any one:</u>

i) Cyclone separator.

ii) Electro static precipitator.

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

P953

[3723] - 315

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 391: Environmental and Analysis of Industrial Materials

(New Course)

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

Instructions to the candidates:

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

SECTION - I

1) Attempt any four of the following:

a) Discuss analytical method for the determination of phosphorous from fertilizer.

b) What are colouring constituents of the glass? Give the procedure for estimation of iron from coloured glass.

c) What is detergent ? How unsulphonated and unsulphated materials are extracted and estimated from it.

d) What are pigments? Discuss the analytical method for the estimation chromium from pigment sample.

e) In estimation of calcium from 2.250 g sample, calcium was precipitated as calcium oxalate. The precipitate was dissolved in H_2SO_4 and the solution was titrated with 0.05 N K MnO_4 solution. The titration reading was 40 ml. Calculate percentage of CaO in the given sample. (Given: At. wt. Ca = 40, O = 16).

2) Attempt any four of the following:

a) Describe a method to estimate anionic surfactants.

b) What are propellants and explosives? Explain adiabatic colorimeter method to measure heat of explosion.

P.T.O.

c) What are cosmetics? Give the procedure for the estimation of zinc from cosmetics.

d) 1.5 g of brass sample was analysed for estimation of tin and zinc. It gave 0.025 g of SnO_2 and 0.520 g of $Zn_2P_2O_7$. Calculate the percentage of each metal in the sample.
(Given: At. wt. Sn = 118.7, O = 16 , Zn =65.38, P = 30.97).

e) A sample of iron ore weighing 0.635 g was dissolved in acid. After removal of silica the filtrate was diluted to 100 ml. An aliquot of 25 ml after reduction of iron to Fe^{+2} was titrated with 0. 025 N $KMnO_4$. The titration reading was 45 ml. Calculate percentage of Fe as Fe_2O_3.
[Given At.wt. Fe = 55.85, O =16]

SECTION - II

3) Attempt any four of the following:

a) Mention the constituent of Ilmenite ore. Describe in brief the estimation of titanium from Ilmenite ore.

b) Give composition of steel and explain the analytical procedure for estimation of nickel from steel.

c) Outline the analytical procedure for the determination of any two of the following.

i) Calcium from dolomite.

ii) Iron from bauxite.

iii) Copper from brass alloy.

d) 0.240 g of bauxite ore was disintegrated for analysis of aluminium by fusion with Na_2O_2. The mass was extracted with dil. HCl and was diluted to 100 ml. From 50 ml aliquot aluminium was precipitated by using 8 - hydroxyquinoline when 0.860 g precipitate of complex was obtained. Calculate the percentage of aluminium in the sample.
(Given: At. wts. Al =26.98. N = 14, O = 13.99).

e) 0. 240 g borosilicate glass was fused with sodium carbonate and the melt was converted into boric acid by suitable method. To the whole solution sufficient amount of mannitol was added and it was titrated with 0.12 N NaOH solution using paranitrophenol indicator. The titration reading was 24.8 ml. Calculate percentage of B_2O_3 in the sample.
(Given: At. wts B = 10.81, O = 15.99)

4) Attempt <u>any four</u> of the following:

a) Give analytical method for the estimation of arsenic from waste water.

b) Explain activated sludge process for waste water treatment.

c) How SO_x is generated. Give it's hazardus effect on material .How is it controlled?

d) Mention the meaning of the following terms.

i) Aerosole.

ii) Dust.

iii) Suspended particulate matter.

iv) BOD.

v) Mist.

e) Write short note on <u>any one:</u>

i) Cyclone separator.

ii) Electro static precipitator.

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

P960

[3723] - 322
M.Sc
BIOCHEMISTRY
BCH - 373: Recent Trends in Biochemistry and Toxicology
(New)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures on 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)

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

a) Describe briefly the theory of NMR spectroscopy.

b) Describe the techniques used for studying protein folding pathway.

c) Explain the patent specification.

d) How will you differentiate the generations of biosensors on the basis of redox reaction.

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

a) ORD and CD are manifestation of same phenomenon justify.

b) Enlist any five empirical rules for interpreting fluorescence spectrum of protein.

c) Give the principle and working of ESR.

d) What is fluorescence polarization and depolarization? What is the basic rule and consequences of this?

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

a) LCMS.

b) Intellectual property right.

c) Helix - turn - helix motif.

P.T.O.

(_____)

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

a) Describe the cellular effects of arsenic.

b) What are the components of oxidative type of air pollution? How are they generated.

c) Give the mechanism of phototoxicity caused by plant toxins.

d) Discuss the toxic effects caused by methanol.

e) What are the aims of experimental toxicology slivdies?

f) What is the underline mechanism of lipid peroxide formation by carbon tetrachloride?

g) Explain the mechanism of cytochrome P-450 catalyzed oxidative type of xenobiotic biotransformation.

5) Give the pathogenesis and clinical manifestations of the following (any three)

a) Hypotension and shock due to snake bitting. **[15]**

b) Microcytic and hypochromic anemia by lead intoxication.

c) Muscarinic, nicotinic and CNS effects due to organophosphrous insecticide poisoning.

d) Renal dysfunction due to antibiotics.

e) Aplastic anemia and leukemia due to benzene.

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

a) Explain the hypersensitivity reactions caused by various metals.

b) Explain the terms detoxication and bioactivation with suitable examples.

c) How delayed neurotoxicity of organophosphrous insecticides is evaluated?

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

P963

[3723] - 332

M.Sc.

DRUG CHEMISTRY

CH - 362 : Advanced Analytical Methods

(2008 Pattern)

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

Instructions to the candidates :

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

SECTION - I

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

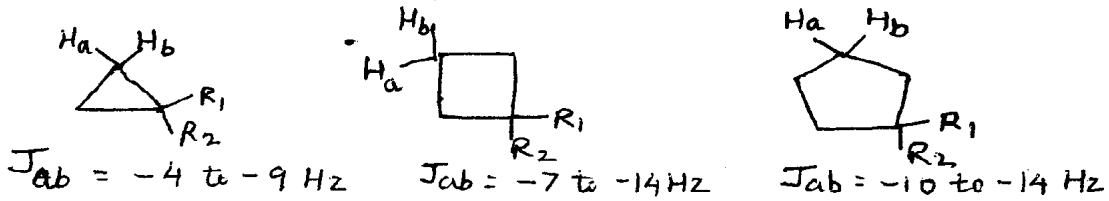
a) Molecular ion intensity decreases in the order cyclic > Acyclic > branched.

b) The substitution pattern of trisubstituted benzene with one bromine and two methoxy substituents which exhibits three resonance frequencies at 6.4, 6.46 and 7.41 δ .

c) In CMR, signals are sharp while in PMR they appear as peaks.

d) The temperature effect on the PMR spectrum of 1, 1, 2 - trichloroethane.

e) The observed coupling constant values.



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

a) Deduce the structure:

M.F. : $C_8H_{12}O$

IR : 2875, 1685, 1620 cm^{-1}

PMR : 1.26(s, 6H) 1.83(t, 7Hz, 2H) 2.5(dt, 7 & 2.6 Hz, 2H) 6.78 (t, 2.6 Hz, 1H) 9.82(s, 1H).

CMR : 189.2, 154.3, 152.7, 43.6, 40.8, 30.3, 26 (str).

P.T.O.

b) Deduce the structure:

M.F. : $C_7H_{12}O_3$

IR : 1720, 1738 cm^{-1}

PMR : 1.25(t, 7Hz, 3H) 2.23(s, 3H) 2.54(t, 6Hz, 2H)
2.81(t, 6Hz, 2H) 4.15(q, 7Hz, 2H)

CMR : 14, 28, 30, 38, 61, 173, 207

DEPT 135 : 14, 30, up
28, 38, 61 down
173, 207 absent

DEPT 90 : All signals absent

c) Deduce the structure:

M.F. : $C_3H_6Cl_2$

PMR : 1.6(d, 6Hz, 18mm) 3.52(dd, 7 & 9Hz, 6mm)
3.78(dd, 4 & 9 Hz, 6mm) 4.1(ddq, 4, 6 & 7 Hz, 6mm).

Explain the non equivalance observed.

d) Assign the structure

M.F. : $C_6H_9NO_2$

CMR : 21, 23, 26, 28, 136, 150

DEPT 135 : 21, 23, 26, 28, down
136 up

DEPT 90 : 136 up

e) Deduce the structure:

M.F. : $C_{11}H_{14}O$

Mass : 162, 134, 119, 91, 77, 71, 43

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

a) A_2, AB and AX spin systems.

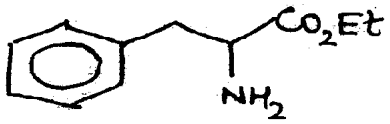
b) 2D Techniques in NMR.

c) Ionization techniques in mass spectrometry.

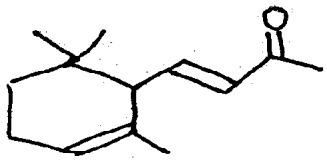
d) NOE with Soloman's diagram.

SECTION - II

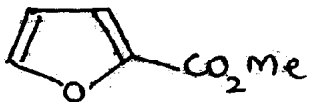
Q4) A) Explain the genesis of the following ions (Any three): **[9]**

a) 

193, 120, 102, 91

b) 

192, 136, 121, 92

c) 

126, 96, 95, 67

d) Ethyl isobutyl ether 102, 87, 73, 59, 57, 45, 31, 29

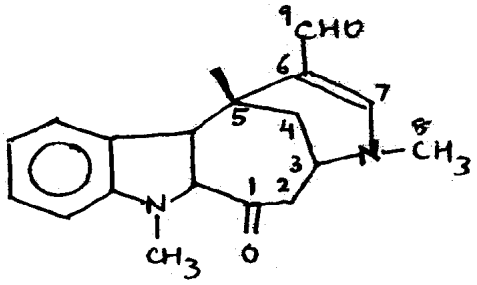
B) The isomeric methyl pent-1-enes A, B, C have mass spectral data as detailed below. Identify A, B, C and justify your answer. **[3]**

A (m/z, %) : 84 (30) 69(71) 56(13) 55(100)
42(21) 41(79) 29(40) 27(48)

B (m/z, %) : 84 (31) 69(36) 57(44) 56(100) 55(43)
42(29) 41(80) 29(28) 27(35)

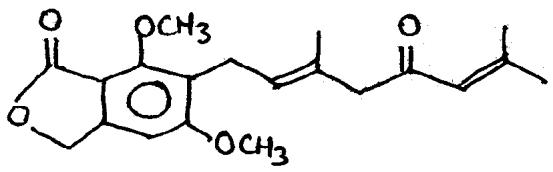
C (m/z, %) : 84(11) 57(20) 56(44) 43(100)
42(33) 41(72) 27(33)

Q5) A) Assign the signals to the numbered carbons in the following compound. Justify your answer. **[4]**



23.9 (s) 30.7 (t) 41.5 (q) 48 (t) 54.4 (d) 125.6 (s) 153.1 (d) 184.9 (d) 193.6 (s)

B) Assign the following signals to different protons using the decoupling and NOE experiments. **[6]**



1.79 (d, 1.2Hz, 3H) 1.85 (s, 3H) 2.13 (s, 3H) 3.02(s, 2H)

3.47 (d, 6.6 Hz, 2H) 3.91 (s, 3H) 4.07 (s, 3H) 5.19 (s, 2H)

5.26 (m, 1H) 6.08 (s, 1H) 6.64(s, 1H)

Spin decoupling expt.	Irradiation at	Change at
	1) 1.79 δ	5.26 (t, 6.6 Hz)
	2) 5.26 δ	3.47 (s)
NOE	3.91 δ	15% enhancement at 6.65 δ

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

i) Explain the theory and instrumentation of HPTLC.

ii) Discuss the various detectors used in GCMS.

iii) Draw the schematic diagram and explain the various parts in GLC.

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

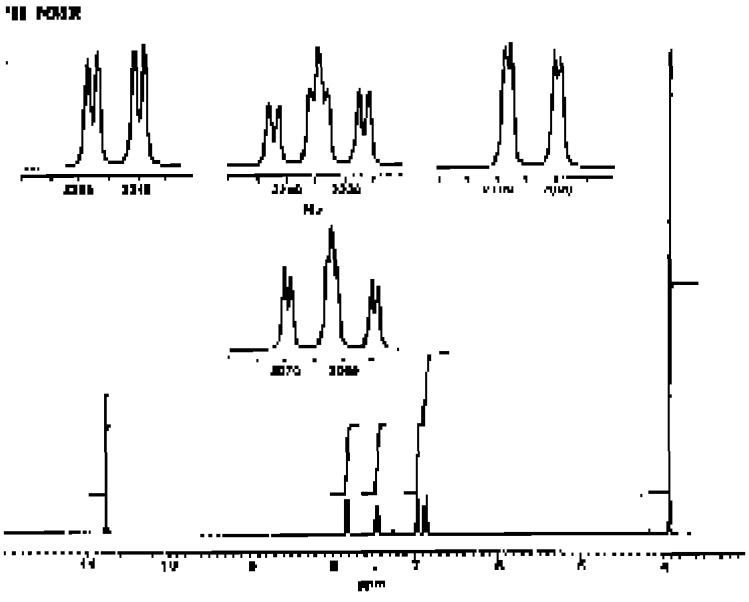
MASS SPECTRAL DATA:

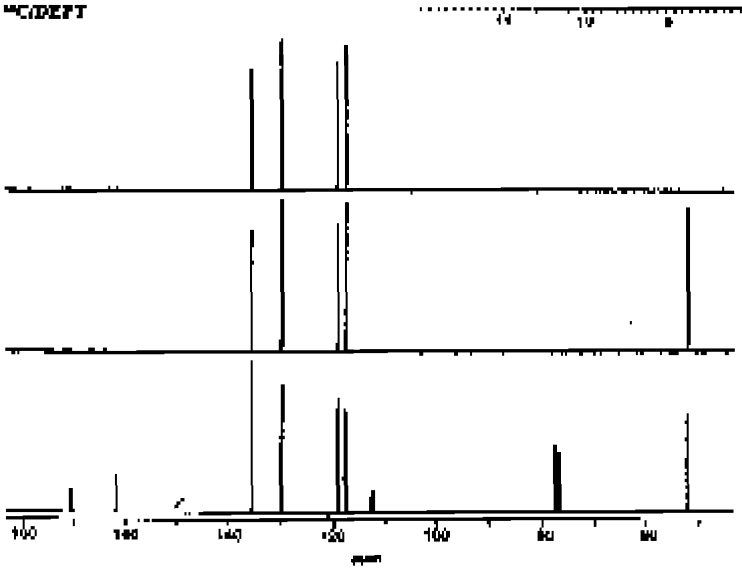
m/z : 152, 126, 99, 65, 39

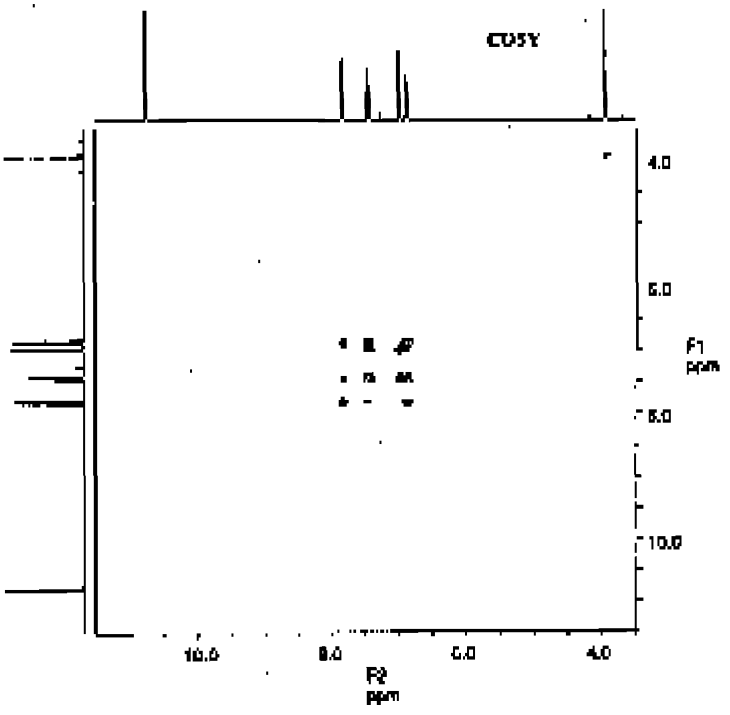
INFRARED DATUM:

3240, 1699, 1615, 1441
1305, 1216, 1158, 1090
757, 701 cm^{-1}

M.F : $C_8H_8O_2$







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

P964

[3723] - 333

M.Sc.

DRUG CHEMISTRY

CH - 363 : Drug Development (2008 Pattern) (New)

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

Instructions to the candidates :

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

SECTION - I

Q1) Answer any three: **[15]**

a) How microorganisms are screened for their ability to produce antimicrobial compounds? Once isolated how are they improved for obtaining better yield of the product?

b) What is difference between plate assay and turbidometric assay? Explain the principle behind plate assay.

c) List the factors to be critically observed during downstream process of a fermentation with reason behind.

d) What is the difference between continuous culture and batch culture? Which type of growth pattern is used for antibiotic production & why?

e) Explain any three of the following terms-

i) Acidophilic microorganisms. ii) Photoautotrophs.

iii) Chemolithotrophs. iv) Thermophilic microorganisms.

Q2) Answer any three: **[15]**

a) Which are the bodies three lines of defense? What is the difference between second and third line of defense? What happens if third line of defense is evaded?

b) What is ELISA technique? What one understands by direct and indirect elisa? What is the significance of elisa technique?

c) What are immunoglobulins? On what basis are they differentiated? Give the role of each type of immunoglobulin.

d) What are immuno modulators? Which role immunomodulators play in enhancing immune response?

P.T.O.

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

a) Give a brief history of drug discovery. What are the characteristics expected of an ideal drug? What are the strategies to achieve these?

b) How do drugs exhibit their effect? Discuss how Bioassays are planned to study the effect of drugs? Explain Agonist & Antagonist.

c) Discuss the various dosage forms of drugs? What is the need for so many dosage forms - explain with examples.

SECTION - II

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

a) Explain the difference between pharmacodynamics & pharmacokinetics. Discuss the factors that affects pharmacokinetics of drug action.

b) Explain the following:

i) Intellectual property.

ii) Patentable Inventions.

iii) Patent specification.

iv) Revocation of patent.

v) Process of grant of a patent.

c) Explain clearly the adjectives of Phase I, II & III of clinical trials? How are the clinical trials performed & the data presented to FDA for marketing approval? In what conditions are the trials suspended or cancelled?

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

a) Discuss in brief the various drug targets? How does a through knowledge of structure & function of these targets helps in drug discovery? Explain with examples.

b) Explain in brief the processes involved in studying the following toxicological tests.

i) LD_{50} ii) Chronic loxicity

iii) Mutagenicity

c) Explain the following terms:

i) Bio isosteres. ii) Drug potency & Efficacy.

iii) IC_{50} & ED_{50} iv) Bioequivalence.

d) Discuss the following in brief:

i) Characteristics of a good Industrial process.

ii) Strategies involved in process development & scale up of process.

iii) Validation & Documentation in QA / QC.

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

a) Discuss the reactions involved in Xenobiotic biotransformation.

b) Discuss the role of Ayurveda in drug discovery & development.

c) Discuss the chemical development strategies used for a NCE.

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

P965

[3723] - 334

M.Sc.

Drug Chemistry

CH - 364 : Stereo Chemical Principles and Applications (New) (2008 Pattern)

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

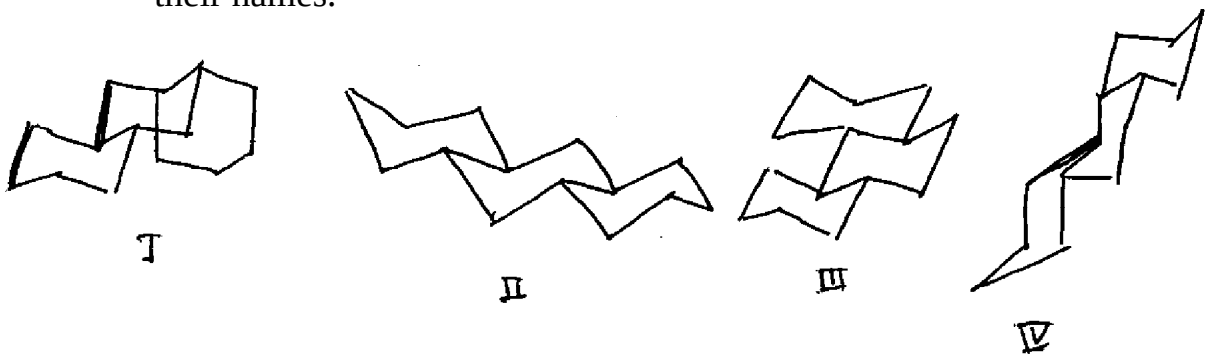
Instructions to the candidates :

- ***i) All questions are compulsory.***
- ***ii) Figures to the right side indicate full marks.***
- ***iii) Answers to the two sections should be written in the separate answer books.***

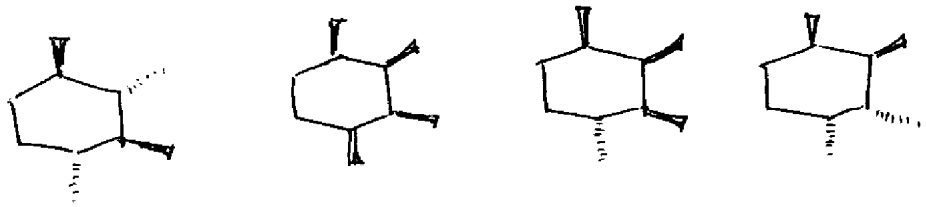
SECTION - I

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

a) Arrange following Stereo isomers in decreasing order of stability. Write their names.



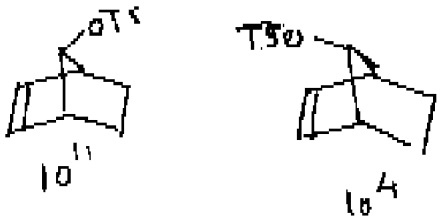
b) Give the preferred conformations of the four tetramethyl cyclohexanes given below. Estimate the enthalpy of these based on this indicate the stability of these compounds. Explain your answer clearly.



c) Give stable conformations for the following compounds and comment on their $V_{C=0}$ (strech) in IR and absorption in UV.

P.T.O.

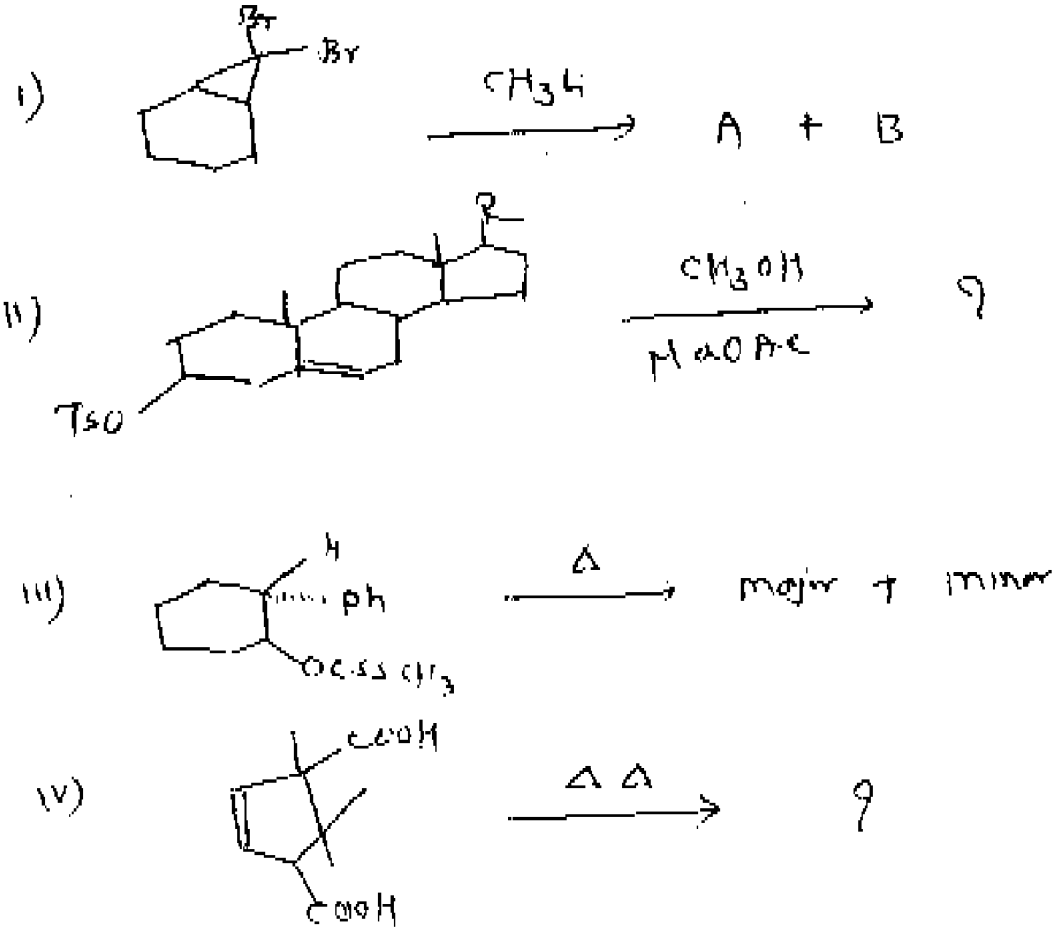
d) Rate of acetolysis of the following compounds are



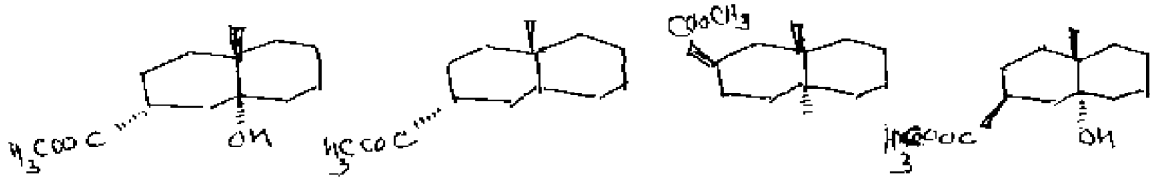
Explain

e) Camphox on LAH reduction yield mainly isoborneol. Explain.

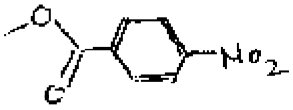
Q2) a) Predict the product/s and explain mechanism and stereo chemical principles involved (Any three): **[6]**



b) Arrange the following esters in increasing order for Saponification. Justify your arrangement. **[3]**



c) Explain, why $K_{trans} \mid K_{cis} = 2.5$ for I, while $K_{trans} \mid K_{cis} = 20$ for II **[3]**

I R = 

II R = $-COOC_2H_5$

Q3) Discuss the following (Any three): **[12]**

a) Transannular Interactions.

b) Effect of axial halo ketone UV and IR.

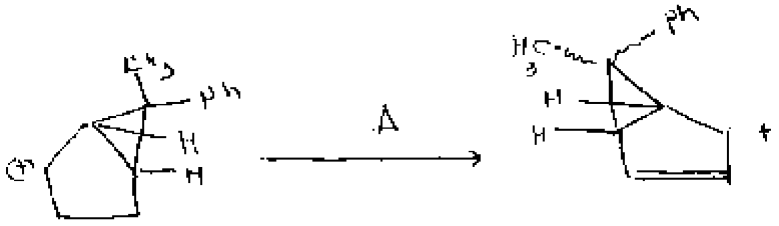
c) Von - auwers - skita rule and its limitations.

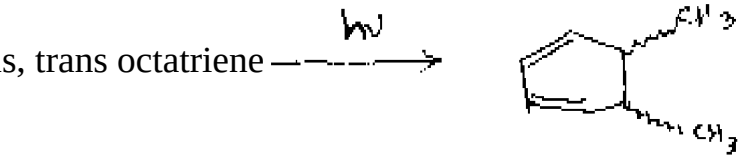
d) Wagner Meerwein rearrangement in bicyclic mono terpenoids.

SECTION - II

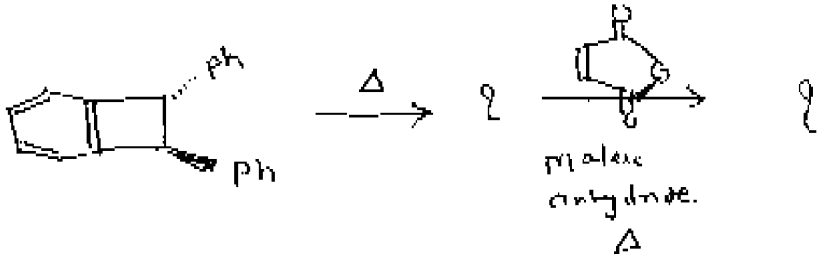
Q4) a) Draw the correlation diagram for the Cycloaddition between Pentadienyl and ethylene. **[4]**

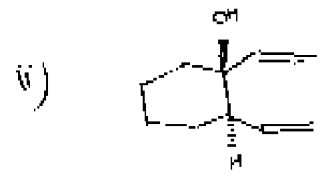
b) Predict the stereochemistry of the products in following pericyclic reactions. **[6]**

i) 

ii) 2, 4, 6 - trans, cis, trans octatriene 

c) Predict the products in any three of the following reactions and justify your answer in the mechanism. **[6]**

i) 

iii) 

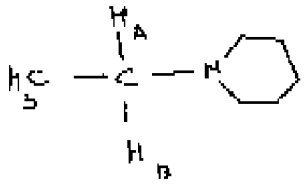
iii) 

(Boiling $C_{12}H_{16}$)

iv) 

Q5) a) Attempt the following: **[8]**

a) Write Pro-R and Pro-S for the following compound:

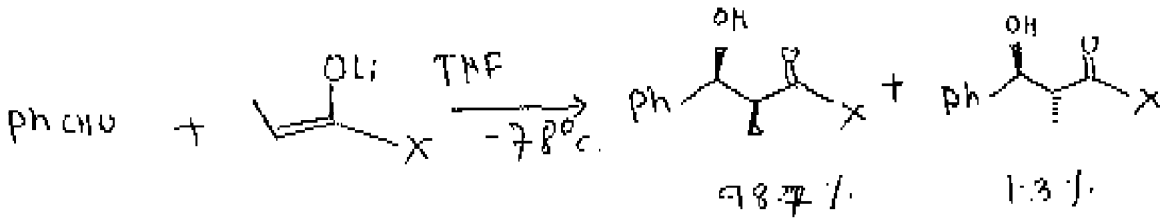


b) Write Re and Si faces for the following compound:

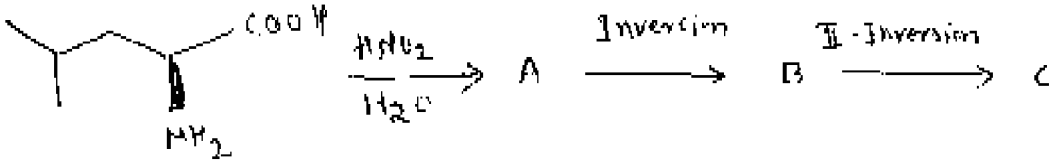
$Ph(CH_3)\ CH\ CO\ CH_3$

c) Give one application of chiral auxiliary in asymmetric synthesis.

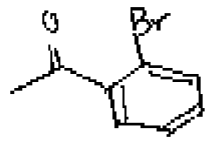
d) Calculate the diastereomeric excess in the following reaction.



b) Complete the following reaction sequence. **[4]**



Q6) a) Predict the products and write correct stereochemistry. Justify your answer (Any three): **[6]**

i) 

H_2

$RuCl_2$

(R)-BINAP

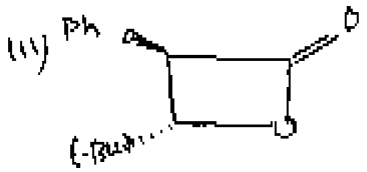
?

ii) 

PhMgBr

THF

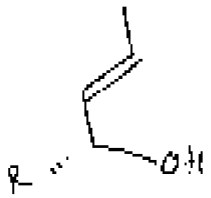
?

iii) 

i) LDA, $-70^{\circ}C$

ii) $H_2C=CHCH_2Br$

?

iv) 

(-) Diethyltartrate

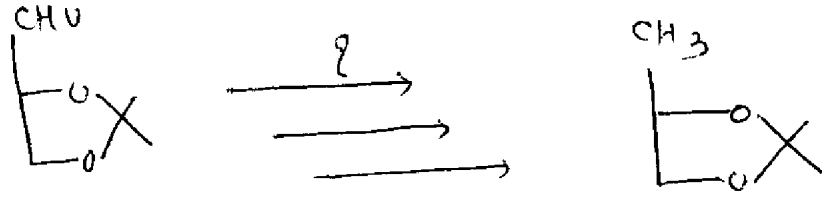
$Ti(OPr^i)_4$

TBHP

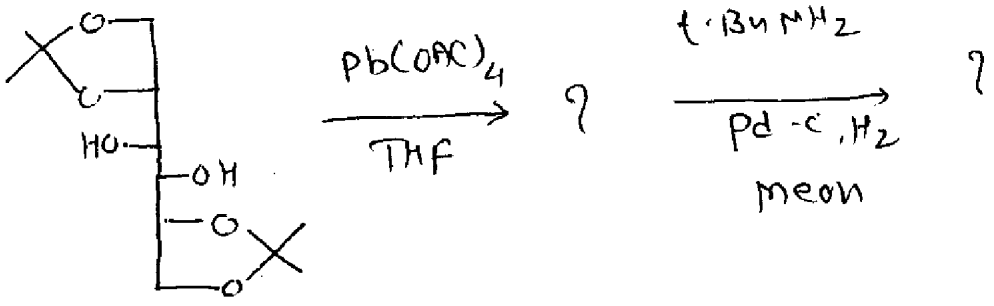
?

b) Attempt any two of the following: **[6]**

i) Complete the following reaction sequence. Write the suitable reagent for each step.



ii) Predict the products in the following reaction.



iii) Write evidences for the ring structure of D.Glucose.

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

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[3723] - 401

M.Sc.

PHYSICAL CHEMISTRY

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Explain classical and quantum mechanical approaches to nmr in brief.

b) Describe the ^{1}H nmr spectrometer. Discuss the characteristics of a high resolution nmr spectrometer.

c) Explain the terms : Chemical shift, coupling constant, Larmor precession and spin lattice relaxation in nmr spectroscopy.

d) Write a note on : ^{19}F nmr spectroscopy.

e) Discuss any one application of nqr spectroscopy.

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

a) Explain the working of X-ray band esr spectrometer using block diagram.

b) What is McConnell relationship? Discuss its applications.

c) Describe the instrumentation of PAS.

d) Explain the nature of the esr spectrum of the naphthalene anion.

e) Why esr spectra are always recorded in the derivative from? Explain.

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

a) Determine the distance between any two successive states of the H nuclei at field strength of 13000 G.
[Given : $g_N = 5.5854$]

b) Predict the esr spectrum of $K_3 [Mo (CN)_8]$ in water at RT.
(Given ^{95}Mo has I = 5/2).
What will be the change in esr if the complex is enriched with ^{13}C?

c) The centre of esr spectrum at atomic hydrogen lies at 329.12 mT in a spectrometer operating at 9.2231 GHz. What is the 9-value of the electron in hydrogen atom?

SECTION - II

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

a) Define X-ray diffraction. Discuss the phenomena of constructive and destructive interference with the help of suitable diagrams.

b) Discuss Bragg method of crystal analysis and state its limitation.

c) Draw a neat labelled diagram of an X-ray powder camera and show when the radius of powder camera is 57.296 mm, 1º is equal to 1mm.

d) State and explain the differences between X-ray diffraction and electron diffraction.

e) Enlist the applications of electron diffraction technique.

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

a) State the principle of electron diffraction technique. What are its limitations?

b) Define and explain the terms -

i) magnetic induction and

ii) magnetic susceptibility.

c) Derive the expression for gram susceptibility (χ_g) as used in Guoy method.

d) Deduce the equation for calculating the susceptibility of a liquid sample relative to a liquid reference.

e) Write a note on Pascal's constants and constitutive corrections.

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

a) Calculate the volume and mass paramagnetic susceptibilities of a sample of a complex salt with three unpaired electrons at 278 K.

[Given : Density = 2.55 gm / cm^3, molar mass = 315.5]

b) Calculate the molar susceptibility of hexane using Pascal constants.
[Given χ_A of C = -6.0×10^{-6}, χ_A of H = -2.93×10^{-6}].

c) X-rays of wavelength of 1.25 Å are used to calculate the spacing of (200) planes in aluminium. The Bragg angle for first order reflection is 20.8º. What is the size and volume of the aluminium crystal?

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

P967

[3723] - 402

M.Sc.

PHYSICAL CHEMISTRY

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) What is Gibbs monolayer? Show that it obeys two - dimensional ideal gas law for dilute solutions.

b) Explain the wetting phenomenon using young equation.

c) Starting with chemical potential, derive the equation for isosteric heat of adsorption.

d) Describe with a neat sketch, the volumetric method for the study of gas adsorption.

e) Stating the assumptions, how is surface area of a solid determined by using B.E.T. equation?

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

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

b) Adsorption hysteresis is a consequence of hysteresis of wetting. Explain.

c) Discuss the geometrical theory of heterogeneous catalysis.

d) What is catalyst deactivation? Describe different methods of deactivation.

e) Discuss the role of zeolites as a catalyst in industrial processes.

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

a) The pressures of nitrogen required to cause the adsorption of $1.0 cm^3 g^{-1}$ of gas on carbon black are 24 Pa at 77.5K and 290 Pa at 90.1K. Calculate the enthalpy of adsorption using the clausius - clapeyron equation.

b) A fatty acid forms a surface film on water that obeys the two dimensional perfect gas law. If the lowering of the surface tension is $10 \times 10^{-3} Nm^{-1}$ at 25°C, what is the surface excess concentration and the surface area per adsorbed molecule?

c) The following table gives the number of millilitres (ϑ) of nitrogen adsorbed per gram of active carbon at 0°C at a series of pressures:

P/Pa	524	1731	3058	4534	7497
ϑ / $cm^3 g^{-1}$	0.987	3.04	5.08	7.04	10.31

Plot the data according to Langmuir isotherm and determine the constants, K and ϑ_m.

SECTION - II

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

a) Describe the structure of water when ion is present in it.

b) Discuss the postulates of Debye - Huckel theory and explain how the excess charge density occurs around an ion in electroneutral solution.

c) What are three methods of ion transport in solution? Derive Fick's first law of steady state diffusion.

d) Describe Helmholtz model of double layer at the electrode - solution interface.

e) What is exchange current density? How is the concept understood using Butler - Volmer equation.

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

a) Explain the terms:

i) Galvani potential

ii) Surface potential

iii) Outer potential

iv) Electrochemical potential

v) Standard electrode potential

b) Explain the principles involved in the methods of preventing corrosion.

c) What are storage cells? Describe the construction and working of any one storage cell.

d) Describe the $H_2 - O_2$ fuel cell with neat and labelled diagram.

e) Write a short note on electrosynthesis.

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

a) The diffusion coefficient of K^+ and Cl^- ion in 0.02 M KCl solution at 20ºC was measured as $D_{Na^+} = 1.25 \times 10^{-9}\ m^2 s^{-1}$ and $D_{Ci} = 0.20 \times 10^{-9}\ m^2\ s^{-1}$. Calculate the equivalent conductance of solution.

b) Calculate the constants A and B in Debye - Huckel equation for a solvent with dielectric constant 2.6 at 20ºC.

c) Calculate the electricity storage density and energy density of Fe electrode. Whose reversible electrode potential for the reaction

Fe $\rightarrow$ $Fe^{++} + 2e$ is 0.44 V. [At. Wt. of Fe is 55.85].

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

P968

[3723] - 403

M.Sc.

Physical Chemistry

CH - 414 : Biophysical Chemistry and Related Techniques (New)

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

Instructions to the candidates :

1) ***Answers to the TWO sections should be written in separate answer books.***
2) ***All questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicates FULL marks.***
4) ***Use of logarithmic table / calculator is ALLOWED.***
5) ***Neat diagrams must be drawn WHEREVER necessary.***

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Define biophysical chemistry. Explain briefly the Needham concept.

b) Sketch and explain the structure of a plant cell.

c) Discuss the strategy to study the details of a biophysical macromolecule.

d) Explain two tests of proteins. What are heat shock proteins?

e) Compare the structures of RNA and DNA molecules.

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

a) Define 'contour length' of a polymer macromolecule chain. Deduce the expression $\overline{R} = \sqrt{\frac{8N}{3\pi}} \times l$ where the terms have the usual significance.

b) Explain the role of chaperones in protein folding.

c) Why are water molecules called flickering clusters? State the difference between water molecules attached to RNA or DNA molecules and free water molecules.

d) Define reverse osmosis. Write a note on membrane potential.

e) Discuss the role of myosin and actin in muscle contraction.

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

a) Calculate R_{rms} for a linear polymeric chain containing 250 monomer units each being 45 Å long.

b) Calculate the pH of a 10L solution containing $100cm^3$ of 5m CH_3COOH and $100cm^3$ of 1M sodium acetate [pKa = 4.7447]

c) Calculate the mass of a single water molecule in kg. given that its molecular mass is 18.

SECTION - II

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

a) Describe the general structure of a cell membrane.

b) Explain the thermodynamic treatment of membrane transport.

c) Enlist the functions of enzymes.

d) Discuss briefly the electron diffraction method for determining shapes and sizes of biopolymer particles.

e) Discuss sedimentation equilibrium method to determine the molecular weight of biopolymers.

f) Differentiate between micelles and biolayers with respect to their structure and function.

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

a) Explain how the ions are transported through a cell membrane.

b) What is enzyme inhibition? Explain briefly reversible inhibition.

c) Describe the viscosity method for the determination of molecular weight of biopolymers.

d) Briefly discuss any two methods for determination of the size of biopolymers.

e) Explain membrane equilibrium with the help of an example.

f) Write a note on optical rotatory spectroscopy.

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

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[3723] - 404

M.Sc.

Physical Chemistry

CH - 415 : Special Topics in Nuclear Radiation Chemistry (New)

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

Instructions to the candidates :

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) What do you understand by the term in-vivo diagnosis? Explain any one method of in-vivo diagnosis using radio isotope.

b) Enlist the various methods of food preservation. What are the advantages of using ionizing radiations for food preservation?

c) Discuss the working of a technicium generator.

d) What are the various methods of isotope separation? Discuss any one of them in details.

e) Describe the method of separation of uranium isotopes.

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

a) Give an account of radioactive solid waste management.

b) Define maximum permissible dose for radiation workers. Which are the points to be considered while applying this?

c) Explain the terms cosmochemistry, primordial nucleosynthesis, stellur nucleo synthesis and γ process.

d) Write a note on : CNO Bicycle.

e) Discuss in short solar neutrino problem.

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

a) Write down the reactions in PP I, PP II and PP III process.

b) Find out the activity of 99M technitium extracted from technitium generator after a period of 4 hour of loading 99Mo.

[Given : Initial activity of 99Mo is 24000 cpm].

$t_{1/2}$ of 99Mo = 66h and of 99M Tc = 6h

c) Complete the following reactions.

i) ^{203}Tl (P, 3n) $\square$ $\xrightarrow{\beta^+}$ $\square$ $\xrightarrow{\varepsilon}$ $\square$

ii) $^{124}Xe\ (n,\gamma)$ $\square$ $\xrightarrow{\varepsilon}$ $\square$ $\xrightarrow{\varepsilon}$ $\square$

SECTION - II

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

a) Draw and discuss the complexometric titration curve of three ions wherein ions complexing first and last are labelled.

b) Draw the experimental set-up used by Duncan and Thomas for studying radiometric titrations.

c) Discuss the applications of radiometric titrations.

d) State all possible radiolysis reactions for organic compounds.

e) Write a note on radiolysis of alcohol.

f) Discuss the problems encountered in the preparation of target by reactor irradiation.

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

a) 20 cm^3 of NaCl labelled with radioactive chlorine was titrated with 0.01M $AgNO_3$. Addition of 2.0 cm^3 of titrant followed by removal of AgCl precipitate showed a loss in activity from 10,000 counts for 2 minutes to 8,000 counts for 3 minutes. Calculate the amount of NaCl in the original solution.

(Given : Atomic weight of Na = 23, Cl = 35.5, Ag = 108, N = 14, O = 16).

b) Explain the necessity of thin targets and techniques for their preparation.

c) Write a note on carriers.

d) Discuss the effect of solute concentration on the molecular yields of hydrogen and hydrogen peroxide.

e) Explain competition kinetics with a suitable example.

f) Define a chain reaction and discuss its basic types.

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

P970 [3723]-405

M.Sc. - II

INORGANIC CHEMISTRY

CH - 430 : Inorganic Polymers and Heterogeneous Catalysis (New)

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 & calculator is allowed.***

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

a) Explain the use of diborane in hydroboration?

b) Write a short note on ZSM - 5 and FAV type zeolite material.

c) In carborane, why it's lithiated forms are useful to synthesize ring chain polymers? Explain with suitable example.

d) Draw the structures of B_6H_{10} and $B_5H_9(P(CH_3)_3)_2$ and indicate the number of bridging hydrogens?

e) Write note on p-n compounds.

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

a) Explain the role of alkali and water in the synthesis of zeolite.

b) Find out framework is in given cluster compounds $[Rh_6(CO)_{15}C]^{2-}$ and predict it's structure.

c) Give the structure and preparation of S_4N_4 and write in detail about polythiozal?

d) Write a note on Keolinite & ultramarine minerals.

e) Based on pore structure and $SiO_2 : Al_2O_3$ ratio, classify zeolite material.

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

a) Explain Fisher - Tropsch synthesis.

b) Describe the synthesis of ammina using iron based catalyst, alumina and K - salts.

P.T.O.

c) Explain hydration of alkane using ‘Ni’ as catalyst.

d) Explain why d-block metals act as a good catalyst.

e) Explain basic principle of heterogeneous catalyst. Describe how adsorption isotherms explains the catalytic activity of heterogeneous catalyst.

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

a) Explain formation of SO_2 using V (V) as a catalyst.

b) Describe the oxidation reactions catalysed by metallic nanoparticles.

c) What are the different methods that are employed for the synthesis of metal nanoparticles.

d) Explain how MCM - 41 catalyst is prepared? Mention their acidic properties.

e) What are photocatalytic reactions? Explain with suitable example.

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

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[3723]-406

M.Sc. - II

INORGANIC CHEMISTRY

CH - 431 : Material Science (New)

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

Instructions to the candidates :

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

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

a) What is meant by imperfections in solids? Differentiate between Frenkel and Schottky defects?

b) Explain the origin of valence and conduction bands in solids.

c) Discuss the interstitial and cheveral compounds.

d) Calculate the atomic density on the (110) plane of α - iron BCC lattice in atoms per square mi Lattice constant of α - iron is 0.287 nm.

e) What is meant by diffusion in solids? Explain various mechanisms of diffusion.

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

a) Give an account of Carbon based super conductors.

b) Explain the peltier effect and seebeck effect.

c) Explain the super conductivity exhibited by pervoskites.

d) Explain magnetic super exchange in an insulator.

e) Write an account on microwave, Josephson Junction and Super Conducting Quantum Interference Device.

Q3) Attempt the following: **[20]**

a) Tick the correct answers:

i) The atomic diameter of an FCC crystal (Lattice parameter is 'a') is

a) $a\sqrt{2}/2$ b) $a\sqrt{2}/4$ c) $a\sqrt{3}/4$ d) a/2

P.T.O.

ii) The unit cell with three lattice parameters is

a) tetragonal b) orthorhombic

c) monoclinic d) triclinic.

iii) The fastest diffusing species in Fe is

a) H b) Ni

c) C d) W

iv) Pure silicon at OK is an

a) Intrinsic semiconductor b) Extrinsic Semiconductor

c) Metal d) Insulator.

v) A cation vacancy and an anion vacancy in a crystal of the type AB is called

a) Schottky defect b) Frenkel defect

c) Pair of vacancies d) None of these

b) Draw the systerisis curves for hard magnetic materials and softmagnetic materials and explain the curves.

c) With the help of suitable diagrams explain the formation of magnetic bubbles in a ferrimagnet.

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

a) Sol - gel method & Ceramics.

b) Electroactive ceramics.

c) Biosolids.

d) Molecular magnets.

e) Dislocation theory & line defects.

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

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[3723]-407

M.Sc. - II

INORGANIC CHEMISTRY

CH - 445 : Inorganic Applications in Industry, Biotechnology and Environmental Chemistry (New)

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

Instructions to the candidates :

1) ***Attempt any two sections from the following.***
2) ***Both sections should be written in the same answer book.***
3) ***All questions are compulsory.***
4) ***Figures to the right indicate full marks.***
5) ***Neat diagrams must be drawn wherever necessary.***
6) ***Use of logarithmic table / calculators is allowed.***

SECTION - A

Applications of Inorganic Materials

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

a) What is the difference between a pigment and dye? Explain the use of chromium in dyeing of wool using azodyes? Give the structure of the compounds involved.

b) Explain the methods for electroplating of precious metals.

c) What are formazans? How are they classified as lizands? Give at least two examples of each types and draw the structure of the metal complexes they form.

d) Explain the microstructure of softwood.

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

a) How are redox centers ligand to PVP electrode coating? Explain the effect of increasing the positive potential of the platinum electrode on electro deposition.

b) Explain two methods of electroplating of tin.

c) A piece of wood containing moisture weight 165.3gm. and after oven drying a constant weight, weighs 147.5gm. What is its percentages moisture content? Justify of your answer on the quality of wood.

d) Give in detail production of Portland cement.

P.T.O.

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

a) Give two examples and draw structures of

i) Metallized dyes.

ii) Addition Reagent.

iii) Medially metallized azodyes.

b) Explain the production and properties of glass fibers.

c) Write a note on - Natural earth colour pigment.

SECTION - B

Environmental Chemistry

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

a) Describe how nitrogen can be removed from the waste water by biological treatment.

b) How do you differentiate between active and Passive solar heating system.

c) Explain how the detergents and pesticides are responsible for water pollution.

d) Draw a schematic of polymer electrolyte membrane (PEM) fuel cell.

i) What reaction is occurring at the cathode.

ii) What reaction is occurring at the anode.

iii) Show the over all reaction.

iv) Why is the PEM often referred to as a "Proton exchange membrane" fuel cell?

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

a) What is a powerball? Draw a Schematic diagram of a plant for producing powerball?

i) How is hydrogen gas liberated from a powerball?

ii) How is the powerball manufactured?

b) What does tertiary treatment in a sewage treatment plant remove from the waste stream?

c) Determine pE for waste water that contain 5.0×10^{-4} M S^{-2}. Does this waste water favour oxidation or reduction?

$S + 2\bar{e} \rightarrow S^{-2}$, $pE^{o} = -8.47$

d) Compare aerobic treatment process with an anerobic treatment process.

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

a) Energy from biomass.

b) Electrodialysis.

c) Biorefractory organic pollutant.

SECTION - C

Biotechnology

Q7) Attempt any three of the following: **[15]**

a) Describe an experiment to study the effect of temperature on the action of renin on milk.

b) Point out the differences in Pruteen production and methane production using microbes.

c) Outline the main stages in biotechnological purification of drinking water.

d) What are monoclonal antibodies? How do they work.

Q8) Answer any three of the following: **[15]**

a) Describe main stages in making yoghurt.

b) Compare between bath fermenters and continuous fermenters.

c) Name three groups of antibiotics in common use. How are they used to treat different kinds of diseases.

d) What is gasohol? How is it produced?

Q9) Write notes on (any two): **[10]**

a) Enzymes renzyme mobilization.

b) Tissue culture.

c) Cultures in vaccine production.

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

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[3723]-411

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

ANALYTICAL CHEMISTRY

CH-481 : Bioanalytical and Forensic Science

(Old & New)

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

Instructions to the candidates:

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

SECTION - I

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

a) What are micronutrients? Explain with suitable examples.

b) Outline the analytical method for estimation of pectin from Jam.

c) Explain the method used to estimate HMF content of honey.

d) Enlist the methods used for food processing. Explain irradiation method in detail.

e) A sample of 1.58 g Saccharin tablet was subjected to Saccharin estimation and it requires 1.3 ml of 0.1 N Sodium hydroxide. Calculate percentage of Saccharin in given sample.
[Given: - Molecular weight of Saccharin = 183.2]

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

a) State the precautions which are taken during collection of blood sample from patient.

b) Give the principle for estimation of protein and describe Lowry's method.

P.T.O.

c) Explain suitable method for estimation of free amino acid.

d) How are total carbohydrates estimated?

e) Biological sample was analysed for net protein utilization, digestability and biological value, give following observations:

i) Intake nitrogen 22.4 mg.

ii) Fiecal nitrogen 13.4 mg.

iii) Endogenous faecal nitrogen 8.3 mg.

iv) Endogenous urinary nitrogen 7.1 mg.

Calculate net protein, digestability and biological value.

SECTION - II

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

a) State a principle and explain technique for extraction of caffeine form biological sample.

b) Outline the procedure for determination of benzodiazapines.

c) Explain type B procedure in detail for determination of barbiturates.

d) Outline the procedure for determination of heroin from urine sample.

e) Urine sample was analyzed for metamphetamine conteint using gas chromatographic method. It gave following observations:

Internal standard conteint in chloroform = 1.93 μg/ml

Peak height for metamphetamine in standard reference solution = 3.87

Peak height for internal standard in specimen = 2.96

Peak height for internal standard in standard reference solution = 1.43

Volume concentration factor for internal standard = 0.53

Calculate the concentration of metamphetamine in urine sample.

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

a) Define the terms:

i) Canabis (Hemp)

ii) Narcotic drug

iii) Alcohol

iv) Poppy straw

b) Write note on bonded manufactory.

c) Give the classification of medicinal and toilet preparations containing alcohol.

d) Explain in detail 'cultivation of opium poppy and production of opium poppy straw'.

e) Discuss 'Ayurvedic preparations containing alcohol'.

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

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[3723]-412

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

ANALYTICAL CHEMISTRY

CH-490 : Analytical Spectroscopy

(Old & New Course)

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

Instructions to the candidates:

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

SECTION - I

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

a) State and explain the limiting law in absorption spectroscopy. Explain it's instrumental cause for deviation from limiting law.

b) Explain the principle and working of following detector's.

i) Gas-ionisation.

ii) Scintillation.

c) Draw a schematic diagram and explain working of single beam spectrophotometer.

d) Beryllium (II) forms a complex with acetylacetone having molecular mass 166.2 g $mole^{-1}$. Calculate the molar absorptivity of complex, given that 1.34 ppm solution has a transmittance of 55.7% when measured in a 1.00 cm cell at 295 nm.

e) Estimate the thickness of foil composed of an alloy having mass absorption coefficient 631.75 cm^2/g and density 8.012 g/cm^3. If the detector recorded 10,848 counts/min of transmitted X-rays when foil was not in the path of X-rays and 1023 counts/min when foil was placed in the path.

P.T.O.

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

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

b) With neat diagram explain electrostatic field analyser in electron spectroscopy.

c) What is meant by gas-phase chemiluminescence? Explain with one example gas-phase chemiluminescence.

d) 2 s electron of sulphite ion has binding energy 160.9 eV. Estimate the kinetic energy of measured electron, if the incident radiation has the K_α line of aluminium with wavelength 8.28 Å and the work function of electron spectrometer is 8.9 eV.

e) Calculate the potential difference between the filament and the target in an X-ray tube which has a short-wavelength cutoff of 0.110 nm.

SECTION - II

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

a) Explain the following terms:

i) Coupling constant in NMR spectroscopy.

ii) Solvents used in NMR spectroscopy.

b) Write a critical note on magnetic resonance imaging.

c) What is meant by relaxation? Explain spin-spin and spin-lattice relaxation.

d) A proton appears at a quartet at 4.5 δ, J = 6 Hz on a 300 MHz instrument, indicates the line position in Hz of each lines. Give the relative intensities of these lines.

e) A pmr of compound with empirical formula C_4H_8O shows triplet at 1.05 δ (J = 6 Hz), singlet at 2.05 δ and quartet at 2.4 δ (J = 6 Hz). The integration of each peak shows 3 : 2 : 3 ratio respectively. Identify the compound.

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

a) Distinguish between NMR and ESR spectroscopy with reference to it's principle, sources, reference compounds, applied magnetic fields and detectror's.

b) Name two types of scanning microscopes. How they differ? Give their advantages and disadvantages.

c) Explain the following terms in ESR spectroscopy.

i) g-Factor

ii hyperfine splitting.

d) Discuss ESR spectrum of benzene anion radical.

e) A 0.5 ml sample containing an organic free radical which contained one unpaired electron for each radical yielded an ESR spectrum that contained a singlet with a peak-to-peak line width of 0.15 G and relative peak height of 24.3. The spectrum of 0.5 ml of a 2.5×10^{-5} M DPPH sample was recorded with identical Instrumental settings. The peak-to-peak line width of the DPPH spectrum was 0.12 G and relative peak height was 31.6. Calculate the concentration of free radical in the sample.

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

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[3723]-413

M.Sc. - II

ANALYTICAL CHEMISTRY

CH-491 : Polymer Technology

(Old & New Course)

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

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Draw diagrams wherever necessary.***

SECTION - I

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

a) Explain the kinetics of free-radical polymerisation.

b) Write a note on 'Vulcanisation reaction'.

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

i) Nylon-66

ii) Polychloroprene

d) What is thermal degradation of polymers? Explain the factors affecting the degradation process.

e) Give the salient features of emulsion polymerisation.

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

a) Explain the mechanism of cationic polymerisation.

b) Write a note on 'cross-linking reactions in polymerisation'.

c) What are polymers? Explain the role of polymers in society and their effect on environment.

d) Explain the effect of radiation on polymer degradation.

e) Differentiate between the followings:

i) Organic polymer and Inorganic polymer.

ii) Addition polymer and Condensation polymer.

P.T.O.

SECTION - II

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

a) Give the role of X-ray diffraction in polymer analysis.

b) Explain the term fibre-spinning. Explain importance of post treatments of fibres.

c) Describe the ebulliometry method used for the determination of number average molecular weight of polymer.

d) Explain the term sol-gel and gelation. Describe the steps involved in the preparation of sol-gel.

e) The intrinsic viscosity of myosin is 308 cm^3/gm. Calculate approximate myosin concentration in water in gm/dl with an relative viscosity of 1 : 3.

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

a) Explain the terms:

i) Hardness

ii) Softening temperature

iii) Gloss

iv) Haze

v) Vapour permeability.

b) Give an account of optical properties of polymeric materials.

c) Enlist the different techniques used for the processing of the polymer and explain Injection moulding.

d) Explain the term reinforcing. Give an account of 'Hand lay-up technique'.

e) 0.01 M Acetic acid is used with 0.8 moles on of an difunctional polymer. Determine functionality factor and degree of polymerisation for polymer having percent conversion 0.99.

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

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[3723]-414

M.Sc.

BIOCHEMISTRY

BCH-470 : Biochemical Endocrinology and Tissue Culture (New)
Biochemical Endocrinology and Plant Biochemistry (Old)

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

Instructions to the candidates:

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

SECTION - I

Biochemical Endocrinology

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

a) Give the classification of hormones with examples.

b) How steroid hormones regulate the gene expression?

c) How calcium homeostasis is regulated in the body?

d) Describe the structural aspects of insulin receptor.

e) What are the physiological effects of glucagon?

f) Discuss how G proteins exert dual control over the activity of adenylate cyclase.

g) Describe the biochemical reactions involved in catecholamine degradation.

P.T.O.

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

a) Discuss the steps involved in thyroid hormone synthesis.

b) Describe the synthesis and degradation of angiotensin II.

c) Explain the mechanism of action of hormones by CAMP and phosphatidyl inositol biophosphate.

d) Explain the physiological functions of Growth hormone.

e) How regulation of hypothalamic secretion takes place?

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

a) Give the pathogenesis and clinical manifestations of gigantism and acromegaly.

b) How synthesis of mineralocorticoid is regulated?

c) Discuss the deficiency syndrome of antidiuretic hormone.

SECTION - II

Tissue Culture (New)

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

a) What are micronutrients? Enlist micronutrients present in MS Media.

b) What care should be taken to maintain aseptic condition during inoculation?

c) What the term cell line implies?

d) Give the advantages of serum when used in media.

e) Explain the concept of organ culture.

f) Give the application of ovule culture.

g) Give the protocol of root tip culture and give its significance.

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

a) Discuss the different types of suspension culture and give the methods used to measure the growth.

b) Write a note on haploid production under invitro condition.

c) Explain in detail the concept of cell banking.

d) Describe the steps to obtain primary culture.

e) What is hardening? Why it is necessary? Give its significance.

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

a) Protoplast fusion.

b) Micro propagation.

c) Tissue engineering.

SECTION - II

Plant Biochemistry (Old)

Q7) Attempt any three of the following: **[15]**

a) What do you know about plant tissue culture technique? Comment on its applications.

b) Describe working model of nitrogenase complex.

c) Give the classification of plant hormones.

d) Enlist major plant diseases. Add a note on the present strategies employed to control them.

Q8) Attempt any three of the following: **[15]**

a) What do you know about protoplast fusion? Give its role in agriculture.

b) What is seed dormancy? Give different way to break seed dormancy.

c) What are Secondary Metabolites? Give their role in plant defence.

d) Explain in detail the nutritional requirements of crop plants.

Q9) Write short note on any two of the following: **[10]**

a) Polyploidy.

b) Pectins & gums.

c) Circadian rhythm.

❐❐❐

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

P980

[3723]-415

M.Sc. (Sem. - IV)

BIOCHEMISTRY

BCH-471 : Fermentation & Enzyme Technology and Food Technology (New)

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

Instructions to the candidates:

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

SECTION - I

Fermentation & Enzyme Technology

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

a) What is meant by batch culture?

b) How microorganisms are isolated by enrichment culture?

c) What is meant by media formulation?

d) How precursors will affect the fermentation process?

e) What are the steps involved in recovery of product?

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

a) Biological treatment of effluents.

b) Methods of immobilization of enzymes.

c) Range of fermentation processes.

d) Sterilization of Media.

e) Development of inoculum for Baker's yeast.

P.T.O.

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

a) Role of agitation and aeration in fermentation.

b) Applications of immobilized enzymes.

c) Factors influencing choice of carbon sources.

SECTION - II

Food Technology

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

a) Explain why nitrates and sulfides are preferred for extending the life of food.

b) What is meat tenderization? Explain the process in detail.

c) Enlist and give the significance of natural and synthetic colours.

d) What are the principles and basis of food preservation? Explain with suitable examples.

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

a) What are genetically modified foods? Add a note on its merits and demerits.

b) Describe the method of dehydration exploited in food industry.

c) Write an account on enzyme detoxification of food.

d) Explain the process of starch production.

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

a) SCP

b) Foods of animal origin

c) Principles of food processing

❐❐❐

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

P981

[3723]-416

M.Sc.

BIOCHEMISTRY

BCH-472 : Genetic Engineering (New)

Genetic Engineering and Molecular Biochemistry (Old)

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

Instructions to the candidates:

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

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

a) Explain in detail the cloning methods in bacillus and stryptomyces.

b) What are restriction enzymes? Why they are named as restriction endonucleases? Explain the role of any five indicating their restriction sites.

c) What are the applications of genetic engineering in industry and medicine?

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

a) Describe the protocol for amplification and preparation of plasmid DNA from E. coli cells.

b) What do you understand by the term 'chromosome walking'? Explain it in detail and give its application.

c) What is PCR and DDRT PCR? Give their working and applications.

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

a) What are Ti plasmids? Give their structure and role in plant genetic engineering.

b) What is in vitro mutagenesis? Explain the concept in detail.

c) Explain the role of maternal genes in the development.

P.T.O.

Q4) Write short notes on <u>any four</u> of the following: **[20]**

a) Metagenomics

b) Transgenic plants

c) Restriction mapping

d) Cosmids

e) Northern blotting

❐❐❐

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

P982

[3723]-431

M.Sc.

DRUG CHEMISTRY

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

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

Instructions to the candidates:

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

SECTION - I

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

i) Pyrrolidine enamine of 2-methyl cyclohexanone on reaction with methyl iodide gives 2,6-dimethyl cyclohexanone as the major product after work-up.

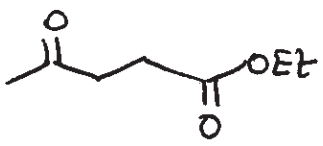
ii) The alcohol formed by hydration of Ph-CH=CH_2 is different than the alcohol formed by reaction of B_2H_6 followed by reaction with H_2O_2/NaOH.

iii) Trityl chloride can be used for selective protection of 5^1-hydroxy^1 group in deoxy-ribo-nucleosides.

iv) PhCHO could be converted into $PhCOCH(OH)CH_3$ using umpolung of reactivity.

b) Complete any two of the following transformations. Justify your answer. **[6]**

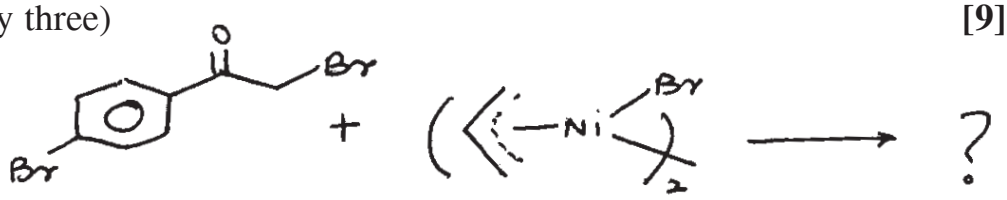
i) 

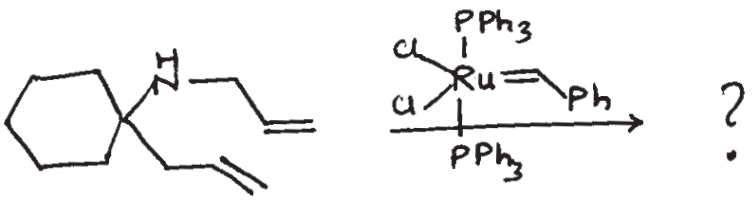
ii) CH_3CHO 

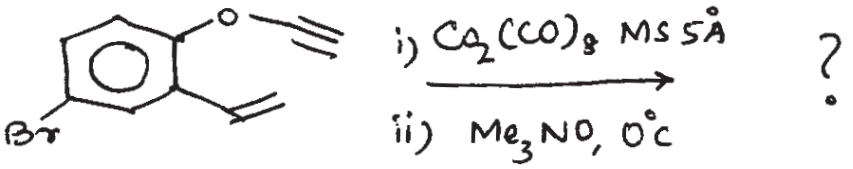
iii) Ph-CH=CH_2 ⟶ $PhCH_2CH_2CH{=}CH\text{-}COOEt$

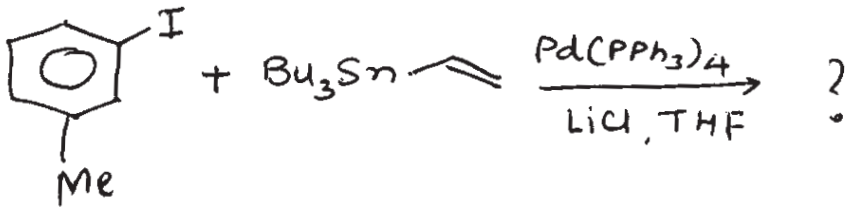
P.T.O.

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

i) 

ii) 

iii) 

iv) 

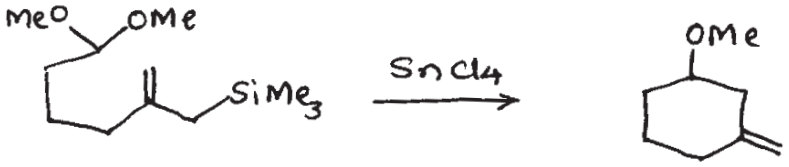
b) Explain <u>any two</u> of the following: **[6]**

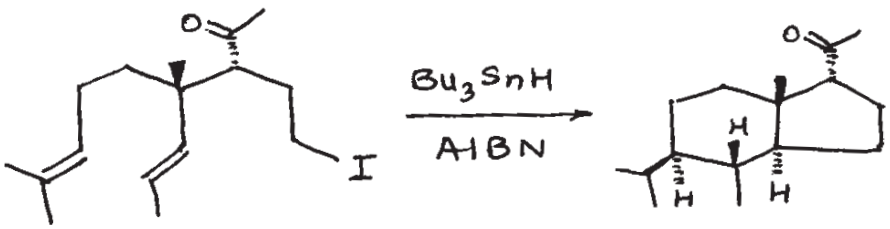
i) Role of $Na_2Fe(CO)_4$ in organic synthesis.

ii) Role of Π-allyl palladium complexes in organic synthesis.

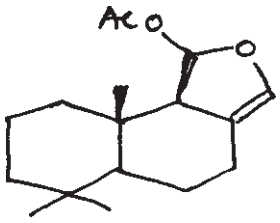
iii) Role of $AlEt_3/TiCl_4$ in polymerization reactions.

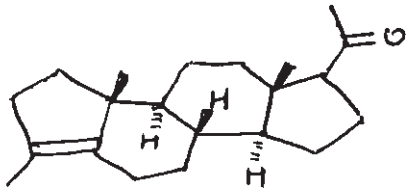
Q3) a) How domino reaction is different from stepwise reaction? Explain the steps involved in <u>any one</u> of the following domino reaction. **[5]**

i) 

ii) 

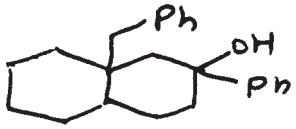
b) Explain the biomimetic approach to the reterosynthesis of any one of the following: **[5]**

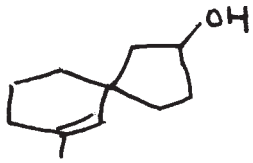
i) 

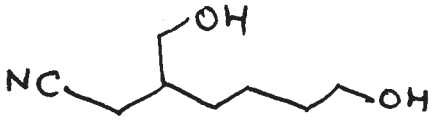
ii) 

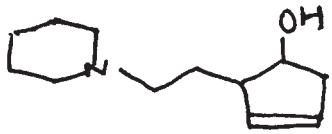
SECTION - II

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

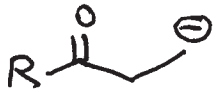
a) 

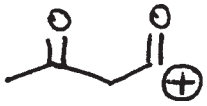
b) 

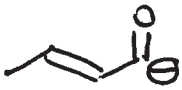
c) 

d) 

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

i) 

ii) 

iii) 

b) Employing umpolung, carry out the following transformations any two: **[6]**

i) 

ii) 

iii) 

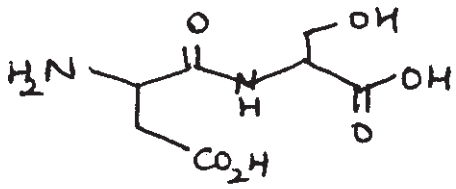
Q6) a) Give brief account of <u>any one</u> of the following: **[4]**

i) Atom economy in Green Chemistry.

ii) Urethane protection of amino group in peptide synthesis.

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

i) Discuss the steps involved in the synthesis of the following peptide.



ii) How the following conversion can be achieved?

iii) Carry out the transformation using the reagents given below (Arrange the reagents in proper order)

Reagents: n-BuLi, THF, –78°C ; LiBr,  ; H_3O^+, Δ ; PPh_3, CH_3CN ; MSCl, Et_3N, CH_2Cl_2 ; PhCHO, THF.

iv) Give four methods for the synthesis of epoxides.

v) Carry out the following conversion using organo borane chemistry.

❐❐❐

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

P983

[3723]-432

M.Sc. - II

DRUG CHEMISTRY

CH-462 : Chemotherapy

(Old & New Pattern)

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

Instructions to the candidates:

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

SECTION - I

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

a) Explain the mechanism of action of β-lactam antibiotics & sulfonamides. Why are these drugs selectively toxic to bacteria?

b) Give a brief account of the discovery of Penicillins. Discuss with structural details how semisynthetic Penicillins become more popular.

c) Discuss what strategies were adopted to improve the following in Cephalosporins with examples.

i) Oral absorption.

ii) Gram negative β-lactamase resistance.

iii) Potency.

d) Explain the use of polypeptide antibiotics & Macrolides. How do they exhibit antibiotic activity?

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

a) Draw a neat diagram of Neuron & explain the steps involved in neurotransmission. Explain the role of Excitory & Inhibitory neurotransmitters. What happens in convulsions & depression?

b) Describe in brief cancer. What are the Cytological & Biochemical differences in normal cells & cancer cells? Explain in brief how alkylating agents & intercalators halt this growth?

P.T.O.

c) Give a brief account of the following (any two):

i) Inhibitors of early stages of DNA synthesis.

ii) DNA gyrase Inhibitors an drugs.

iii) Antibiotic drug resistance.

Q3) Discuss in brief <u>any three</u> of the following & one strategy to treat them: **[9]**

a) Tuberculosis

b) Candidiasis

c) Herpes

d) Malaria

e) Seizures

SECTION - II

Q4) Answer <u>any three</u> of the following: **[18]**

a) What are hormones? How do they exhibit their action? Discuss in brief regulation of hormonal secretion? What is the need of synthetic/ modified hormones?

b) Explain in brief the following:

i) Role of Ca^{2+} in cardiac muscle contraction.

ii) Pathophysiology of Myocardial Infraction & Angina.

iii) The Renin-Angiotensin Pathway & its role in cardiovascular disorders.

c) Describe in brief Diabetis. What is the role of Insulin in regulation of blood glucose-explain its mechanisms? Discuss the strategies to manage NIDDM & IDDM with drugs.

d) Explain the biosynthesis of prostaglandins from Arachidonic acid. How would this study help in understanding the Inflammation process & strategies to design & discover novel antiinflamatory compounds?

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

a) Explain in brief viral life cycle. Discuss how some of the current antiviral drugs inhibit this steps.

b) Discuss how β-blockers, Diuretics & Ca^{2+} channel blockers help in controlling hypertension.

c) Give a brief account of Antimetabolites as drugs.

Q6) Discuss the made of action & uses of the following drugs (any four): **[12]**

a) Sulfadiazine

b) Morphine

c) Chloramphenicol

d) Artemesinin

e) Methotrexate

f) Taxol

❐❐❐

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

P984

[3723]-433

M.Sc.

DRUG CHEMISTRY

CH-463 : Drug Design

(Old & New Pattern)

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

Instructions to the candidates:

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

SECTION - I

Q1) Answer any two of the following: **[14]**

a) What do you mean by r-DNA? Which are the advantages of using r-DNA to produce lymphokines and hormones?

b) Explain any two of the following:

i) DNA vaccines.

ii) Use of peptide nucleic acid as antisense molecule.

iii) Restriction endonuclease type II.

c) What is gene therapy? How someone suffering from SCID by gene therapy?

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

a) In an experiment of pea breeding out of 1600 seeds 908 were round & green, 293 were wrinkled green, 310 were round yellow and 89 were wrinkled yellow. The Mendel's theory says that these seeds should be in ration 9 : 3 : 3 : 1. Test at 5% level of significance whether the experiment fits the theory or not.

(x^2_3, 5%=7.813)

P.T.O.

b) What is a regression line? Fit a linear regression line for the below given data.

Height of father in cm (x) :	160	165	167	168	172	175	178
Height of son in cm (y) :	162	169	167	170	175	174	180

c) In a desert region, or an average every year 5 people fall sick by eating a certain plant. Assuming Poisson distribution, in a particular year find the probability that (i) exactly ten fall sick (ii) at least one fall sick (iii) less than three will fall sick.

Q3) Answer <u>any two</u> of the following: **[14]**

a) Discuss the steps involved in signal transduction when an against binds to GPCR.

b) Draw a neat diagram of membrane, highlighting the membrane bound proteins & explain their functions. How are there an attractive drug target? Discuss.

c) What are prodrugs? What benefits they offer over the routine drugs? With illustration explain their design criteria.

SECTION - II

Q4) Answer <u>any three</u> of the following: **[18]**

a) Describe in brief solid phase synthesis & combinational chemistry have become important in drug discovery / design approach. Explain the steps involved & also the deconvolution approaches.

b) How are the various terms in Hansch equation calculated/experimentally determined? How is the equation of best fit selected?

c) Explain the shortcoming's & benefits of (i) Quantum Mechanics & (ii) Molecular Mechanics in CADD.

d) Discuss in brief:

i) Systematic Search

ii) Monte Carlo Simulation

iii) Distance Geometry

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

a) Discuss how 3D QSAR is performed. What are the eventual benefits over routine QSAR methods?

b) Explain the concept of structure based dry design. Describe the steps involved & application.

c) You are appointed on a program to design novel AIDS drugs. Discuss how will you approach towards the problem. Justify your approach.

Q6) Discuss the following in brief: **[10]**

a) Role of Internet & databases in drug designing.

b) Application of Craigs plet & Topiss method.

c) Signalling mechanism for Tyrosine Kinase family.

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

P894 **[3723]-5**

M.Sc.

DRUG CHEMISTRY

CH - 362 : Advanced Analytical Methods

(2005 Pattern)

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

Instructions to the candidates :

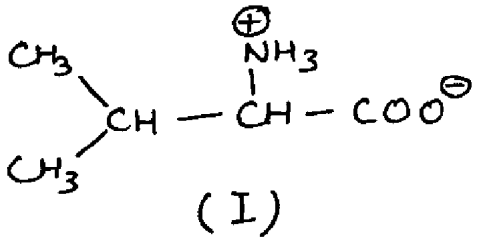
1) ***All questions are compulsory.***
2) ***Figures to the right side indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

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

a) In CMR $^{13}C - {}^{13}C$ coupling is not observed.

b) L - Valine (I) shows separate doublets for each methyl group.



(I)

c) O - dichlorobenzene shows peaks at m/z 96, 98, 100 in the ratio 9 : 6 : 1 in MS.

d) In CMR spectroscopy integration is not used in interpretation.

e) In $CF_2 = CH_2$, the two protons are magnetically non - equivalent.

Q2) Deduce the structure from the given spectral data. (Any Four): **[16]**

a) M.F. : $C_7H_{10}O_2$

PMR : 1.41(d, 7Hz, 3H); 2.4(t, 7Hz, 2H)

4.53(sextet, 7Hz, 1H); 5.89(tq, 2 & 7Hz, 1H)

2.1(d, 2Hz, 3H)

b) M.F. : $C_{11}H_{11}NO_4$

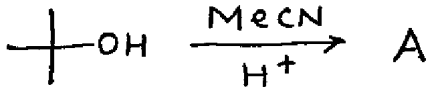
IR : 1712 cm^{-1}

P.T.O.

PMR : 8.24(d, 8Hz, 2H); 7.68(d, 16.5Hz, 1H)
7.52(d, 8Hz, 2H); 6.50(d, 16.5Hz, 1H)
4.28(q, 7Hz, 2H); 1.22(t, 7Hz, 3H)

c) M.F. : $C_7H_{10}O_3$
IR : 1800, 1765 cm^{-1}
Mass : 142, 70, 56
CMR : 172(s) 168(s) 38(s) 30(t) 28(t) 25(q, str.)
PMR : 2.8(t, 7Hz, 2H); 1.8(t, 7Hz, 2H); 1.3(s, 6H)

d) M.F. : $C_{10}H_{15}N$
CMR : 10.2(q) 20.1(q) 29.6(t) 49.7(d)
113.1(d, str.) 116.6(d) 129.1(d, str.)
147.7(s)

e) 

IR : 3435, 1686 cm^{-1}
CMR : 169, 50, 29, 25
Mass : 115(7) 100(10) 64(5) 60(21)
59(17) 58(100) 56(7)

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

a) Various detectors in mass spectrometry.

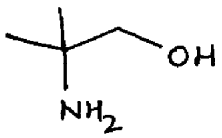
b) Off - resonance spectroscopy.

c) Heteroatom correlated spectroscopy.

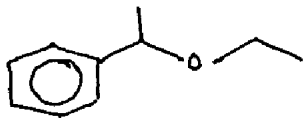
d) Pseudo contact shift reagents.

SECTION - II

Q4) a) Write the genesis of the ions (Any three): **[9]**

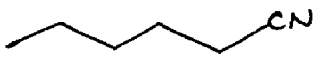
i) 

74, 58, 31

ii) 

150, 135, 105, 79, 77, 106

iii) 3-Methyl-4-phenyl-butan-2-one 162, 147, 91, 43

iv)  97, 82, 68, 41

b) Ethyl aceto acetate shows following ^{1}H NMR and ^{13}C NMR signals. Justify your answer. **[3]**

^{1}H NMR : 1.25 (t) 1.9 (s) 2.2 (s) 3.6 (s) 4.2 (q)
5.1 (s) 12.0 (s)

^{13}C NMR : 14 (str) 21 (W) 30(str) 50 (str) 60 (W)
62 (str) 90 (W) 168 (mod) 205 (W)

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

i) Draw a schematic diagram of GLC and explain the factors important in resolution.

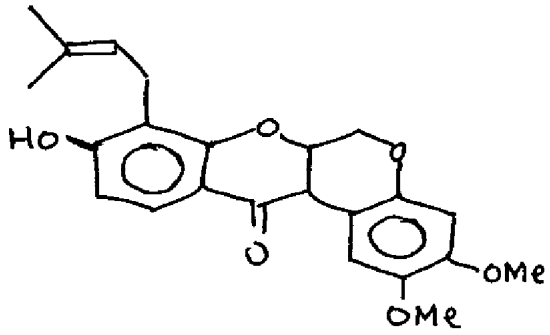
ii) Explain the following terms:

1) Reverse phase chromatography.

2) Ion exchange chromatography.

iii) Discuss the theory of HPLC.

b) Assign the signals to different protons in the following compound on the basis of the decoupling and NOE experiment. Justify your answer.**[6]**



1.76 (s, 6H) 3.4 (d, 7Hz, 2H) 3.78 (d, 2Hz, 1H)

3.81 & 3.76 (bs, 6H) 4.64 (dd, 12 & 2Hz, 1H)

4.2 (d, 12Hz, 1H)

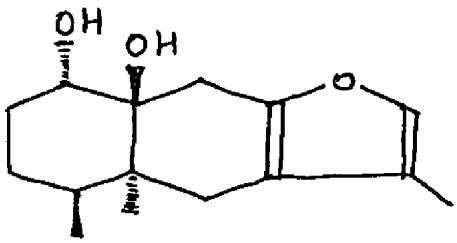
4.96 (t, 2Hz, 1H) 5.28 (t, 7Hz, 1H) 6.48 (s, 1H)

6.52 (d, 8Hz, 1H) 6.8 (s, 1H) 6.08 (bs, exch., 1H)

7.8 (d, 8Hz, 1H)

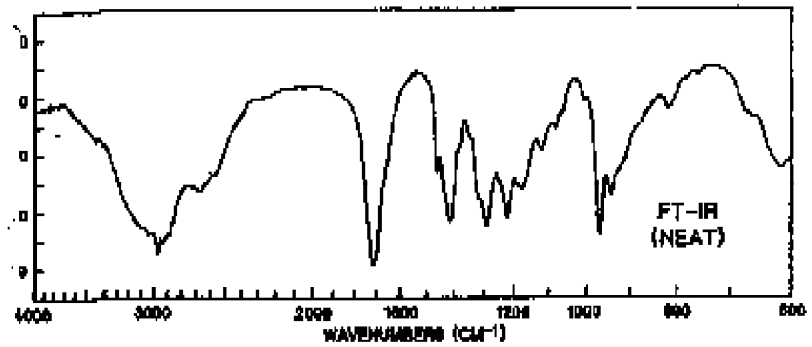
Spin decoupling expt.	Irradiation at	Change at
	i) 4.96	4.64 (d, 12Hz) 3.78 (s)
	ii) 5.28	3.4 (s)

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



8.0 (q) 17.0 (q) 20.0 (q) 28.0 (t) 29.0 (t) 34.01 (t)
35.0 (t) 49.0 (s) 72.0 (d) 82.02 (d) 85 (s) 125.0 (s)
128.0 (s) 135.0 (d) 148.0 (s).

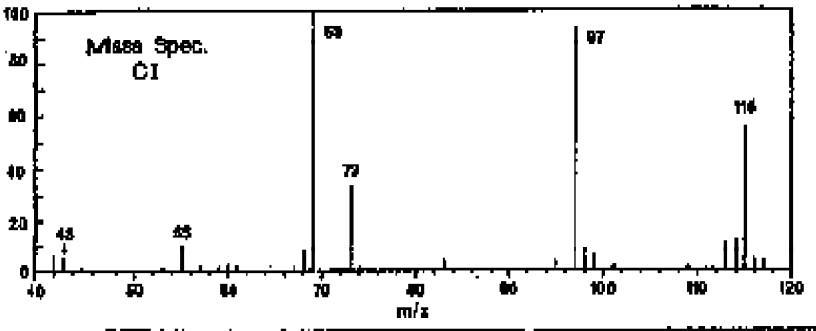
Q6) Deduce the structure of the compound whose spectral information is given on the next page. Justify your answer. **[12]**

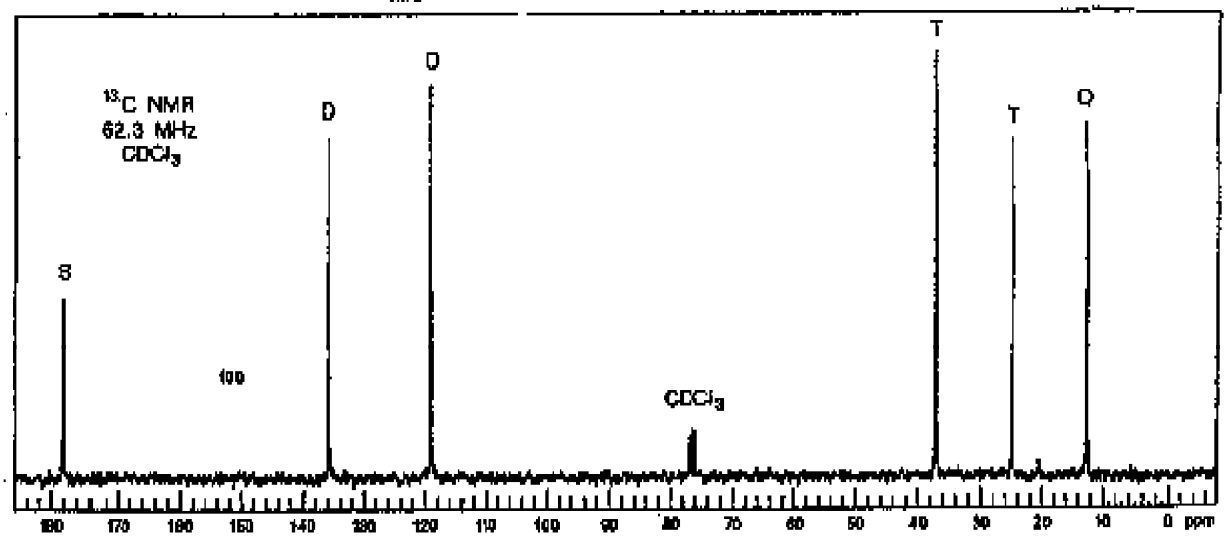


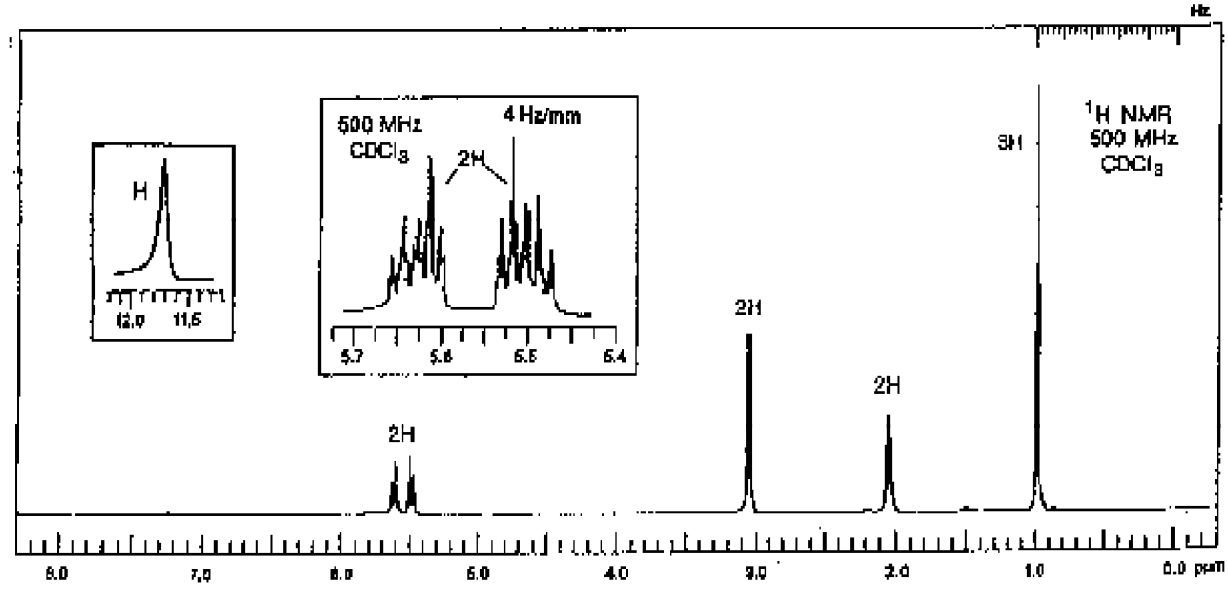
Exact M.S. (CI) = 115.0759

$UV\lambda_{max}$ = BLANK

M.F. $C_6H_{10}O_2$







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

P923

[3723]-67

M.Sc.

ORGANIC CHEMISTRY

CH-450 : Chemistry of Natural Products

(2005 Pattern) (Old Course)

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

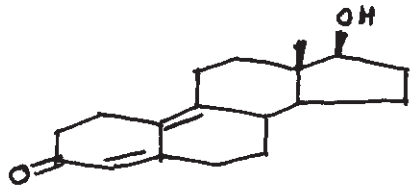
Instructions to the candidates:

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

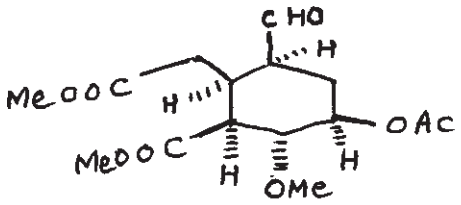
SECTION - I

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

a) (+) - Estrone ⟶

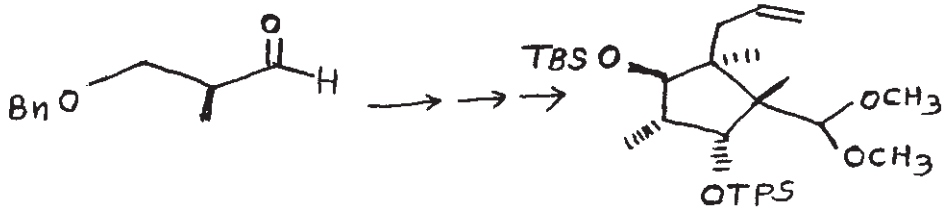


b)

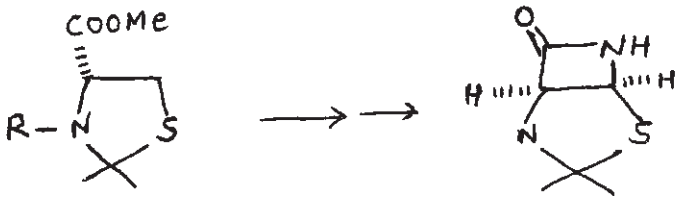


⟶ (±) - Methyl - O-acetyl isoreserpate

c)

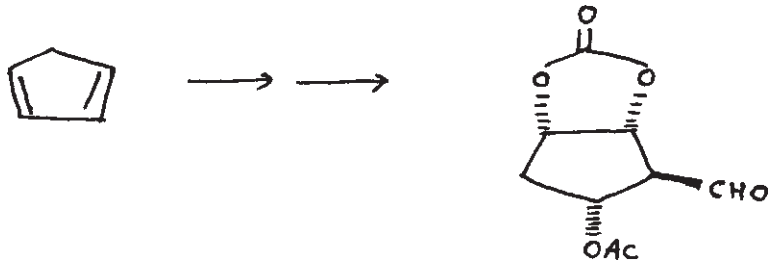


d)



P.T.O.

e)



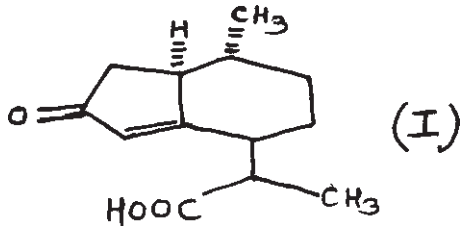
Q2) Give evidence to prove the following structural features (any three): **[12]**

a) The presence of β-substituted furan ring and conjugated ester in Hardwickiic acid.

b) The presence of an epoxide, an α-methylene-γ-lactone in Arteannuin-B.

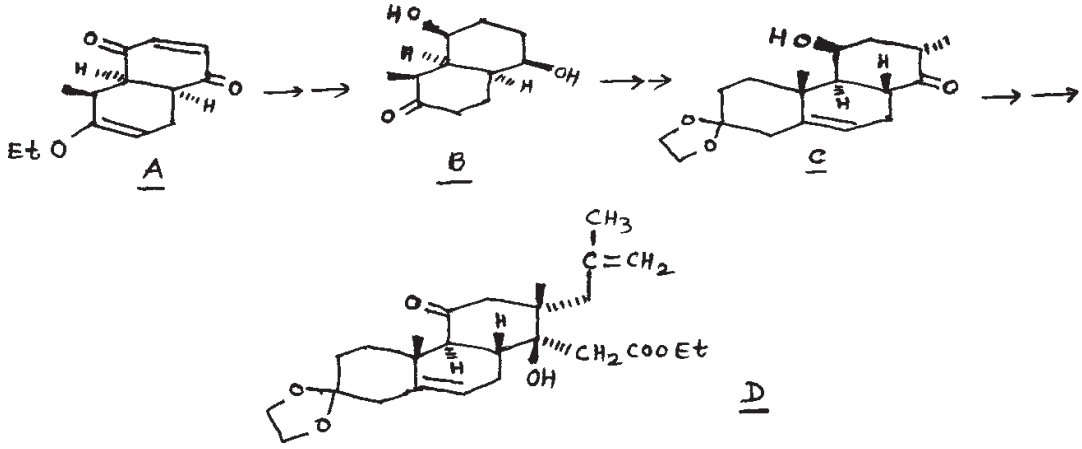
c) Presence of hydroxy group in ring A of Hydroxycamptothecin.

d) An α, β - unsaturated carbonyl group and a carboxyl group in compound (I).



Q3) Answer the following:

a) The reagents for the conversion of A to B, B to C and C to D are shown below. Arrange these in correct order. Explain the different steps involved. **[6]**



Reagents for A to B i) HCl/aq.ACOH ii) $LiAlH_4$/THF
iii) H_2/Raney Ni

for B to C i) $CH_3I/t\text{-}BuO^-K^+$ ii) Oppenauer oxidation

iii) CrO_3/Pyridine iv) $CH_2{=}CH{-}COCH_3$/Triton B

v) $\begin{matrix}CH_2OH\\|\\CH_2OH\end{matrix}$ / H^+

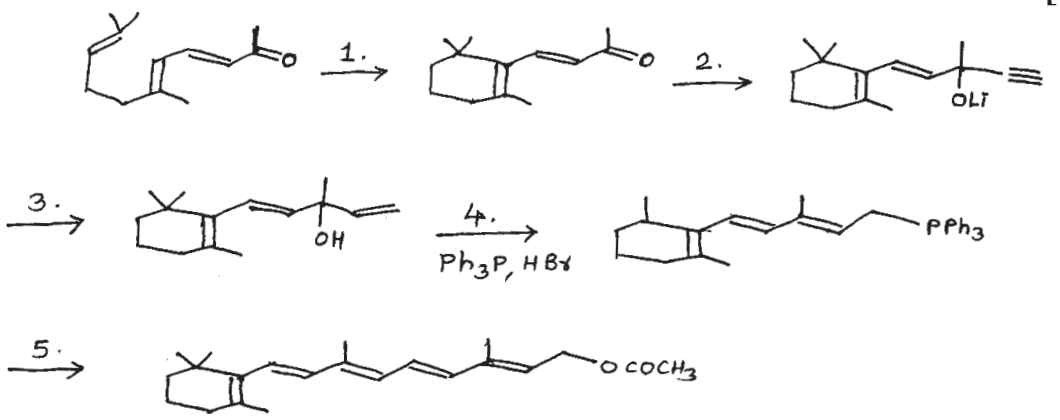
for C to D i) $H_2O{-}H^+$ mild conditions

ii) E+O–C≡C–Mg Br

iii) CrO_3/Pyridine

iv) $CH_2{=}\underset{\displaystyle CH_3}{\underset{|}{C}}{-}CH_2I$ / $t\text{-}BuO^-K^+$

b) **[6]**



i) Suggest the reagents for steps 1, 2 and 3.

ii) Predict the mechanism for step 4.

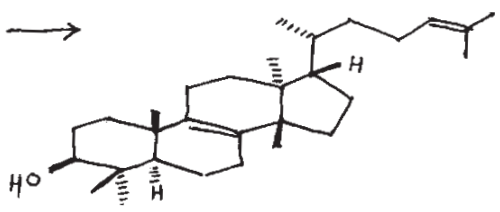
iii) Show how step 5 can be achieved by Witting reaction.

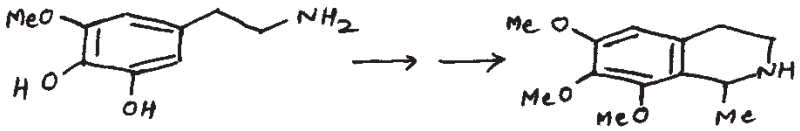
SECTION - II

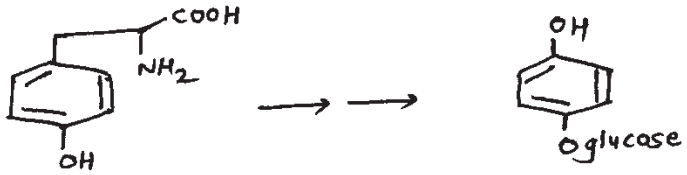
Q4) a) Explain the role of S-Adenosylmethionine in forming O-methyl, N-methyl and C-methyl linkages giving one example of each. **[4]**

b) Suggest biogenetic scheme for any two of the following : **[8]**

i) Squalene ⟶ ⟶

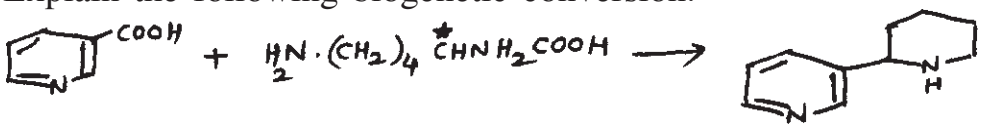


ii) 

iii) 

Q5) Answer <u>any two</u> of the following: **[12]**

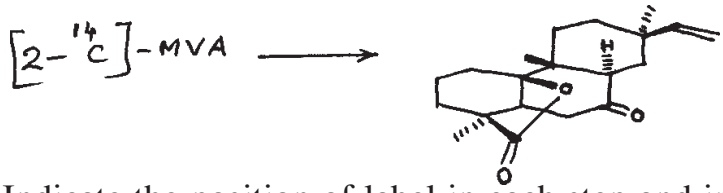
a) Explain the following biogenetic conversion.



Clearly indicate the position of label in each step and in the final product.

b) Explain the probable mechanism for the formation of squalene from farnesylpyrophosphate.

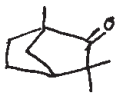
c) Explain the following biogenetic conversion

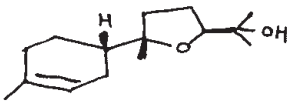


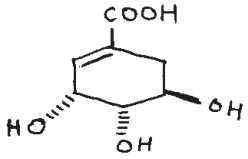
Indicate the position of label in each step and in the final product.

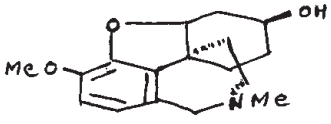
Q6) a) Explain the importance of cytochrome P-450 dependent mono-oxygenase enzymes in biogenesis with suitable examples. **[4]**

b) Suggest suitable biogenetic scheme for <u>any three</u> of the following: **[12]**

i) Nerylpyrophosphate ⟶ 

ii) 2Z,6E – FPP ⟶ 

iii) Phosphoenol pyruvate ⟶ 

iv) Phenylalanine + Tyrosine ⟶ 

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

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M.Sc.

ORGANIC CHEMISTRY

CH-451 : Synthetic Methods in Organic Chemistry

(2005 Pattern) (Old Course)

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

Instructions to the candidates:

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

SECTION - I

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

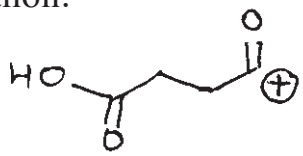
i) 1, 3 - dithiol is used for umpolung reaction, but its oxygen analoge cannot be used. Explain.

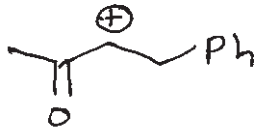
ii) Explain Simmon-Smith reaction with a suitable example.

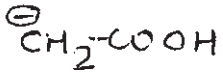
iii) Why 1, 2 - dihydropyran cannot be used to protect chiral alcohols?

iv) Explain synthesis and synthetic use of vinylborane.

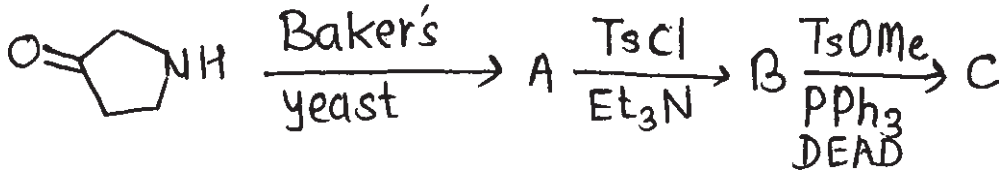
b) Suggest suitable synthetic equivalent reagent for the following synthon. **[3]**

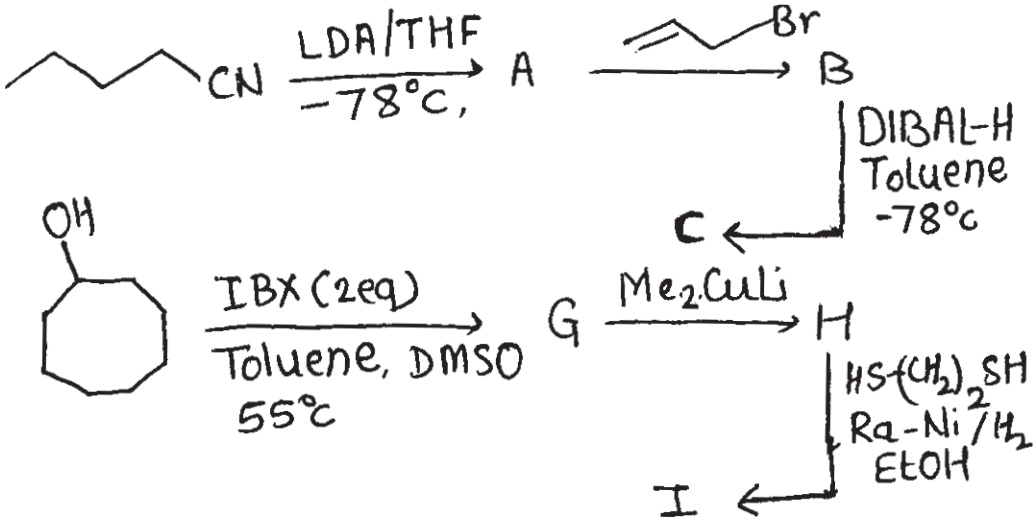
i) 

ii) 

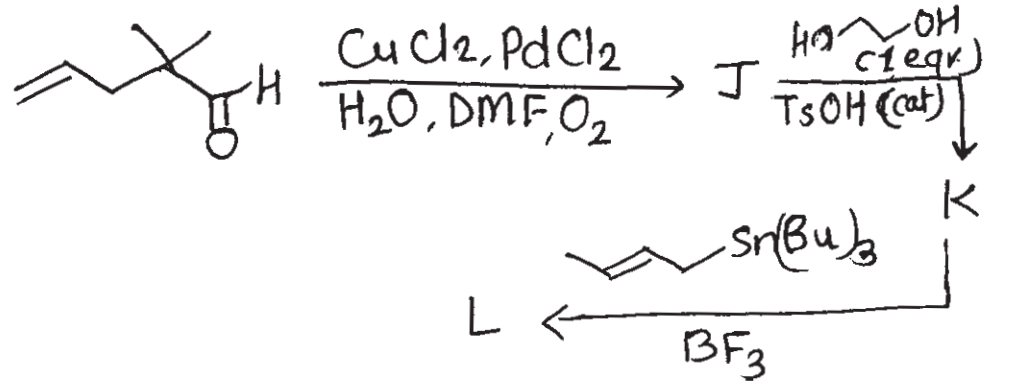
iii) 

Q2) a) Predict the products in any three of the followings: **[9]**

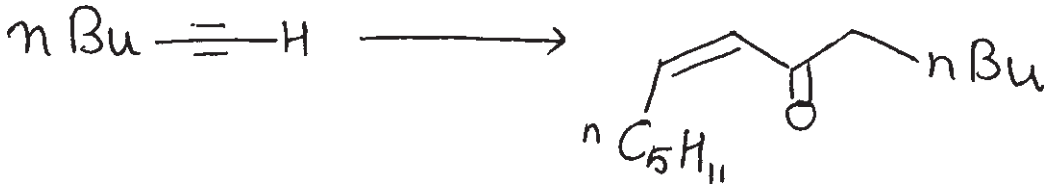
i) 

ii) 

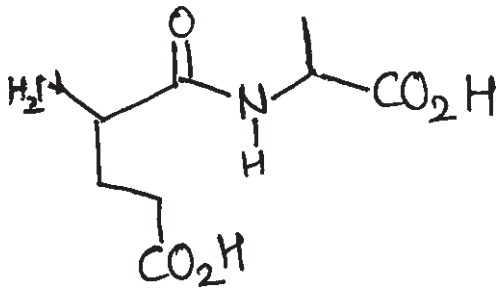
iii)

iv) 

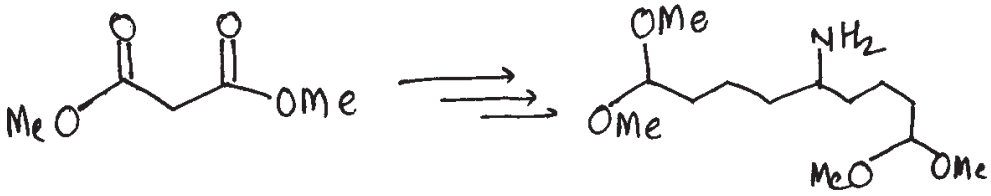
b) Complete the following transformation using appropriate reagents. **[3]**

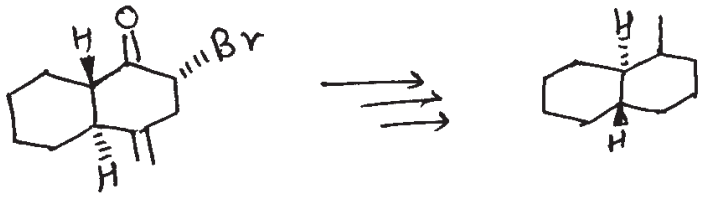


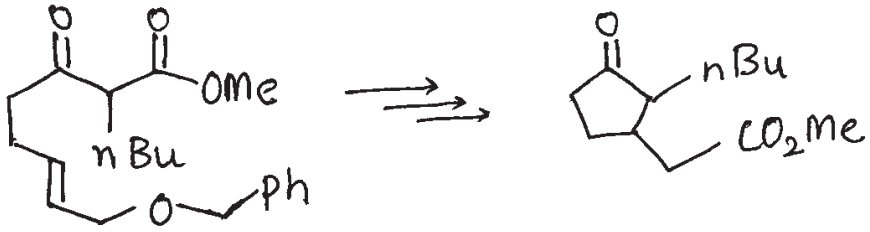
Q3) a) Suggest a synthesis of the following peptide, emphasizing the choice of protecting groups. **[4]**

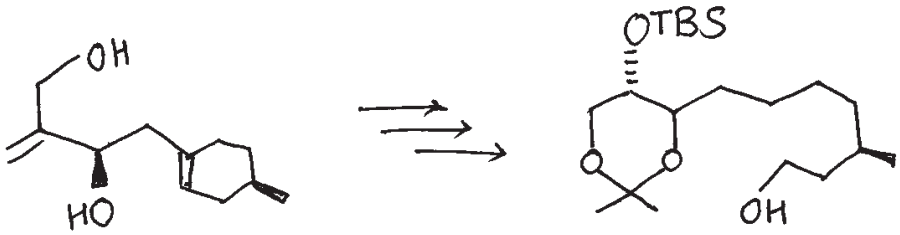


b) Complete the following transformations and justify your answer : (any four) **[12]**

i) 

ii) 

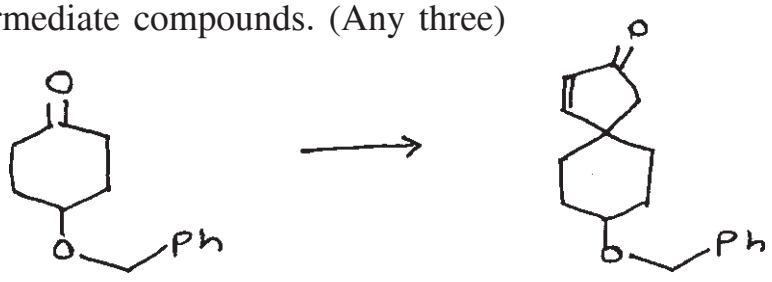
iii) 

iv) 

v) 

SECTION - II

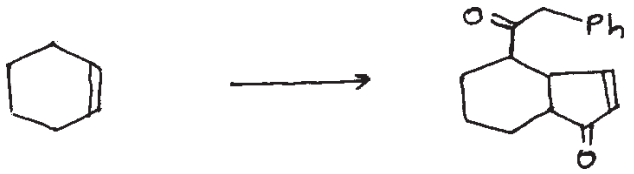
Q4) a) You are provided reagents for the following conversions. Arrange them in proper order to achieve the conversions. Write the structures of the intermediate compounds. (Any three) **[9]**

i) 

Reagents: $OSO_4/NaIO_4$; NaOH/EtOH ;  MgBr, Cu_2I_2 ; $(EtO)_2P(O)CH_2COCH_3$, NaOH

ii) 

Reagents: NaOEt ; TsCl, Py ; HO  , H^+ ; KCN ; LAH ; EtOH, H^+ ; H_3O^+

iii) 

Reagents: $Na_2Fe(CO)_4$; $CO_2(CO)_8$; NBS ; Ph  Br ; HC≡CH

iv) 

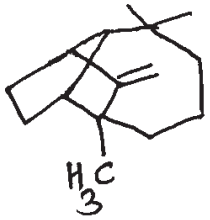
Reagents: LAH ; HONO/H^+, CuCl ; Me_2CHCN/^{n}BuLi ; $Cr(CO)_6$; CH_3CN

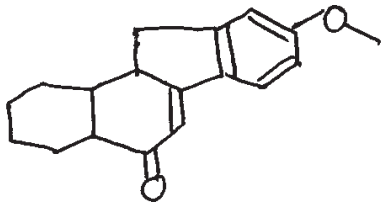
b) Discuss the use of following reagents with suitable examples (any two): **[3]**
i) TBDMS-Cl ii) Wilkinson Catalyst iii) $Ni(CO)_4$

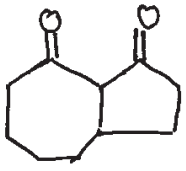
Q5) Write short notes on <u>any three</u> of the followings: **[12]**

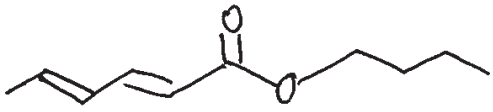
a) CBS reagent
b) Merrifield resins
c) Ring closing metathesis
d) Heck reaction

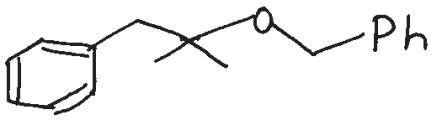
Q6) Discuss retrosynthetic analysis of <u>any four</u> of the followings and device a synthetic route. Justify your plan. **[16]**

a) 

b) 

c) 

d) 

e) 

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Total No. of Questions : 12] **[Total No. of Pages : 6**

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M.Sc.

ORGANIC CHEMISTRY

CH-452 : Pericyclic Reactions, Chiron Approach, Chemotherapy, Medicinal Chemistry, Vitamins, Antibiotics etc.

(2005 Pattern) (Old Course)

Section-I : Pericyclic Reactions, Photochemistry and Green Chemistry

Section-II : Medicinal Chemistry

Section-III : Chiron Approach and Newer Methods in Organic Synthesis

Section-IV : Vitamins, Antibiotics and Hormones

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

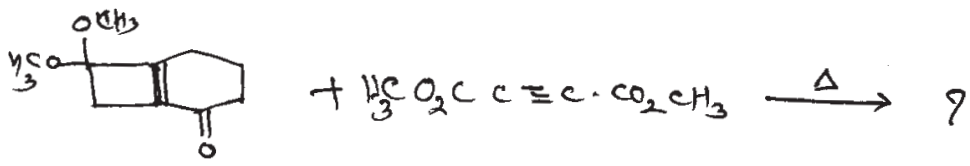
Instructions to the candidates:

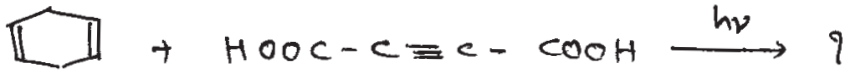
1) ***Solve any two sections out of four.***
2) ***All questions are compulsory from both sections.***
3) ***Figures to the right indicate full marks.***
4) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

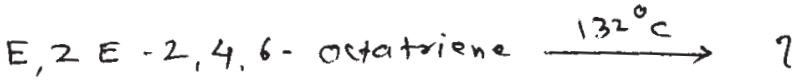
Q1) a) Write the molecular orbitals of pentadienyl system and comment on their symmetry with respect to plane of symmetry and C_2-axis of symmetry. **[6]**

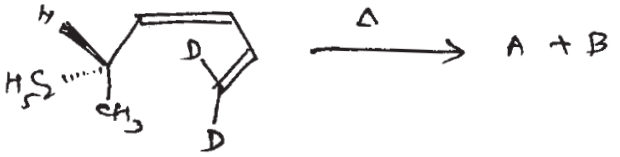
b) Predict the products in any four of the following. Justify your answer. **[8]**

i) 

ii) 

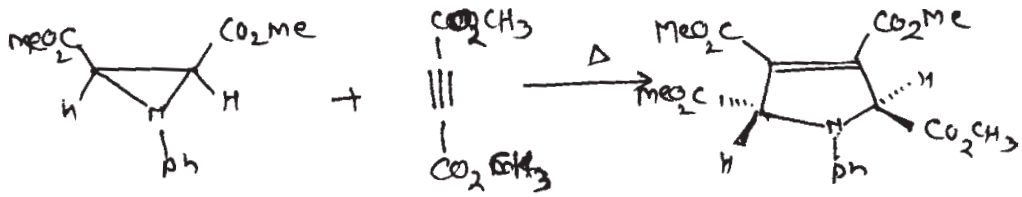
iii) 

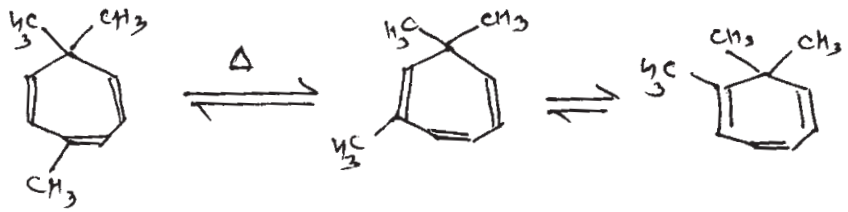
iv) 

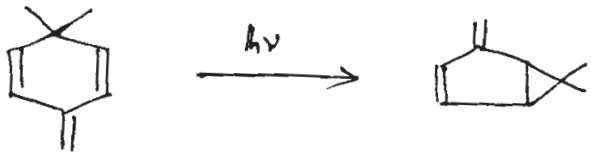
v) 

Q2) a) Construct correlation diagram for the $\pi^4 s + \pi^2 s$ cycloaddition reaction and predict whether it is thermally allowed or photochemically allowed process. **[4]**

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

i) 

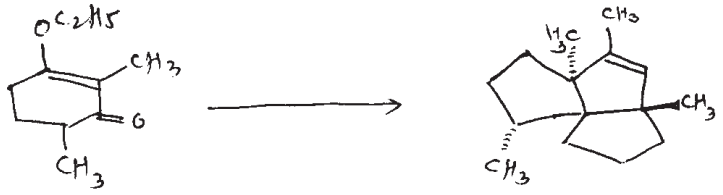
ii) 

iii) 

c) What is atom economy? Explain how it is calculated? **[4]**

Q3) a) Give the retrosynthesis of Isocomene. **[4]**

b) Complete the following synthetic sequence, write all intermediates and reagents required (Any one). **[4]**

i) 

ii) 

c) Explain the use of 1,3-arene olefin cycloaddition for the synthesis of natural products. **[4]**

SECTION - II

Q4) a) Define pharmacodynamics of drug action. Explain in brief the receptor theories and forces involved in Drug-receptor interactions. How does an understanding of these factors help in designing the drugs? **[8]**

b) Solve any two: **[6]**

i) Give a brief account of II generation cephalosporins.

ii) Describe in short computer aided drug design.

iii) Write note on - peptide antibiotics.

Q5) a) Describe the structural modifications in penicillins to develop a better antibiotic with relevant examples. **[8]**

b) Write note on any two: **[6]**

i) Topliss Mannual Scheme ii) Antiviral agents

iii) Tetracyclins.

Q6) a) What are antimetabolites? Give brief account w.r.t. methotrexate and 6-mercaptopurins. **[4]**

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

i) Write note on polyene antibiotics.

ii) Discuss the mode of action of Rifampicin and vinblastin.

iii) Give a brief account of enzyme inhibitors as drugs.

SECTION - III

Q7) a) Differentiate between anomers, epimers and diastereomers with suitable examples. **[4]**

b) Write a short note on anomeric effect. **[4]**

c) Write equations to show how D-(+)-glucose can be converted into

i) Methyl-β-D-glucoside ii) Glucaric acid

iii) n-hexanoic acid iv) 2-iodohexane

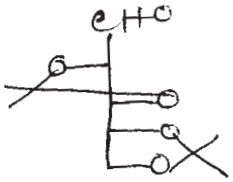
[4]

d) Discuss the role of HIO_4 in glucose chemistry. How much HIO_4 is consumed per mole of glucose? What are the products formed? **[4]**

Q8) a) Write a note on "rule of five". **[4]**

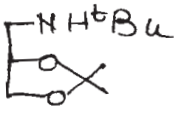
b) Predict the products in any four of the following: **[8]**

i) D-mannitol $\xrightarrow[2)\ Pb(OAc)_4]{1)\ \text{acetone},\ H^+}$? $\xrightarrow[2)\ TsCl,\ Pyr]{1)\ NaBH_4}$?

ii)  $\xrightarrow[2)\ HOH]{1)\ PhMgBr,\ Ether}$? + ? $\xrightarrow[2)\ Ag\cdot AcOH]{1)\ MeI,\ Ag_2O}$?

iii)  $\xrightarrow[2)\ CrO_3,\ acetone]{1)\ MeMgI,\ ether}$? $\xrightarrow[DMSO]{Ph_3P=CH_2}$?

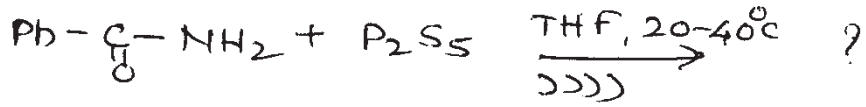
iv)  $\xrightarrow[2)\ H_2O_2,\ NaOH]{1)\ B_2H_6}$? $\xrightarrow[NaOH,\ DMF]{\text{allyl bromide}}$?

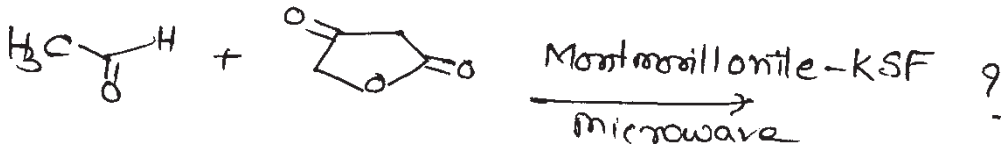
v)  $\xrightarrow[2)\ PhCHO,\ \Delta]{1)\ H_3O^+}$? $\xrightarrow[t\text{-BuOK},\ t\text{-BuOH}]{1)\ 3\text{-chloro-4-(N-morpholino)-1,2,5-thiadiazole}}$? $\xrightarrow{2)\ H_3O^+}$

Q9) Answer any three of the following: **[12]**

a) Discuss the disadvantages of biocatalyst.

b) Predict the products in following reactions.

i) 

ii) 

c) What is immobilization of enzymes? How it carried out?

d) Describe the phenomenon of cavitation in ultrasound.

SECTION - IV

Q10) Solve <u>any four</u>: **[16]**

a) What are hormones? Explain their function.

b) Draw the structure of folic acid and explain its biosynthesis.

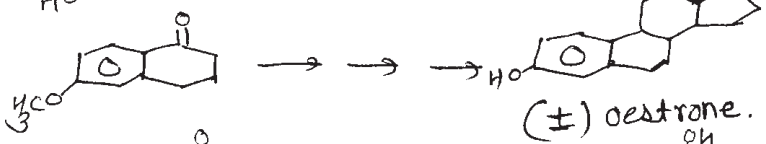
c) Discuss the deficiencies caused by Vit. B_2 and Vit. B_6.

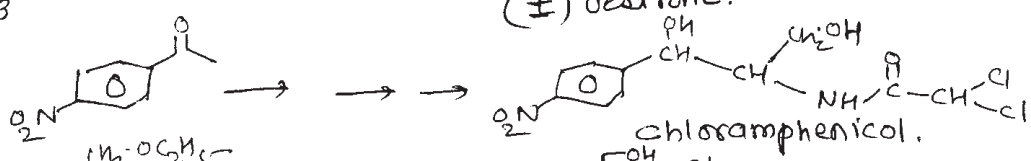
d) What are antibiotics? How are they classified?

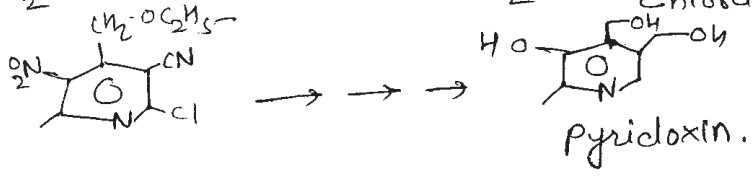
e) Discuss the mode of action of penicillin and tetracyclins.

Q11) Explain the steps involved in following conversions. (Any three) **[12]**

a) 

b) 

c) 

d) 

Q12) Solve any four: **[12]**

a) Describe the Karner's synthesis of α-tocopherol.

b) Give clinical applications of quinolones.

c) Write note on - Aminoglycosides.

d) Describe biochemical role of pantothenic acid.

e) Give evidences to establish the presence of sidechain and structure of Biotin.

❐❐❐

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

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[3723]-316

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 392: Advanced Analytical Techniques

(New Course)

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

Instructions to the candidates:

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

SECTION - I

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

a) Explain the terms-

i) Resistors

ii) Conductance

iii) Capacitors

iv) Inductors

v) Transformers

b) What are zener diodes? Explain their use for voltage regulation. How the pinch off potential of a zener diode can be controlled?

c) Give the block diagram of microprocessor controlled potentiometric titrator.

d) Write a note on continuous flow analyzer.

e) Calculate the resistance of 0.002 μf capacitor at a frequency 3 kHz and 3 MHz.

P.T.O.

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

a) What are amplifiers? Explain operational amplifier with its characteristics.

b) Explain the term process control and draw the block diagram of control loop that is used in automated process control.

c) Draw schematic diagram microprocessor-controlled liquid chromatograph.

d) Define the term Robots. Explain its merits and demerits.

e) Three capacitors of 5 μf, 10 μf and 20 μf are connected in parallel. Find equivalence capacitance.

SECTION - II

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

a) "The radiation source in Atomic absorption instrument is usually modulated". Explain

b) State and explain supercritical fluid chromatography mention its merits and demerits.

c) Describe the principle and mechanism of emission, fluorescence and absorption spectra.

d) Compare inductively coupled plasma emission spectroscopy and direct current plasma emission spectroscopy with respect to their principle and working. Mention one important application of each.

e) 5 ml sample of blood was treated with trichloroacetic acid to precipitate proteins. After centrifugation, the resulting solution was brought to pH 3 and extracted with 2 ml portion of methylisobuty ketone containing the organic lead complexing agent. The extract was aspirated directly into an air acetylene flame and yields absorbance 0.502 at 283.3 nm. 5 ml of an aliquot of standard solution containing 0.400 PPM and 0.600 PPM of lead were treated in same way yielding absorbance 0.396 and 0.599. Calculate PPM of lead in blood sample.

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

a) Explain the principle of radioimmunoassay. Give any two applications.

b) Define and explain with reference to AAS.

i) Automization

ii) Chemical interference

iii) Releasing agents

iv) Protective agent

c) Explain the term Lasers. Give its classification with suitable example.

d) Write a note on Immuno-electrophoresis and immunoblotting.

e) A well water sample is analysed by flame photometrically for sodium at 589.5 nm. The emission signal is 4.5 unit an emission scale. A series of standard solution give the following results.

Standard sodium in PPM	Emission Reading
0.2	0.32
1.0	1.40
5.0	6.50

Determine sodium level in PPM in well water sample.

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

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M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 380: Pharmaceutical Analysis

(New Course)

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

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Draw diagrams, equations wherever necessary.***
4) ***Use of logarithmic tables/nonprogrammable calculator is allowed.***

SECTION - I

Q1) Attempt any four of the following.

a) Discuss the atmospheric and microbial contaminants associated with pharmaceuticals.

b) Describe biological assay of tetanus antitoxin.

c) Explain 'loss on drying and loss on ignition'. How personal error is controlled?

d) Give a method used for determination of foreign organic matter from vegetable drug.

e) 0.45 g Sulphadiazine sample was dissolved in 10 ml of concentrated hydrochloric acid and 50 ml of water. After cooling and maintaining temperature 15^{o}C was titrated with 0.1N sodium nitrate using acryflavin indicator gave burette reading 14.3 ml. Calculate percentage of Sulphadiazine in given sample.

P.T.O.

Q2) Attempt <u>any four</u> of the following.

a) Discuss in brief media used for microbiological limit test.

b) Give dissolution test for tablets.

c) Explain in brief membrane filtration method used in sterility test.

d) How Rh factor of blood donar is determined?

e) 0.59 g sample containing calcium lactate [$C_6H_{10}O_6Ca5H_2O$] was dissolved in 100 ml of water containing 2 ml hydrochloric acid. After dissolution it was titrated with 0.05 M EDTA solution using muroxide and naphthol green indicator, gave burette reading 24.2 ml. Calculate percentage of calcium lactate in given sample.

SECTION - II

Q3) Attempt <u>any four</u> of the following.

a) Discuss the use of ointments and creams as a dosage form.

b) Explain good manufacturing practices in packaging and labeling control.

c) Discuss in detail 'clinical study' in development of new drug.

d) What are the precautions under taken in manufacture of blood products?

e) 0.314 g benzocaine [$C_9H_{11}NO_2$] was dissolved in mixture of 25 ml hydrochloric acid and 50 ml distilled water. After cooling this solution to 15^oC titrated with 0.095 N $NaNO_2$ using acryflavin indicator gave burette reading 12.2 ml. Calculate percentage of benzocaine in given sample.

Q4) Give an assay of <u>any four</u> of the following:

a) Mannitol.

b) Saline.

c) Sodium benzoate.

d) Salicylic acid.

e) Aspirin.

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

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M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 381: Medicinal Chemistry

(Old & New Course)

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

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

Q1) Attempt any four of the following:

a) Discuss in brief the classification of drugs on the basis of therapeutic action.

b) Give history and development of QSAR.

c) Define the terms-

i) Pro-drug

ii) Isosterism

iii) Resonance

d) Give the synthesis of chloramphenicol.

e) Write short note on 'Molecular modelling'.

Q2) Answer any four of the following:

a) Explain the role of alkylating agents in cancer therapy.

b) Write a brief account of different physico-chemical parameters affecting drug action.

P.T.O.

c) Discuss the concept of chiral drug with suitable examples.

d) Give the steps involved in the synthesis of ampicilin.

e) Write short note on 'Biological assay'.

SECTION - II

Q3) Answer any four of the following:

a) What are sedatives and hypnotics? Give their classification.

b) Explain the mechanism of anti-cancer metabolites with suitable examples.

c) Give the synthesis of ciprofloxicin and isoniazid.

d) Explain the mode of action of Quinolan antibacterial.

e) Write short note on 'Stereochemical aspects of psycotropic drugs'.

Q4) Answer any four of the following:

a) Give the general principle involved in the drug development with suitable examples.

b) Write a brief account of recent development in cancer therapy.

c) Define the terms-

i) CNS depressants.

ii) Antibiotics.

iii) Cardiovascular drug.

d) Give the synthesis of any two of the following:

i) Chlorazepam.

ii) Ethambutal.

iii) 6-mer captopurine.

e) Write short note on 'Psycoactive drug'.

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

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[3723]-319

M.Sc.

BIOCHEMISTRY

BCH - 370: Molecular Biology

(Old & New)

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

Instructions to candidates:

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

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

a) Give the role of DNA polymerases in E.coli and add a note on their comparative information.

b) How pyrimidine dimer is formed? How it affects the activity of E.coli.

c) Give a flow sheet that will explain a typical gene expression.

d) Write a short account on tRNA, its structure and function.

e) Explain the action of any five inhibitors of protein biosynthesis.

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

a) Give the mechanism of activation of any typical tRNA.

b) Write short note on RNA polymerase.

c) Distinguish between retro and adeno viruses.

d) Give the role of Rec A,B,C and D.

e) Describe the role of sigma and nusa during transcription.

P.T.O.

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

a) Describe in detail the post-transcriptional modifications in pre-mRNA.

b) Explain the molecular structure of ribosome and its role in protein biosynthesis.

c) Describe in detail the structure of HIV-1 virus and its genes.

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

a) Replication fork.

b) Eukaryotic chromosome.

c) SOS response in E.coli.

d) Recombination Technology.

e) Ribozyme.

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

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M.Sc.

BIOCHEMISTRY

BCH - 371: Medical Biochemistry and Immunology

(Sem.- III) (Old & New)

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

Instructions to the candidates:

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

SECTION - I

(Medical Biochemistry)

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

a) What are broad spectrum antibiotics? Explain the mechanism of streptomycin and erythromycin as antibacterial drug.

b) Explain the cascade of blood coagulation via Intrinsic and Extrinsic pathway initiated by different activators.

c) Discuss the physiological role of lysosomes.

d) Differentiate between the structural features of normal hemoglobin and hemoglobin isolated from sickle cell anemia patient. How does the difference in structure affect the functional ability of hemoglobin?

e) Describe the involvement of chemicals and viruses in the etiology of cancer.

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

a) What are analgesics? Explain the mechanism of analgesics with suitable example.

b) Give the composition of cerebrospinal fluid and give their physiological significance.

P.T.O.

c) Discuss the causative factors, clinical features and treatment of Arteriosclerosis.

d) What are Anticancer drugs? Elaborate on the role of Methotrexate as a competitive inhibitor in treatment of cancer.

Q3) Write short notes on <u>any two</u>: **[10]**

a) Hallucinogens.

b) Tamiflu resistant HINI Virus.

c) Apoptosis.

SECTION - II

(Immunology)

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

a) Differentiate between cell mediated immunity and humoral immunity with suitable example.

b) When a person has hay fever, common symptoms include running nose, swollen sinuses, difficulty in breathing. In terms of humoral immunity discuss the mechanism behind these symptoms and justify the reason for giving antihislamines to the patient.

c) Explain the principle procedure and applications of ELISA technique.

d) Discuss the etiology and treatment of autoimmune diseases.

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

a) Elaborate on live attenuated vaccines and recombinant vaccines with suitable example.

b) Explain the mechanism of complement fixation by classical pathway and alternate pathway.

c) List out the different types of Immunoglobutins and describe the structural feature of IgG.

d) Differentiate between monoclonal and polyclonal antibodies

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

a) Blood group antigens.

b) Western blotting technique.

c) Interferons.

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

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M.Sc.

BIOCHEMISTRY

BCH - 372: Signal Transduction Pathways (New)

Membrane Biochemistry & Specialized Tissues (Old)

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

Instructions to the candidates:

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

SECTION - I

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

a) Discuss the role of ca^{2+} in the regulation of muscle contraction.

b) Describe the ultrastructure of muscle cell and add a note on protein components in myofibril.

c) Write a short note on sodium channels.

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

a) What is acetylcholine? Explain how nerve impulses are transmitted?

b) Discuss the effect of neurotoxins on the nervous system.

c) Write a short note on biochemistry of hearing.

d) Explain the biochemistry of vision and add a note on colour blindness.

P.T.O.

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

a) How sound is generated.

b) Compare myosin with kinesins and dyenins.

c) Biochemistry of taste.

d) Neurotransmitters.

SECTION - II

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

a) Discuss how natural, genetical and environmental factors affect the development of central nervous system.

b) Describe in detail the metabolism of neurotransmitters.

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

a) Distinguish between afferent and efferent pathways.

b) Describe the transmission of nerve impulse across the synapse.

c) Explain the types of receptors and their properties.

d) Describe in detail chemical composition of brain.

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

a) Peripheral nervous system.

b) Sensory perception.

c) EEG patterns.

d) Zinc fingers.

SECTION - I

(Membrane Biochemistry)

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

a) What is receptor mediated endocytosis.

b) Write a short account on membrane asymmetry.

c) Describe the molecular mechanism of Valinomycin.

d) How mitochondrial proteins are imported.

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

a) Describe the assembly of virus membrane receptor.

b) Describe the mechanism of Ca^{2+} ATPase.

c) Write a short note on bacterial toxins.

d) Discuss chemiosmotic hypothesis of mitchell.

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

a) Flip-flop.

b) Bacterial cell envelope.

c) Membrane glycosylation.

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

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[3723] - 1

M.Sc.

DRUG CHEMISTRY

CH - 211 : Physical Chemistry - II

(Sem. - II) (New) (2005)

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

Instructions to the candidates:

1) ***Answer of two sections should be written in separate answer book.***
2) ***Use of graph paper/ calculator is allowed.***
3) ***All questions carry equal marks.***

SECTION - I

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

a) Explain the effect of temperature on the microwave and infrared spectra of simple diatomic molecule.

b) Sketch qualitatively normal vibrations in nitrate ion. Assign the vibrations with Milliken notation. Which of these are infra red active? Which are Raman active?

c) Explain in brief :

i) Doppler broadening.

ii) Rule of mutual exclusion.

d) What are parallel and perpendicular vibrations? Why the bending vibration of HCN exhibit intense Q branch whereas the stretching vibration do not exhibit Q branch.

e) State and Explain Franck Condon principle with a suitable diagram.

f) How the Birge sponer extrapolation method can be utilized to determine the dissociation energy of a molecule? Why the value of dissociation energy thus obtained agrees better with experimental data than that obtained from infrared spectra alone?

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

a) The rotational constant for $H^{35}Cl$ is observed to be $10.5909cm^{-1}$ What are the value of B for $D^{35}Cl$.

P.T.O.

b) i) How many normal modes of vibration are possible for : OCS, SO_2, BCl_3.

ii) Which of the following molecule exhibits pure microwave spectrum? Why? Benzene, SF_6, HCN.

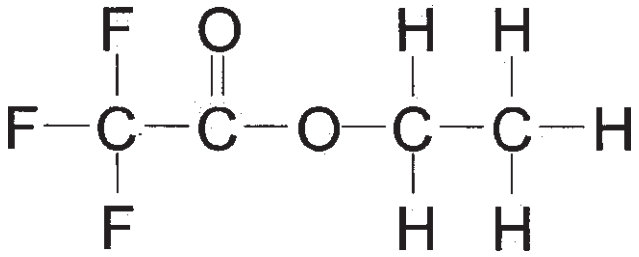
c) A molecule AB2 has the following infrared and Raman spectra.

cm^{-1}	Infrared	Raman
3756	Very strong, perp	-
3652	Strong parallel	Strong polarized
1595	Very strong, parallel	-

The rotational fine structure of the infrared bands is complex and does not show simple PR or PQR characteristics. Comment on the molecular structure and assign the observed vibration as fat as possible.

d) The absorption spectrum of O_2 shows vibrational structure which became a continuum at 56876 cm^{-1}, the upper electronic state dissociates into one ground state and one excited atom (the excitation energy of which measures from the atomic spectrum is 15875 cm^{-1}) Estimate the dissociation energy of gound state O_2 in kJ mol^{-1}.

e) How carbon region of the XPES spectrum of ethyl trifluoroacetate will appear? Explain your answer. The structure of the molecule is.



f) If the separation of 'P' and 'R' maxima of CO has been observed to be 54 cm^{-1} at 300K. Estimate the rotational constant for the molecule.

SECTION - II

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

a) Outline in brief radiolysis of water.

b) What is the GM counter? Explain the construction and functioning of the GM counter. What is the dead time of the counter? Explain with a suitable diagram.

c) State and Explain Neutron Activation Analysis.

d) Outline in brief how the solubility of a sparingly soluble substance can be determine by using radiotracer technique.

e) Explain in brief :

i) Ceric sulphate dosimeter.

ii) Carbon dating.

f) What are secular and transient equilibrium? Explain with suitable examples is each case.

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

a) The reaction ^{9}Be (p,n) ^{9}B has threshold energy of 2.059 MeV. What is the Q value?

b) A sample containing an unknown amount of germanium metal is irradiated in a neutron flux of 10^{12} n $cm^{-2}S^{-1}$ for 1hr when the ^{76}Ge forms ^{77}Ge of half life 1 min. Suppose the activity measured 1 min after the 1 hr irradiation is 2500 dis. sec^{-1}. Find the amount of germanium in the same. Given:: The cross section for the reaction is 3.28 mb and the isotopic abundance of ^{76}Ge to be 7.8%.

c) A mixture of equal weights of ethanol and acetic acid is irradiated by γ radiation from a ^{60}Co source. What fraction of the energy is observed by ethanol (take $\overline{Z/A}$ for this mixture to be the mean $\overline{Z/A}$ value of the components).

d) Find the thickness of lead required to reduce the level of radiation due to ^{60}Co source at a point (a) from 100 Gy/min to 0.1 mGy/h.

e) ^{210}Bi is shorter lived than the daughter ^{210}Po (τ = 138 d). If the parent and daughter are found to decay at the same rate exactly at the end of 24.86 d compute the half life of the element.

f) Calculate the molecular and mass absorption coefficients of benzene given its density 0.879 g cm^{-3} and linear absorption coefficient as 0.06014 cm^{-1}.

✪✡✪✡

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

P891

[3723] - 2
M.Sc. - I
DRUG CHEMISTRY
CH - 231 : Inorganic and Analytical Chemistry
(Sem. - II) (Old Course)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***
4) ***Use of log table and calculator is allowed.***
5) ***Atomic numbers: Co = 27, Fe = 26, V = 23.***

SECTION - I

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

a) Assign the spin multiplicities to the Mulliken terms arising from $t_{2g}^1\ e_g^1$ configuration when an infinitely strong field is relaxed in O_h stereochemistry.
[Given : $T_{2g} \times E_g = T_{1g} + T_{2g}$]

b) Determine the ground state term for the following complexes:
   i) $[Co(NH_3)_6]^{3+}$
   ii) $[Fe\ Cl_4]^{2-}$ tetrahedral

c) Interprete the spin allowed transitions in terms of Racah parameter and crystal field splitting parameter in the following complexes
   i) $[V(H_2O)_6]^{3+}$.
   ii) $[Co\ Cl_4]^{-2}$ Tetrahedral.

d) Construct microstate table for P^3 configuration and derive R-S terms for the same.

e) Determine the degeneracy of following states.

$^4I,\ e_g^2,\ d^3,\ d^3p^2,\ ^6G$

P.T.O.

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

a) Write an explanatory note on Homeostatis.

b) Explain the uptake and storage of iron in biological system.

c) What are metalloenzymes? Explain their functions and suitable reactions.

d) What are benificial and toxic effects of metals in biological system?

e) Explain acetyl choline receptor ion channels.

SECTION - II

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

a) Explain how graphite tubular furnace increases sensitivity and utility of AAS.

b) Explain the construction and working of phototube and photomultiplier tube.

c) Describe the technique of isotope dilution analysis.

d) Draw a schematic diagram of HPLC, explain its essential components and their functions.

e) Describe the technique of plasma emission and arc emission.

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

a) Describe the working of GC with the help of schematic diagram. How thermal conductivity detector is used in GC?

b) Explain the following terms :

i) Releasing agent ii) Atomization

c) Calculate how much amount of an organic acid would be extracted from 100 ml of water containing 5.0 g of it when extracted with ether in 5 lots of 50 ml each. partition coefficient of an acid in water and ether is 5.5.

d) A substance X and Y have retention times 11.4 and 16.7 minuts respectively. On a 30 cm column the unretained species passes over the column in 1.10 minuts. The peak width at the base for X and Y are 1.2 and 1.35 minuts respectively. Calculate plate height, average number of plates and column resolution.

e) Radiation wavelength of 315 nm was passed through 1.0 mm of solution that contained C_6H_6 at a concentration of 0.05 M. The light intensity is found to reduce to 22% of initial value. Calculate the absorbance and molor absorption coefficient of sample. What would be transmittance through 2.0 mm cell?

Character Table for O rotational group

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

Correlation Table for the Group O_h

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

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

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

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

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

For all groups :

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

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

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

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

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

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

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

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

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

(c) For D_{4d} :

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

irrespective of the suffix on B.

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

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

irrespective of the suffix on B.

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

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

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

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

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

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

(c) For D_{4d} :

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

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

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

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

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

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

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

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

$E_1 \times E_2 = E_1 + E_2$.

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

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

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

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

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

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

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

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

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

6. The complete results for O are :

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

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

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[3723] - 4

M.Sc.

DRUG CHEMISTRY

CH - 361 : Chemistry of Heterocycles & Biologically Active Compounds (Old 2005 Pattern)

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

Instructions to the candidates:

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

SECTION - I

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

a) Indole 3-aldehyde does not take part in benzoin condensation as benzaldehyde.

b) 4-Bromopyridine gives two isomeric products on treatment with $NaNH_2$ in liq. NH_3, but with NaOMe it gives single product. Explain.

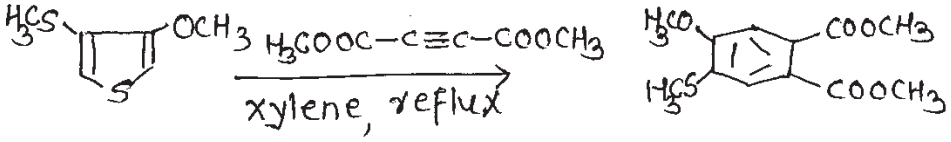
c) Electrophilic substitution reaction occur at c-2 in pyrrole while at c-4 in 1,2 azoles.

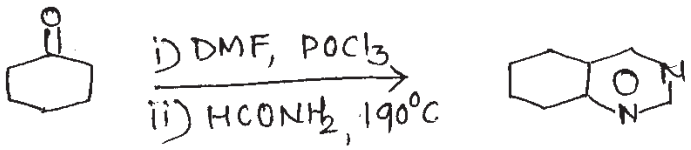
d) Pyrimidine is resistant to electrophilic substitution as compared to imidazole.

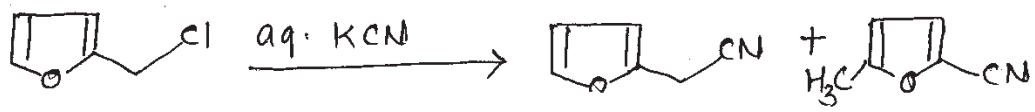
e) 5-methoxy quinoline can not be synthesized easily using skraup synthesis.

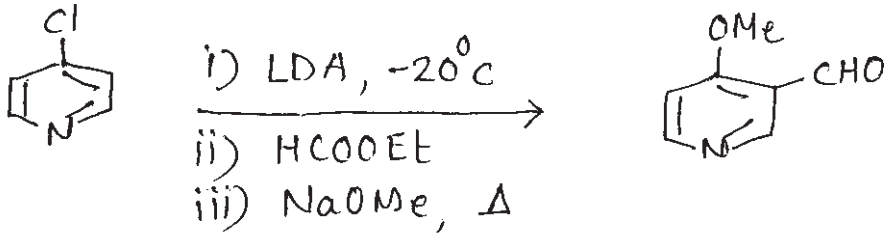
P.T.O.

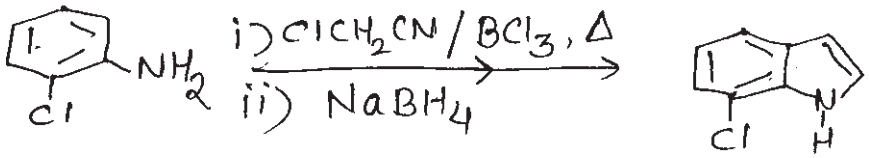
Q2) Suggest the suitable mechanism for <u>any four</u> of the following conversions: **[12]**

a) 

b) 

c) 

d) 

e) 

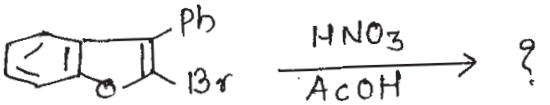
Q3) a) Give synthesis of <u>any two</u> of the following : **[7]**

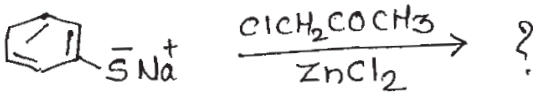
i) Paat Knorr synthesis.

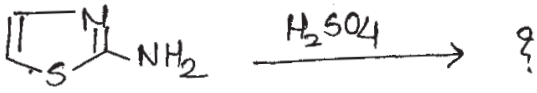
ii) Hantzsch Pyridine synthesis.

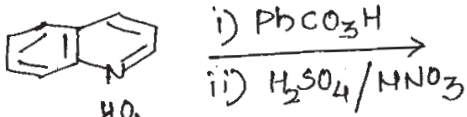
iii) Madelung Indole synthesis.

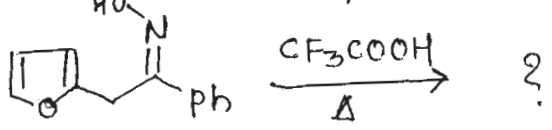
b) Predict the products with mechanism (any three) : **[9]**

i) 

ii) 

iii) 

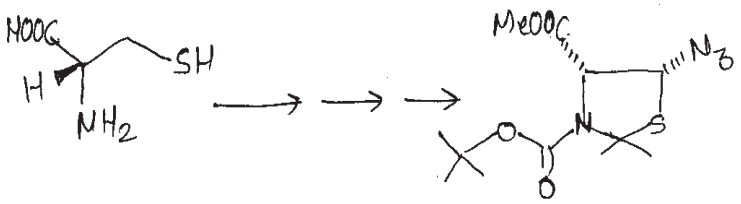
iv) 

v) 

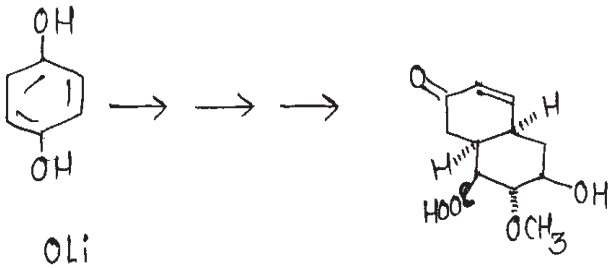
SECTION - II

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

a)



b)



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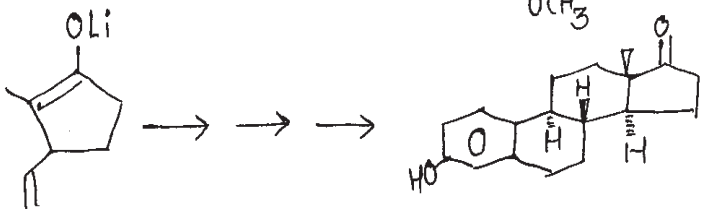

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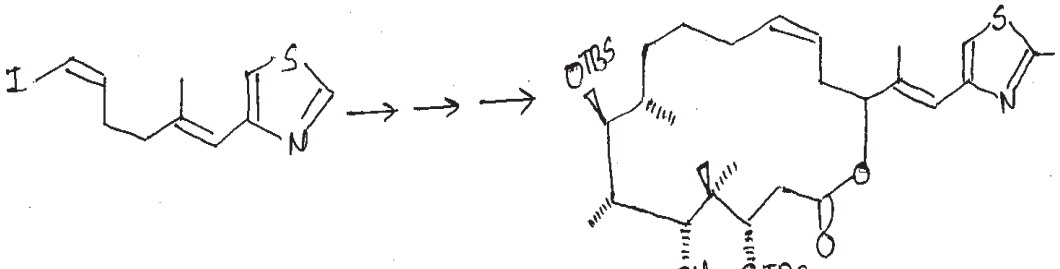
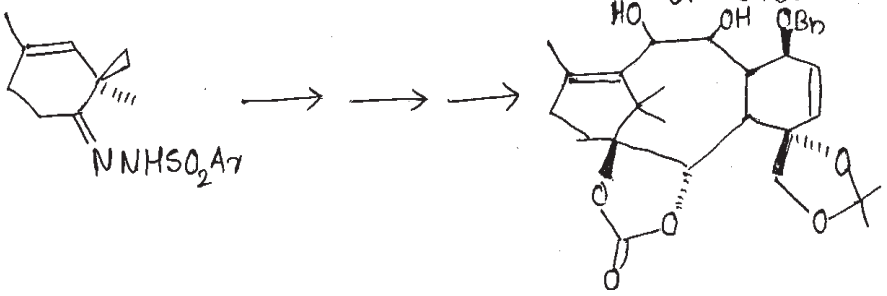
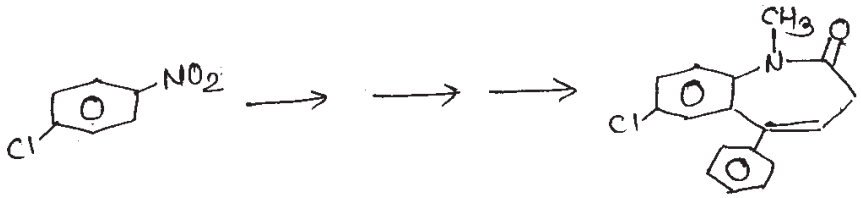
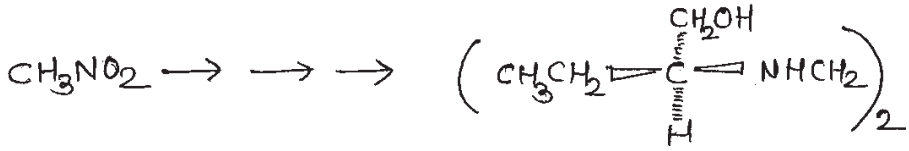


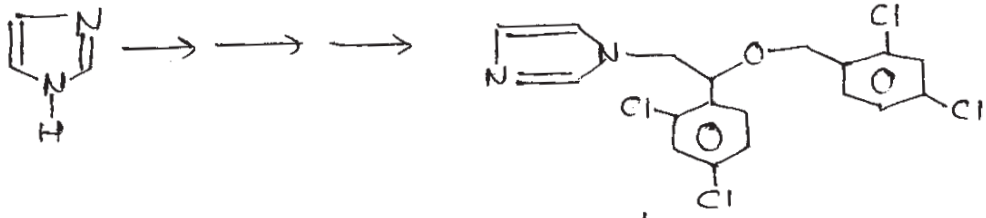
e)

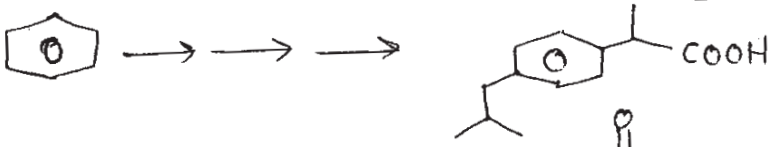


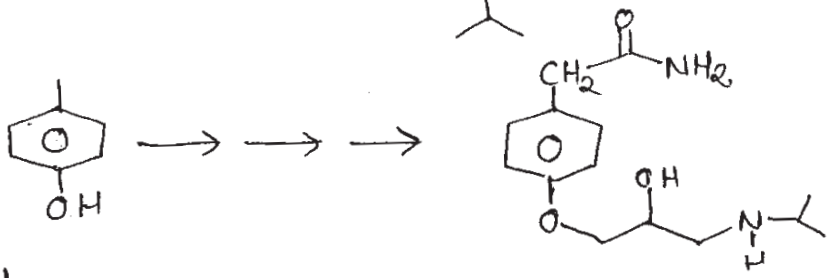
Q5) Describe the step involved in the synthesis of following drug molecules. Explain the mechanism involved (any four) : **[16]**

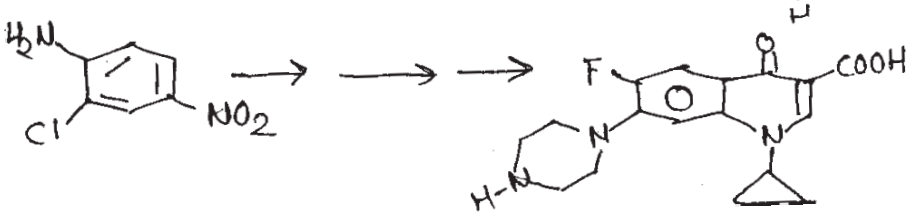
a) 

b) 

c) 

d) 

e) 

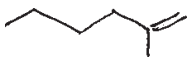
f) 

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

a) The reagents involved in the following transformations are.

i) HCl, H_2O

ii) P-TsOH

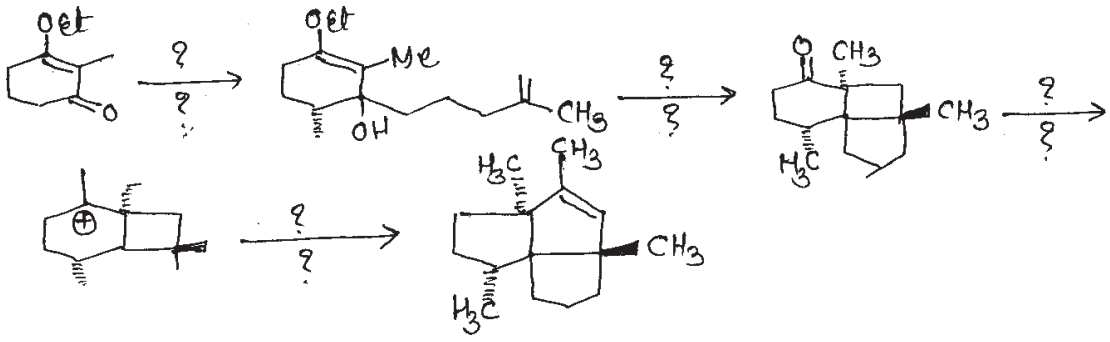
iii) BrMg 

iv) $PPh_3{=}CH_2$, DMSO

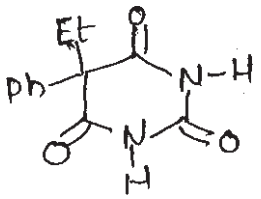
v) hν, (350nm), hexane.

vi) LDA, THF, MeI

vii) Bond migration



b) Carry out etrosynthetic analysis of barbiturate given below



c) Explain in brief :

i) Robinson Annulation reaction.

ii) Schiemann reaction.

✪✡✪✡

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

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[3723] - 6

M.Sc.

DRUG CHEMISTRY

CH - 363 : Drug Development (2005 Pattern)

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

Instructions to the candidates:

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

SECTION - I

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

a) How effluent is treated to reduce its organic load before its discharge? Why organic load of industrial effluent is to be reduced before discharge?

b) What are antimicrobial assays? How one can estimate the concentration of antimicrobial compound in sample using these assays?

c) Explain the microbial (bacterial) growth pattern with help of graph and comment on the activity of cells seen in different phases of growth.

d) How screeing of microorganism is carried out to test their ability to synthesize antibiotics and the strain is further improved wrt to final yield?

e) Name the common ingredients used for preparation of microbial growth medium & give the function of each component in it.

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

a) Comment on the primary and secondary lymphoid organs?

b) Explain cell mediated immunity.

c) What is immunodiagnosis? Explain any one method in detail.

d) What are subunit and DNA vaccines? Explain the significance of both.

e) With suitable examples comment on innate immunity.

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

a) Discuss in brief how the bioavailiability of drug changes when given sublingually, Rectally, Orally & Topically-Explain.

b) Give a brief commentory on sources of drugs. What are the characteristics expected of a goal drug.

P.T.O.

c) Discuss in brief safety measures employed in a Pharma industry; also comment on the precaution to be taken in RlD labs.

SECTION - II

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

a) Give a brief account of Preclinical trials-explain the tests performed & the utility of these results in planning clinical trials.

b) What is a patent? What are the conditions to be fulfilled to obtain patent rights? Discuss patent infringements & remedies for it?

c) Give a brief account of the factors which affect. Absorption, Distribution, Metobolism & Excretion of drugs with some examples.

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

a) Explain the following

i) Pharmacophore ii) QSAR

iii) Local & systemic effects iv) First pass

b) What is a lead compound? How is it obtained? Discuss the various strategies employed in lead discovery? With examples.

c) What is the need for clinical trials? What are the objectives of phase I & phase II. Discuss the various tests, observations & conclusions drawn in these phases.

d) Discuss in brief how biological activity evaluation of a compound is carried out - explain atleast two tests. What are the benifits of Invitro & virtual testing?

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

a) Strategies employed to make a process economical, safe & environment friendly.

b) Roles of the following

i) FDA / Commissioner of Drugs.

ii) Head, Quality Assurance.

iii) Institutional Review Board.

c) Rational design & discovery of drugs.

✪✡✪✡

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

P896

[3723] - 7

M.Sc.

DRUG CHEMISTRY

CH - 364 : Stereochemical Principles and Applications
(Old 2005 Pattern)

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

Instructions to the candidates:

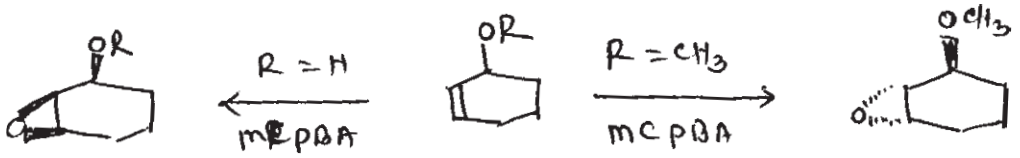
1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in the same answer books.***
3) ***Figures to the right side indicate full marks.***

SECTION - I

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

a) Bromo camphor foils to undergo dehydro bromination on treatment with base. Explain.

b) Account for the stereochemical principles involved in following reaction.



c) predicts the products obtained due to trans-annular rearrangement with correct stereochemistry.

i) cis cyclodecene $\xrightarrow[ACOH]{Br_2}$?

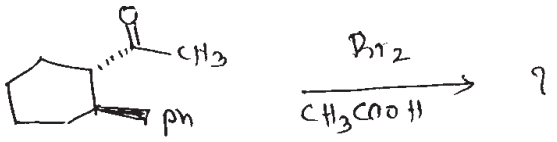
ii) trans cyclo octane $\xrightarrow{HCOOH}$?

d) During pb$(OAC)_4$ oxidation of cyclopentane-1,2-diols the cis-isomer reacts several thousand times faster than the trans isomer, where as in cyclohexane-1,2-diols the trans isomer reacts forty times faster than cis isomer.

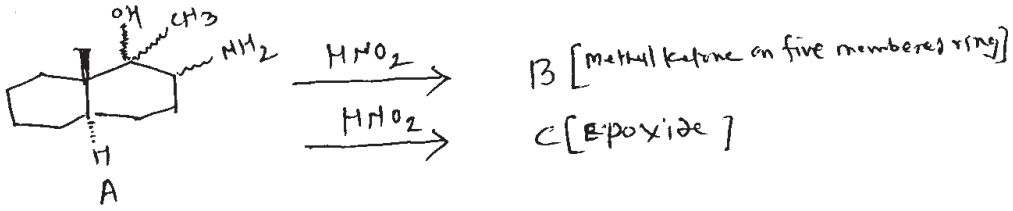
e) For cis hydroxylation of alkanes O_5O_4 is used, while for trans hydroxylation the reagent is Per acid.

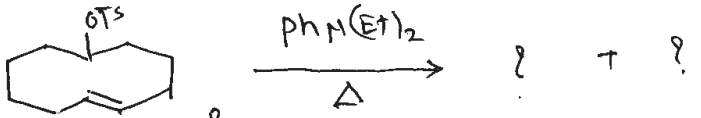
P.T.O.

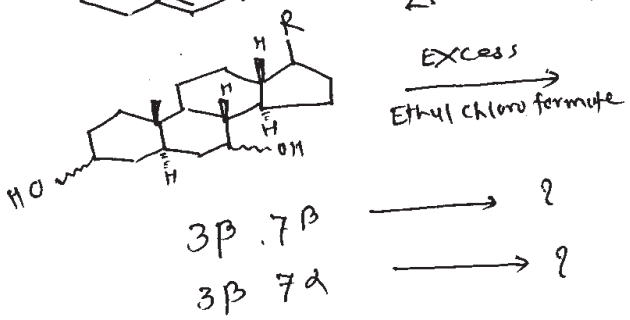
Q2) Predict the products and explain the stereo chemistry involved in the following reactions (Any four) : **[12]**

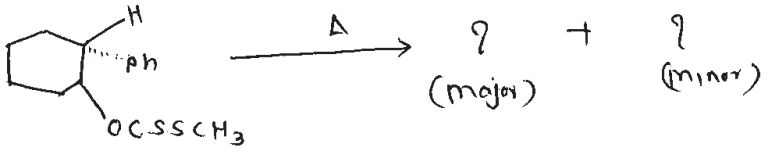
a) 

b) Draw the stereoisomers obtained in following reaction.



c) 

d) 

e) 

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

a) Stabilities of trans-syn-trans and cis-syn-trans perhydro anthracenes.

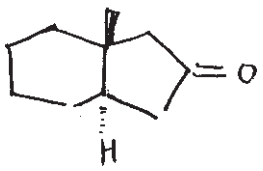
b) Torsional strain in 3 to 6 membered rings.

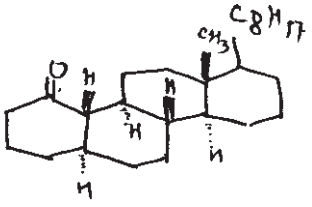
c) Explain Pk_1 and Pk_2 in cis and trans 1,2-dicarboxylic acid.

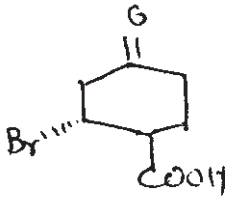
d) Give short account of Von Auwers - Skita rule.

SECTION - II

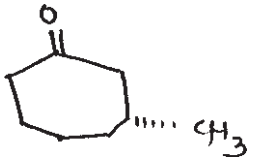
Q4) a) Using octant rule predict the sign of cotton effect for any two of the following and clearly show octant projection. **[8]**





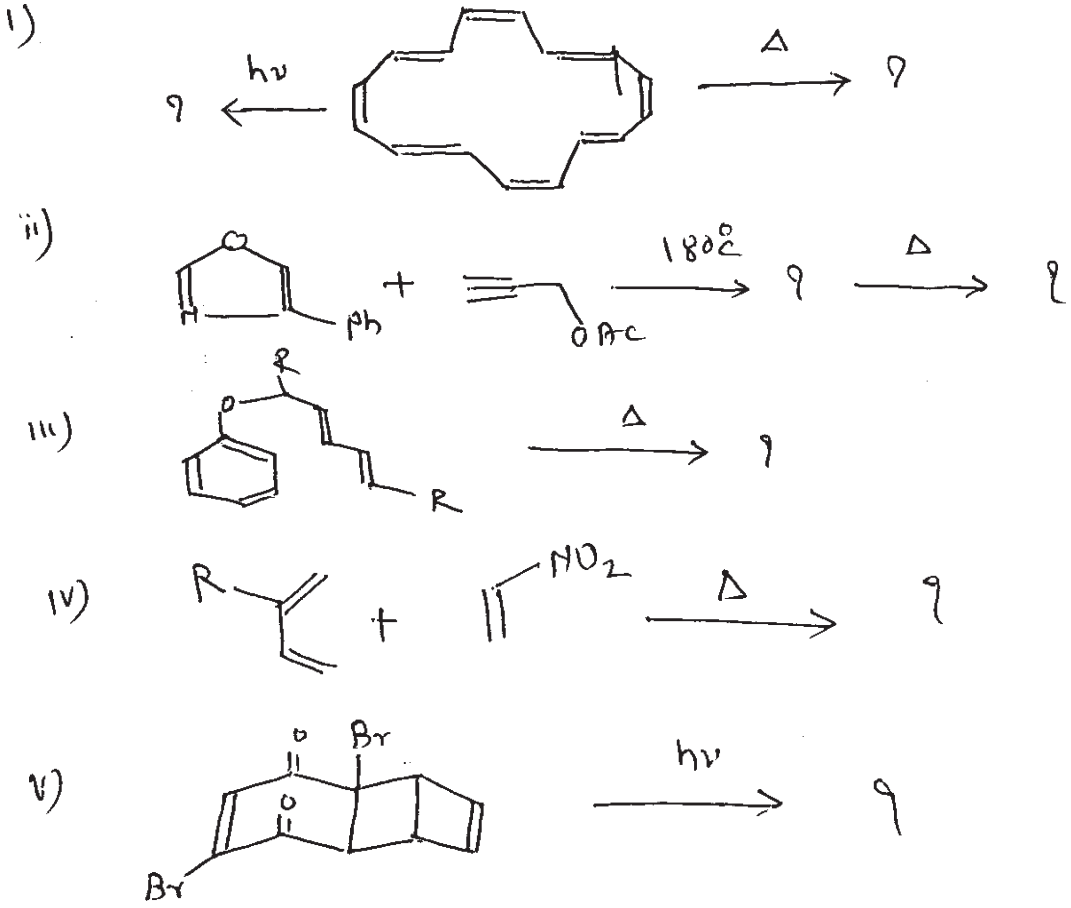


b) 3-Methyl cycloheptanone (I) showed - ve cotton effect. Using this information predict the conformation of the cycloheptanone. **[4]**

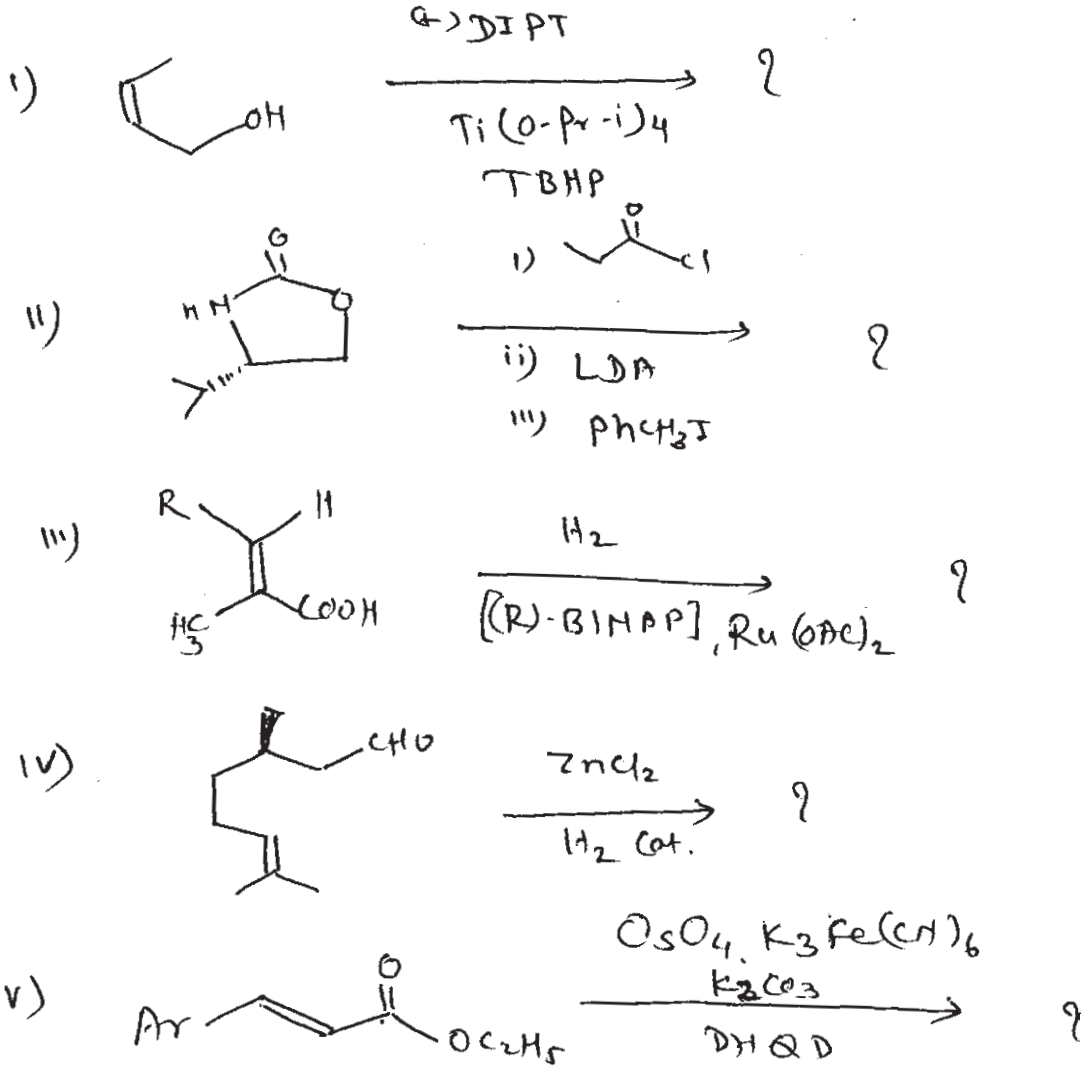


Q5) a) Explain with the help of FMO approach wheather [1.5] sigmatropic shift is thermally or photochemically allowed. **[4]**

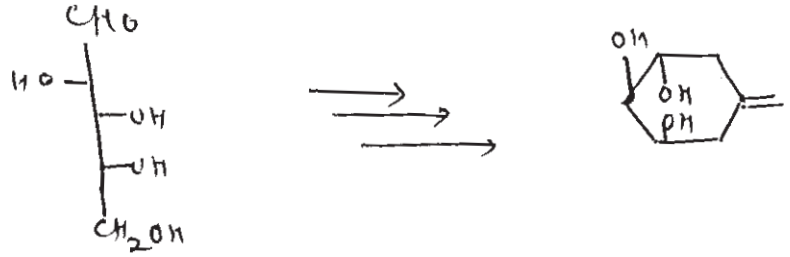
b) Predict the product/s explain mechanism and stereochemistry of the following reactions (Any Four) : **[8]**



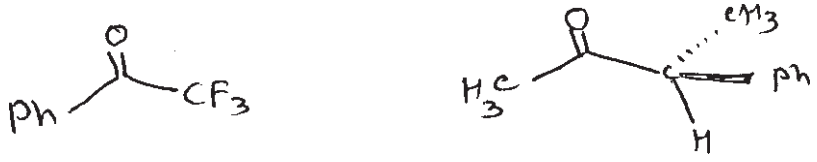
Q6) a) Predict the product/s and assign correct stereochemistry. Justify your answer (any four) : **[8]**



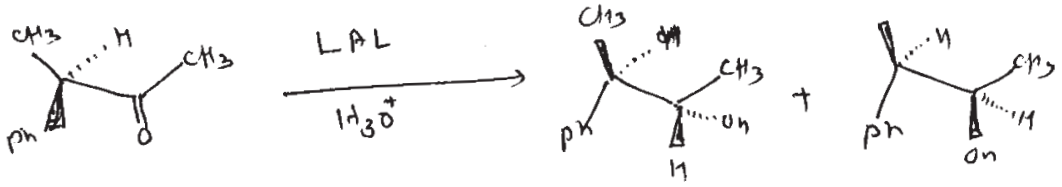
b) Complete the following reaction sequence. **[3]**



c) Give Re and Si faces of the following compounds. **[2]**



d) Using Felkin rule explain the following transformation. **[3]**



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

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[3723] - 21

M.Sc.

PHYSICAL CHEMISTRY

CH - 210 : Physical Chemistry - II (Old)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Discuss the important factors governing the intensity of spectral lines.

b) Which of the following molecules are microwave active? Why?

CH_3Cl, para $C_6H_4(OH)_2$, SF_6, C_6H_6, ICl.

c) Explain with suitable example the effect of isotopic substitution on microwave spectrum of a molecule.

d) Explain the following :

i) The difference of Do and De energies is largest for H_2.

ii) The bending mode of HCN exhibits intense Q branch where as in the symmetric stretching vibration this Q branch is absent.

e) Discuss the advantages of FTIR spectroscopy.

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

a) Give an account of rotational Raman spectra of linear molecule.

b) Explain the classical theory of Raman effect.

c) State and explain the Frank-condon principle.

d) What is predissociation spectra. Explain it with the help of suitable energy level diagram.

e) Explain the applications of ESR spectra.

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

a) Successive line spacing in the microwave spectra of $^{1}H\ ^{35}Cl$ is 21.181 cm^{-1}. Determine the corresponding value for $^{2}D\ ^{37}Cl$.

b) For an electronic state the value of $\overline{we}$ and xe in c_2 are 1641.4 cm^{-1} and 0.00711 respectively. Find the number of vibrational levels below the dissociation limit and hence the dissociation energy of this state.

c) If HCl is irradiated with 404.7 nm Hg-line, calculate the first two antistokes and stokes lines observed in the rotational Raman spectrum. [Given : Bond distance of HCl molecule is 0.1275 nm].

SECTION - II

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

a) Discuss construction and working of scintillation counter.

b) Derive the expression for the first order radioactive decay kinetics.

c) Explain the terms, radiation tracks, spurs, δ-rays and stopping power.

d) Explain units for measurement of radiation absorption.

e) Explain, distribution of prp's of water with respect to the Samuel-Magee model and Lea-Grey-Platzaman model.

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

a) Explain, radiochemical principle in the use of tracers.

b) Discuss kinetic study with respect to isotope exchange reaction.

c) Using radiotracer technique, discuss the mechanism of Friedel-craft reaction.

d) Explain the use of radioactive isotope in detection of microcracks and defects in machine parts and casting.

e) Discuss the use of ^{35}S in the determination of structure of thiosulphate ion.

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

a) The half-life of radon is 3.8 days. After how many days will one twentieth of radon sample be left over.

b) Calculate the molecular and mass absorption coefficient of benzene. [Given : $e^{\mu} = 0.211$ b/e, Z of H = 1, C = 6 and A of H = 1, C = 12.]

c) A one litre mixture of halides was to be analyzed for its iodide content. 2 mL of labelled iodide with activity 5000 counts for 2 min. was added to the mixture. After through mixing 3 mL of pure iodide was separated which have the activity 5850 counts for 15 min. Calculate the iodide content of the mixture.

✪✡✪✡

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

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[3723] - 23

M.Sc. - I

ORGANIC CHEMISTRY

CH - 250 : Synthetic Organic Chemistry & Spectroscopy (2005 Pattern) (Sem. - II)

Time : 3 Hours] [Max. Marks :80

Instructions to the candidates:

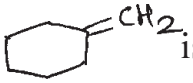
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

SECTION - I

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

a) Ethyl acetoacetate on reaction with $NaBH_4$ / MeOH gives β-hydroxy butyrate, while on reaction with $LiAlH_4$ gives l,3-diol.

b) In Baeyer villiger oxidation phenyl group migrates in preference to methyl group.

c) Better route to prepare 

is to start with cyclohexanone rather than dehydrochlorination of 

d) Treatment of cyclohexanone with hydroxylamine hydrochloride gives caprolactum in acidic medium while with per acid cyclohexanone produces a lactone.

e) Erythro l-chloro-1, 2-diphenyl propane on elimination of hydrogen chloride gives Z-methylstilbene whereas threo isomer gives E-methylstilbene.

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

a) Hoffmann Rearrangement

b) E_1 CB reaction.

c) Synthetic utility of hydroboration reaction.

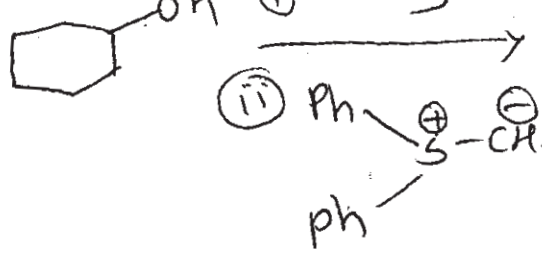
d) Michael reaction.

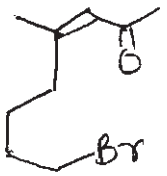
e) Methods of preparation of epoxides.

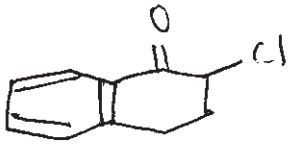
P.T.O.

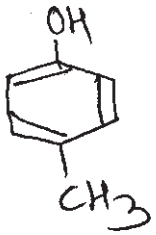
Q3) Predict the products and suggest mechanisms of <u>any four</u> of the following :**[12]**

a)  $NaBH_4$ → Major + Minor

b)  (i) CrO_3 (ii) $Ph-\overset{\oplus}{S}(Ph)-\overset{\ominus}{C}H_2$?

c)  Me_2CuLi → ?

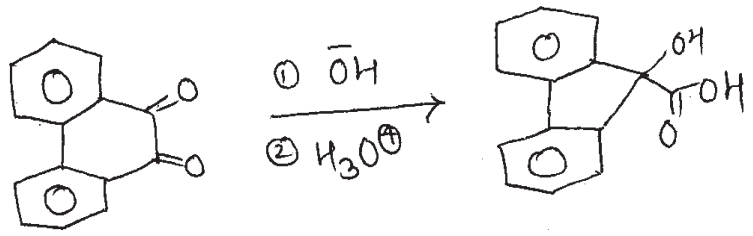
d)  + $\overset{\ominus}{O}H$ $\xrightarrow{H^{\oplus}}$?

e)  (i) $H_2C=CH-CH_2Br$ (ii) Δ ?

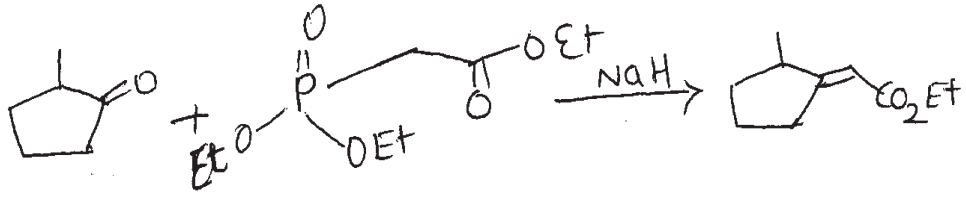
SECTION - II

Q4) a) Suggest the mechanisms for the following conversions (any two) : **[6]**

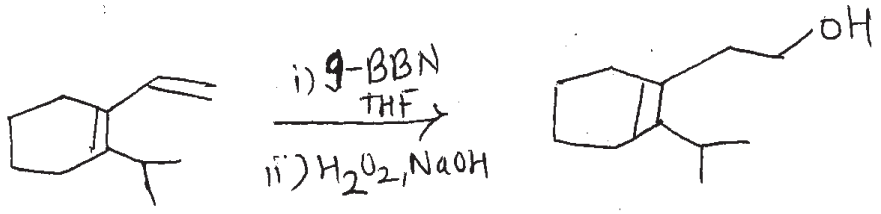
i)



ii)

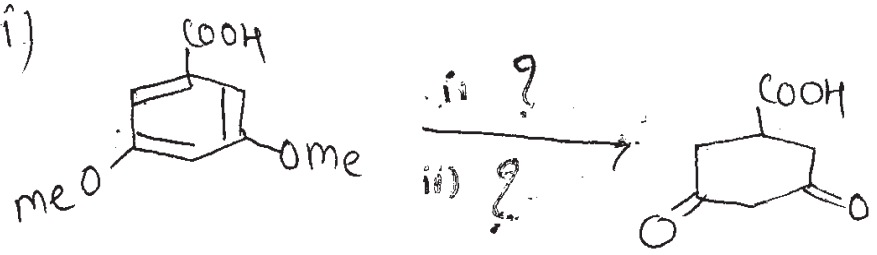


iii)

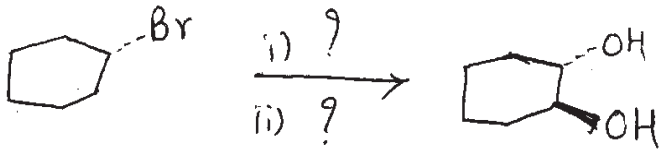


b) Suggest the reagents for the following conversions (any three) : **[6]**

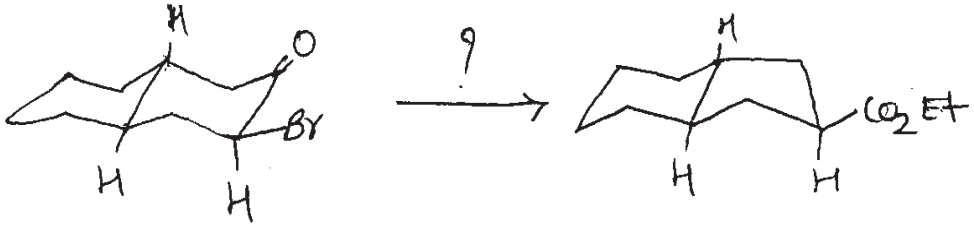
i)



ii)



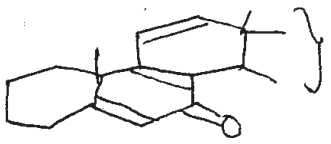
iii)

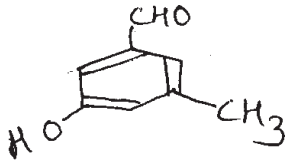


iv) PhCOOH $\xrightarrow{?}$ PhCHO

Q5) Answer <u>any four</u> of the following :

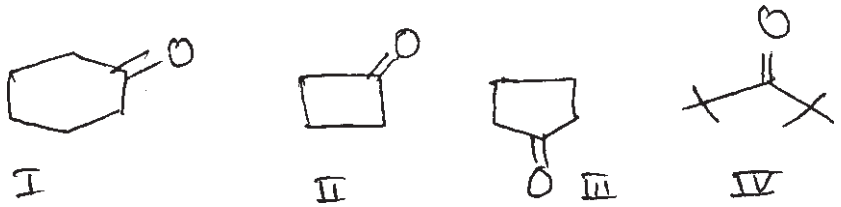
a) Calculate λ_{max} of the following compounds **[16]**

i) 

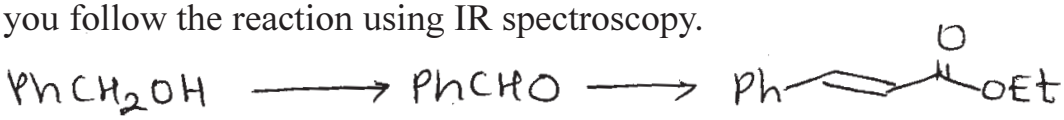
ii) 

b) How will you distinguish cis and trans stilbene by UV spectroscopy and NMR?

c) Arrange the following compounds according to increasing order of their IR carbonyl stretching frequencies and justify your answer.



d) Suggest the reagents for the following conversion and explain how will you follow the reaction using IR spectroscopy.



e) Write a short note on anisotropic effect.

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

a) Molecular Formula = $C_5H_8O_2$

UV	:	transparent above 220 nm.
IR	:	1770 cm^{-1}
PMR-		1.3 δ (d, J = 7 Hz, 3H);
		1.5-2.6 δ (m, 4H)
		4.5 δ (sex tet, J = 7Hz, 1H)

b)

M.F.	:	C_8H_7N
UV	:	235 nm
IR	:	2220, 1620, 1510 cm^{-1}
PMR	:	2.4 δ (s, 3H)
		7.2 δ (d, J = 8Hz, 2H)
		7.5 δ (d, J = 8Hz, 2H)

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

IR : 3350, 1500-1600, 750, 700 cm^{-1}

PMR : 2.2 δ broad s 1 H (exch. with D_2O),
2.7 δ, t (J = 6.5Hz) 2H
3.68 δ, t (J = 7Hz) 2H
7.2 δ, m 5H

d) M.F. : $C_{10}H_{10}O_2$

UV : 230, 320 nm,

PMR : 2.4 δ s 3H
6.7 δ d (J = 16Hz) 1H
7.3 δ d (J = 8Hz) 2H
7.5 δ d (J = 8Hz) 2H
7.9 δ d (J = 16Hz) 1H
8.25 δ bs (exch.) 1H

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

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[3723] - 31

M.Sc.

PHYSICAL CHEMISTRY

CH - 310 : Quantum Chemistry, Statistical Thermodynamics and Phase Rule (Old)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt <u>any four</u> of the following : **[20]**

a) Show that

$$\left[\hat{L}_x, \hat{L}_y\right] = i\hbar \hat{L}_z$$

for a set of angular momentum operators

$\hat{L}_x, \hat{L}_y$ and $\hat{L}_z$

b) Which of the following functions are eigen functions of the operator d^2/dx^2

i) $\sin 3x$ ii) $6 \cos 4x$ iii) x^{-2}

Give the corresponding eigenvalues.

c) State and prove the variation theorm.

d) The perturbed Hamiltonian $\hat{H}$ is given by the relation $\hat{H} = \hat{H}^0 + \hat{H}'$ show that if $\hat{H}$ and $\hat{H}^0$ are hermitian, $\hat{H}'$ must also be hermitian.

e) Derive the expression for the first order correction to the energy of the non-degenerate unperturbed level.

f) State the postulates of quantum mechanics.

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

a) Apply Hückel's theory to the cyclobutadiene molecule and estimate the magnitude of the delocalization energy.

b) Explain the 4m+2 rule of Hückel as applied to the cyclo octatetraene dianion.

c) Draw the HMO's of benzene and their nodal characteristics.

d) What are Roothan-Fock equations? Explain what is a basis set.

e) Write the slater determinant wave function for a hydrogen molecule. Explain the basis for calculations of the M.O. energies.

f) What were the drawbacks of Hückel's method of calculating delocalization energies of conjugated hydrocarbons? How did Hess and Schaad's method predict the aromaticity of these compounds more reliably?

SECTION - II

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

a) What is an ensemble? What are its types? State the need of an ensemble in statistical thermodynamics.

b) Show that, the value of Lagrange's constant (β) is equal to 1/KT.

c) Outline the procedure for calculating translational partition function.

d) Explain the following terms.

i) Population. ii) Configuration of system.

iii) Weight of configuration. iv) Most probable configuration.

e) How is equipartition theorm used to estimate the high temperature value of heat capacity?

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

a) What are the salient features of Bose-Einstein and Fermi-Dirac statistics? How do the distribution law expressions obtained from these compare with that obtained from the Boltzmann statistics?

b) Write a note on zone refining method.

c) Sketch and explain the phase diagram of n-hexane - water.

d) Obtain an expression for the entropy in terms of canonical partition function.

e) State and explain the lever rule with suitable example.

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

a) Calculate the vibrational partition function for Br_2 at 300K, if the vibrational frequency is 151.2 cm^{-1}.

b) Using equipartition principle, calculate the molar heat capacities of the following molecules at room temperatures.

i) C_2H_2 ii) HI iii) CO_2 iv) N_2O

c) Calculate the standard entropy of neon gas at 205K. (The mass of Ne atom is 20.18 u).

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

P900

[3723] - 32

M.Sc.

PHYSICAL CHEMISTRY

CH - 311 : Nuclear and Radiation Chemistry (Old)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Discuss with suitable examples, the significance of magic numbers.

b) Write the sequence of filling of nuclear orbitals. Explain the necessity of proposing spin-orbit coupling.

c) Deduce Bethe-Weizsacker equation.

d) Discuss the charge distribution of fission fragments and deduce the expressions for the atomic numbers of the primary fission fragments.

e) '^{235}U undergoes fission by thermal neutrons while at least 1 MeV neutrons are required for fission of ^{238}U'. Explain on the basis of Bohr-wheeler theory.

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

a) Draw a schematic diagram of a nuclear reactor. Explain briefly the functions of various parts in it.

b) Define multiplication factor. What is the condition for controlled chain reaction? How is it achieved in a reactor?

c) Derive expressions for the K.E. transferred to target by the projectile in a nuclear reaction and threshold energy.

d) Discuss the experimental evidence for Bohr's theory of compound nucleus.

e) Give an account of photonuclear reaction.

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

a) Find out geometric capture cross-section for ^{127}I and ^{23}Na. (Given : $r_o = 1.4 \times 10^{-15}$ m).

b) Derive the expression for atomic number of primary fission fragment and hence find out the primary fission fragment in the fission of $^{239}_{94}Pu$ if the stable end products observed are $^{100}_{42}Mo$ and $^{138}_{56}Ba$.

c) ^{7}Li target is bombarded by protons of energy 7 MeV. Calculate the energy of protons scattered through an angle of 90°.

SECTION - II

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

a) Explain the terms hot atom and recoil energy. Discuss the principle and applications of Szilard-chalmer reactions.

b) Enlist primary and secondary products of radiolysis of water. Discuss the physical and chemical properties of hydrated electron.

c) State the properties of semiconductors. What is the effect of dopant on their properties? Explain in brief advantages and limitations of semiconductor detectors over scintillation counters.

d) Write the various stages of interactions of radiations with biological cells.

e) Give an account of long term effects of nuclear radiations on human being.

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

a) Discuss the genetic effects of radiation.

b) Discuss the mechanism of radiolysis of air saturated ferrous sulphate solution. Enlist the factors affecting $G(Fe^{3+})$ in it.

c) Enlist various man made and natural sources of radiations.

d) Define MPD. Write down MPD values for various organs.

e) Explain the terms : G value, radiation annealing and scavanging.

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

a) Find out the dose due to 400 mCi of Fe - 59 at a distance of 2 m. Given : E_r = 1099 and 1292 keV.

b) Find out the dose absorbed by NaI in 7 h in terms of rad.

Given : (Z/A) of Fricke solution = 0.553 and dose absorbed by Fricke solution at the same position is 6.2 Gy/min., Z of Na = 11, I = 53

A of Na= 23, I = 127.

c) Calculate the thickness of lead required to reduce the level of radiation from 390 Gy/min to 40 Gy/min. (Given : $\mu_{pb} = 0.57\ cm^{-1}$).

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

P901

[3723] - 33

M.Sc.

PHYSICAL CHEMISTRY

CH - 312 : Electrochemistry and Physico-Chemical Methods of Analysis (Old)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Describe Eley and Evans thought experiment in the determination of heat of solvation.

b) Write the Debye-Huckel equation for mean activity coefficient of ion for appreciable concentration explaining the terms involved in it.

c) Derive the equation for charge density ρ_r in the Debye-Huckel model of ion-ion interaction.

d) What is exchange current density? How is the concept understood using Butler-Volmer equation?

e) Derive the Einstein relation between the absolute ionic mobility and diffusion coefficient.

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

a) Discuss the electrical double layer theory using Goy-chapman model.

b) What are storage cells? Describe the construction and working of any one storage cell.

c) Explain the Wagner-Traud mechanism for corrosion of ultrapure metal.

d) With suitable example distinguish between true electrolyte and potential electrolyte.

e) Discuss with suitable example the different ways of preventing corrosion.

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

a) Transfer coefficient of an electrode in contact with M^{3+} and M^{4+} in aqueous solution at 25ºC is 0.41. Current density in 50 mA cm^{-2} when overvoltage is 125mV. What is overvoltage required for current density 70 mA cm^{-2}? What is the exchange current density in the first case?

b) Calculate the diffusion coefficient of a monovalent ion in water at 25ºC, given that its mobility is 5×10^{-4} $cm^2v^{-1}s^{-1}$.

c) Calculate the mean activity coefficient of KCl in water of ionic strength 0.05 at 25ºC. The constants A and B for water are 0.509 and 3.29×10^{-7} respectively, the ion size parameter a is 3Å.

SECTION - II

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

a) Explain the principle of NAA and describe the terms involved in the activation equation.

b) Draw and explain with suitable example radiometric titration curve where in both titrant and titrand are labelled.

c) Enlist the thermal methods of analysis with property measured and apparatus used.

d) Explain the terms :- target, matrix, geometric cross section, excitation function and saturation activity.

e) Using energy level diagram of sample solid and spectrometer explain the principle of ESCA.

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

a) Draw a schematic diagram of mass spectrometer and explain the inlet system.

b) Explain the principle of PIXE and discuss the ionization and x-ray emission processes.

c) Discuss the principle of magnetic analyzer. Obtain the relationship between M/Z and magnetic field applied.

d) Discuss the applications of PIXE.

e) Describe the apparatus used for DSC.

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

a) The work function of spectrometer is 50 eV. The binding energy of the emitted electron is 1070 eV. If the kinetic energy of electron in 177 eV find the wavelength of incident x-ray.

b) 0.25 gm sample containing 10% tin was irradiated in a neutron flux of 1.8×10^{8}n $cm^{-2}s^{-1}$ for 2 hrs. What will be the activity of the sample in dpm?

Given $\gamma = 5.6\%$; $\sigma = 0.13$ barn

$t_{1/2}$ of $^{125}In = 9.5min$

c) 130 mg sample containing mixture of NaCl and calcium oxalate monohydrate showed a loss of 7.24 mg at 40ºC in TGA. Determine the percentage of Ca in the sample

At weights Ca – 40 , O – 16. Cl – 3s

H – 1 Na – 23 C – 12

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

P902

[3723] - 34

M.Sc.

PHYSICAL CHEMISTRY

CH - 314 : Polymer Chemistry - I (Old)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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4.	Electronic Charge	e	=	4.803×10^{-10} esu
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5.	1 eV		=	23.06 k cal mol^{-1}
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			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} ergK^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
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7.	Faraday Constant	F	=	96487 C equiv^{-1}
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9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) Explain quantitatively how molecular weight of a polymer can be controlled by keeping the concentration of one of the reactant slightly away from the stoichiometric balance.

b) Distinguish between thermoplastic and thermo setting polymer. Cellulose is a linear polymer and not thermo setting. Explain.

c) Explain how stereoregular polymers are obtained in condensation polymerization using ziegler-nutta catalyst.

d) Explain with suitable examples how polymers can be classified on the basis of i) applications and ii) method of preparation.

e) 'Chemical reactivity is independent of molecular size'. Explain.

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

a) What is bulk polymerization? Describe quiescent bulk polymerization with the help of temperature time profile.

b) Discuss how polymerization of certain monomers shows marked deviation from first order kinetics. How is it explained?

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

d) Discuss with a suitable example, the mechanism of anionic chain polymerization.

e) Derive the copolymer equation.

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

a) 138.5 g of p-chlorostyrene (r_1 = 0.45) is copolymerized with 33.5 g methyl acrylonitrile (r_2 = 0.73). Find the instantaneous composition of the copolymer.

[Atomic masses, H = 1, C = 12, 0 = 16, Cl = 35.5, N = 14]

b) A condensation polymerization reaction is 99% complete. Find $\bar{x}_n$, $\bar{x}_w$, PI and weight fraction of $\bar{x}_n$ -mers.

c) Show by chemical equations the four steps in anionic polymerization of acrylonitrile using kNHz as catalyst.

SECTION - II

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

a) Define entropy of polymerization. Why is the entropy negative?

b) Describe the initiation step in free radical chain polymerization. What is the evidence for the mechanism? What is cage effect?

c) Write kinetic equation for i) the overall rate of polymerization and ii) degree of polymerization (DP) for free radical polymerization. Show how the rate and DP are related to concentration of monomer, concentration of initiator and concentration of radicals.

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

e) What are the different ways of expressing average molecular weight of a polymer? Explain the term polydispersity index. What are the factors affecting it?

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

a) Discuss the instrument used for membrane osmometry.

b) Discuss the significance of molecular weight of polymer sample.

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

d) Describe GPC technique. How is it different from other chromatographic techniques?

e) Describe the viscosity method of determination of molecular weight of a polymer. What precautions should be taken?

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

a) Calculate $\overline{M}n$, $\overline{M}w$ and PI from the data given.

Fraction	0.05	0.2	0.40	0.20	0.15
Molecular weight	65,000	80,000	90,000	1,00,000	1,20,000

b) Calculate the molecular weight of the polymer from the following sedimentation equilibrium data rotar speed - 15000 rpm, temperature = 12.4 ºC,

buoyancy factor $(1-\overline{V}\rho)=0.277$, concentration at equilibrium = 3.52u at x = 6.827 cm and 13.52 u at x = 7.093 cm.

c) Calculate the molecular weight of a polymer in benzene (ρ = 0.8682) at 30ºC from the data

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

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

P903

[3723] - 36

M.Sc.

PHYSICAL CHEMISTRY

CH - 316 : Environmental Chemistry (Old)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) Describe the hydrologic cycle with the help of labelled diagram.

b) Explain troposphere and stratosphere zones of the atmosphere with neat diagram.

c) What are primary pollutants? Discuss oxides of sulphur on the basis of reactions.

d) Define the terms :

i) BOD ii) COD iii) TLV
iv) receptor and v) aerosol

e) What are the reactions of CO and CO_2 in the atmosphere?

f) Write a note on air pollution due to hydrocarbons.

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

a) Explain the role of surfactants in pollution problem.

b) Give the comparison between pollution due to air and water.

c) Write informative note on sewage and water pollution.

d) Give an account of organic particulate matter. How they get adsorbed on sort particles along with toxic metals?

e) What are the hazardous effects of SO_x on human health and environment and how can these be controlled?

f) Explain the nature and composition of ground water and surface water.

SECTION - II

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

a) Describe the composition of soil.

b) What is noise? Describe the sources of noise pollution.

c) Discuss briefly different factors promoting polymer decay.

d) Explain the effect of radioactive pollutants present in the soil.

e) Discuss the diagnostic tests and treatment of lead poisoning.

f) What is weathering? Enlist the different weathering trials conducted on polymers.

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

a) Explain the following :

i) Environmental noise

ii) Thermal noise

iii) Shot noise.

iv) Partition noise and

v) Flicker noise.

b) Describe the diagnosis and remedial measures for mercury poisoning.

c) What are the sources of cadmium pollution? Explain the effects of cadmium poisoning.

d) What is the source of chemical toxicology? Enlist the toxic gases with their recommended limits.

e) Write a note on carcinogenic compounds.

f) Give an account of biotic damage due to thermal pollution.

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

P904

[3723] - 37

M.Sc. - II

INORGANIC CHEMISTRY

CH - 326 : Organometallic Compounds in Synthesis and Homogeneous Catalysis

(Revised Course)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Neat diagram must be drawn wherever necessary.***
3) ***Figures to the right indicate full marks.***
4) ***At No. : Co = 27, Ni = 28.***

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

"Many homogeneous catalysis reaction involved metal-alkene compounds as intermediates" give example of these. Explain any one of the catalytic cycle in detail.

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

i) Give the preparation and electrophilic substitution reaction of ferrocene.

ii) How will you convert carbonmonoxide into carbene and acyl ligands.

iii) Explain the effect of the following factors on oxidative addition reaction.

1) Nature of ancillary ligand.

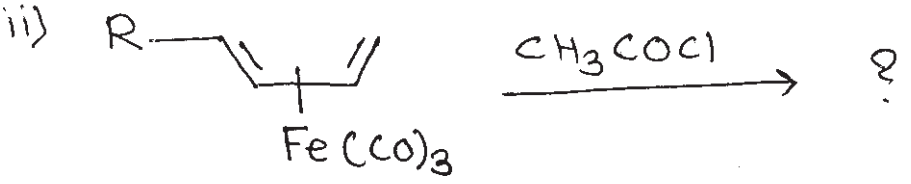
2) Nature of metal.

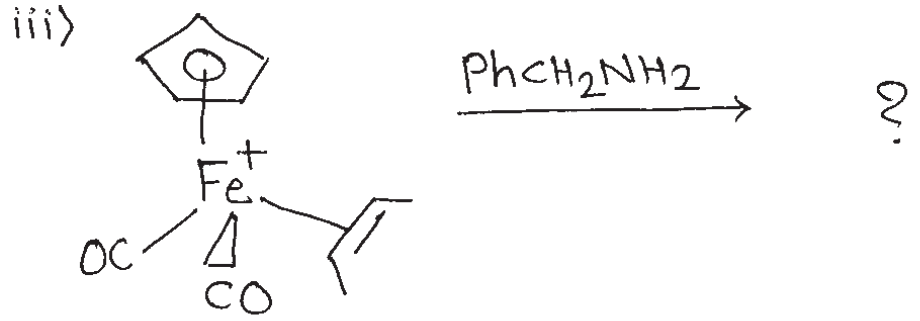
3) Oxidation state of metal.

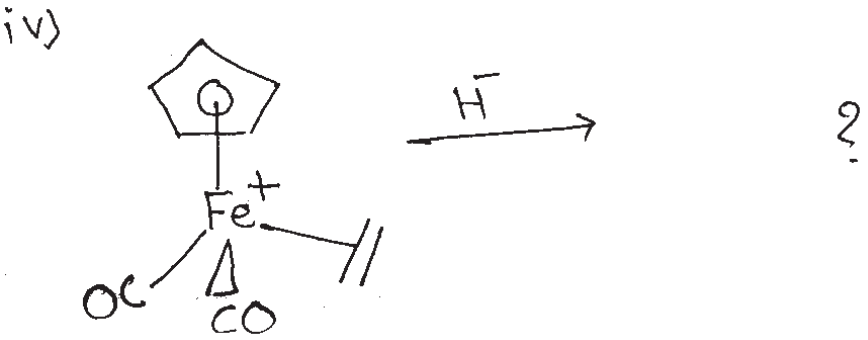
P.T.O.

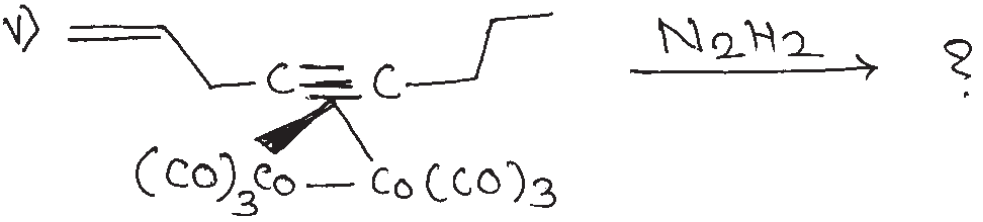
Q2) a) Predict the products and state type of reaction - any four : **[8]**

i) $[Cp(CO)_3Re] + Br_2 \longrightarrow$?

ii) 

iii) 

iv) 

v) 

b) Attempt any two of the following : **[12]**

i) What do you understand by haptacity? What haptacities are possible for the following ligands?

C_2H_4; cyclopentadienyl; C_6H_6; cyclooctatetraene.

ii) Draw structure and give $\bar{e}$ count of the following.

1) $(\eta^3 - C_3H_5)_2$ Ni

2) $(\eta^4 - C_4H_4)$ $(\eta^5 - C_5H_5)$ Co

3) $(\eta^3 - C_3H_5)$ Co $(CO)_3$.

iii) Name the model used for explaining the bonding in the metal-alkene complexes. Explain the model in detail.

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

a) The V – C bondlength in $[V(CO)_6]^-$ and $[V(CO)_6]$ are 193 pm. and 200pm. Explain.

b) ^1H nmr of a compound with formula $[(\eta^5- Cp)_2 Fe(CO)_2]_2$ shows a single peak at +28ºC, while the same compound show two distinct peaks at –70ºC. Explain and draw the structure of the compound.

c) Comment on the following IR data of transition metal-alkene complexes. (Free C_2H_4 1623 cm^{-1}).

	Complex	ν (C = C), cm^{-1}
1.	$PdCl_2(C_2H_4)_2$	1527
2.	$PtCl_2(C_2H_4)_2$	1516
3.	$K[PdCl_3(C_2H_4)]$	1525
4.	$K[PtCl_3(C_2H_4)]$	1516
5.	$Ag(C_2H_4)$	1550

d) Give an account of the typical reactions of $TiCpCl_2$.

e) Enumerate the different synthetic routes for metalnitrosyl compounds and explain the different bonding modes exhibited by the nitrosyl ligand.

Q4) a) Name the catalyst used for hydroformylation of alkenes. Explain the catalytic cycles involved using these catalysis. **[10]**

OR

Explain Wacker process and the importance of $CuCl_2$ in the process.

b) Write notes on- any two : **[10]**

i) Organometallic compounds in medicine.

ii) Sandwich compounds.

iii) Tertiary phosphine compounds of transition metals.

✪✡✪✡

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

P905

[3723]- 38
M.Sc. - II
INORGANIC CHEMISTRY
CH - 330 : Coordination Compounds & Structural Methods

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

Instructions to the candidates:

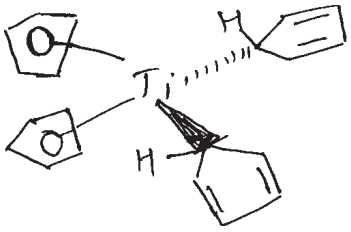
1) ***All questions are compulsory and carry equal marks.***
2) ***Neat diagrams must be drawn wherever necessary.***
3) ***Use of logarithmic tables and calculator is allowed.***
4) ***Atomic number Co = 27, Ni = 28.***

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

a) Give nomenclature for following compounds.

i) $[(NC)_5\ Co - C \equiv N - Fe\ (CN)_5]^{6-}$

ii)



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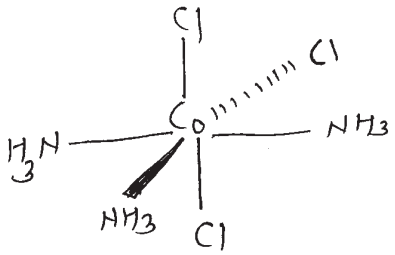

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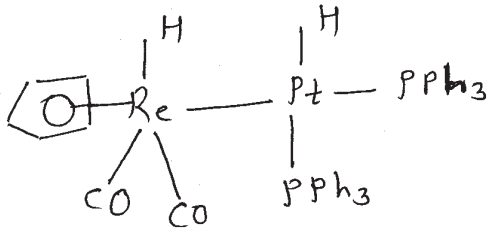

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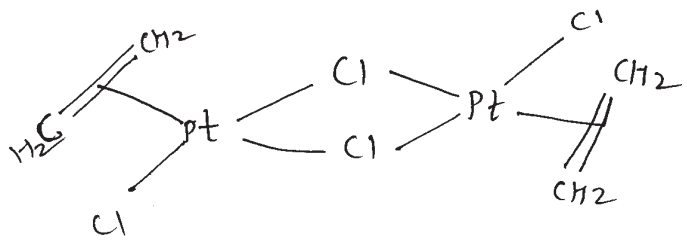


P.T.O.

b) Draw the structures of following compounds.

i) Acetyl - η^6 - benzene carbonyl iodo iron (II).

ii) Quadro Bis (dimethylglyoximato) nickel (II).

iii) Bis [μ - carbonyl carbonyl - η^5 - cyclopen - ta - dienyl iron (I)].

iv) mer - trihydrido tris (triphenyl phosphine) iridium (III).

v) bis (acetylacetone) ethylene diamino - copper (II).

c) Give selection rules in d - d transitions.

d) Explain any two factors that affect CFSE.

e) Explain the nature of bonding in $[Re_2\ Cl_8]^{2-}$ ion.

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

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

i) $[Co\ (H_2O)_6]^{2+}$ μ B.M. = 4.85

ii) $[NiCl_4]^{2-}$ μ B.M. = 3.8

b) In which of the following low spin octahedral complexes would you expect orbital contributions?

d^4, d^5, d^6, d^7, d^8.

c) What are mixed valence compounds? Explain with the help of

i) Photo chemical and thermal electron transfer.

ii) Their electronic spectra.

d) For Cu (II) complex μ = 1.813 B.M. at room temperature. Predict the type of magnetic exchange likely to be present in this complex.

e) Write a note on "magnetically dilute and magnetically concentrated systems".

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

a) Explain the principle of esr technique. Using selection rules show the possible transitions for benzene radical with intensity ratio in detailed.

b) What is chemical shift in nmr technique? Discuss the factors that affect the chemical shift of a proton.

c) Indicate the number of resonance lines expected for the following nuclei

i) ^{127}I (I = 5/2), η = 0 Ho = 0

ii) ^{14}N (I = 1), η = 1 Ho $\neq$ 0

d) Explain the mössbauer spectra of spin paired and spin free complexes of 'Fe'.

e) Explain the CV parameters with the help of cyclicvoltammogram of 6mM $K_3Fe(CN)_6$ in 1M KNO_3.

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

a) Draw the $^{31}P_{nmr}$ spectrum and stick interpretation expected for HPF_2 with conditions

i) If J P-F > J P-H

ii) If J P-H > J P-F.

b) Discuss the application of mössbauer spectra with respect to structural determination.

c) With the help of CV technique give the criterion for reversible and irreversible electron transfer reactions.

d) How the structural information is obtained from esr spectrum for $[(NH_3)_5 - Co - O - O - Co(NH_3)_5]^{5+}$.

e) Which type of nuclei give rise to nqr? Write about 'asymmetric parameter'.

☒☒☒☒

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

P906

[3723] - 39

M.Sc. - II

INORGANIC CHEMISTRY

CH - 331 : Inorganic Reaction Mechanism (Revised Course)

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

Instructions to the candidates:

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

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

a) Explain the role of inorganic bridging ligands in inner sphere mechanism.

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

c) Give a brief account of 'anation reactions.

d) What is trans effect? How will you explain it on the basis of π-bonding theory?

e) Derive the rate laws for nucleophilic substitution reaction of $[Co\ A_5\ X]^{+2} + Y^- \rightarrow [Co\ A_5\ Y]^{+2} + X^-$, by using dissociative and associative mechanism. Distinguish between these two mechanisms.

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

a) Give a brief account of reactions in a solid state.

b) Explain the mechanism of oxidative addition with the help of a suitable example.

c) Explain the meaning of the following terms with suitable examples.

i) Inert and labile complexes.

ii) Outer-sphere mechanism.

d) Explain in a brief about the two electron transfer reaction.

e) "The replacement of water from an aquo complex is the opposite of acid hydrolysis". Explain.

P.T.O.

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

a) Give a brief account of photochemical reactions.

b) Write a note on Isomerisation reactions.

c) Explain the use of radioisotopes for study of reaction mechanism.

d) Explain the mechanism of insertion reaction with suitable examples.

e) i) The hydroxide ion is a stronger base than ammonia and yet it reacts more slowly with a square planar complex. Explain.

ii) Arrange the following in order of increasing rate of water exchange.

1) $[V\ (H_2O)_6]^{+2}$ 2) $[Cr\ (H_2O)_6]^{+3}$

3) $[Mg\ (H_2O)_6]^{+2}$ 4) $[Al\ (H_2O)_6]^{+3}$

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

a) Template reactions.

b) Acid hydrolysis.

c) Reductive elimination reactions.

d) Reactions of coordinated lizands.

e) Polarisation theory.

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

P907

[3723] - 40

M.Sc. - II

INORGANIC CHEMISTRY

CH - 332 : Metalloproteins and Bioinorganic Medicine

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

Instructions to the candidates:

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

Q1) Answer the following any four :

a) Discuss the characteristics of biochemistry of copper.

b) Which are the important reactions catalysed by methyl cobalamine.

c) Give an account of the biologically important oxidation states of Manganese with reference to thermodynamics and kinetics of the reactions of Manganese in different oxidation states.

d) "New nuclear instrumentation and new radio nuclides lead to progress of nuclear medicines". Justify.

e) Explain in brief about metalclusters in nitrogenases.

Q2) Attempt any four of the following :

a) Explain the role of vanadium in the biological system.

b) Explain the role of metal complexes as "Conformational Probes".

c) Explain the consequences of pt-DNA binding.

d) Explain the functions of copper containing oxidases.

e) "Distribution of radionuclides in the atmosphere depends upon the site of nuclear explosion". Explain.

Q3) Attempt any four of the following :

a) Discuss the bonding interaction of tris (phenan throline) metal complexes with DNA.

b) Explain how Bone-density measurements are used in diagnostic radio pharmaceuticals.

P.T.O.

c) Discuss the biological importance of the following metals.

i) Iron ii) Copper

iii) Manganese iv) Nickel

d) Draw the structures of :

i) Iron porphyrine.

ii) F-430.

iii) Carbo-platin.

iv) Molybdopterin cofactor.

v) Bleomycin.

e) Give the names of enzymes containing the following metals (two each) :

i) Molybdenum

ii) Copper

iii) Iron

iv) Nickel

v) Tungsten

Q4) Write short notes on (any four) :

a) Iron Buffering.

b) Metallo regulatory proteins.

c) Super oxide Dismutases.

d) Fenton reaction & DNA cleavage.

e) Redox active DNA cleaving complexes.

✪✡✪✡

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

P908

[3723] - 42

M.Sc.

ORGANIC CHEMISTRY

CH - 350 : Organic Reaction Mechanism

(Old Course 2005 Pattern)

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

Instructions to the candidates:

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

SECTION - I

Q1) Write short notes on any three : **[12]**

a) Claisen condensation.

b) Trapping of intermediates.

c) Base catalyzed halogenation of ketones.

d) Role of lysase enzyme in conversion of phenylalanine into cinnamic acid.

Q2) Answer any three : **[12]**

a) What is Taft equation? Explain how the Taft substituent constant σ^* values determined?

b) Calculate how much faster p-bromo benzyl chloride will solvolyse in water than p-nitrobenzyl chloride.

Given $\rho = -1.31$, $\sigma_{p\text{-}Br} = 0.23$, $\sigma_{p\text{-}No_2} = 0.78$

c) Account for the σ values of the following substituents.

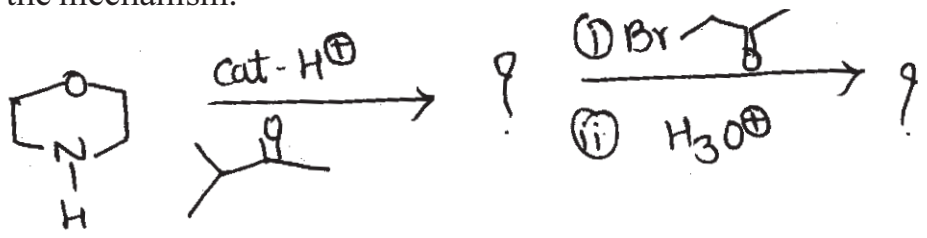
Substituent	σ_{m-}	σ_{p-}
–OH	0.12	–0.37
$-OCH_3$	0.12	–0.27
$-OCF_3$	0.37	0.35
$-SCF_3$	0.37	0.42

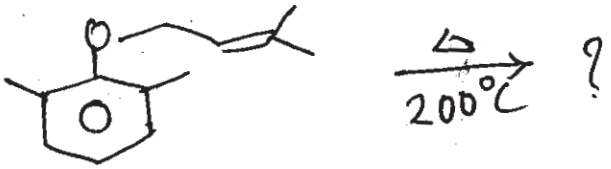
d) Explain the significance of ϱ in Hammett equation.

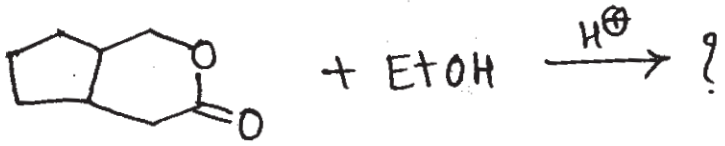
P.T.O.

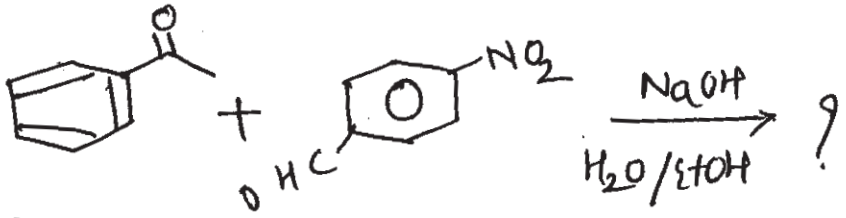
Q3) Predict the products (any 4) **[16]**

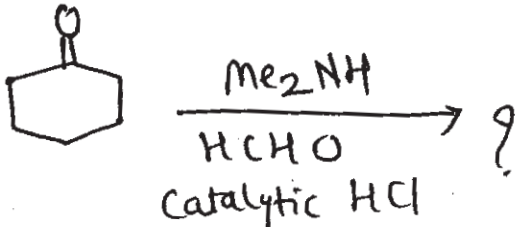
Suggest the mechanism.

a) 

b) 

c) 

d) 

e) 

SECTION - II

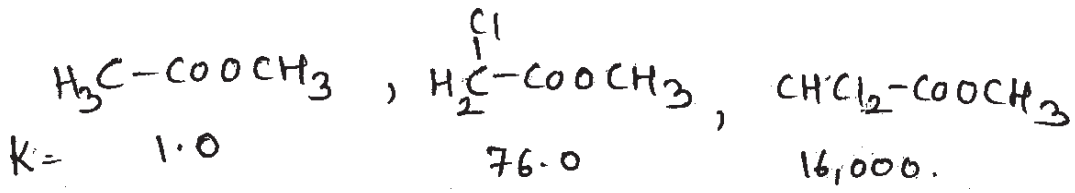
Q4) Answer the following (Any three) : **[12]**

a) Explain AAC2 mechanism.

b) 1,2 cyclopentadione is almost 100% enolized but it is not so in case of 1,2-cyclohexadione.

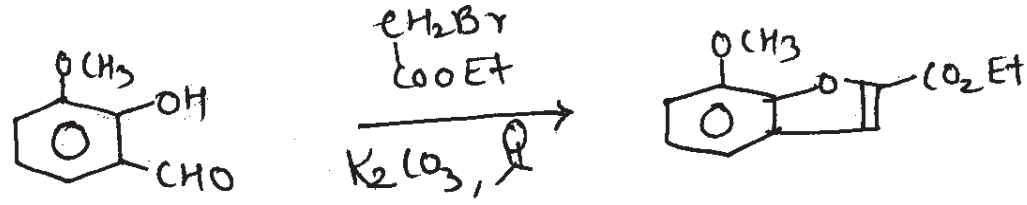
c) When propanoic acid is refluxed with H_2SO_4 in water enriched in $H_2{}^{18}O$, ^{18}O gradually appears in carboxylic acid group.

d) Explain the relative rates of saponification given below.



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

a)



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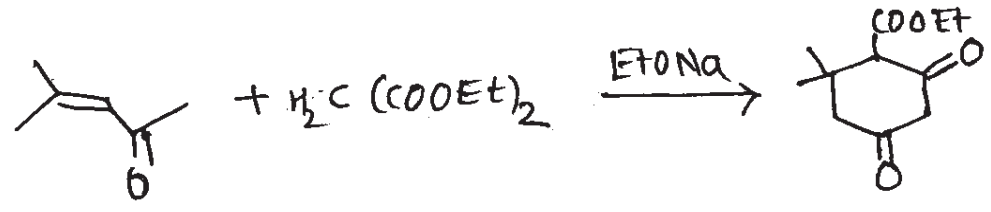

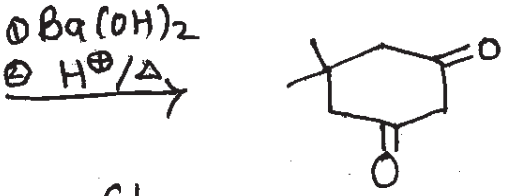

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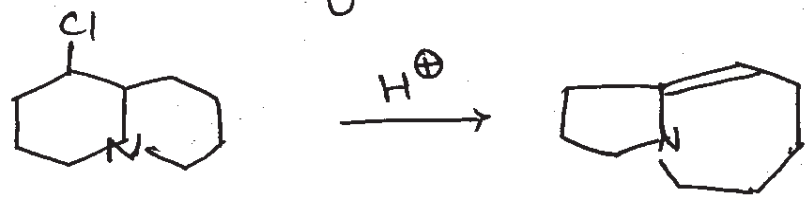

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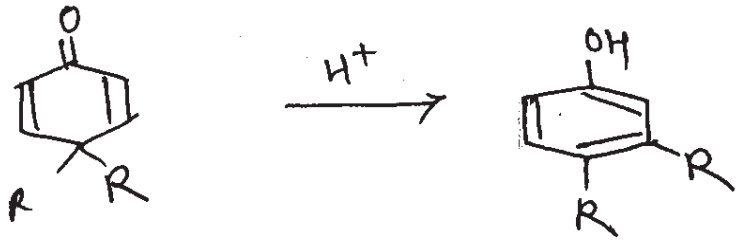

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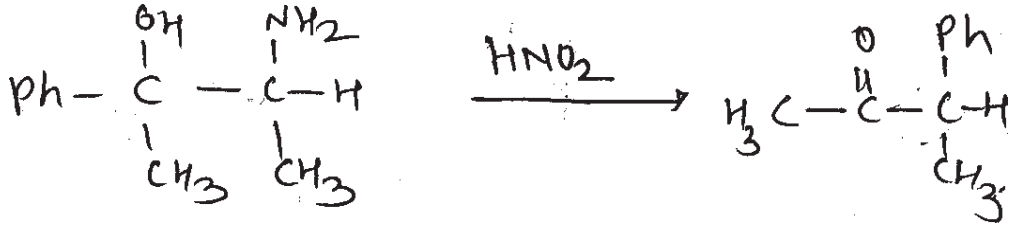


Q6) Answer <u>any three</u> of the following : **[12]**

a) Predict which member will enolize more extensively. Justify your answer.

i) Cyclopentanone or diethyl ketone.

ii) 1,3-cyclohexanedione and 1,2-cyclohexanedione.

b) Explain essential factors for the stabilization of carbanions.

c) Michael reaction fails with α-phenyl cinnamic ester.

d) Explain acid catalyzed halogenation of ketones.

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

P909

[3723] - 43

M.Sc.

ORGANIC CHEMISTRY

CH - 351 : Spectroscopic Methods in Structure Determination (2005 Pattern)

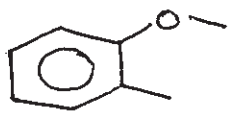
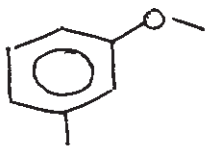
Time : 3 Hours] ***[Max. Marks :80***

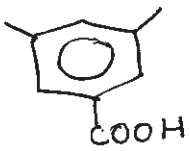
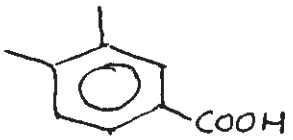
Instructions to the candidates:

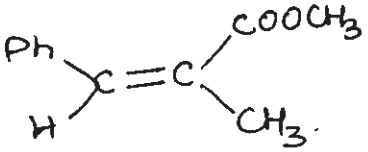
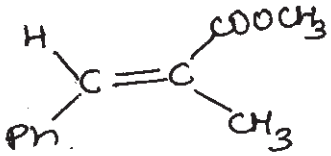
1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***

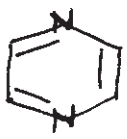
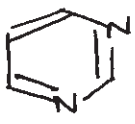
SECTION - I

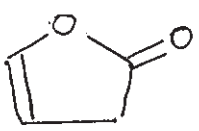
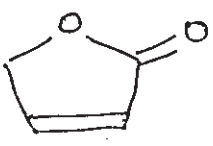
Q1) a) Distinguish between the following pairs by using the indicated spectral methods (any four) : **[8]**

i)  and  mass

ii)  and  pmr

iii)  and  pmr

iv)  and  cmr

v)  and  cmr

P.T.O.

b) Explain <u>any four</u> of the following : **[8]**

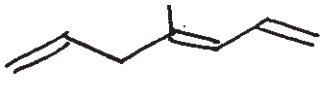
i) CH_2 DBr shows a triplet with 1:1:1 intensity ratio in PMR.

ii) The para and ortho isomers of amino benzoic acids may be identified by mass spectroscopy.

iii) Quaternary carbons in ^{13}C NMR shows weak intensity signals.

iv) Methyl proton in compound 1 and 2 resonates at 2.34 δ and 1.95δ ppm respectively

(1)



(2)

v) How the four isomers of $C_3H_6Br_2$ can be differentiated using CMR spectroscopy?

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

a) Deduce the structure using following CMR data

M.F. : $C_7H_{16}O_2$

CMR : 7.1 (q)*, 22.9 (t)*, 41.0 (s, weak), 67.6(t)*

*equally strong

b) Predict the structure

M.F. : $C_7H_{10}O_2$

PMR : 1.41 (d, J = 7Hz, 3H); 2.4 (t, J = 7Hz, 2H); 4.52 (sextet, J = 7Hz, 1H); 5.89 (tq, J = 2 and 7Hz, 1H) 2.1 (d, J = 2Hz, 3H).

c) Predict the structure

M.F. : C_8H_9NO

CMR : 161 (d) 142 (s) 129 (d, str) 125 (d, str) 121 (d) 31 (q)

d) Deduce the structure

M.F. : C_7H_7N

PMR : 5.03 (dd, J = 1.5 & 8 Hz , 4 mm)

5.90 (dd, J = 1.5 & 13 Hz , 4 mm)

6.62 (dd, J = 8 & 13 Hz , 4 mm)

7.22 (bd, J = 5.5 Hz , 16 mm)

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

a) Spin decoupling.

b) McLafferty rearrangement.

c) Chemical Ionization technique in mass spectrometry.

d) Allylic and Homoallylic coupling.

e) 2D COSY.

SECTION - II

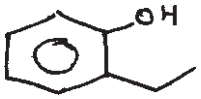
Q4) a) Explain the genesis of the ions (any four) : **[8]**

i) Methyl-5-dimethyl aminopentanoate

159, 128, 74, 59, 58

ii) 3-Methyl-4-phenyl-2-butanone

162, 147, 91, 43

iii) 

122, 107 (100%), 121 (3.5%), 104 (2%), 77

iv) Octan-4-one 128, 85, 71, 57, 43

v) Ph-NHCOCH$_2$ CO CH$_3$ 177, 119, 93, 92, 43

b) The isomeric methyl pent-1-enes A, B, C have mass spectral data as detailed below. Identify A, B, C. Justify your answers. m/e (%) are shown against each isomer. **[4]**

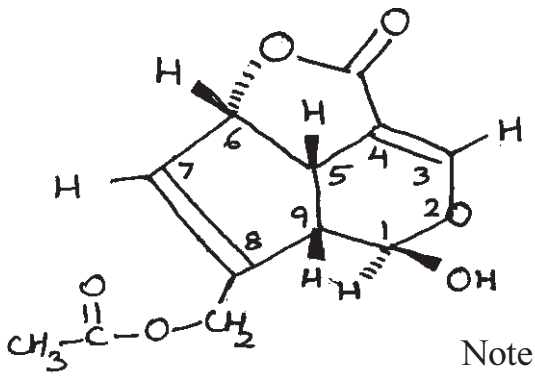
A : 84 (30), 69 (71), 56 (13), 55 (100), 42 (21), 41 (79), 29 (40), 27 (48)

B : 84 (31), 69 (36), 57 (44), 56 (100), 55 (43), 42 (29), 41 (80), 29 (28), 27 (35)

C : 84 (11), 57 (20), 56 (44), 43 (100), 42 (33), 41 (72), 27 (33)

Q5) a) Assign the given 'H NMR signals to various protons in the given compound A and comment on the double resonance experiments given below : **[8]**

'H NMR : δ 7.38 (d, J = 2Hz, 1H)
5.82 (d, J = 1.5Hz, 1H)
5.70 (s, 1H)
5.54 (d, J = 8Hz, 1H)
4.65 (AB quartet, J = 14Hz, 2H)
3.55 (dt, J = 8 & 2Hz, 1H)
3.22 (dd, J = 8 & 1.5Hz, 1H)
2.04 (s, 3H)



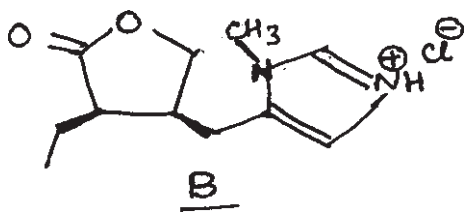
A

Note : 1) –OH not shown
2) Dihedral angle between H-7 and H-6 is 90°

In spin decoupling Experiments :

	Irradiation at	Change at
i)	3.55 δ	1) 5.54 (d) → (s) 2) 7.38 (d) → (s) 3) 3.22 (dd) → (d, J = 1.5 Hz)
ii)	3.22 δ	1) 5.82 (d) → (s) 2) 3.55 (dt) → dd (J = 8 & 2Hz)

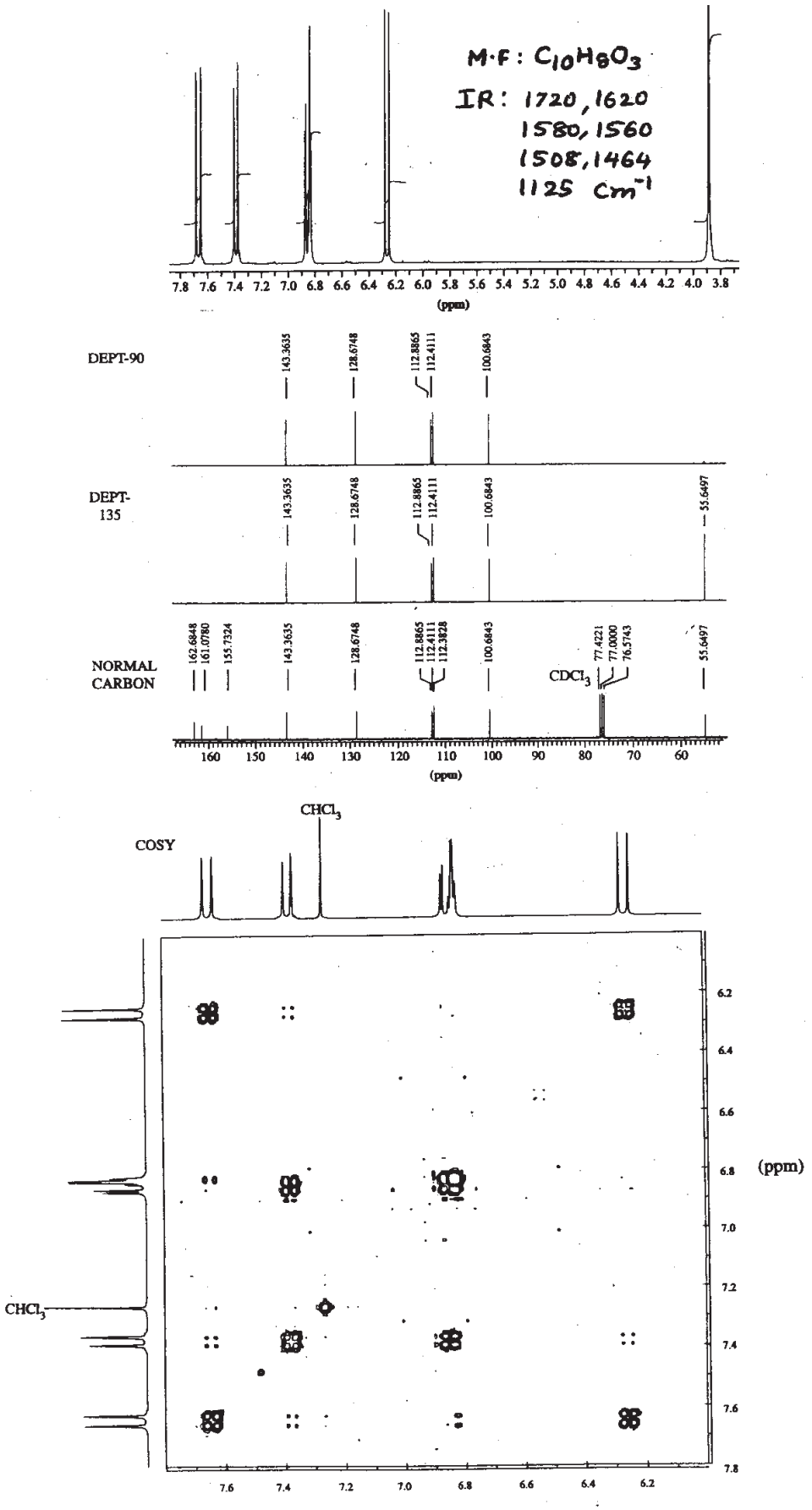
b) Assign the signals to the different carbons of compound B. Explain your answer. **[8]**



B

CMR : 12.2 (q) 18.6 (t) 21.5 (t)
34.1 (q) 36.8 (d) 45.0 (d)
71.8 (t) 133.2 (s) 182.3 (s)
117.6 (d) 136.1 (d)

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


M·F: $C_{10}H_8O_3$
IR: 1720, 1620
1580, 1560
1508, 1464
1125 cm^{-1}
7.8 7.6 7.4 7.2 7.0 6.8 6.6 6.4 6.2 6.0 5.8 5.6 5.4 5.2 5.0 4.8 4.6 4.4 4.2 4.0 3.8
(ppm)
DEPT-90
143.3635
128.6748
112.8865
112.4111
100.6843
DEPT-135
143.3635
128.6748
112.8865
112.4111
100.6843
55.6497
NORMAL CARBON
162.6848
161.0780
155.7324
143.3635
128.6748
112.8865
112.4111
112.3828
100.6843
$CDCl_3$
77.4221
77.0000
76.5743
55.6497
160 150 140 130 120 110 100 90 80 70 60
(ppm)
COSY
$CHCl_3$
$CHCl_3$
6.2
6.4
6.6
6.8
7.0
7.2
7.4
7.6
7.8
(ppm)
7.6 7.4 7.2 7.0 6.8 6.6 6.4 6.2

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

P910

[3723]-44

M. Sc. - II

ORGANIC CHEMISTRY

CH-352 : Organic Stereochemistry

(2005 Pattern)

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

Instructions to the candidates :

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

SECTION - I

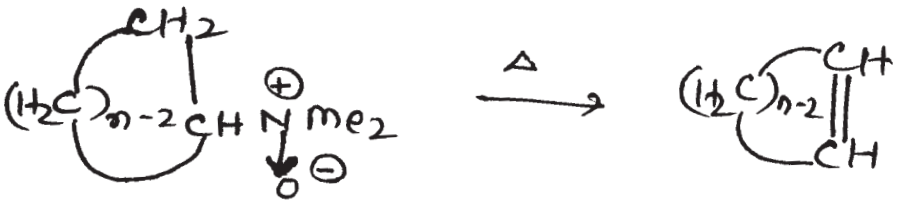
Q1) Answer any four of the following : **[16]**

a) Trans hydrindane is more stable than cis isomer below 466K while above 466K the cis isomer is predominant.

b) Draw structures for cis-anti-trans and cis-anti-cis isomer of perhydrophenanthrenes and compare their stabilities comment on their optical activity.

c) Discuss the stereoisomerism of cis and trans – 1-telt-butyl-2–methyl cyclohexane.

d) Explain the following observation.



n = 7 ..... only cis olefin.

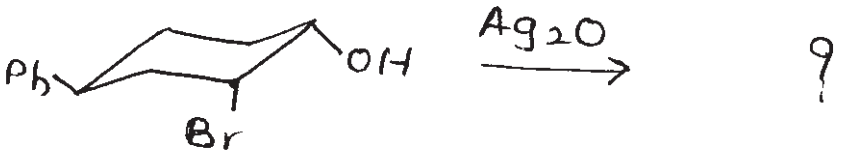
n = 8 ..... only cis olefin.

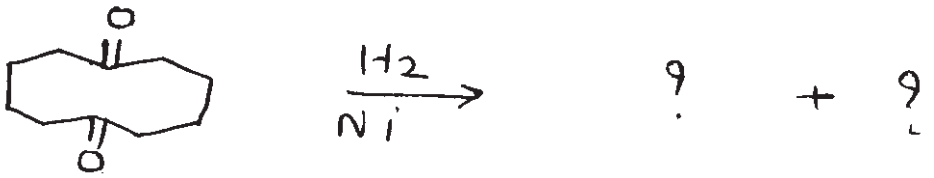
n = 9 ..... only trans olefin.

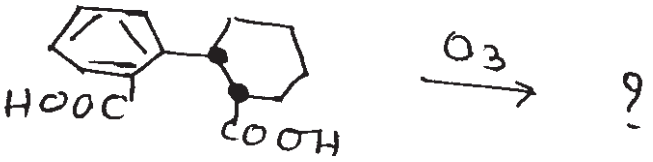
e) Trans– 4 – t –butyl cyclohexanol is more strongly adsorbed on alumina than cis isomer.

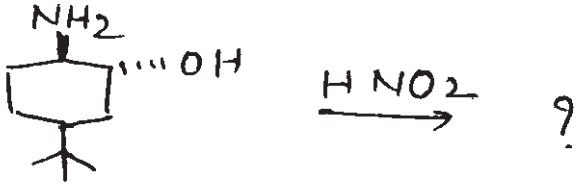
P.T.O.

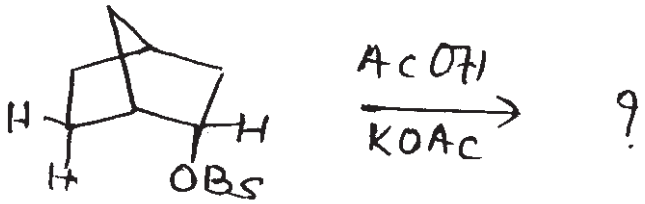
Q2) Predict the product/s in <u>any four</u> of the following and explain the stereochemical principles involved. Justify. **[12]**

a) 

b) 

c) 

d) 

e) 

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

a) Relative stabilities of <u>cis</u> and <u>trans</u> decalins.

b) pK_1 and pK_2 of cis and trans–1, 2–cyclohexane dicarboxylic acids.

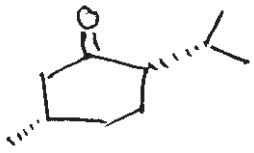
c) Bredt's rule.

d) Transannular strain.

SECTION - II

Q4) a) Using Octant rule predict the sign of cotton effect of <u>any two</u> of the followings : **[6]**

b) (–) Isomenthone (I) whose absolute configuration is shown below displays a strong negative cotton effect. Predict the sign of cotton effect for both the possible chair conformation of (I). **[6]**



(I)

Q5) Solve <u>any three</u> of the following : **[12]**

a) Give experimental evidances to establish relative configurations of C_5 and C_6 in Morphine.

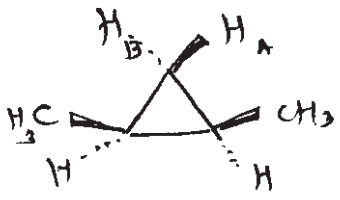
b) Explain the stereochemistry of C_6 & C_{13} is Dihydro isocodeine.

c) In cinchonine and quinine C_3 - Vinyl and C_8–C_9 100 nos are on the same size. Explain with evidance.

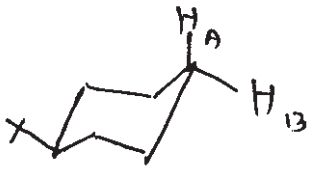
d) Prove that loctone is transfused to the 10-membered ring in enhydrin.

Q6) a) Attempt the following : **[6]**

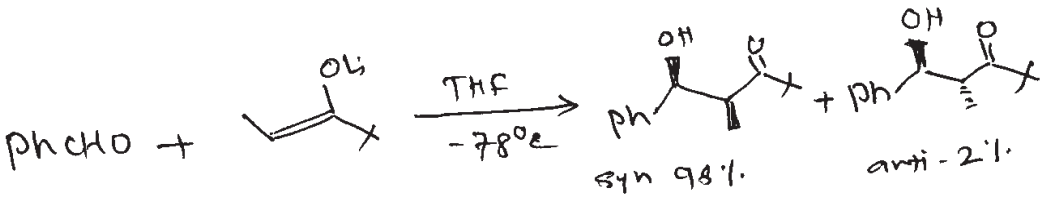
i) Write Pro-R and Pro-S for the following compounds.



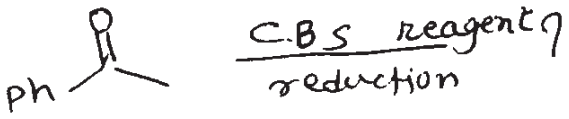
ii) Write Pro-cis and Pro-trans in the following compound.

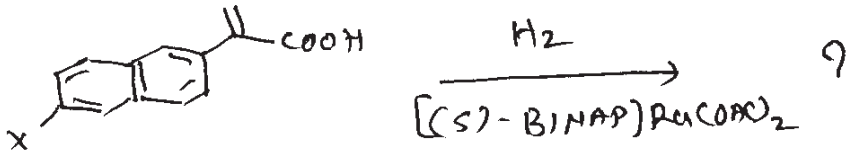


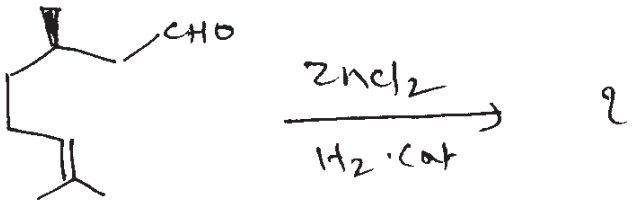
iii) Calculate diastereomeric excess in the following reaction.

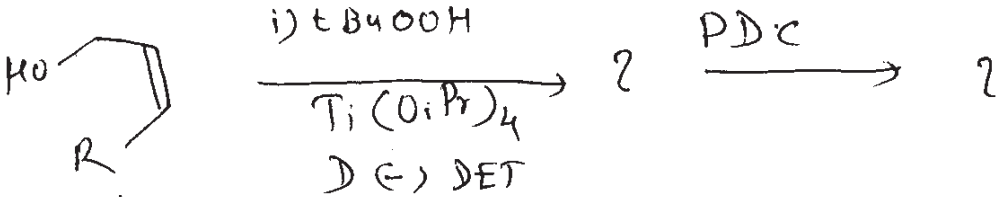


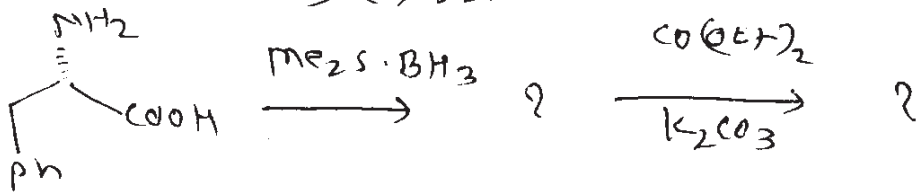
b) Predict the product/s. Write the correct stereochemistry and justify your answer for <u>any four</u> of the following. **[10]**

i) 

ii) 

iii) 

iv) 

v) 

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

P911

[3723] - 45

M.Sc. - II

ORGANIC CHEMISTRY

CH - 353 : Heterocyclic Chemistry, Photochemistry and Free Radicals (2005 Pattern)

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

Instructions to the candidates:

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

SECTION - I

Q1) a) Explain any three of the following : **[6]**

i) Imidazole and Pyrazole have boiling points 256ºC and 187ºC respectively at 760 mm.

ii) Furan undergoes cycloaddition reaction more easily than other five membered heterocycles.

iii) 2-Bromo pyridine undergoes substitution with sodium methoxide more easily than chlorobenzene.

iv) 3-Chloroquinoline is one of the products when indole reacts with chloroform, KOH and ethanol as a solvent.

b) Write notes on any two of the following : **[8]**

i) Use of amidine in imidazole synthesis.

ii) Tschitschibabin reaction.

iii) Synthesis of benzofuran from coumarin.

Q2) a) Give any one method each to synthesize following heterocycles (any two) : **[6]**

i) 8-Hydroxy quinoline.

ii) 2-Amino thiazole.

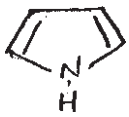
iii) 3-Hydroxy-benzothiophene.

P.T.O.

b) Predict the product when the given heterocycle (any one) reacts with the respective reagents. **[4]**

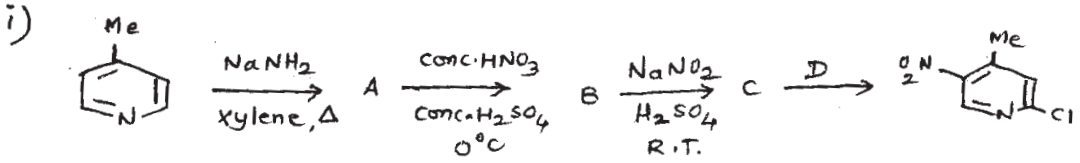
i) 

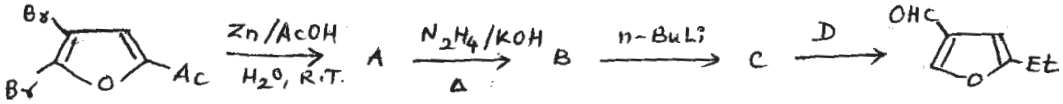
1) aq . N_2H_4, 130ºC
2) PhLi, Ether; $KMnO_4$, R.T.
3) $p-NO_2C_6H_4\overset{\oplus}{N}_2$, NaOAC, R.T.
4) H_2O_2, ACOH

ii) 

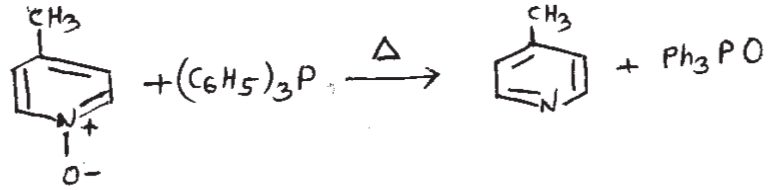
1) $CHCl_3$, NaOH, Δ
2) $N_2CH_2COOC_2H_5$, Cu, 100ºC
3) DMF, $POCl_3$; NaOAC, H_2O
4) SO_2Cl_2 (4 moles), ether, 0ºC

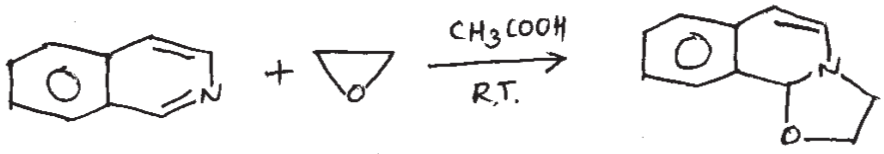
Q3) a) Complete the following reaction sequences by filling the blanks with suitable reagents and products, (any one). **[4]**

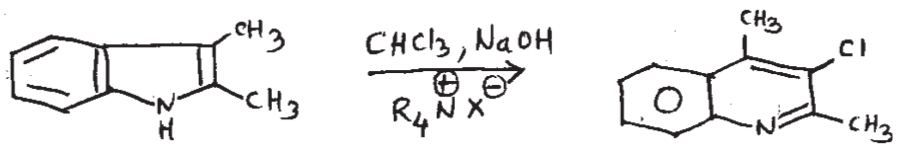
i) 

ii) 

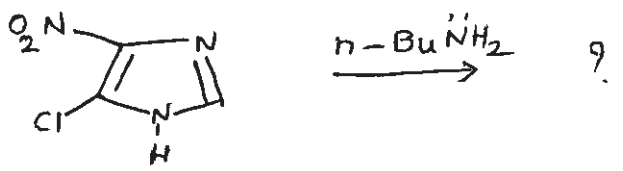
b) Suggest the mechanism for <u>any two</u> of the following : **[6]**

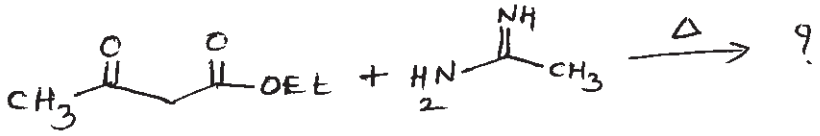
i) 

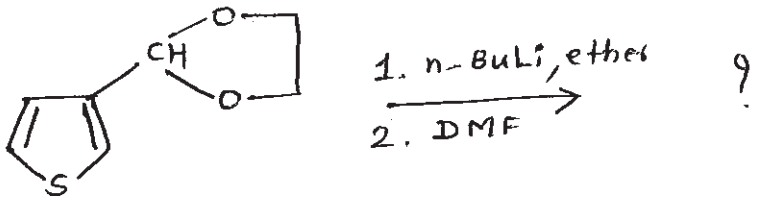
ii) 

iii) 

c) Predict the product in any two of the following : **[6]**

i) 

ii) 

iii) 

SECTION - II

Q4) Write short notes on any three of the following : **[12]**

a) Jablonski diagram.

b) Hunsdiecker reaction.

c) Paterno Buchi reaction.

d) Stable free radicals.

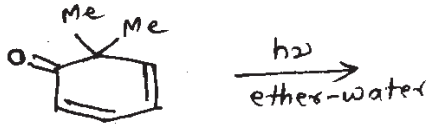
Q5) a) Explain any two of the following : **[6]**

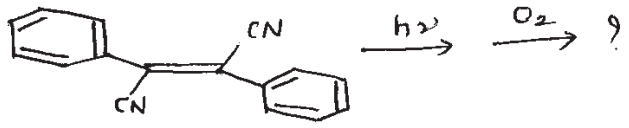
i) Ortho-Methyl benzophenone is not photoreduced efficiently by isopropanol while ortho-tert-butylbenzophenone undergoes efficient reaction under similar conditions.

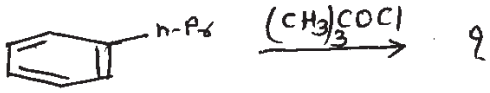
ii) When the erythro form of PhCHD-CHBrPh is treated with NBS, deuterium atoms are found to be removed from the substrate nearly twice as rapidly as are hydrogen atoms.

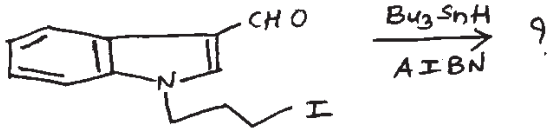
iii) Hexa-p-nitrophenylethane is dissociated to a large extent at 25°C in benzene as compared to hexaphenylethane.

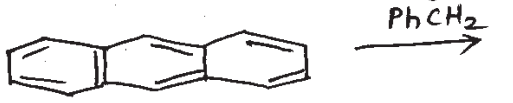
b) Predict the product/products indicating mechanism in any five of the following : **[10]**

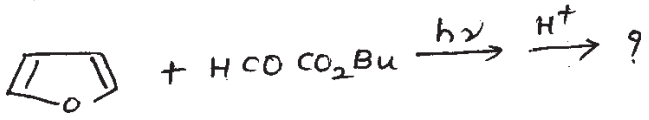
i) 

ii) 

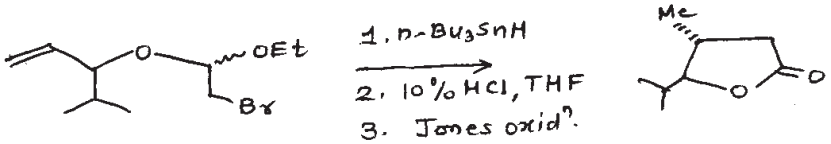
iii) 

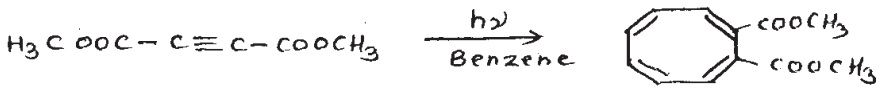
iv) 

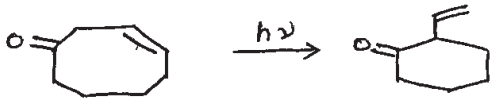
v) 

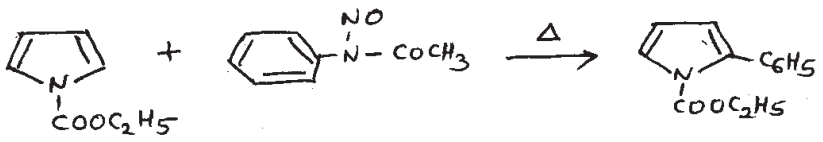
vi) 

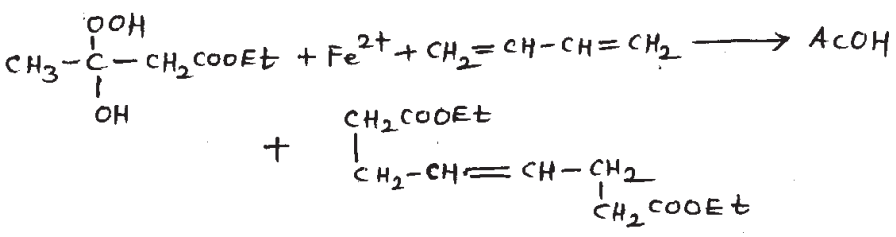
Q6) Suggest suitable mechaism for any four of the following : **[12]**

i) 

ii) 

iii) 

iv) 

v) 

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

P912

[3723] - 49

M.Sc.

BIOCHEMISTRY

BCH - 373 : Recent Trends in Biochemistry (Old)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures on the right hand side indicate full marks.***

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

a) Give the mechanism of bioluminescence in fire flies.

b) What is meant by chemical shift in NMR spectroscopy?

c) What is nuclear overhauser effect? Explain with suitable example.

d) Which transducer system are suitable for development of urea biosensor? Why?

e) Explain the theory of DRD and describe its instrument.

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

a) Emmison occurs at larger wave length than absorption. Why? What is quantum yield?

b) Explain the principle of nuclear gamma rays resonance spectroscopy.

c) What is magnetic phenomenon? Give its application in different spectroscopy.

d) Explain the relationship between electrical response and rate of diffusive flux.

e) Describe the technique used for studing protein folding pathway.

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

a) Describe briefly the theory of NMR spectroscopy.

b) Explain the principle and working of ORD instrument.

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

P.T.O.

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

a) Ellipticity.

b) Intrinsic Flurors.

c) Rotational strength.

d) Application of biosensor.

e) Helix-turn-helix motif.

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

P913

[3723] - 52

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 380 : Pharmaceutical Analysis

(Old Course)

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

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Answers to the two sections should be written in separate answer book.***

SECTION - I

Q1) Attempt any four of the following :

a) Describe various sources of impurities in pharmaceuticals.

b) Discuss in adequate storage conditions and their effects on pharmaceutical products.

c) What are tablets? Give with the help of suitable example the wet granulation method for preparation of tablet.

d) Explain the terms infusion and injection. How are these sterilized?

e) A sample containing 0.120 g of β-naphthol (C_8H_8O) was dissolved in 25 ml ethylenediamine and was titrated with 0.1N potassium methoxide (in methanol) using O-nitroaniline as a indicator. The burette reading was 7.1 ml. Calculate percentage of β-naphthol.

Q2) Answer any four of the following :

a) What are opthalmic preparations? Give necessary precautions required to be taken at the time of preparation.

b) What are powders? Describe powders as dosage form.

c) What are ointments? Give classification of ointment bases.

d) What are gels? Give classification of gels.

e) 1.85 g oil sample was refluxed with 25 ml (0.5N) alcoholic KOH for one hour. After cooling, excess KOH was titrated with 0.5N HCl. The blank titration reading and back titration reading were 25.0 ml and 15.2 ml respectively. Calculate saponification value of an oil.

P.T.O.

SECTION - II

Q3) Attempt any four of the following :

a) Explain biological test for tetanus antitoxin.

b) Give the procedure for determination of trace water from pharmaceutical product.

c) Explain major steps involved in developing new drugs.

d) Give general procedure for sterility test. Explain membrane filteration method in detail.

e) 0.275 g ointment sample containing benzoic acid was dissolved in alcohol and titrated with sodium hydroxide solution gave burette reading 9.7 ml. When 10 ml of standard 0.1N oxalic acid was titrated with sodium hydroxide gave burette reading 11.6 ml. Calculate percentage of benzoic acid in ointment.

Q4) Write short notes on any four :

a) Disintegration test for tablets.

b) Aromatic waters.

c) Dry heat sterilization.

d) Role of FDA.

e) Expiry date fixation.

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

P914

[3723] - 54
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 390 : Electroanalytical and Current Analytical Methods in Industries
(Sem. - III) (Old Course)

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

Instructions to the candidates:

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

SECTION - I

Q1) Attempt any four of the following :

a) Discuss the advantages and disadvantages of DME.

b) State and explain the working of chronopotentiometry.

c) What is stripping voltametry? Discuss the steps involved in stripping voltametry.

d) The characteristic of capillary is 1.30, the diffusion current is observed to be 20 μA and the diffusion coefficient is 7.2×10^{-6} cm^2/sec. Find out the concentration of cd(II) present in given sample solution.

e) Calculate the mass of copper deposited from the solution of copper sulphate by passing current 2.21 A for 3 hours 15 minutes
(Given : At.wt. of cu = 63.54).

Q2) Attempt any four of the following :

a) Draw the ideal polarographic wave. Explain the role of maximum suppressor and bubbling of N_2 gas through the solution in polarographic analysis.

P.T.O.

b) State principle of amperometry. Describe the nature of amperometric titration curve of lead nitrate with potassium dichromate.

c) How electrogravimetric methods differ from potentiometric methods?

d) In coulometric titration of 25ml $k_2Cr_2O_7$ solution is titrated with Fe(III) solution which took 30 minutes to reduce completely, when 250 mA of current was used calculate the normality of potassium dichromate.

e) What is the diffusion current of univalent metal ion in solution having concentration 2.4×10^{-3} M, if drop-time was measured at the rate of 4.39 sec/drop and the mercury flow rate was 1.86 mg/sec? (Given : diffusion coefficient of metal ion = 6.6×10^{-6} cm^2/sec).

SECTION - II

Q3) Attempt any four of the following :

a) Enlist various detectors used in radiochemical analysis. Describe the working of any one of them.

b) Distinguish between DTA and DSC. Discuss any two applications of DSC.

c) Explain the principle and instrumentation of turbidimetry. Give the typical applications of this method.

d) On a TGA apparatus a mixture of crystalline barium chloride and sodium chloride was analysed. Initially the weight of mixture was 1.482g at room temperature and at 200°C loss in weight was 82 mg due to dehydration of crystalline salt. Determine the percentage composition of the mixture

(Given : At wt. of Ba = 137.32, Cl = 35.5, Na = 23, O = 16, H = 1).

e) A sample containing an unknown amount of germanium metal is irradiated in a neutron flux of 10^{12} n $cm^{-2}s^{-1}$ for 1 hour when the ^{76}Ge forms ^{77}Ge of half life 1 min. The activity measured 1 min after the irradiation is 2500 dis/s, find the amount of germanium in the same, given the cross section for the reaction is 3.28 mb, and the isotope abundance of ^{76}Ge to be 7.8%.

Q4) Attempt any four of the following :

a) Discuss the working of the electrochemical sensors.

b) Discuss the important applications of neutron activation analysis.

c) What is the principle of a radiometric titration? Discuss the nature of the titration curve of calcium by EDTA with solid radioactive silver iodate as an indicator.

d) Turbidimetry was used to examine sample. The transmittance of sample was 36.8%, the cell path length was 1cm. Calculate the concentration of sample if the turbidity coefficient of the sample is $3.88 \times 10^{-3}\ Lmg^{-1}cm^{-1}$.

e) An excess of sodium chloride was added to a series of standard solutions containing silver (I) and to a sample solution. The resulting silver chloride solutions were determined nephelometrically. From the below tabulated results determine the concentration of silver (I) in the sample.

Ag(I) conc. (ppm)	1.00	3.00	5.00	7.00	9.00	sample
Relative intensity	16.0	37.5	51.5	63.8	79.7	56.8

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

P915

[3723] - 55

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 391 : Environmental and Analysis of Industrial Materials (Old Course)

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

Instructions to the candidates:

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

SECTION - I

Q1) Attempt any four of the following :

a) Discuss any one method for determination of phosphorous from fertilizers.

b) Describe a method to estimate anionic surfactants.

c) Explain the analytical method for estimation of sodium from glass.

d) What is detergent? How unsulphated and unsulphonated materials are extracted and estimated from it?

e) Find the amount of K of fertilizer in percent K_2O, if it's elementary K content is 5.4%
[Given : At.Wt. K = 39.1, 0 = 16]

Q2) Attempt any four of the following :

a) Comment on general scheme of analysis of soap.

b) Outline the procedure for determination of chromium from pigment.

c) What is cosmetics? Explain the procedure for determination of zinc from cosmetics.

P.T.O.

d) In estimation of calcium from 1.98 gm sample calcium was precipitated as calcium oxalate. The ppt was dissolved in H_2SO_4 and the solution was titrated with 0.05N $KMnO_4$ solution. The titration reading was 35ml. Calculate the percentage of CaO in the given sample.
(Given : At.Wt. Ca = 40, O = 16).

e) A sample of chromel alumel containing chromium was disintegrated for the determination of chromium as lead chromate. A sample of 0.540gm of this alloy gave 475mg of lead chromate ppt. Calculate percentage of chromium in the sample.
(Given : At. Wt. O = 16, Cr = 51.99, Pb = 207.01).

SECTION - II

Q3) Attempt any four of the following :

a) Give the composition of brass? Explain analytical procedure for estimation of copper from brass.

b) Describe the method for determination of phosphorous from steel.

c) Give the analytical procedure for the determination of any two of the following :

i) Thorium from Monazite sand.

ii) Aluminium from bauxite.

iii) Nickel from Cupronickel.

d) 100 ml water sample was titrated with 0.01M EDTA in alkaline condition using eriochrome black T as indicator. It gave burette reading 27.9ml. Calculate amount of Mg in the water sample.
(Given : At. Wt. Mg = 24.30).

e) 240 Mg. of brass sample was analysed for the determination of copper iodometrically. After disintegration of sample was extracted with dil HCl and diluted to 250ml. A 25ml aliquot of this sample requires 22ml of 0.011 N $Na_2S_2O_3$. Calculate percentage of copper in alloy.
[Given : At. Wt. Cu = 63.54].

Q4) Attempt <u>any four</u> of the following :

a) How SO_x is generated? Explain it's hazardous effect on material, how it is controlled?

b) Give the estimation of the following (any one) :

i) Cyanide from water.

ii) COD from waste water.

c) Mention the meaning of the following terms :

i) BOD.

ii) Aerosole.

iii) Suspended particulate matters.

iv) Dust.

v) Mist.

d) Write note on (any one) :

i) Cyclone separator.

ii) Electrostatic precipitator.

e) Define sludge. Explain different methods of sludge disposal.

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

P916

[3723] - 56
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 392 : Advanced Analytical Techniques
(Old Course)

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

Instructions to the candidates:

1) ***Answers 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) Explain the term diode and discuss the use of diode as full wave rectifier.

b) Draw circuit diagram showing forword and reverse biasing of a pn junction.

c) State and explain Kirchhoff's Law and Ohm's Law. Discuss with suitable example how these laws are useful in circuit analysis.

d) Compare R.C. circuit as high pass and low pass filter.

e) Determine the power that is dissipated in 1.2×10^3 Ohms resistor when potential of 2.49V is applied accross the resistor.

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

a) Give the classification of amplifire on the basis of :

i) Frequency response.

ii) Depending on coupling.

b) Draw block diagram of digital computer and explain the function of each component.

P.T.O.

c) Explain the use of operational amplifier as an integrator.

d) Calculate out put voltage of the transformer with turn ratio 5:1 when voltage of 1.30V is applied to the primary coil.

e) i) Convert 11010 in the binary system to decimal number.

ii) Perform the addition 29 + 6 with binary arithmatic.

SECTION - II

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

a) Explain the term :

i) Pressure broadening.

ii) Oppler broadening.

iii) Plasma.

iv) Electron multiplier.

b) What is atomization? Why hydride generator is used in the determination of arsenic by AAS. Out line the analytical procedure for the determination of mercury from polluted sample of water using cold vapour method.

c) Mention various mass analyzer used in atomic mass spectrometer and discuss any one of these.

d) A sample of water analyzed for potassium by flame emmission technique using standard addition method. Observations are tabulated below.

SrNo	Added pottassium ppm	Meter reading arbitrary unit
1	0.0	5.5
2	0.1	6.7
3	0.2	8.9
4	0.3	10.1
5	0.4	11.3
6	0.5	12.5

Calculate concentration of potassium in ppm in the sample.

e) The amplification factor for perticular nine-dynode photo multiplier tube is 5.8×10^5. Calculate average number of electrons that are emitted at each dynode.

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

a) Discuss the technique of super critical fluid extraction. Give its important applications.

b) Explain the principle of single immuno diffusion and double immuno diffusion technique of analysis list the applications and give the detail of any one.

c) Give analytical method used for protein blotting.

d) Compare super critical fluid chromatography with column chromatography.

e) Magnesium in blood serum can be determined AAS. A 5.0ml serum sample was diluted to 100ml and its absorbance was found to 0.125.A standard containing 2×10^{-5}m of Mg^{2+} gave absorbance 0.187 calculate magnesium concentration percent of sample of blood.

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

P917

[3723] - 61
M.Sc.
PHYSICAL CHEMISTRY
CH - 410 : Molecular Structure (Old)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Describe the 'H nmr spectrometer. What are the characteristics of a high resolution nmr spectrometer?

b) Explain the nmr studies of ^{13}C and ^{19}F nuclei with suitable examples.

c) Define chemical shift in nmr. Distinguish between δ and τ chemical shifts. Give suitable examples.

d) Explain the terms-deshielding, spin decoupling and coupling constant with reference to nmr.

e) Discuss NQR spectroscopy and explain its applications.

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

a) Explain the terms-zero field splitting, polarization mechanism and unpaired spin density in esr.

b) With the help of a block diagram, explain the working of an X-band esr spectrometer.

c) Discuss the surface applications of PAS.

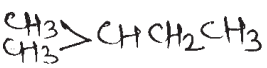
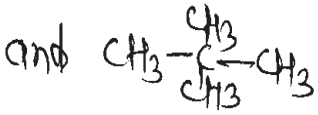
d) Explain why esr spectra are always recorded in the derivative form.

e) Discuss the concept of 'Kramer's degeneracy' and 'hyperfine coupling constant'.

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

a) At what temperature would the population of electron spins in the β level be 0.5% greater than the α level for a field of 0.78T? [$\mu_e = 9.27 \times 10^{-24}\ JT^{-1}$]

b) Calculate the esr frequency of an unpaired electron in a magnetic field 3300G. [Given : $g_e = 2$].

c) How will you distinguish among $CH_3CH_2CH_2\ CH_2CH_3$,  and  using PMR spectra?

SECTION - II

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

a) State how the structure factor is used to determine the electron density distribution.

b) Compare the usefulness of XRD and electron diffraction techniques.

c) Define the structure factor and explain how it is related with the reflection intensities.

d) Describe briefly powder diffraction method for investigating the internal structure of crystals.

e) Write a note on indexing in X-ray diffraction.

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

a) Derive Langevin equation for magnetic susceptibility.

b) Distinguish between ferromagnetism and antiferromagnetism with suitable examples.

c) Discuss Pascal's constants and their applications.

d) Why does electron diffraction occur? How it is experimentally studied?

e) State the principle of faraday method and describe working of faraday balance with suitable diagram. What are the advantages of the method over uniform field method?

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

a) Determine molecular weight of FCC crystal having cubic unit cell dimensions 6.3Å and its density is 1.984 gcm^{-3}.

b) Calculate the molar susceptibility of phenantroline using the data :

i) χ_A : C = -6.0×10^{-6}, H = -2.93×10^{-6}, N = -4.61×10^{-6}.

ii) λ : C (shared by two ring) = -3.07×10^{-6}, C(in one ring) = -0.24×10^{-6}.

c) The density of lysozome crystal 1242 kgm^{-3}. The crystal contained 65% proteins. Calculate the mass of protein per unit cell.

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

P918

[3723] - 62
M.Sc.
PHYSICAL CHEMISTRY
CH - 411 : Surface & Solid State Chemistry (Old)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) If E_p is the energy required to move pair of ions from crystals interior to the surface. Derive the expression for number of Schottky defects produced in crystal at temperature T.

b) In case of metals conductivity decreases with increase of temperature, where as in semiconductor it increases with increase of temperature, explain this using band theory.

c) Write a note on photovoltaic effect.

d) Explain with a suitable example the point contact transistor, underlying its principle and merits.

e) With suitable example, explain how sign of charge carrier is determined in insulators.

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

a) With neat diagram explain piezoelectric effect.

b) What are color centers? Explain the terms :

i) F-center

ii) K-band

iii) F′-center

iv) V-center

c) Explain the mechanism of the following reactions with suitable diagram

i) $AgCl\ (s) + NaI\ (s) \longrightarrow AgI\ (s) + NaCl\ (s)$

ii) $2\ AgI\ (s) + HgI_2 \longrightarrow Ag_2HgI_4$

d) Draw and explain the sigmoid shape curve obtained in thermal decomposition of a single solid.

e) Discuss the formation of spiral during crystal growth.

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

a) Energy require to form one Shottky detect in an ionic crystal is 200 kJ mol^{-}. Calculate the number of Shottky detects in crystal at 550 K.

b) The intrinsic resistivity of semiconductor at 300 K is 50 Ω cm. What is the intrinsic carrier concentration when electron and hole mobilities at 300 K are 3900 $cm^2v^{-1}s^{-1}$ and 1900 $cm^2v^{-1}s^{-1}$.

c) Assuming that only Na^+ contribute to the ionic conductivity in NaCl, what is the value of diffusion coefficient per unit area for Na^+ in NaCl? If the measured conductivity of NaCl at 600 K is 10^{-6} mhos cm^{-1}. The edge length of unit cell of NaCl crystal is 5.63Å.

SECTION - II

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

a) Write Gibb's equation for adsorption and explain terms involved in it. Describe one experimental method of its verification.

b) Define detergency. Explain various factors involved in detergent action.

c) Distinguish between physical adsorption and chemisorption.

d) Discuss with a neat sketch Brunauer's different types of adsorption isotherms.

e) Explain the term heat of adsorption. How it is determined from adsorption isoster?

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

a) What is specific surface area of adsorbent? Describe one method for its determination.

b) What are zeolites? Give the structural difference between A, X and Y type of zeolites.

c) What is catalyst deactivation? Discuss in brief the causes of deactivation.

d) Describe the modless method for obtaining pore size distribution in case of porous solids.

e) Define the terms :

i) Catalyst.

ii) Catalyst activity.

iii) Catalyst selectivity.

iv) Negative catalyst.

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

a) The mass x of a solute adsorbed per gram of solid adsorbent is given by Freundlich adsorption isotherm as $x = Kc^n$ where K and n are 0.160 and 0.431, respectively, calculate the amount of acetic acid that 1kg of charcoal would adsorb from 0.837m vinegar solution.

b) Stearic acid $C_{17}H_{35}COOH$ has density of 0.85 g/cm^2. The molecule occupies an area of 0.205 nm^2 in close packed surface film. Calculate the length of the molecule.

c) The surface tension of ethanol-water mixture follows equation

$$\gamma = 72 - 0.4C + 0.15C^2$$

Where C is the ethanol concentration in moles lit^{-1}. If the temperature of measurement is 25°C. Calculate the surface excess of ethanol in moles cm^{-2} for 0.2m solution.

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

P919

[3723] - 63
M.Sc.
PHYSICAL CHEMISTRY
CH - 414 : Polymer Chemistry - II (OLd)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt <u>any four</u> of the following: **[20]**

a) Describe the behaviour of polymeric substances on heating.

b) Write a note on : the process of calendering.

c) Define 'molding'. What are the different types of molding? Describe the technique of blow molding with a neat diagram.

d) Distinguish between configuration and conformation. Discuss the structure of flexible and rigid chain polymers.

e) What are polypeptides? Discuss the properties and structure of wool.

f) Predict giving reasons, whether the following polymers will undergo crosslinking or degradation on irradiation.

i) Natural rubber. ii) Cellulose.

iii) PVC. iv) Poly (α methyl styrene).

v) Poly (Vinylidene chloride).

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

a) What is glass transition temperature? Describe the relation between T_g and T_m.

b) Explain the following :

i) Nylon-6 is highly crystalline.

ii) Polyethylene is crystalline while its random copolymer is amorphous.

c) Discuss the elastomer forming properties of a polymer.

d) Define the terms : Tenacity, Pilling, Crimp, Vulcanization.

e) Describe the polymerization of tetrafluoroethylene. What are the properties of polytetrafluoroethylene?

f) Discuss the effect of degree of Crystallinity on hardness, modulus and permeability.

SECTION - II

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

a) Define 'cold rubber'. How is cold rubber prepared? What are its properties?

b) Explain the terms : fiber, denier, moisture content and moisture regain.

c) What are polyurethanes? Discuss the formation, properties and applications of it.

d) Write a note on : coating.

e) Describe the geometric isomerism shown by polymer formed from butadiene.

f) Discuss the effect of radiation exposure on polyethylene.

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

a) Describe the calorimetric method of determination of T_g.

b) Write the structure of natural rubber. What are its drawbacks?

c) Explain the term glass transition temperature. What is the effect of plasticizers on it?

d) Describe microscopic analysis for study the polymers.

e) Explain :

i) Polyvinyl carbazole is amorphous while PVC is crystalline.

ii) Polyethylene is crystalline while its random copolymer is amorphous.

f) Write a note on : Pultrusion technique.

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

P919

[3723] - 63
M.Sc.
PHYSICAL CHEMISTRY
CH - 415 : Environmental Pollution (Old)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Define and explain pathways of pollutants with suitable example.

b) Explain perfect cycle with suitable example.

c) Discuss the biochemical effect of MIC.

d) What are ecological effects of air pollutants.

e) Write a note on : 'Environmental reservoir'.

f) Discuss the toxic elements in water.

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

a) What is biogeochemical cycle? Explain sulphar cycle.

b) Explain the term biomagnification and give the biochemical effect of DDT.

c) Discuss the ecological impact of organochlorine compounds.

d) Write a short note on : Residence time.

e) Explain the impact of toxic chemicals on enzymes with suitable examples.

f) Explain the health effect of air pollutants.

SECTION - II

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

a) Write a note on : photo chemical smog.

b) Discuss the toxic effects of lead and mercury on human being.

c) Explain nitrogen cycle in atmosphere.

d) Explain the different types of water samples with respective their sources & chemical composition.

e) Discuss the importance of physical examination of water.

f) Explain the following impurities in water

i) Oil and grease.

ii) Ammonia.

iii) Cyanides.

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

a) What is alkalinity of water? How is it determine?

b) Discuss various effects of noise pollution on human health.

c) Discuss the importance of qualitative and quantitative examination of water.

d) What is the effect of CFC on ozone layer?

e) What is acidic rain? What are the reasons of acidic rain?

f) What is COD? Explain the method for determining COD.

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

P919

[3723] - 63
M.Sc.
PHYSICAL CHEMISTRY
CH - 416 : Special Topics in Physical Chemistry (Old)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Why are ceramics used in sensors? What are the requirements for conducting electrodes for operation of sensors?

b) Write a note on chemiresistors.

c) Write proton condition for H_3PO_4 and H_2Se.

d) Define the terms :

i) Catalyst.

ii) Activity.

iii) Selectivity.

iv) Poison and

v) Inhibitor.

e) Discuss adsorption isotherms used in sensors.

f) Explain the dependence of the observed rate constant for oximation of acetone on pH at 25°C.

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

a) What are active and passive sensors?

b) Discuss the catalysis in concentrated strong acid solutions.

c) The pH of 0.02M solution of a salt of succinic acid is 5.5. Find the concentration of $C_6H_6O_4$, $C_4H_5O_4^-$ and $C_4H_4O_4^{2-}$

[given : $pKa_1 = 4.19$, $pKa_2 = 5.48$].

d) Calculate the pH and concentration of all ionic species for 0.01M CH_3COON_9 [given : $Ka = 1.85 \times 10^{-5}$].

e) Discuss the influence of surrounding gas atmosphere on the properties of semiconductor porous ceramics.

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 alloys exhibiting shape memory?

b) Write a note on-stress transforming composite.

c) What are the applications of aero soles?

d) With a neat labelled diagram, explain the working of an astronomical telescope .

e) What are the applications of carbon nanotubes?

f) Draw a ray diagram and describe the working of a compound microscope.

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

a) What are the applications of aerogels and aerosols?

b) What is the calibration temperature used in thermo couple?

A wattmetre records 100Nm torque corresponding to 500 Watts power. Calculate the deflection torque corresponding to 250 Watts power.

c) Calculate the resolution of a diffraction microscope used for a medium having refractive index $\frac{3}{2}$, glancing angle 42° and the radiation frequency 30THz.

d) Explain the use of pzt as a smart material.

e) Write a note on sushi sensor.

f) What are the applications of nano-particles in the medical field?

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

P920

[3723] - 64

M.Sc. - II

INORGANIC CHEMISTRY

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

(Old)

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

Instructions to the candidates:

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

SECTION - I

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

a) Classify the multidentate macrocyclicligands and draw the structure of any two complexes containing macrocyclicligands.

b) Explain what is meant by heterogeneous catalysis. Describe the oxidation of SO_2.

c) What are Zeolites? Give an account of properties & applications.

d) Draw the structure of $[Ni_6(Co)_{16}]^{2-}$ and explain it's electron framework.

e) Discuss the importance of pH in the crystallisation of zeolite.

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

a) Explain the terms; polyphosphates, polyoxyanions. Give an account of synthesis and properties of polyoxyanions.

P.T.O.

b) "X-ray diffraction technique is powerful tool to understand the structure of zeolite". Justify the statement.

c) Give an account of inorganic benzene and compare it with organic benzene.

d) Write a note on allotropes of carbon.

e) What is meant by metal cluster compounds? Explain with the help of suitable example the effect of pyrolysis of high nuclearity carbonyls.

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

a) Electro catalysis.

b) Heteropoly anians of molybdenum.

c) Phosphazenes.

SECTION - II

Q4) Answer (any four) : **[16]**

a) Explain in detailed the instrumentation of DTA & compare it with DSC.

b) Discuss the effect of experimental factors on TGA.

c) What is meant by Miller indices? Sketch the planes in a cube having Miller indices (010), (112), (312) & (111).

d) $NiSO_4$. $7H_2O$ was heated from RT to 300°C to study the dehydration reactions two sample weights were used :

i) 15mg.

ii) 100mg.

What difference do you expect in their thermograms.

e) Cs in FCC structure has lattice constant 0.458nm. Calculate value of interplanar spacing d_{212} in nanometers.

Q5) Attempt the following (any four) : **[16]**

a) State Bragg's law of diffraction & describe a method to determine the length of unit cell of a cube using XRD.

b) Explain in details steps involved in determining miller indices of a crystal plane.

c) Calculate the interplanar spacing of a set of planes, if the angle of 1^{st} order reflection is 22.7° When X-rays of wavelength 1.54Å are used.

d) "$CaCO_3$ When heated in oxygenated atmosphere gives CaO while remains unchanged when heated in N_2 atmosphere". Justify this statement with chemical reactions.

e) With the help of suitable example, explain the DTA curve.

Q6) Write short notes (any two) : **[8]**

a) DSC.

b) Dynamic and isothermal TGA.

c) Braris lattices.

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

P921

[3723] - 65

M.Sc. - II

INORGANIC CHEMISTRY

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

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

Instructions to the candidates:

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

SECTION - I

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

a) Give the free ion ground term and ligand field term in the following :

i) $[Fe(H_2O)_6]^{2+}$;

ii) $[Fe(SCN)_6]^{3-}$,

iii) Mn^{3+} At. No : Fe = 26, Mn = 25

b) Define the term :

i) Diamagnetism.

ii) Paramagnetism.

iii) Magnetic flux.

iv) Magnetic field strength.

v) Lenz law.

c) Explain mechanism of magnetic exchange in insulators.

d) Draw a schematic flow diagram of cement making process.

e) Give the applications of simple ceramic oxides.

P.T.O.

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

a) What do you understand by super conductivity? Explain the mechanism of superconductivity with the help of BCS theory.

b) Explain the physical and chemical processes taking place in the furnace during formation of glass.

c) Differentiate between Portland and Non-Portland cement.

d) Give the different laws which govern the functions of Hard magnetic material such as loud speaker, microwave oven etc.

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

a) Sol-gel process.

b) SQUID.

c) Plastisizer.

SECTION - II

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

a) "Some metals are commonly used in dye stuffs". Which special properties make them useful in dyes? Give two methods of synthesis of chromium-azo dyes.

b) Give classification and important properties of inorganic pigments.

c) What is photothermography? Which metals are used photothermographic system. Explain the use of cobalt system in it.

d) Explain the role of coordination compounds in electroplating.

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

a) Describe the steps involved in conventional silverhalide based photography.

b) Give an account of electroplating of zinc.

c) Which types of isomerism are seen in the chromium and cobalt complexes of tridentate AZO compounds? Explain any one type of isomerism.

d) Give an account of formazans.

Q6) Solve the following :

a) Draw the structure of : **[5]**

i) Neolan Blue.

ii) Perlon fast violet BT.

iii) Irgalan Brown violet DL.

b) Write note on (any one) : **[5]**

i) Alloy pigment.

ii) Yellow and White pigments.

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

P922

[3723] - 66

M.Sc. - II

INORGANIC CHEMISTRY

CH - 445 : Inorganic Applications in Material Science, Biotechnology and Environmental Chemistry

(Old) (Sem. - IV)

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

Instructions to the candidates:

1) ***Attempt any two sections from the following.***
2) ***Both sections should be written in the same answer book.***
3) ***All questions are compulsory.***
4) ***Figures to the right indicates full marks.***
5) ***Neat diagram must be drawn wherever necessary.***
6) ***Use of logarithmic table / calculator is allowed.***

SECTION - I

Material Science

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

a) How are elements classified on the basis of band theory of solids?

b) Give the mechanism of addition of chain polymerization.

c) Describe Czocharlski method for obtaining single crystals of solid state materials.

d) Explain the working of n-p-n junction transistor as amplifier.

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

a) Distinguish between thermosoftening or thermoplastic and thermosetting.

b) What is photovoltaic effect? How it can be used for conversion of visible light into electrical energy?

P.T.O.

c) There are 5 polymer molecules of mol.wt. 10^4, 20 polymer molecules of mol.wt. 10^3 and 50 polymer molecules of mol. wt. 10^2. Find out number average mol.wt. ($\overline{Mn}$) and weight average mol.wt. ($\overline{Mz}$).

d) What is electro plating? Describe coating of metal by electroplating.

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

a) Peltier and seebeck effect.

b) Pilling-Bed Worth Rule (PBR).

c) Photoconductivity.

SECTION - II

Biotechnology

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

a) What do you understand by the term "vaccine"? Describe one method of production of vaccines.

b) Which are the common cultures used in the production of antibiotics?

c) What is sewage? How is it converted into usable water?

d) Explain the different stages involved in genetic engineering.

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

a) Describe the "Deep Shaft Process" used in water treatment.

b) Explain the different stages of bread making.

c) Compare microbial food production with agricultural food production.

d) Explain the different steps involved in tissue culture.

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

a) Antibiotics.

b) Fermenters.

c) Vaccines.

SECTION - III

Environmental Chemistry

Q7) Attempt any three of the following : **[15]**

a) What is the cause of "Acid Rain"? How can pollutant responsible for acid rain be controlled?

b) What are Xenobiotics? Suggest the pathway by which xenobiotics might from trichloroacetic acid metabolically.

c) Explain why plants grow on either excessively acidic or excessively basic soils may suffer from calcium deficiency.

d) What do you understand by electrodialysis? Explain its use in environmental analysis.

Q8) Answer any three of the following : **[15]**

a) What are pollutants? Name two water and two air pollutants. Discuss their contribution to air pollution.

b) Explain the conditions that favour the build up of organic matter in soil.

c) Explain the environmental chemistry of Hg & As in an aquatic ecosystem.

d) List the different methods for the estimation of the following parameters in water sample :

i) Cyanide. ii) Nitrates.

iii) Ammonia. iv) Ca & Mg.

v) Dissolved oxygen.

Q9) Write short notes on (any two) : **[10]**

a) Ion-liquid chromatography.

b) Total Organic Carbon (TOC)

c) Biorefractory organic pollutant.

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

P926

[3723] - 71
M.Sc.
BIOCHEMISTRY
BCH - 471 : Biochemical and Environmental Toxicology (Old)

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

Instructions to the candidates:

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

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

a) What are the aims of experimental systemic toxicity studies?

b) Define the toxic agent. Discuss the different ways of classification of toxic agents.

c) Explain with suitable diagram the dose-response relationship.

d) What do you understand the following terms :

i) Additive effects.

ii) Syvergistic effects.

iii) Potentiation effects.

e) Explain why inhibition of mitochondrial respiration gives rise to cellular edema.

f) Explain with examples the chemical and receptor antaganism.

g) How mutagenicity of chemical agent is screened?

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

a) What are the sources of soil and water pollutants? How are they degraded?

b) Discuss the toxic effects caused by chlorinated insecticides.

P.T.O.

c) Distinguish between
   i) Venomous and poisonous animals.
   ii) Immediate v/s systemic toxicity.

d) Explain the mechanism of inhibition of acetylcholinesterase by organophosphrous insecticides.

e) Discuss the toxic effects of amphibian toxins.

f) Give the mechanism of toxic effects caused by inhalation of O_3 and PAN.

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

a) Discuss the role of sulfotransferase in xenobiotics detoxication.

b) Explain in brief the effect of various parameters on xenobiotic biotransformation.

c) Give the mechanism of cytochrome p-450 catalyzed biotransformation.

d) What are the forensic applications of toxicology.

e) Explain the biochemical reactions involved in benzene biotransformation.

f) Give an account of plant toxins causing emesis and cardiovascular disorders.

Q4) Explain the pathogenesis of any five : **[20]**

a) Renal disorder due to lead.

b) Pulmonary disease and hypertension due to cadmium.

c) Hypersensitivity due to gold therapy.

d) Hypotension by snake biting.

e) Delayed neurotoxicity caused by intoxication of organophosphrous insecticides.

f) Hematopoietic effects of benzene.

g) peripheral vascular disease due to arsenic.

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

P927

[3723]-101

M. Sc.

PHYSICAL CHEMISTRY

CH-110 : Physical Chemistry - I (New)

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

Instructions to the candidates :

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

Physico - Chemical Constants

1.	Avogadro Number	N	=	6.022×10^{23} mol^{-1}
2.	Boltzmann Constant	k	=	1.38×10^{-16} erg K^{-1} molecule^{-1}
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) Explain inexact and exact differentials giving examples.

b) State the zeroth law of thermodynamics and give its applications. Define thermodynamic temperature scale.

c) What is partial molar volume? Explain any one method to determine partial molar volume of a substance.

d) Deduce the Gibbs-Duhem equation. Which expression is called the fundamental equation of chemical thermodynamic?

e) Derive the Clapeyron – Clausius equation and give its applications.

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

a) Using the concept of chemical potential, derive an expression for elevation in boiling point when a non-volatile solute is added to a solvent.

b) State the third law of thermodynamics. State the relation between equilibrium and spontaneity of reaction.

c) State the expression for osmotic pressure on the basis of Vant Hoff's equation. Explain briefly phenomenon of dialysis.

d) State the Planck's hypothesis. How did it provide a break through in resolving ultraviolet catastrophe?

e) State the Schrodingers time dependent and time independent equations. Which one is used by chemists? Explain the significance of the term therein.

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

a) Calculate the no. of photons emitted by a mW lamp ($\lambda = 560$ nm) in a ps.

b) Determine ΔS when a mole of water is formed from its elements under standard conditions at 25°C. $\Delta H = -286 kJ\ mol^{-1}$.

c) Find the energy change for the transition from $n = 2 \rightarrow n = 1$ for an electron in a molecule of length 578 pm.

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) What are complex reactions? Show that in parallel first order reactions, the products are in constant ratio to each other.

c) Discuss the Lindemann's theory for first order reactions.

d) Explain the mechanism of explosive reactions.

e) Discuss the various flow techniques used to study the fast reactions.

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

a) Discuss the activated complex theory.

b) Derive Dyring equation for reaction rate.

c) Obtain the expression for translational partition function for monoatomic gas.

d) What are diffusion controlled limits? Derive the equation for diffusion controlled reactions.

e) Discuss Bose–Einstein statistics.

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

a) A first order reaction has, $K = 1.5 \times 10^{-6}$ per second at 200°C. If the reaction is allowed to run for 10 hrs, what percentage of the initial concentration would have changed in the product? What is the half-life of this reaction?

b) Calculate the ratio of the number of molecules in two energy levels at 27°C, given that $E_2 = 9.75 \times 10^{-13}$ erg mol^{-1}, $E_1 = 6.95 \times 10^{-13}$ erg mol^{-1}, $g_1 = 2$ and $g_2 = 3$.

c) Calculate the vibrational partition function at 300K and 500K, when vibrational frequency of diatomic molecule is 1600 cm^{-1}.

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

P928

[3723]-102

M. Sc. (Part - I)

INORGANIC CHEMISTRY

CH-130 : Inorganic Chemistry - I

(New Course) (Sem. - I)

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

Instructions to the candidates :

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

SECTION - I

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

a) Give stereographic projection of D_4h and D_2h point group. Justify your answer.

b) What are equivalent symmetry elements and equivalent atoms? Show that three vertical planes of symmetry in NH_3 molecule are equivalent.

c) Explain with suitable examples the following symmetry elements and symmetry operations.

i) Principal axis and proper rotation.

ii) Center of inversion and inversion.

d) By schematic representations give the products of following symmetry operations in BF_3 molecule

i) $C_3 \times \sigma_v^2$

ii) $\sigma_v^1 \times \sigma_v^3$

P.T.O.

e) Fill the missing entries X, Y, Z, V and W in the following character table. Justify your answer.

	E	$8C_3$	$3C_2 (= C_4^2)$	σC_4	σC_2
A_1	1	1	1	1	1
V	1	1	X	−1	−1
E	2	−1	2	0	0
T_1	3	0	−1	Y	−1
W	3	Z	−1	−1	1

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

a) Sketch and explain all the symmetry elements for $[MnCl_4]^{-2}$ complex ion and classify it into appropriate point group.

b) Discuss the symmetry criterion for a molecule to be optically active. Predict the optical activity for the following compounds.

i) Cis $[P + (NH_3)_2 Cl_2]$

ii) Cis $[P + (NH_3)_2 Cl Br]$

c) What are the conditions of a mathematical group? Explain them considering the point group C_2h.

d) Using matrix multiplication method show that

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

ii) $C_2 = i$

e) For a $[Fe(CO)_5]$ complex, find the reducible representation for which sigma bonds form the basis and find out which orbitals from the Fe atom will be offered for sigma bonding.

Given : Character table for D_3h point group.

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

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

a) Match the following point groups under B with appropriate molecule under column A

	A		B
i)	$[Ni(CN)_4]^{-2}$	a)	C_2h
ii)	Trans $C_2H_2Cl_2$	b)	Td
iii)	$[NiCl_4]^{-2}$	c)	$C_\infty V$
iv)	HCN	d)	D_4h
v)	$XeOF_4$	e)	$D_\infty h$
		f)	C_4V
		g)	C_3V

b) Define the term with examples.

i) Unit cell

ii) Crystal lattice

iii) Space lattice

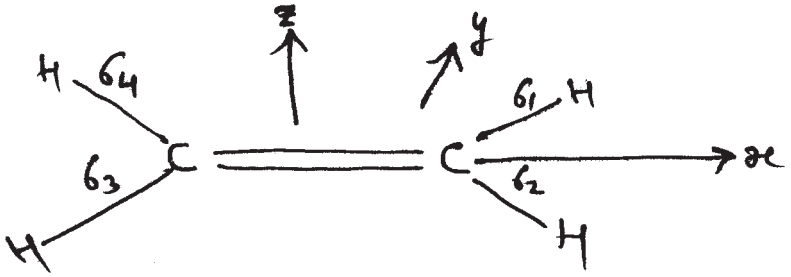
iv) Miller indices

v) Weiss indices

c) Find out the normalised SALC using projection operator of B_{1g} irreducible representation on σ_2 orbital of the following molecule which belongs to D_2h point group.

Given :

i)



ii)

D_2h	E	$C_2(z)$	$C_2(y)$	$C_2(x)$	i	σxy	σxz	σyz
B_{1g}	1	1	−1	−1	1	1	−1	−1

SECTION - II

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

a) Comment on oxidation states of nitrogen and their stability.

b) Draw a chart showing the characteristic reactions of $COCl_2$.

c) Give an account of nitrides of boron.

d) What are crown ethers? How they are useful in the separation of alkali metals?

e) Give an account of electron deficient compounds.

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

a) Metal fullerene compounds.

b) Phosphazenes.

c) Green house effect.

d) Oxoacids and Oxoanions of Chlorine.

e) Solution of alkali metals in liquid ammonia.

Q6) a) Draw <u>any five</u> structures : **[5]**

i) $B_3N_3H_6$

ii) P_4O_{10}

iii) IF_7

iv) $Al_2\ (Ph)_2(Et)_4$

v) XeF_2O_2

vi) B_6H_{10}

b) Complete the following reactions : (<u>any five</u>) **[5]**

i) $6RGeCl_3 + Li \longrightarrow ? + LiCl$

ii) $Na + C_{10}H_8\ (THF) \longrightarrow ?$

iii) $SiF_4 + 2F^-_{(aq)} \longrightarrow ?$

iv) $Al_2(CH_3)_6 + \begin{matrix} Et \\ Et \end{matrix}\!\!\diagdown\!\!\diagup C = 0 \longrightarrow ?$

v) $P(OR)_3 + O_3 \xrightarrow{-78^\circ C} ?$

vi) $I^-_{(aq)} + NO^+_{(aq)} \longrightarrow ?$

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

P929

[3723]-103

M. Sc. - I

ORGANIC CHEMISTRY

CH-150 : Organic Reaction Mechanism & Stereochemistry

(2008 Pattern)

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

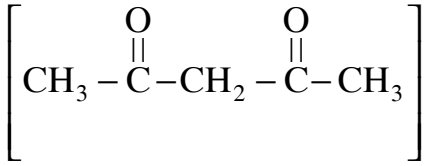
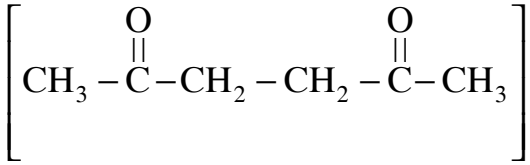
Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Answers to the two sections should be written in separate answer books.***
4) ***Students admitted 2008 onwards must attempt new pattern (2008 Pattern).***

SECTION - I

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

a) Write the structure of the product(s) from the epoxidation of 1-butene. Assign R and S descriptions to stereocentres. Is the reaction stereoselective.

b) Acetyl acetone  is a stronger acid than acetonylacetone  . Explain.

c) Explain the relative rates of solvolysis.

d) Anti elimination occurs readily for cis but not for trans – 1-bromo-4-(1, 1-dimethylethyl) cyclohexane. Explain.

e) Br^- is displaced by SN^2 mechanism more rapidly from CH_2BrCl than from CH_2Br_2. Explain.

P.T.O.

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

i) Vilsmeier-Haack reaction

ii) Catenanes

iii) Regioselectivity and chemoselectivity

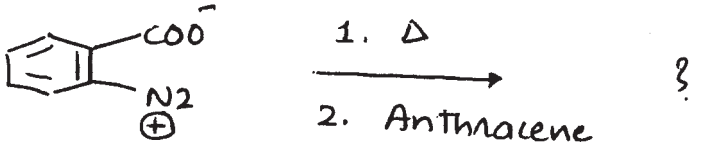
b) Explain the following conversions by giving complete reaction sequence (any two) : **[8]**

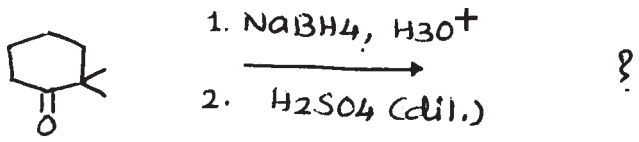
i) Phenol to O-nitroanisole.

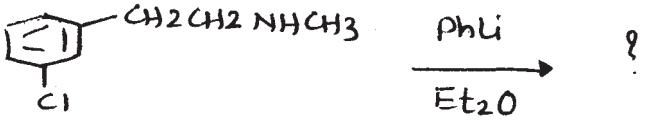
ii) Chlorobenzene to 2, 4-dinitrophenyl hydrazine.

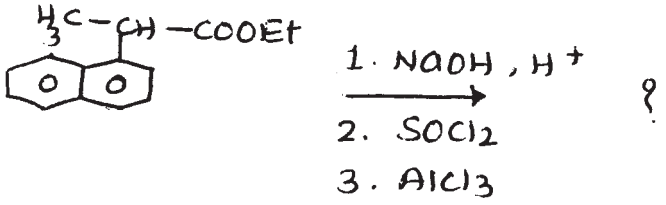
iii) 2-butyne to meso 2, 3-dihydroxybutane.

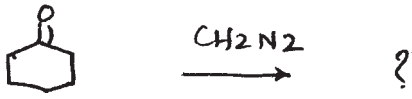
Q3) Predict the product/s and justify your answer (any four): **[12]**

a) 

b) 

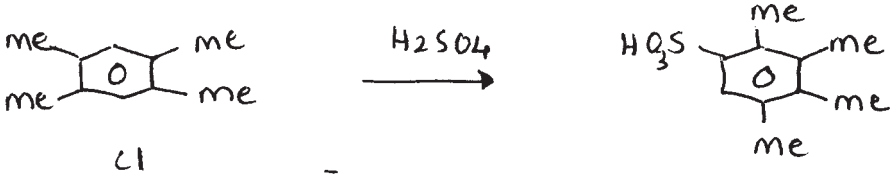
c) 

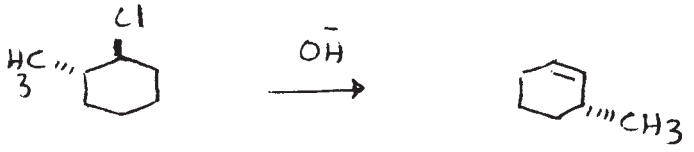
d) 

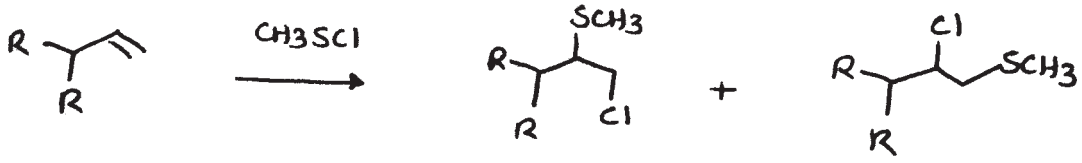
e) 

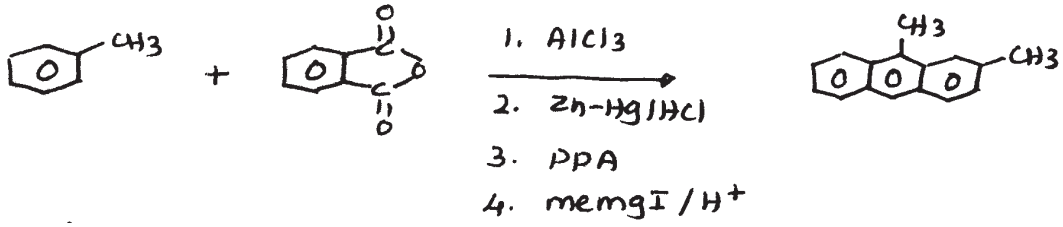
SECTION - II

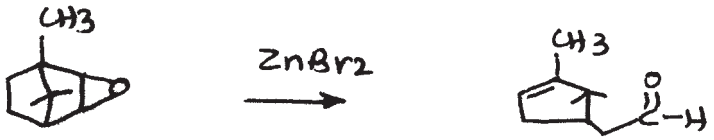
Q4) Suggest mechanism for any four of the following : **[12]**

a) 

b) 

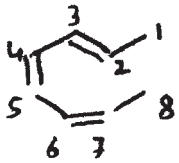
c) 

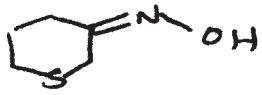
d) 

e) 

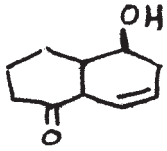
Q5) Attempt <u>any eight</u> of the following : **[16]**

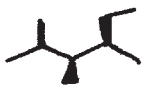
a) Assign E/Z configuration to the following.



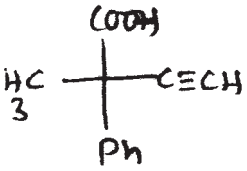


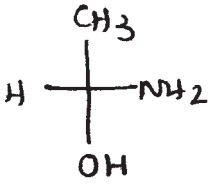
b) Label the stereocentres and calculate the no. of stereoisomers in the following.





c) Assign 'R' and 'S' configuration.

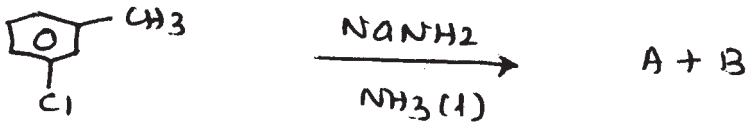




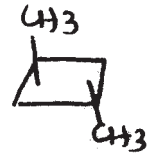
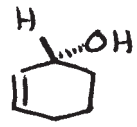
d) Assign 'Si' and 'Re' faces in the following.

$C_6H_{11}CHO$ $PhCOCH_2CH_3$

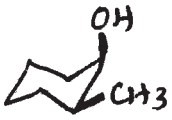
e) Predict the products.

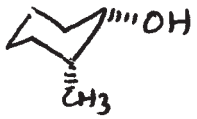


f) Which of the following is optically active? Justify.

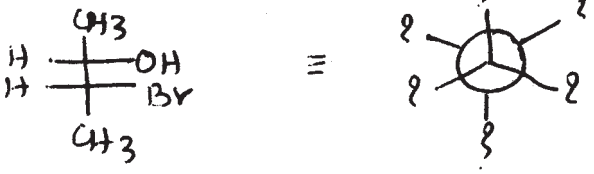
g) Give the Stereochemical relationship between the following compounds.



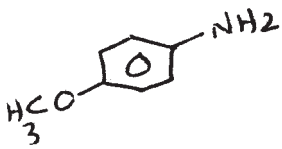


I II III

h) Convert Fischer to Newmann for the following structure.



i) Draw resonance structures for the following.




Q6) Attempt <u>any four</u> of the following : **[12]**

a) Arrange the following compounds according to their increasing order of reactivities towards solvolysis. Explain your answer.

$PhCH_2Cl$ $PhCHCH_3$ (Cl) $(Ph)_2CH–Cl$ $(Ph)_3C–Cl$

I II III IV

b) What are epimers? Explain it with suitable examples.

c) Write a short note on oxymercuration-demercuration reaction.

d) Cycloheptatrienyl cation is aromatic. Explain.

e) 2, 6 – Diisopropylaniline is a stronger base than aniline. Explain.

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

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[3723]-104

M. Sc.

BIOCHEMISTRY

BCH-170 : Biomolecules

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

Instructions to the candidates :

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

SECTION - I

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

a) Explain the term macromolecule with suitable example.

b) What is aldose? Give any two examples of it.

c) Explain the Pyran ring structure with reference to glucose.

d) Give physiological significance and importance of Phospholipid.

e) Define the term buffer. "Phosphate buffer is the first choice of a Biochemist". Explain.

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

a) What are water soluble vitamins? Give their importance with suitable example.

b) Give the various lipoproteins. Significance with suitable example.

c) Explain the structure of eukaryotic cell.

d) Describe the structure and functioning of glass electrode.

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

a) Write a note on sugar derivatives.

b) Discuss the classification of carbohydrates with one example from each class.

c) Explain the biological significance of lipids.

d) Discuss the ionization of water.

P.T.O.

SECTION - II

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

a) Give acid base property of amino acid.

b) Give the structure of following tri peptide.

Val - Ile - Trp

c) Explain why proteins are insoluble at their isoelectric point.

d) Give FDNB reaction used for terminal determination.

e) Give the levels of protein structure.

f) What is essential amino acid?

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

a) Explain how X-ray diffraction is useful in understanding of biomolecule structure.

b) Write a note on Ramchandran Plot.

c) Describe the classification of amino acid on the basis of side chain.

d) What is protein sequencing? Give the methods involved in protein sequencing.

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

a) Define hydrogen bond. Give its role and importance.

b) Explain α-helical structure of protein.

c) Write a note on classification of protein.

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

P931

[3723]-105

M. Sc.

BIOCHEMISTRY

BCH-171 : Enzymology and Physiological Biochemistry

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

Instructions to the candidates :

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

SECTION - I

ENZYMOLOGY

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

a) Define the terms, apoenzyme, allosteric site and isoenzyme.

b) What is steady-state assumption? Derive Michealis-Menten equation by applying steady-state assumption.

c) Explain the induced fit hypothesis of Koshland.

d) What is the significance of variation in temperature an enzyme catalyzed reaction?

e) Discuss the effect of acid and base catalysis an enzyme catalysis.

f) What are the advantages of having the final product of multistep metabolic pathway inhibit the enzyme that catalyze the first step?

g) How specificity of modifying agent is increased?

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

a) Irreversible change in covalent structure of controls the activity of enzyme. Explain.

b) What is the significance of enzyme turnover? Which enzymes are degraded fast?

c) Distinguish between Monod, Wyman and Changenx and Koshland, Nemethy and Filmer model for allosteric enzymes.

P.T.O.

d) How activity of mammalian pyruvate dehydrogenase multienzyme complex is regulated?

e) What conditions must be fulfilled by an enzyme to qualify as diagnostically important enzyme? Give the clinical significance of α-amylase.

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

a) What are the different types of bisubstrate reactions? Distinguish between bisubstrate reaction involving ternary complex from double displacement reaction.

b) Study of presteady-state kinetics determines the mechanism of enzyme catalysis. Explain.

c) Explain, how activity of carbamoyl phosphate synthetase is regulated during pyrimidine and argimine synthesis?

SECTION - II

PHYSIOLOGICAL BIOCHEMISTRY

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

a) Describe different forms of Haemoglobin.

b) Explain Serum Proteins.

c) Why Hb is a good carrier of O_2 than Mb? Explain.

d) What is anion gap? Give its significance.

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

a) Write a note on Chloride shift.

b) How urine is acidified? Give its significance.

c) What is the importance of minerals to the body?

d) Explain the term liver cirrhosis and liver function test.

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

a) Diuretics

b) Buffer system of blood

c) W. B. C.

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

P932

[3723]-106

M. Sc.

BIOCHEMISTRY

BCH-172 : Cell Biochemistry / Microbiology and Cell Biology

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

Instructions to the candidates :

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

SECTION - I

Cell Biochemistry / Microbiology

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

a) What are the different nutritional types of bacteria?

b) What is the use of filtration in control of microorganisms?

c) Explain the action of halogens as antimicrobial agents.

d) Discuss the mode of action of streptomycin, tetracycline and chloramphenicol.

e) Explain in detail the contributions of Robert Koch and Antonie Van Lecwenhock.

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

a) Fluorescence microscopy.

b) Biosynthesis of peptidoglycan.

c) Growth curve of bacteria.

d) Mechanism of Lysogeny & Lytic cycle of bacterial viruses.

e) Endotoxins.

P.T.O.

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

a) Difference between pourplate and spreadplate method.

b) Define Disinfectant, Germicide, Pathogen, Sanitizer and Sterilization.

c) Industrial production of Lysine.

SECTION - II

Cell Biochemistry / Cell Biology

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

a) Differentiate Prokaryotic cell from eukaryotic one.

b) What is subcellular fractionation? Give the role of this technique in Cell Biochemistry study.

c) Explain the process of Mitotic cell division.

d) Distinguish SER and RER.

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

a) Write an account on xylem and phloem.

b) Explain structure and function of mitochondria.

c) What do you know about collagen and elastic fibronectin? Explain.

d) What is spermatogenesis? Discuss the process of spermatogenesis.

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

a) Crossing over.

b) Leptotene.

c) Lysosome.

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

P933

[3723]-201

M. Sc.

PHYSICAL CHEMISTRY

CH-210 : Physical Chemistry - II (New)

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

Instructions to the candidates :

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) What is the energy range of IR radiation? Write a note on signal to noise ratio.

b) Explain the factors determining intensity of spectral lines.

c) Discuss the influence of nuclear spin on the spectrum of molecules having a centre of symmetry.

d) Discuss the advantages of FTIR spectroscopy.

e) State the selection rules for anharmonic and harmonic oscillators. Sketch and explain the vibrational modes of the H_2O molecule, which of these are IR active?

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

a) Is O–C–S a microwave active molecule? How does isotope substitution help in elucidating O–C and C–S bond lengths in the O–C–S molecule?

b) Sketch and explain the polarizability ellipsoids for the various vibration modes of the H_2O molecule, which of these are Raman Active?

c) Write a note on Fortrat Parabola.

d) Explain the photoelectron spectrometer used to measure the kinetic energy of ejected electron in PES.

e) Explain the applications of ESR spectra.

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

a) The force constant for HF is $970 Nm^{-1}$, calculate the frequency of vibration necessary to excite the molecules from $v = 0 \rightarrow v = 1$ (Atomic weights, H = 1, F = 19)

b) It takes 10 seconds to record on FTIR spectrum. How long will it take to record a dispersive spectrum? Measurements are made at every cm^{-1} over the range 4000 cm^{-1} to 400 cm^{-1}.

c) Fundamental vibrational frequency and anharmonicity constant of a molecule are 1641.4 cm^{-1} and 0.00711. Find the vibrational energy level at convergence limit and the dissociation energy of the molecule.

SECTION - II

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

a) Show that radioactive decay process obey first order kinetics.

b) Define the term dose and dose rate. What are the various units of dose? Give their conversion equivalents.

c) What is hydrated electron? Give different methods to obtain the hydrated electron.

d) Describe the working of a Fricke dosimeter. What precautions must be taken while using it?

e) What is separation factor? Explain the electromagnetic method for separation of isotopes.

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

a) Discuss the four factor formula used in reactor technology.

b) Explain critical size of a thermal reactor.

c) Give an account of recovery of Uranium and Plutonium from spent fuels.

d) Describe how solubility of a sparingly soluble salt can be determined using a radiotracer.

e) What is radiation gauging? Name the radio-isotopes used for this purpose. Explain how the thickness of a sheet can be controlled with a radiation guage.

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

a) 0.1 g of Mn sample was irradiated in a flux of 10^7 n $cm^{-2}s^{-1}$ for 30 min. What will be its activity at the end of irradiation, if r = 100% σ = 13.3 barn and $t_{½}$ of ^{56}Mn = 2.58h?

b) Find the molecular and mass absorption coefficients of propanol.
[A of H = 1, C = 12, O = 16,
Z of H = 1, C = 6, O = 8,
Given e^{μ} = 0.211 b/electron]

c) Calculate the half-life of radium-226 if 1 g of it emits 3.7×10^{10} alpha particles per second.

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Total No. of Questions : 6] **[Total No. of Pages : 7**

P934

[3723]-202

M. Sc. - I

CHEMISTRY

CH-230 : Inorganic Chemistry - II

(Old & New Course)

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

Instructions to the candidates :

1) ***All questions are compulsory.***
2) ***Answers to the two sections should be written in separate answer books.***
3) ***Neat diagrams must be drawn wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of log tables and calculators is allowed.***
6) ***Given Atomic Numbers : V = 23, Co = 27, Ni = 28, Cr = 24, Fe = 26, Cu = 29.***

SECTION - I

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

a) Prepare microstate table for three equivalent P electrons and hence derive allowed R. S. terms for the same.

b) Explain the hole equivalency theorem and mention two instances where this theorem comes to our aid.

c) A d^2 system gives the following transitions.

i) $^3T_{1g}$ (F) $\longrightarrow$ $^3T_{2g}$ (F)

ii) $^3T_{1g}$ (F) $\longrightarrow$ $^3A_{2g}$ (F)

iii) $^3T_{1g}$ (F) $\longrightarrow$ $^3T_{1g}$ (p)

Correlate these transition in terms of crystal field splitting parameter, D_q and Racah parameter, B.

d) Explain the following :

i) The value of molar extinction coefficient for $[NiCl_4]^{2-}$ is of the order of $10^2 - 10^3$ lit.mol^{-1}cm^{-1} while that of $[Ni(H_2O)_6]^{2+}$ is of the order of $10 - 10^2$ lit.mol^{-1}cm^{-1}.

ii) $KMnO_4$ is intense purple in colour while $MnSO_4$ is Faint pink in colour.

P.T.O.

e) Write short on :

Nephelauxetic effect and nephelauxetic series.

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

a) ^3F R. S. term is allowed for d^2 configuration.F V^{3+} free ion. Find out how it looses its degeneracy when $[V(H_2O)_6]^{2+}$ ion is formed.

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

i) $[Fe(CN)_6]^{3-}$

ii) $[Cu(H_2O)_6]^{2+}$

c) Calculate the degeneracy of following terms / configurations / states.

i) P^2d^2

ii) ^4G

iii) $^3T_{1g}$

iv) $(t_{2g})^2eg^1$

v) f^3

d) Arrange the following transitions in octahedral complexes according to increasing intensity. Justify your answer.

i) $E_g \longrightarrow E_g$

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

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

e) How would you account for the magnetic moment listed against each of the following complexes?

i) $Na_4[CO(NO_2)_6]$, μ = 1.88 B.M.

ii) $[CO(H_2O)_6]SO_4$, μ = 5.1 B.M.

Q3) Answer the following : **[10]**

a) Construct correlation diagram for d^2 Tetrahedral System.

Given :

i) R. S. terms for d^2 configuration in increasing order of energy

^3F, ^1D, ^3P, ^1G, ^1S

ii) The Mulliken symbols for R.S. terms.

^3F — $^3T_1 + {}^3T_2 + {}^3A_2$

^1D — $^1T_2 + {}^1E$

^3P — $^3T_1$

^1G — $^1T_1 + {}^1T_2 + {}^1E + {}^1A_1$

^1S — $^1A_1$

OR

a) Solve the following :

Hexa auqo Ni(II) complex shows three absorption bands at 356.8 nm, 571.2 nm and 891.2 nm. Calculate the crystal field splitting parameter D_9 and nephelauxetic parameter B and β with the help of following data :

Comment on nature M–L bonding

$B_O = 1030\ cm^{-1}$

$$B = \frac{2\nu_1^2 - \nu_2^2 - 3\nu_1\nu_2}{15\nu_2 - 27\nu_1}$$

b) For the complex $[Cr(OX)_3]^{3-}$ the ν_1 transition is observed at 17000 cm^{-1}. The spin orbit coupling constant for Cr^{3+} ion in this complex is +92 cm^{-1}. Calculate effective magnetic moment of the complex.

SECTION - II

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

a) What is bio-inorganic chemistry? Mention the functions of various metal ions that are used in biomolecules.

b) What are the possible pathways of absorption of metals by cells?

c) Explain the mechanism of detoxification of mercury.

d) Discuss the voltage gated channels for Na-transport.

e) Explain the mechanism of action of cis-platin as anticancer drug.

Q5) Write note on (<u>any three</u>) : **[15]**

a) Irving - William series

b) Fe - S Clusters

c) Mo - Cofactor

d) Zinc - Finger

e) Apo - transferrin

Q6) Draw the structures (<u>any five</u>) : **[10]**

a) Vit B_{12}

b) Enterobactin

c) Siderophores

d) 18 crown 6

e) Flavin

f) ATP.

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DIRECT PRODUCTS

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

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

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

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

(*d*) D_{5d}, D_{2h}, D_3, C_{3v}, C_{3h}, C_3 :

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

$E_1 \times E_2 = E_1 + E_2$.

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

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

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

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

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

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

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

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

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

6. The complete results for O are :

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

CORRELATION TABLE FOR GROUP O_h

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

Character Table for (O) rotational group

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

Total No. of Questions : 6] **[Total No. of Pages : 7**

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[3723]-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 should be written in separate answer books.***

SECTION - I

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

a) Write stereostructures and show why the reaction of bromine with cyclohexene is stereoselective?

b) Addition of alkaline $KMnO_4$ to fumaric acid gives (±) tartaric acid.

c) Partial reduction of alkyne with Lindlar's catalyst yields cis alkene, whereas with $Li/NH_3(l)$ gives trans alkene.

d) In the Sommelet rearrangement the product is formed from the less stable yield.

e) Phosphorous yields having electron donating alkyl groups on the yield carbon on reaction with aldehydes give Z-alkenes.

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

a) Give a brief account of synthetic applications of organocopper compounds.

b) The reaction of α-chlorocyclohexanone with ^{14}C at chlorinated carbon, on reaction with sodium methoxide gave carbomethoxy cyclopentane with 50% label, α-to carbomethoxy group & 50% label, β to the carbomethoxy group.

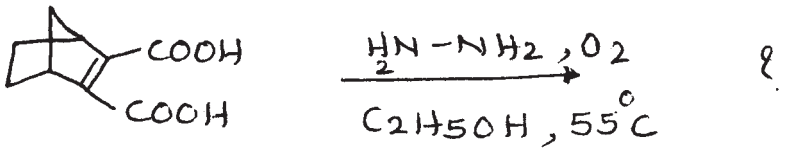
P.T.O.

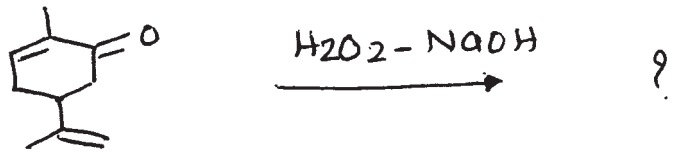
c) Organolithium reagents react with CO_2 to produce ketones, whereas Grignard reagents give carboxylic acids.

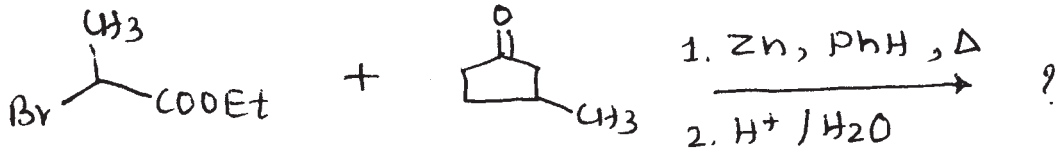
d) Wadsworth-Emmons reaction is preferred over conventional Wittig reaction. Explain.

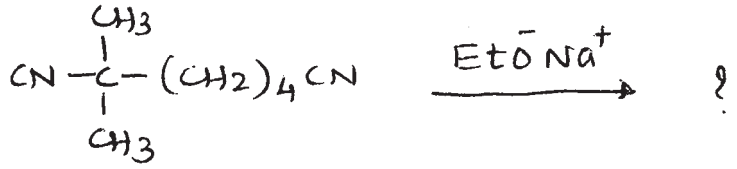
e) Write a brief note on Wilkinson's catalyst.

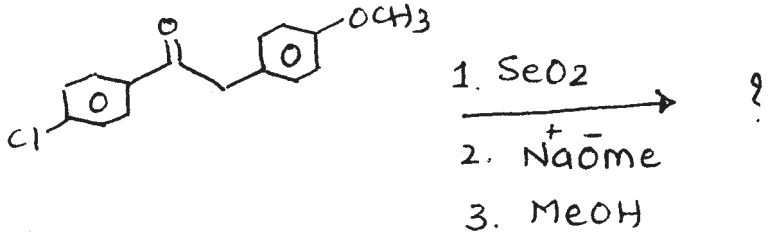
Q3) Predict the product and suggest the mechanism in any four of the following : **[12]**

a) 

b) 

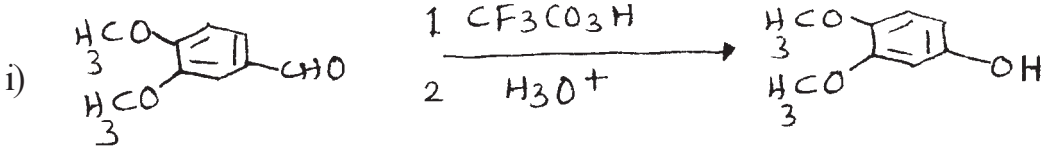
c) 

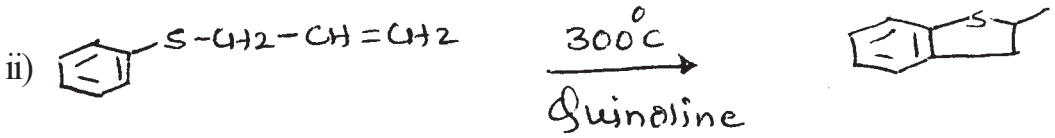
d) 

e) 

SECTION - II

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

i) 

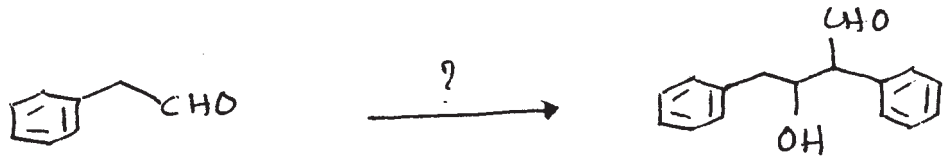
ii) 

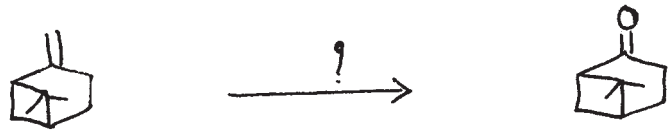
iii) 

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

i) $R_2C = CHR \xrightarrow{?} R_2C = O + RCOOH$

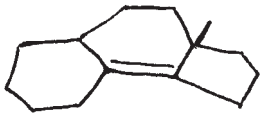
ii) $2ArNH_2 \xrightarrow{?} Ar - N = N - Ar$

iii) 

iv) 

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

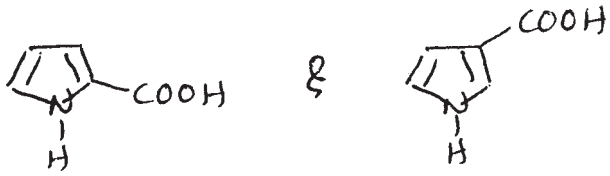
a) The ozonolysis of compound A gives product B, which exhibits $V_{c=0}$ at 1705 and 1735 cm^{-1}. Give the mechanism of the formation of B and justify the IR values.



A

b) O-Hydroxyacetophenone on methylation shows a blue shift while ρ-hydroxyacetophenone on methylation shows a red shift. Explain.

c) How will you distinguish the following pairs by UV?

i) 

ii) 

d) The compound with MF $C_4H_6O_2$ shows following IR spectrum in CCl_4.

3030(w), 1765(s), 1649(s), 1225(s) and 1140(s).

Identify these bands and suggest possible structures.

e) A compound with MF C_8H_8O shows a strong band near 1690 cm^{-1} in its IR spectrum. Which of the following structure is most likely? Justify.

i) $C_6H_5 - CH_2 - CHO$

ii) $C_6H_5 - O - CH = CH_2$

iii) $C_6H_5 - \overset{\overset{O}{\|}}{C} - CH_3$

iv) $HO - C_6H_4 - CH = CH_2$

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

a) MF : $C_6H_{12}Cl_2O_2$

IR : 1150, 1240, 670 cm^{-1}

PMR : 1.2 (6H, *t*),

(δ) 3.7 (4H, *q*),

4.6 (1H, *d*),

4.2 (1H, *d*)

b) MF : $C_{10}H_{11}NO_4$

IR : 1735, 1530, 1350 cm^{-1}

PMR : 1.3 (3H, *t*, J = 7Hz),

(δ) 2.6 (3H, *s*),

4.25 (2H, *q*, J = 7Hz),

7.4 (1H, *d*, J = 8Hz),

7.9 (1H, *dd*, J = 8, 2Hz),

8.3 (1H, *d*, J = 2Hz)

c) MF : $C_9H_6O_2$

UV : 250 nm ϵ = 14,000

IR : 3200-2500 (broad), 2200, 1680, 1600, 1480, 750, 680 cm^{-1}

PMR : 7.4 (3H, *m*),

(δ) 7.7 (2H, *dd*, J = 8 & 2Hz),

11.2 (1H, *s*)

d) MF : C_5H_6O

IR : 1600, 1500 cm^{-1}

PMR : 2.3 (3H, *s*),

(δ) 5.85 (1H, *d*, J = 2Hz),

6.2 (1H, *dd*, J = 1.5 & 2Hz),

7.2 (1H, *d*, J = 1.5Hz).

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

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[3723]-204

M. Sc.

BIOCHEMISTRY

BCH-270 : Bioenergetics and Metabolism (Old & New)

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

Instructions to the candidates :

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

SECTION - I

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

a) List out the energy rich compounds of our body and justify why ATP is referred as energy currency of the cell?

b) What is Pasteur effect? Give its significance.

c) Why TCA cycle is considered as amphibolic pathway?

d) How does glycogenin help in synthesis of glycogen?

e) Define gluconeogenesis. List out the gluconeogenic precursors of our body.

f) What are the salient features of Chemiosmotic hypothesis by Peter Mitchell?

g) Write note on enzymes and coenzymes involved in the conversion of pyruvate to Acetyl CoA.

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

a) Explain β-oxidation of Palmitic acid with energetics.

b) Differentiate between cyclic and noncyclic photophosphorylation.

c) Discuss the effect of inhibitors and uncouplers on ETC and OP that affect ATP synthesis.

d) Explain the control point that regulates glycolysis and gluconeogenesis.

e) Describe the steps involved in Pentose phosphate pathway and its significance.

P.T.O.

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

a) List out the enzymes that form fatty acid synthase complex.

b) What are the anapleurotic reactions of TCA? Give examples.

c) Define the term standard redox potential and give its significance.

d) What are substrate linked phosphorylation reactions? Give examples.

e) What are Ketone bodies? Give their structures.

f) Give the end products of β-oxidation of odd numbered fatty acid and how they enter TCA cycle.

g) How is Cholesterol biosynthesis regulated by allosteric mechanism?

SECTION - II

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

a) Describe the fate of amino acids in the body. Enumerate the reactions involved in amino acid degradation.

b) How urea cycle is regulated?

c) Describe the synthesis of S-adenosylmethionine.

d) Give the biochemical significance of glutamine amidotransferase. Explain its mechanism of action.

e) How deooxyribonucleotides are synthesized from ribonucleotides?

f) Explain the biochemical steps involved in heme degradation.

g) Write the structure of tetrahydrofolate and give two biochemical reactions in which tetrahydrofolate is involved.

Q5) Give the biochemical reactions involved in the following conversions (any three) : **[15]**

a) Phenylalanine to acetoacetate.

b) Proline to α-ketoglutarate.

c) Tyrosine to epinephrine.

d) AMP, GMP to uric acid.

e) Thymine to β-aminobutyrate.

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

a) Explain the synthesis of pyrimidine nucleotides.

b) How biosynthesis of adenine and guanine is regulated?

c) Give the pathogenesis and clinical manifestations of

i) Phenylketonuria

ii) Gout.

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

P939

[3723] - 301

M.Sc.

PHYSICAL CHEMISTRY

CH - 310 : Quantum Chemistry and Solid State Chemistry (New)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

Q1) Attempt <u>any four</u> of the following : **[20]**

a) Show that

$$\hat{L}_x, \hat{L}_y = \hat{L}_z$$

according to commutation properties

b) Discuss the properties of ladder operators.

c) Show that hermitian operators have real eigenvalues.

d) Formulate the total energy operators for i) Be^{+2} and ii) H_2^- ions. State the terms involved in each of these.

e) Derive the equation

$$E_i^1 = \frac{\int \psi_i^{*(o)} H^1 \psi_i^{(o)} dy}{\int \psi_i^{*(o)} \psi_i^{(o)} dy}$$

where E_i^1 is the first order perturbation energy for a non-degenerate state.

f) State the principle of variation method and discuss the various steps involved in the application of the method.

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

a) Derive the secular equation for benzene and evaluate the delocalization energy on the basis of Hückel's approximation.

b) Explain the mnemonic model of Frost and Musulin used to deduce HMO energies for annulenes.

c) Explain the basis of Schaat and Hess model used to modify Hückel's method.

d) Distinguish among antiaromatic and aromatic compounds on the basis of REPE values.

e) Deduce the secular determinant for ethene and obtain the HMO energy values for the molecule.

f) Write a note on Hückel's 4m+2 rule.

SECTION - II

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

a) Compare the resistivities of annealed and unannealed Cu - Au alloys.

b) Write a note on Brillouin zones.

c) Derive the expression for the number of Frenkel defects present in a crystal at a given temperature.

d) Explain the mechanism of diffusion in solids.

e) Discuss the velocity of growth of a crystal on the basis of geometrical considerations.

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

a) Discuss small angle boundaries, stacking faults and secondary recrystallization in plane defects.

b) Explain photoconductivity in ionic crystals.

c) What is nucleation? Explain the kinetics of nucleation.

d) Write and explain the mechanism for the reactions occurring at the

i) Interphase AgI / Ag_2 HgI_4 for the reaction between AgI and HgI_2.

ii) Interphases Cu / CuCl and CuCl / AgCl for the reaction between Cu (s) and AgCl (s).

e) Write a note on transistors.

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

a) In a monoatomic crystal if 1 eV energy is required to move an atom from the crystal's interior to the surface, what is the proportion of vacancies present in the crystal at 1000 K and at 300 K?

b) How deep will Al penetrate in Si at 1300ºC in 1 hr?

[Given : $\Delta H = 73$ kcal / mole

$D_o = 1.55$ cm^2/s]

c) The number of free electrons in a monovalent crystal is 10^{19} per cm^3 at 27ºC. Evaluate E_0 in eV.

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

P940

[3723]-302

M. Sc.

PHYSICAL CHEMISTRY

CH-311 : Nuclear and Radiation Chemistry (New)

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

Instructions to the candidates :

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

Physico - Chemical Constants

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			=	1.602×10^{-19} C
5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
			=	1.987 cal K^{-1} mol^{-1}
7.	Faraday Constant	F	=	96487 C equiv^{-1}
8.	Speed of light	c	=	2.997×10^{10} cm s^{-1}
			=	2.997×10^{8} m s^{-1}
9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
10.	1 amu		=	1.673×10^{-27} kg
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) What are the basic requirements of a good moderator? Enlist various moderators used in nuclear reactors along with their properties.

b) Draw and explain pool type research reactor.

c) What are various types of fission reactions?

d) Explain the terms : critical energy of fission, fission potential energy barrier and spontaneous fission.

e) Discuss the salient features of shell model.

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

a) Explain the terms magic number, square well potential and closed shell nuclides.

b) Derive Breit Wigner formula.

c) Describe how depth profiling measurement is done with Rutherford back scattering technique.

d) Draw a schematic diagram of Cockroft-Waltor's neutron generator and explain its working.

e) Describe how compound nucleus theory is verified experimentally.

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

a) ^{9}Be target is bombarded by protons of energy 6MeV. Calculate the energy of protons observed at 90° after they have excited the Berillium to a level of 0.7 MeV.

b) In the fission of $^{239}_{94}\text{Pu}$, the fragments have the mass numbers 100 and 138 whose stable isobars are $^{100}_{42}\text{Mo}$ and $^{138}_{56}\text{Ba}$. Which will be the primary fragments?

c) Calculate the number of uranium atoms that must fission per fission so that 20 MW power is generated.

Given : energy released per uranium fission is 200 MeV.

SECTION - II

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

a) What are the requirements of a good scintillator? Enlist various inorganic scintillators & explain working of any one of them.

b) Write down the mechanism of radiolysis of ceric sulphate and deduce the expression for GCe^{3+}.

c) Discuss the nuclear reasons for retention in Szilard-Chalmer's reaction.

d) Describe briefly Chemistry of recoil atoms.

e) Write a brief note on LINAC.

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

a) What were the causes of Chernobyl nuclear accident? Describe the sequence of events responsible for this accident.

b) Explain how external radiation hazards can be controlled with distance and shielding.

c) Define maximum permissible dose which are the points to be considered while applying this dose.

d) Distinguish between somatic and genetic effects.

e) Explain the terms G value, PRP of water, radiation annealing and dosimeter.

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

a) Find out the dose due to 200 mCi ^{99m}TC at a distance at 2 meter. Given E_v = 140 KeV.

b) The recoil energy of Mössbauer nuclide $^{119}Sn^*$ is 2.551 MeV. Find the energy emmitted by the nucleus.

c) Find out the dose absorbed by benzene in 2 hours when exposed to gamma radiation. Given (Z/A) of Fricke solution = 0.553, dose absorbed by Fricke solution at the same position = 3.2 Gy/min.

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

P941

[3723] - 303
M.Sc.
PHYSICAL CHEMISTRY
CH - 312 : Advanced Instrumental Methods of Analysis (New)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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7.	Faraday Constant	F	=	96487 C equiv^{-1}
8.	Speed of light	c	=	2.997×10^{10} cm s^{-1}
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9.	1 cal		=	4.184×10^{7} erg
			=	4.184 J
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12.	Nuclear magneton	β_n	=	5.051×10^{-27} J T^{-1}
13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) Comment on the sensitivity of NAA technique. State the parameters affecting the sensitivity. How?

b) What are the advantages of neutron activation analysis?

c) State the various types of detectors used in mass spectrometry. Describe any one of these.

d) Distinguish between chemiluminescence (CL) and electro chemiluminescence (ECL). Briefly discuss the quantitative analysis by CL.

e) Explain liquid-phase CL titrations with a typical example.

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

a) What are the conditions under which prompt radiation activation analysis is used? What are the applications of the technique?

b) Discuss the electron bombardment ionization method used in mass spectrometry.

c) State the various types of detectors used for X-ray methods and explain any one of these.

d) Describe the various sources used in X-ray analysis technique.

e) Enlist the analytical applications of fluorescence.

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

a) Calculate geometrical cross-section for zinc atom.

(Given : $R_o = 1.4 \times 10^{-13}$ cm, mass No of $z_n = 66$)

b) A time-of -flight mass spectrometer has a flight path of 90.0 cm and uses an accelerating potential of 2.4kV. Calculate the time required for ionic fragments with $\frac{m}{z}$ 100 and 101 to strike the detector. Calculate the difference in time of arrival of the two ions at the detector.

c) Calculate the mass absorptive coefficient at 0.436nm of an alloy consisting of 85.0 percent iron, 5.0 percent nickel, 9.0 percent copper and 1.0 percent zinc. The mass absorptive coefficients for the pure elements at 0.436nm are 610, 715, 760 and 910 cm^2/g respectively for Fe, Ni, Cu and Zn.

SECTION - II

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

a) State the principle of inductively coupled plasma atomic emission spectroscopy technique. Discuss the applications of the technique.

b) Discuss the method of quantitative analysis by ICP-AES technique. What is the detection limit?

c) Enlist the criteria for a good thermobalance in TGA technique.

d) Describe the applications of DTA.

e) Draw and describe the energy level diagram for solid sample and spectrometer used in ESCA.

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

a) With a neat labelled diagram, describe the retarding potential analyzer used in ESCA.

b) Enlist the applications of controlled potential coulometric methods.

c) Describe constant current coulometric analysis technique with a neat labelled diagram.

d) Briefly describe the applications of pulse voltammetry.

e) Draw and explain the typical cyclic voltammogram.

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

a) Determine the eqivalent weight of an organic acid if 0.0400g in alcohol-water mixture required a constant current of 50mA for 500 sec to generate sufficient hydroxyl ions to reach a phenolphthalein end point.

b) The thermal curve of a 125.70mg sample that contained a mixture of $CaC_2O_4.H_2O$ (MW = 146.12) and a thermally stable salt had a mass loss Δm of 6.98mg at an onset temperature of about 140°C corresponding to vapourization of water. Determine the percentage (w/w) of $CaC_2O_4.H_2O$ in the sample.

c) The is electron of Na has a binding energy of 1071.9 eV. Estimate the work function of the electron spectrometer if the incident radiation is $k\alpha_1$ line of magnesium (λ = 988.8 pm) and the kinetic energy of the measured electron is 175.8 eV.

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

P942

[3723]-304

M. Sc.

PHYSICAL CHEMISTRY

CH-314 : Polymer Chemistry (New)

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

Instructions to the candidates :

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Distinguish between condensation and addition polymerization.

b) Explain, with suitable examples, how polymers can be classified based on

i) Structure and ii) Conformations

c) Discuss the Flory-Krigbaum theory for dilute polymer solutions.

d) Write expression for the entropy of mixing explaining the terms involved, and explain on the basis of a simple molecular model why entropy of mixing of polymer solutions has small value.

e) Derive the copolymer equation.

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

a) Using the copolymer equation, derive the expression for instantaneous compositions of the polymer formed.

b) 'It is almost impossible to obtain a 100% crystalline polymer'. Explain.

c) Explain how mechanical properties can be used in physical testing of polymers.

d) What is glass transition temperature? Describe the relationship between T_g and T_m.

e) It was expected that the rate of a reaction should decrease with increasing molecular size. But it was experimentally observed that except for very small size, the rate is independent of molecular size. Explain.

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

a) 250 g of Vinyl chloride were copolymerized with 86 g of methyl acrylate. Find the instantaneous composition of the polymer formed if the monomer reactivity ratios of Vinyl chloride and methyl acrylate are 0.12 and 4.4 respectively.

[Atomic weights : C = 12, H = 1, O = 16, Cl = 35.5]

b) A condensation polymerization reaction is 97% complete. Calculate $\bar{x}_n$, $\bar{x}_\omega$ and weight fraction of $\bar{x}_n$-mers.

c) Show by chemical equations, the four necessary and sufficient steps of free radical chain polymerization of butadiene using t-butyl peroxide as initiator.

SECTION - II

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

a) What is TGA? Discuss the use of TGA in analysis of polymers.

b) Describe the preparation of a sample for IR spectroscopy. Comment on the use of IR spectra for crystalline and amorphous polymers.

c) Write a note on use of X-rays in analysis of polymers.

d) Describe, with a neat diagram, the osmometric method of determination of molecular weight of a polymer.

e) Derive the expression for the number average molecular weight of polymer formed by condensation reaction in absence of a catalyst and show that it is directly proportional to square root of time.

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

a) Explain with the help of molecular weight distribution curve, the distribution of molecular weight in a polymer sample. Show the positions of various averages on the curve.

b) Define $\overline{M}_n$, $\overline{M}_\omega$ and polydispersity index. What is the effect of polydispersity index on physical properties of polymer?

c) Explain the following terms :

i) natural rubber

ii) vulcanization

iii) reinforcement and

iv) carbon blocks

d) Distinguish between textile and fabric properties of polymers.

e) Describe conduction mechanism for conducting polymers.

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

a) The osmotic pressures of solutions of a sample of polyisobutylene cyclohexane at 25°C are

C(g/ml)	0.020	0.015	0.010	0.005
Π (bar)	0.0118	0.0067	0.0030	0.00091

Calculate the molecular weight of polyisobutylene.

b) A suspension of a polymer has molecular weight 100000. Another polymer with molecular weight 60000 is added which is 20% by weight. Calculate $\overline{x}_n$, $\overline{x}_\omega$ and polydispersity index.

c) The following viscosity data were obtained for a sample of cellulose acetate in acetone at 25°C.

C(g/100ml)	0	0.114	0.351	0.703
η (millipoise)	3.16	4.06	6.64	13.02

for this solute-solvent system, $K = 1.87 \times 10^{-5}$ $\alpha = 1.03$. Determine the average molecular weight of the sample.

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

P943

[3723]-305

M. Sc.

PHYSICAL CHEMISTRY

CH-315 : Special Topics in Physical Chemistry (New)

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

Instructions to the candidates :

1) ***Answers to the TWO sections should be written in SEPARATE answer books.***
2) ***ALL questions are COMPULSORY.***
3) ***Figures to the RIGHT SIDE indicate FULL marks.***
4) ***Use of logarithmic table/calculator is ALLOWED.***
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13.	Mass of an electron	m_e	=	9.11×10^{-31} kg

P.T.O.

SECTION - I

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

a) What is a sensor? Explain the sensor system with a neat labelled diagram.

b) Classify the sensors on the basis of their purpose and the type of output signals.

c) Write the mass balance on sodium and carbonate in 0.02M $NaHCO_3$ and charge balance for KCN.

d) Write the proton condition for H_3PO_4 and Na_2CO_3.

e) Draw different types of adsorption isotherms and explain the isotherm of type I and IV.

f) What is the influence of the oxygen medium on the properties of surface and grain boundaries in porous ceramics?

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

a) Calculate the pH and concentration of all ionic species for 0.1N H_2CO_3 (Given : $Ka_1 = 4.46 \times 10^{-7}$, $Ka_2 = 5.62 \times 10^{-11}$)

b) Draw a logarithmic concentration diagram for 0.1M CH_3COONa (Given : pKa = 4.75)

c) Write a note on chemiresistors.

d) Explain the dependence of the observed rate constant for oximation of acetone on pH at 25°C.

e) Discuss the catalysis in dilute aqueous solution.

f) Derive the expression for Michaleis-Menten Kinetics.

SECTION - II

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

a) Draw a neat and labelled diagram of electron microscope and name the different spectroscopic techniques associated with it.

b) Describe abnormal physical and chemical properties of nanoparticles.

c) Define actuators. Describe four types of actuators used in smart materials.

d) Write a note on Pachinko Machine.

e) What are the advantages of phase rule?

f) What is the significance of eutectic point?

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

a) Describe the chemical methods of preparing nano particles.

b) Briefly explain the term 'Lithography'.

c) What do you mean by elastic non linearity? How is it used in preparing smart materials?

d) Write a note on Sushi test.

e) Discuss the phase diagram of water system.

f) Derive Raoult's law.

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

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[3723] - 306

M.Sc. - II

INORGANIC CHEMISTRY

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

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

Instructions to the candidates:

1) ***All questions are compulsory & carry equal marks.***
2) ***Figures to the right indicates full marks.***
3) ***Use of log table & calculators are allowed.***

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

a) What do you understand by the term haptacity of a ligand? Give suitable examples? What hapticities are possible for the following ligands. i) C_2H_4 ii) Cyclopentadienyl iii) C_6H_6 iv) Butadiene.

b) Explain the typical reactions of M Cp^*_2.

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

d) Draw the structure and give the electron count of the following.
i) $Fe(CO)_5$, ii) $Fe_2(CO)_9$, iii) $(\eta^3\text{-}C_3H_5)_2Ni$

e) Predict the products.

i) $Cp(CO)_3 Mo - CH_3 + CO \longrightarrow ?$

ii) $MnPh(CO)_5 + PPh_3 \longrightarrow ?$

iii) $R\text{-}Li + W(CO)_6 \longrightarrow ?$

iv) $2\,CoO + 8\,(CO) + 2Cu \longrightarrow ?$

v) $(OC)_5 Cr = C(OMe)(R) \xrightarrow{Py.} ?$

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

a) Describe the molecular orbital representation of structure of ferrocene.

b) Give systamatic classification of fluxional organometallic compounds.

P.T.O.

c) The variable temperature ^1H NMR of $[(\eta^5 - C_5H_5)\ Fe\ (CO)_2]$ shows one sharp signal at + 28ºC, while two sharp signals are seen in the ^1H NMR at – 70ºC.

d) Explain utility of organometallic compounds in agriculture and horticulture.

e) Write a catalytic cycle for the production of acetaldehyde from ethylene by using Wacker process.

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

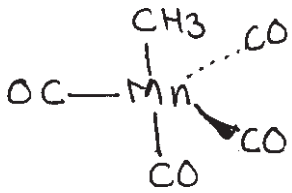
a) Predict the product & state which reaction are oxidative addition, insertion reaction, elimination reaction and cyclometallation reaction.

i) $Mn\ CH_3\ (CO)_5 + CO \longrightarrow\ ?$

ii) $Fe\ (COPh)\ (CO)_2\ (\eta^5 - C_5H_5) \xrightarrow{h\upsilon} ?$

iii) $Ru\ (CO)_3\ (PPh_3)_2 + CH_3I \longrightarrow\ ?$

iv) $Cp\ (CO)_3\ Re + Br_2 \longrightarrow ?$

v) 

$+\ C_6H_5N{=}NC_6H_5 \xrightarrow{100^oC} ?$

b) Draw the structures -

i) $CO_2\ (CO)_8$ in Sol? and Solid state.

ii) $Mo\ (CO)_3\ (\eta^6 - C_7H_8)$.

iii) Cis $CP_2\ Fe_2\ (CO)_4$.

iv) $[CO\ (H)\ (N_2)\ (PPh_3)_2]$.

v) $Fe_5\ (CO)_{15}\ C$.

c) What is catalysis? Why do transition metals act as catalyst? Give two examples of homogeneous catalysis.

d) Discuss mechanism of hydroformylation reaction of alkene with rhodium catalyst and cobalt catalyst.

e) Write a note on-Environmental aspects of organometallic compounds.

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

a) What do you mean by hydrocyanation reaction? Which catalyst are used for this reaction. Explain with one example.

b) What do you mean by Heck reaction? Explain the steps involved in cyclopropanation reaction.

c) Give steps involved in Tolmoris catalytic cycle.

d) Explain with the suitable examples the role of organometallic compounds as 'protecting and activating agents'.

e) Write a note on – Pianostool compounds.

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

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[3723] - 307

M.Sc. - II

INORGANIC CHEMISTRY

CH - 330 : Coordination Chemistry, Magnetism and Reaction Mechanism

(New Course) (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 log. table & calculator is allowed.***

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

a) Explain the magnetic properties in dimeric copper (II) acetate monohydrate.

b) Explain the experimental magnetic moment of the following ions :

i) Mn^{3+}, μ B.M. expt. = ~ 4.9 B.M., At. No. Mn = 25

ii) Fe^{2+}, μ B.M. expt. = ~ 5.5 B.M., At. No. Fe = 26

c) Write a note on 'High spin - low spin' equilibria.

d) Explain the terms :

i) Magnetic domain.

ii) Canting.

iii) Antiferromagnetic material.

e) Give the nomenclature for the following molecules.

i) $Rh(acac)\ (C_2H_4)_2$

ii) $[Co(en)_2\ (ox)]Cl$

iii) $Pd(NH_3)_2\ (C_2H_3O_2)_2$

iv) $K_3[Fe(ox)_3];\ 3H_2O$

v) $[Co(NH_3)_5Cl]C1_2$

P.T.O.

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

a) Explain how magnetic and spectral data can be used for characterisation of Co(II) complexes of various geometries.

b) Explain why $Fe_2(CO)_9$ is diamagnetic?

c) Explain the difference between antiferromagnetic spin-spin exchange and spin pairing.

d) What are mixed valence compounds? What is the nature of electronic spectra of these compounds.

e) Discuss the factors that affect the crystal field stabilization energy in T.M. complexes.

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

a) Which isomers can you obtained from the following two synthetic pathways? Give precise explanation and correct structure of the product

i) $[PtCl_4]^{2-} \xrightarrow{+NH_3} ? \xrightarrow{+NO_2} ?$

ii) $[Pt\ (PR_3)_4]^{2+} \xrightarrow{+Cl^-} ? \xrightarrow{+C\bar{l}} ?$

b) Discuss the relationship between the 'd' electron configuration of the metal and the lability of complex.

c) Explain in brief about the base hydrolysis of cobalt (III) ammine complexes.

d) Explain in brief complementary reactions.

e) Write a note on π bonding theory.

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

a) Discuss in brief about anation reactions.

b) With suitable examples explain the non-complementary reactions.

c) Discuss the factors which affects the rates of electron transfer reactions.

d) Explain the applications of photochemistry of co-ordination compounds.

e) Discuss in brief isomerisation of octahedral complexes.

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

P946

[3723] - 308

M.Sc. - II

INORGANIC CHEMISTRY

CH - 331 : Structural Methods in Inorganic Chemistry (Sem. - III) (New)

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

Instructions to the candidates:

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

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

a) ^{31}P nmr spectra of $HPO(OH_2)$ (1) and $H_2PO(OH)$ (2) showed a doublet for (1) and triplet for (2). Predict the structures of (1) & (2).

b) Low resolution ^{19}F nmr of [W F_6 L] shows three lines with relative intensities 4:1:1. Assign peaks and elucidate the structure of the complex.

c) Discuss the ESR spectrum of methyl radical.

d) What is meant by 'g' value in ESR? Which factors affect the 'g' value of a complex.

e) Explain the electro analytical technique which can be used for studying the mechanism of electron transfer.

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

a) With the help of a schematic diagram and suitable diagram explain the principle of Mössbaver spectroscopy.

b) Give a detailed account of thermogravimetric analysis. Discuss the factors affecting the thermogram.

c) With the help of suitable examples explain the principle and limitations of NQR.

P.T.O.

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

a) Explain the cyclic voltamogram of $(C_p)_2\ C_o$ in acetonitrile.

b) How many lines do you expect in the ESR of hydrogen atom? Explain showing transitions.

c) Draw energy level diagrams of a nucleus having I = 3/2 when

i) $\eta = 0$ ii) $\eta \neq 0$.

d) Explain the terms i) Isomer shift and ii) quadrupole splitting in Mössbaver spectroscopy with reference to iron compounds.

e) What is the significance of spin-spin coupling in NMR? How is it useful for determining structures of compounds?

Q4) Solve <u>(any four)</u> : **[20]**

a) Decomposition of calcium oxalate monohydrate occurs in three stages. Calculate the % weight loss for each stage and suggest the reaction for each weight loss.

b) What are (100), (110), (111) & (200) planes? Explain with reference to cubic and hexagonal close packings.

c) Give reasons :

i) In an ESR spectrum intensity of $\perp$ lines is usually higher than // lines.

ii) In the solution ESR spectrum, the low field lines are broader than high field lines.

d) Explain the effect of the following heatings rates on decomposition of polystyrene in N_2 atmosphere.

i) 1% min ii) 5° per minute.

e) Explain the following chemical shifts of tin compounds in their Mössbaver spectra.

Sn^{+4}	0 mms^{-1}
Sn (covalent)	2.1 mms^{-1}
Sn^{+2}	3.7 mms^{-1}

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

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[3723] - 309

M.Sc. - II

INORGANIC CHEMISTRY

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

(New) (Sem.- III) (Revised)

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

Instructions to the candidates:

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

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

a) Explain the role of the following metals in biology and medicine
   i) Copper ii) Zinc iii) Cobalt

b) Discuss the various aspects of the biochemistry of manganese.

c) "Radionuclides can be used as effective diagnostic agents". Justify this statement with the help of suitable examples.

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

a) What is role of manganese clusters in dioxygen production? Explain.

b) Transition metal complexes are good spectroscopic probes to understand metal-nucleic acid interactions. Justify the statement with the help of suitable examples.

c) Write an account on structural and gene regulatory functions of Zinc.

d) List the enzymes of copper and discuss their functions in brief.

e) Explain the reactions of $[Fe (EDTA)]^{2-}$ complex with DNA.

Q3) a) Draw the structures of any five : **[10]**

i) F - 430.
ii) Ethidium.
iii) Type 1 and Type 3 copper proteins.
iv) Spirogermanium.
v) $(C_5H_5)_2$ Ti Br_2.

P.T.O.

b) Fill in the blanks : **[10]**

i) $O_s O_4$ binds to DNA through _____ interactions.

ii) Ethidium Bromide is an organic _____.

iii) Photolysis of $[Ru (phen)_3]^{2+}$ bound to DNA leads to ____ ____.

iv) Interaction of cis-platin is by _____ _____ into cells.

v) HIPIP stands for _____.

vi) Aurano fin is a ___ ____ drug.

vii) $[Tc (CNR)_6]^{+}$ is used as a ____ agent.

Q4) Write short notes on <u>any four</u> : **[20]**

a) Metalloregulatory proteins.

b) Role of Radionuclides in Pharmacy.

c) Gado linium compounds in MRI.

d) Hydrogenases.

e) Superoxide dismutase.

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

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[3723] - 310

M.Sc.

ORGANIC CHEMISTRY

CH - 350 : Organic Reaction Mechanism

(New Course) (2008 Pattern)

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

Instructions to the candidates:

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

SECTION - I

Q1) Write short notes on (any three) : **[12]**

a) What is stetter reagent explain in brief with suitable example.

b) Explain in brief cross over experiment.

c) $BA6^2$ pathway.

d) Generation and structure of nitrene in brief.

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

a) From the given data calculate how much faster P-bromo benzyl chloride will be solvolysed than P-nitro benzyl chloride in water.

b) The ρ value for base catalysed elimination of HF from a series of l-aryl-2- fluoroethane increases from monofluoro to trifluoro compounds

Explain -	$Ar\text{-}CH_2CF_3$	$Ar\text{-}CH_2CHF_2$	$Ar\text{-}CH_2\text{-}CH_2\text{-}F$
	ρ 4.04	3.5	3.24

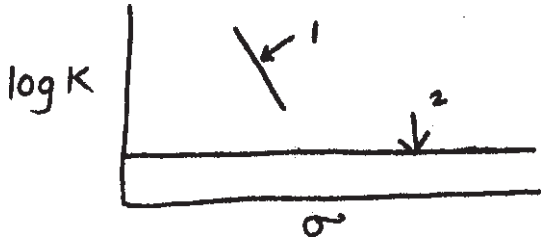
P.T.O.

c) Explain the sign and magnitude of ρ in the following reaction.

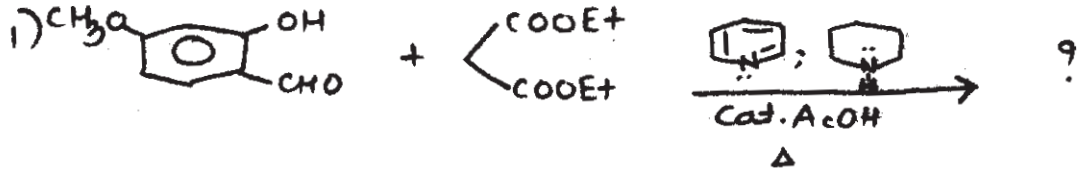
$$Ar\text{-}H + Br_2 \xrightarrow[25^\circ]{HOAC} Ar\text{-}Br \qquad -12.14$$

$$Ar\text{-}H + Cl_2 \xrightarrow[25^\circ]{HOAC} Ar\text{-}Cl \qquad -8.06$$

d) What information is available about ρ(Rho) from the given plots (1,2)?



Q3) Predict the product in the following giving mechanism of their formation (any four) : **[16]**

1) 

2) 

3) 

4) 

5) 

SECTION - II

Q4) Explain <u>any four</u> of the following : **[12]**

a) Indole on reaction with aq. NaOH in chloroform gives 3-formyl indole and 3-chloroquinoline.

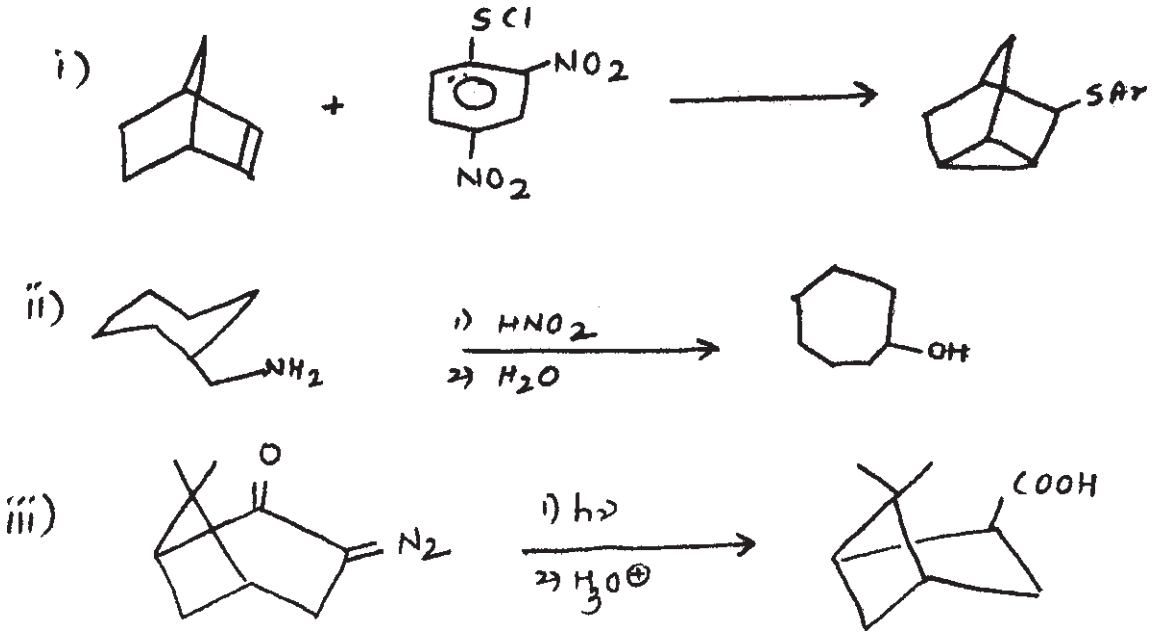
b) Predict which member in the following pair will be hydrolysed more rapidally in dil. NaOH

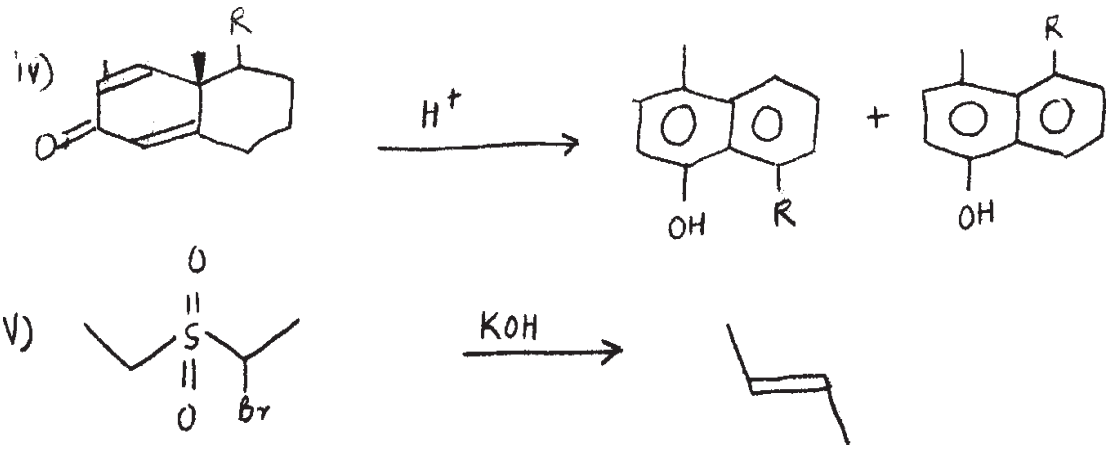
c) Percentage of enol in $MeCOCHPhCO_2E^+$, $MeCOCH_2COMe$, and $PhCOCH_2COMe$ is 30%, 76% and 89% respectively.

d) Stork enamine approach is more selective than enolate ion approach in alkylation reaction.

e) The formation of semicarbazones from ketone and semicarbazide is accelerated by catalytic amount of acid but retarded excess amount of acid.

Q5) Suggest the mechanism for the following conversion (any four) : **[16]**



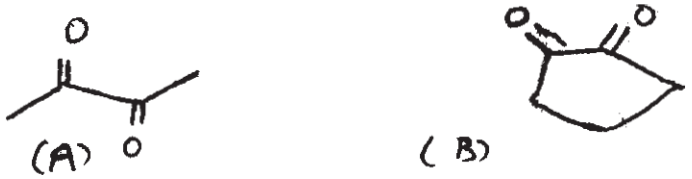


Q6) Attempt <u>any four</u> of the following : **[12]**

a) In benzoin condensation of P-methoxy benzaldehyde and benzaldehyde mixture the major product formed is PhCH(OH)COPh.

b) Decarboxylation of (B) is slower than that of (A)

c) When propanoic acid is refluxed with H_2SO_4 in water enriched in H_2O^{18}, ^{18}O gradually appears in carboxylic acid group.

d) 

Explain (A) almost exclusively exists as keto form & (B) ≈100% in end form.

e) Methyl ethyl ketone when reacted with benzaldehyde in presence of base in acid separately it gives two different products.

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

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[3723]- 312
M.Sc. - II
ORGANIC CHEMISTRY
CH - 352 : Organic Stereochemistry
(2008 Pattern)

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

Instructions to the candidates:

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

SECTION - I

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

a) State and explain conformational rule. Why it is not applicable to alkyl cyclohexanol?

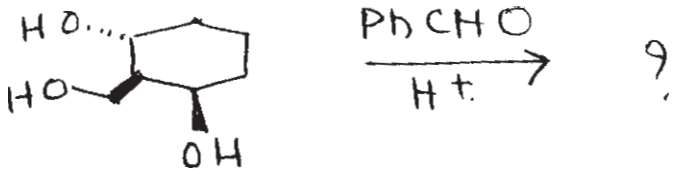
b) How many unsubstituted structural isomers with fused rings are possible for i) bicycloheptanes ii) bicyclooctanes. Give systematic names for each of these. Also indicate whether cis and trans isomers are possible.

c) The methine proton of cyclohexane which shows only averaged ^1H NMR signal at room temperature resolves into two sets of signals at –115°C. Explain.

d) Explain the method of resolution through the formation of diastereomes.

e) Reaction of cyclohexane with per acid followed by hydrolysis gives trans - 1, 2 - diol while similar reaction of trans cyclodecene. gives trans - 1, 6 - diol. Explain.

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

a) 

b) 

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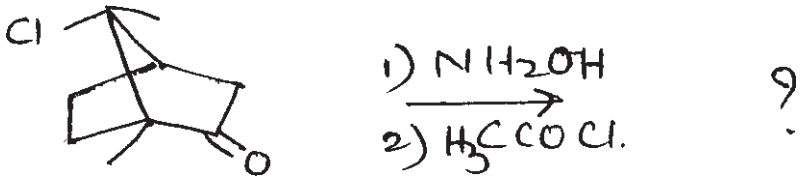
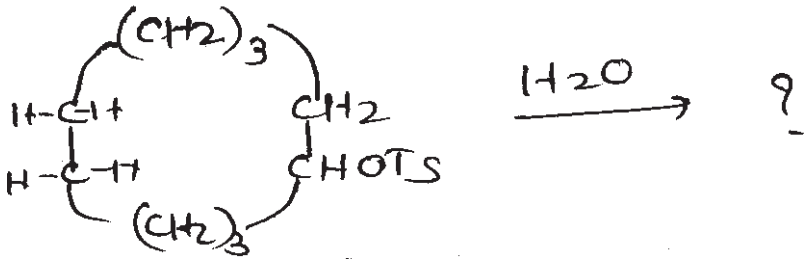
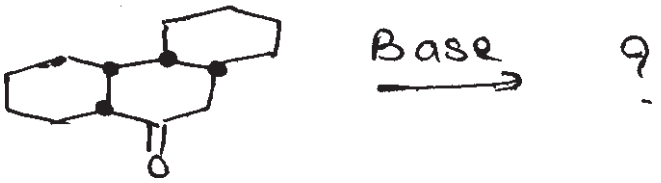
c) 

d) 

e) 

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

a) Limitations of Bredt's rule.

b) Isomers of perhydro anthracene and their stabilities.

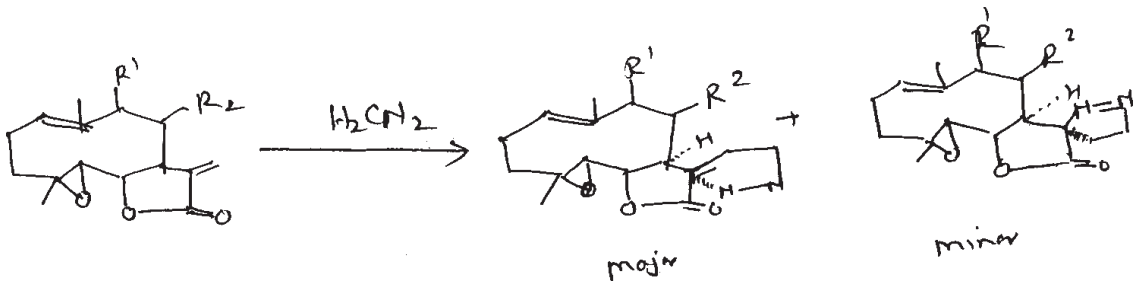
c) Write a note on resolution by chromatography.

d) Describe 3-alkylketone effect.

SECTION - II

Q4) Answer the following questions (any three) : **[12]**

a) How will you use following chemical reaction to establish lactone ring fusion to enhydrin.



b) In cinchonine and quinine $C_8 - C_9$ bond and C_3 – vinyl bond are on the same size.

c) Give the experimental evidences to establish relative configuration of C_5 and C_6 in morphine.

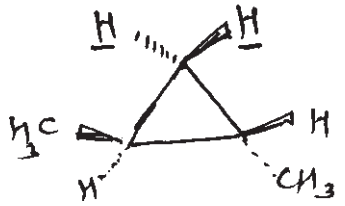
d) Explain the stereochemistry of C_6– OH and C_{13} – C_{15} bonds in codeine and in isocodeine.

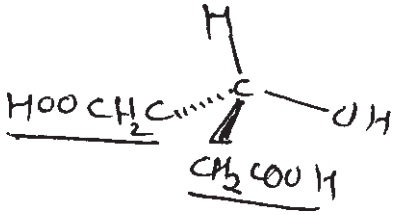
Q5) Answer the following questions (any three) : **[12]**

a) Explain the terms with example (any two)

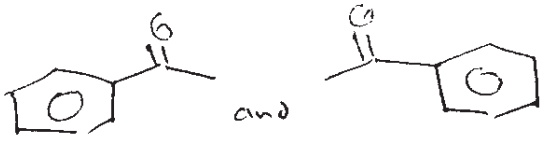
i) Stereotopic ligands.
ii) Heterotopic faces.
iii) Optical purity.

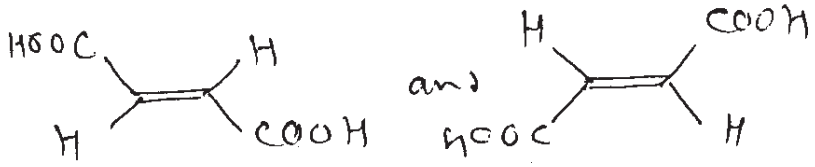
b) Identify the underline groups/atoms as homotopic or enantiotopic.



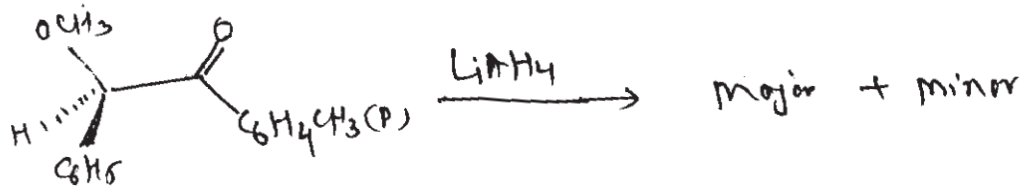


c) Identify Si and Re faces in the following compounds.



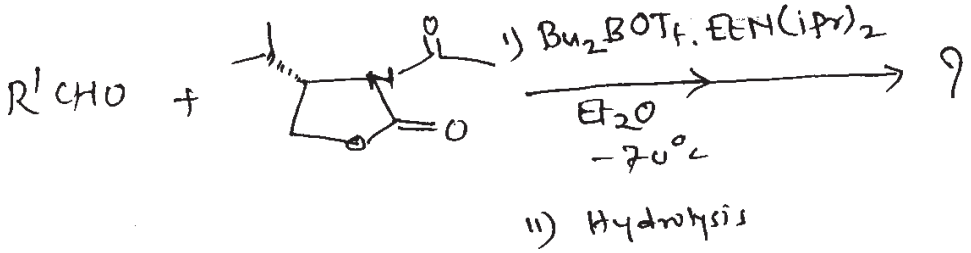


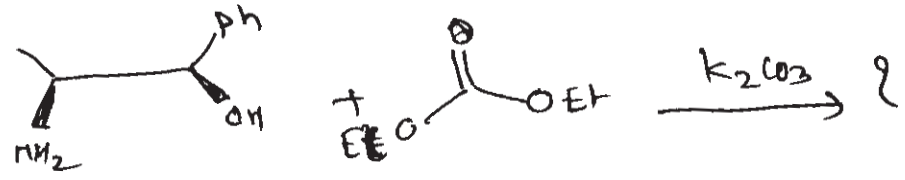
d)

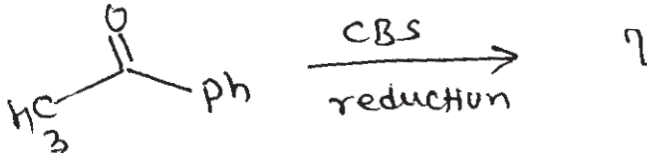


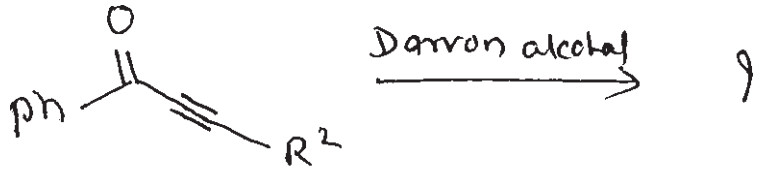
Q6) a) Predict the product/s in the following reactions. Explain the stereochemistry and mechanism in detail (any four) : **[8]**

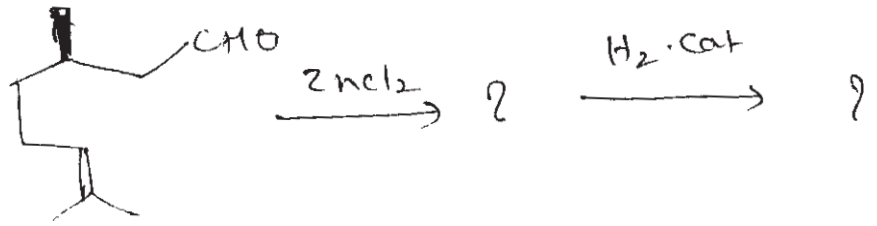
i)



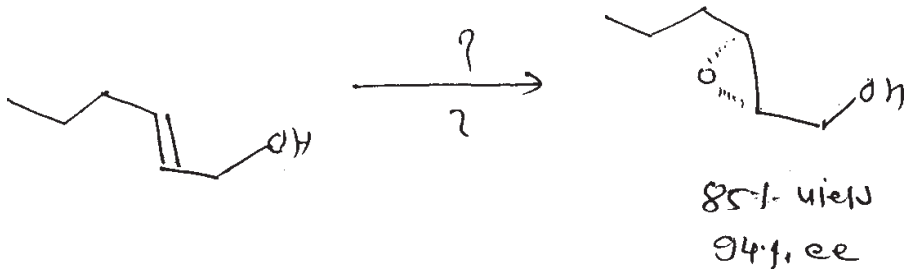
ii) 

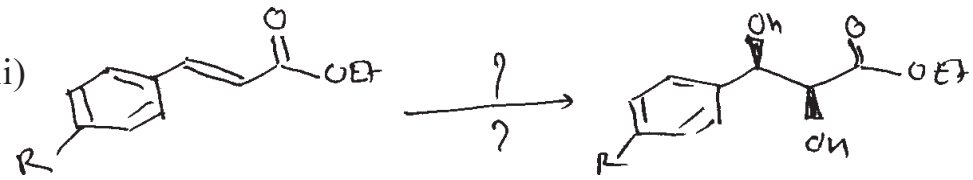
iii) 

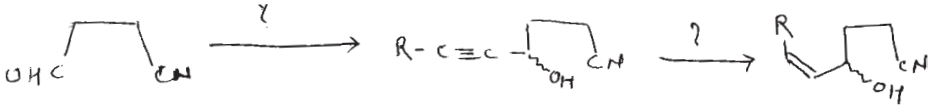
iv) 

v) 

b) Suggest the reagent and stereochemistry of the following reaction (any two) : **[8]**

i) 

ii) 

iii) 

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

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[3723]-314
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 390 : Electro Analytical & Current Analytical Methods in Industries
(New Course)

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

Instructions to the candidates:

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

SECTION - I

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

a) Distinguish between differential pulse polarography and square-wave polarography.

b) Define Residual current. Why in polarographic analysis is it necessary to remove oxygen from the solution? Explain the method of removal of oxygen.

c) Describe the electro gravimetric method for estimation of copper from brass sample.

d) Determine half-wave potential ($E_{1/2}$) of $Ag/AgNO_3$ electrode having electrode potential – 2.420 V at 25ºC, the current generated by the rate of mass transport by diffusion is 2.28 µA. [Given : Cathodic diffusion current = 14.25 µA]

e) During the forward scan of a triangular wave voltamogram at a disk electrode, a peak current of 25.4 µA was observed at a scan rate of 0.250 V/s. Estimate the peak current at a scan rate of 50.0 m V/s, assuming a reversible electro chemical reaction.

P.T.O.

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

a) What is meant by stripping voltametry? What is the purpose of the electrodeposition step in stripping analysis?

b) Explain the principle of amperometric titrations. How amperometric technique used in the successive determination of halides in a mixture?

c) What are nano materials? Explain it's general applications.

d) Potassium ferrocyanide (n = 1) has a diffusion coefficient of 6.5×10^{-6} cm^2/s during its oxidation in 0.1 M Kcl. At a scan rate of 100 m V/s the anodic peak current for the oxidation of unknown solution of potassium ferrocyanide was 32 μA. Estimate unknown concentration of potassium ferrocyanide.

[Given : the electrode area of disk electrode = 0.15 cm^2]

e) Differential pulse polarography was used with the standard addition technique to assay an aqueous solution of nitro-benzene which is a reducible organic pollutant. From the results recorded in the following table, determine the pollutant concentration in the sample.

Added Concentration (mM)	0	0.1	0.2	0.3	0.4
Peak current (μA)	2.51	4.16	5.75	7.42	9.10

SECTION - II

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

a) Explain the principle of activation analysis. Give advantages and limitations of neutron activation analysis.

b) Discuss principle and technique of radio-reagent methods of analysis. State it's limitations.

c) Discuss the principle of double isotope dilution analysis. Explain how isotope dilution analysis is used to assess the volume of blood in patient.

d) A TG curve was obtained for 5.80 mg of sample containing

$CuSO_4$, $5H_2O$, when the monohydrate formation was complete at 200ºC, the loss in mass was 0.89 mg. Find the percentage of the $CuSO_4 . 5H_2O$ in the sample.

[At. Wt. of Cu = 63.54, S = 32, O = 16, H = 1]

e) Turbidimetry was used to examine the concentration of sulfate in unknown sample. The transmittance of the sample was 46.8%, the cell path length was 1.00 cm and the turbidity coefficient of the sample was 4.88×10^{-3} l mg^{-1} $cm^{-1.}$

Determine the concentration of sulfate in unknown sample in ppm.

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

a) Distinguish between nephelometry and turbidimetry.

b) Draw a schematic diagram of a modern thermobalance and discuss significance of each component's.

c) Discuss the principle and technique of radiometric titrations. Draw and describe the nature of radiometric titration curve when only titrant is radioactive.

d) 10.0 ml of KBr tagged with radioactive bromine was titrated with 0.01 M $AgNO_3$. Addition of 2.5ml of titrant followed by removal of AgBr precipitate showed a loss in activity from 12500 counts for 5 min to 6000 counts for 6 min. Calculate the amount of bromide in the original solution. The detector gave background count 100 for 10 min.

[Given : At. Wt. of Ag = 108, N = 14, O = 16, K = 39, Br = 80]

e) One litre mixture of halides was analysed for it's iodide content. 2 ml of labelled iodide having an activity of 5000 counts per 2 min were added to the mixture. After thorough mixing 3ml of pure iodide were separated which was found to give an activity of 6000 counts for 10 min. If background counts are 100 for 20 minutes, determine the percentage of iodide in the mixture.

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