Total No. of Questions :6]

SEAT No. :

P1455

[Total No. of Pages : 4

[5223]-11
M.Sc.
PHYSICAL CHEMISTRY
CH - 110 :Physical Chemistry - I
(2008 Pattern) (Semester - I)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Write a note on black body radiation. Give, Max - Planck's hypothesis to explain the phenomenon.

b) Normalise the following wave function. Sin $\left(\frac{n\Pi x}{L}\right)$ in the range $0 \leq x \leq L$

c) Deduce the Gibb's - Duhem equation. Which equation is called the fundamental equation of chemical thermodynamics.

d) Explain the applications of third law of thermodynamics. State the relation ship between equillibrium constant and spontaneity of chemical reaction.

e) Give a statement for each of the laws of thermodynamics. Explain the thermodynamic functions introduced by these laws.

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

a) Write the three dimensional Schrodinger wave equation. Explain the terms involved in it.

b) Deduce the relation $\frac{E_{n+1} - E_n}{E_n} = \frac{2n+1}{n^2}$ for a particle in a box & hence account for loss of discrete nature of E as $n \to \infty$

c) Discuss Clausius inequality. Hence, explain the criterion for spontaneous change.

d) Obtain an expression for entropy change for an ideal gas for change in temperature and pressure.

e) Derive Clapeyron equation. Explain how it leads to the phase diagram.

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

a) Calculate the change in entropy when 10g of ice at 0ºC is added to 50 g of water at 40ºC in an isolated system. The latent heat of fusion of ice is 334 KJ g^{-1} and the sp. heat of water is 4.18 J k^{-1} g^{-1}.

b) Calculate the de Broglie Wavelength of an electron moving at $\frac{1}{179}^{th}$ the speed of light.

c) Three moles of hydrogen are compressed isothermally and reversibly from 60 dm^3 to 20 dm^3 and 8.22 KJ of work is done on it. Assuming ideal behaviour, calculate the temperature of the gas.

SECTION - II

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

a) Show that for the n^{th} order reaction in A, the half -life period is

$$t1/2 = \frac{2^{n-1} - 1}{(n-1)\, k_n\, [A]_o^{n-1}}$$

where, [A] is the concentration of A at time *t*.

b) Discuss the various flow techniques used to study the fast reactions.

c) Using Bodenstein - Lind mechanism, derive the rate law for the formation of HBr from H_2 and Br_2.

d) Describe the relaxation technique used to study fast reactions and give the expression for relaxation time for first - order reaction.

e) State and explain in short the 'steady state principle'. How does it explain the third order reaction between $NO_{(g)}$ and $O_{2(g)}$?

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

a) What are the assumptions of transition state theory? Derive the expression for the specific reaction rate of a bimolecular reaction according to this reaction.

b) Explain the effect of ionic strength on the rate of ionic reaction. Derive the necessary equation.

c) Derive an expression for Boltzman distribution law for a degenerate system. Explain what is meant by degeneracy.

d) Write the expression for the entropy in terms of partition function. Hence show that the rotational entropy is given by the following expressions:

$$S_r = R(1 + \ln Q_r) \text{ and } S_r = R\left(ln Q_r + \frac{Q'_r}{Q_r} \right)$$

e) What is partition function? Obtain an expression for the internal energy of a molecule in terms of partition function.

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

a) In a first order reaction the reactant concentration reduced by two third in a millisecond. In how much time will it be reduced to one ninth?

b) Calculate the rotational partition function of CO at 298K Given, $I = 14.48 \times 10^{-47}$ kg m^2, $\sigma = 1$.

c) The enzymatic conversion of a substrate at 25ºC has a Michaelis Menton constant 0.035. The rate of the reaction is 1.2×10^{-3} MS^{-1}, when the substrate concentration is 0.11M. What is the rate constant of enzymolysis if the initial concentration of enzyme is considered constant.

♦ ♦ ♦

Total No. of Questions : 6]

SEAT No. :

P1456

[Total No. of Pages :4

[5223] - 12

M.Sc. (Part -I)

INORGANIC CHEMISTRY -I

C4- 130 : Molecular Symmetry and Chemistry of P block elements

(2008 Pattern) (Semester-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_{2h} and C_{3h} point group. Justify your answer.

b) Explain with suitable examples following symmetry elements and symmetry operations

i) Principal axis and proper rotation.

ii) Planes of symmetry and reflection operation

c) Assign any two of the following molecules into appropriate point group

i) PCl_5

ii) Cyclopentadiene

iii) Cis - H_2O_2

d) What are the conditions of a mathematical group ? Explain them with help of H_2O.

e) Prove that in any Abelian group each element is in a class by itself.

P.T.O.

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

a) Using matrix multiplication method find the product of :-

i) $C_2^z \times \sigma_{xy}$

ii) $C_2^z \times C_2^x$

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

Td	E	$8C_3$	$3C_2$	$^{\sigma}S_4$	$6\sigma_d$		
A_1	1	1	1	1	1		$x^2+y^2+z^2$
A_2	1	1	1	−1	−1		
E	2	−1	2	0	0		$2z^2-x^2-y^2$, x^2-y^2
T_1	3	0	−1	1	−1	R_x,R_y,R_z	
T_2	3	0	−1	−1	1		*xy*,yz,*xz*

c) Using great orthogonality theorem, derive the character table for C_{2v} point group. Assign the irreducible representation with appropriate Mullikens symbol. Justify it.

d) Sketch and explain all the symmetry elements for $[PtCl_4]^{2-}$.

e) Discuss the symmetry criterion for a molecule to be optically active Predict the activity for following compounds

i) Cis $[Pt(NH_3)_2Cl_2]$

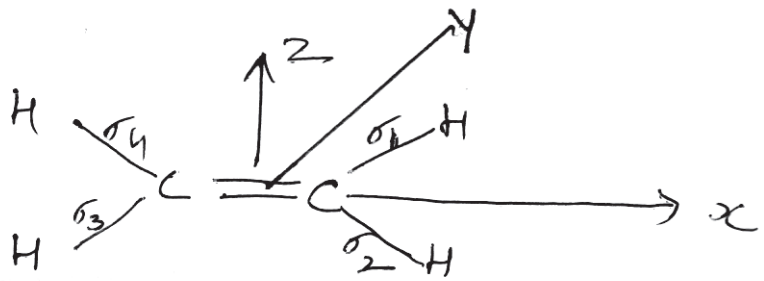
ii) Cis $[Pt(NH_3)_2 Cl Br]$

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

a) Find out the normalized 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	σ_{xy}	σ_{xz}	σ_{yz}
B_{1g}	1	1	–1	–1	1	1	–1	–1

b) What are Weiss indices ? Explain them with the help of suitable example. Draw (3 2 1) and (1 1 1) planes in simple cubic system

c) Write the characters of the representations of the following direct product and determine the set of irreducible representations which comprise them for the point group Td.

Direct product $T_1 \times T_2$

(Character table for Td point group is given in Question 2(b)).

SECTION -II

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

a) Explain what are hydrides? Give their classification.

b) Explain isolation of alkali metals by crown ethers.

c) Give characteristic reactions of PCl_5.

d) Give an account of electron deficient compounds.

e) Write a short note on zeolites.

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

a) Fullerene compounds.

b) Interhalogen Compounds.

c) Sulphur Oxoanions

d) Applications of noble gases.

e) Phosphobenzene.

Q6) a) Draw <u>any</u> <u>five</u> structures. **[5]**

i) BrF_5

ii) S_8

iii) P_4O_{10}

iv) Al_2Br_6

v) B_6H_{10}

vi) $XeF_2\ O_3$

b) Complete the following reactions (<u>any</u> <u>five</u>) **[5]**

i) $PCl_5 + n\ NH_4Cl \rightarrow ? + 4nHCl$

ii) $SF_{6(g)} + H_2O \rightarrow ?$

iii) $Na + C_{10}H_8\,(THF) \rightarrow ?$

iv) $P\ (OR)_3 + O_3 \xrightarrow{-78^oC} ?$

v) $I^-_{(aq)} + NO^+_{(aq)} \rightarrow ?$

vi) $Ph\ AsI_2 + Hg \rightarrow ? + Hg_2I_2.$

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Total No. of Questions : 6]

SEAT No. :

P1457

[Total No. of Pages : 4

[5223] - 13

M.Sc. - I

ORGANIC CHEMISTRY

CH-150 : Organic Reaction Mechanism and Stereochemistry

(2008 Pattern) (Semester - I)

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

Instructions to the candidates:

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

SECTION - I

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

a) An aromatic electrophilic substitution of methyl cinnamate takes place at 3-position. Explain.

b) Neomethyl chloride on treatment with base gives two products. Why?

c) Chloromethyl methylether is solvolyzed by RCOOH at 10^4 times faster than methyl chloride. Explain.

d) Orthochloro anisole on treatment with sodamine and ammonia gives only one product. Why?

e) 

undergoes hydrolysis at much faster rate.

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

a) SNi mechanism.

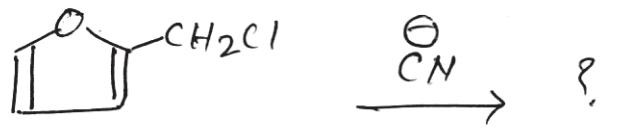
b) E1cb elimination.

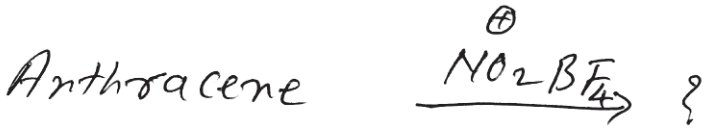
c) Friedal-Crafts acylation.

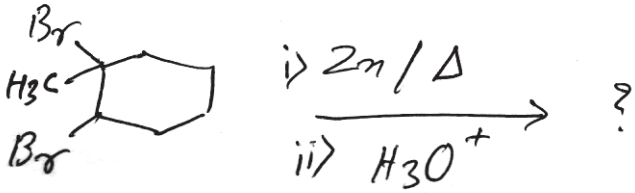
d) SNR1 mechanism.

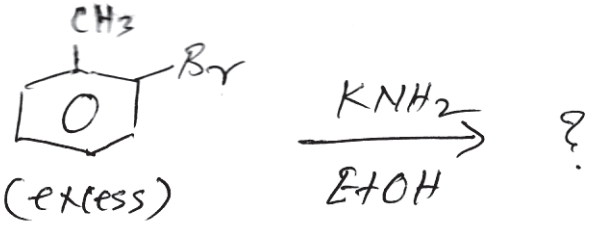
P.T.O.

Q3) Predict the product with mechanism (any three) : **[12]**

a) 

b) 

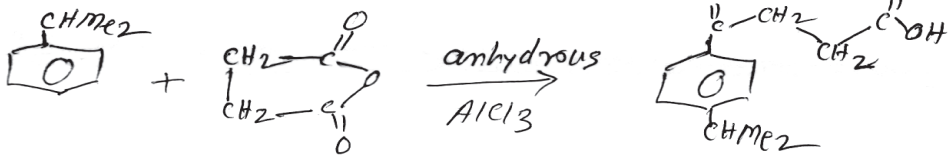
c) 

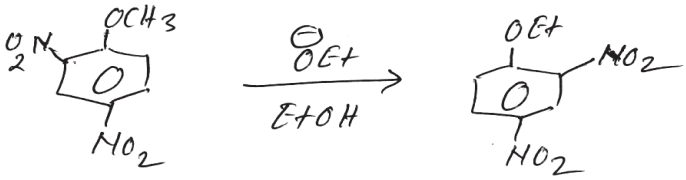
d) 

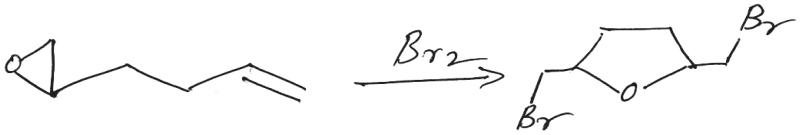
SECTION - II

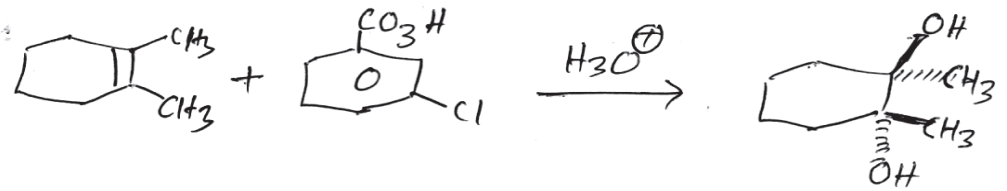
Q4) Suggest mechanism for any four of the following : **[12]**

a) 

b) 

c) 

d) 

e) 

Q5) Attempt any four of the following : **[12]**

a) Maleic acid is stronger acid than fumaric acid in first dissociation but reverse is true in second dissociation. Explain.

b) Comment on Cross conjugated systems.

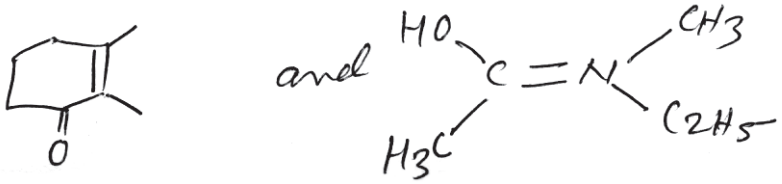
c) Explain tautomerism with suitable examples.

d) What are benzenoid compounds?

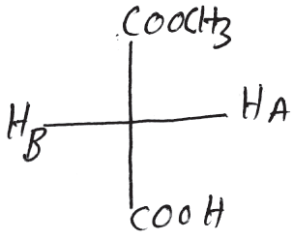
e) Write short note on "Inclusion compounds".

Q6) Attempt any eight of the following : **[16]**

a) Designate E/Z to the following.



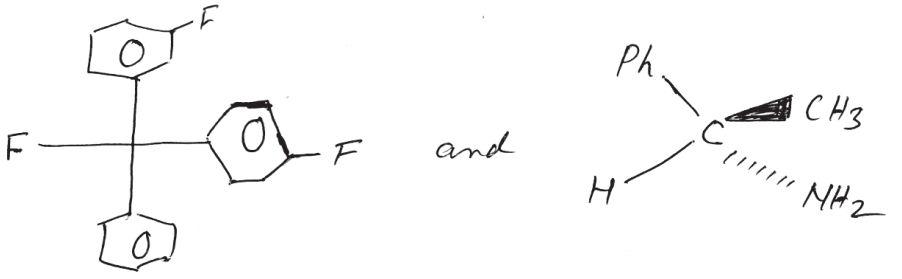
b) Assign Pro R / Pro S to H_A and H_B.



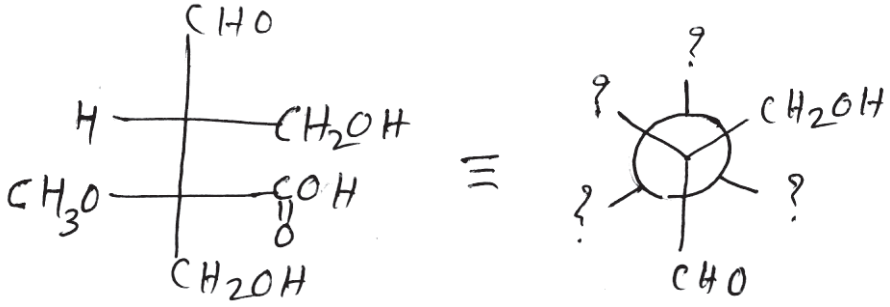
c) Assign Re and Si faces to benzaldehyde.

d) All stereospecific reactions are stereoselective. True or False. Justify.

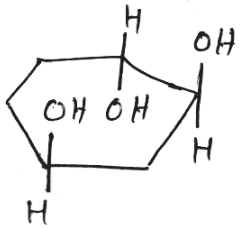
e) Assign R/S designation to the following :



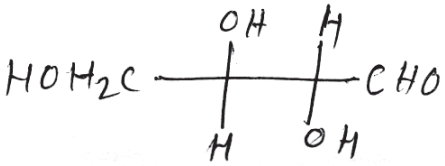
f) Convert Fischer to Newmann for the following structure.



g) Identify chiral carbon atoms and find total number of stereoisomers in the following compounds :



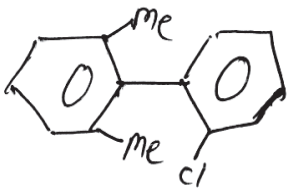
and



h) Explain with examples optical activity in helical compounds.

i) Which of the following is optically active? Justify.

and



Total No. of Questions :6]

SEAT No. :

P1458

[Total No. of Pages : 3

[5223]-21
M.Sc.-I
PHYSICAL CHEMISTRY
CH - 210 :Physical Chemistry - II
(2008 Pattern) (Semester - 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.*
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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}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
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			=	8.314 J K^{-1} mol^{-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 the applications of ESR spectroscopy.

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

c) How does isotopic substitution help in determing the CO and CS bond length in linear OCS molecule.

d) Discuss advantages of FTIR Spectroscopy.

e) Explain the factors which affects the width of Spectral line.

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

a) Explain the classical theory of Raman effect.

b) Discuss pure rotational Raman Spectra for linear diatomic molecule.

c) Explain the structure of nitrous oxide molecule in the light of XPES.

d) Write a note on Fartrant diagram.

e) Write the expression for Morse function and explain harmonic and anharmonic oscillators with respect to selection rule, zero point energy and energy equation.

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

a) The fundamental vibrational frequency for HCl is 2886 cm^{-1}, and first overtone is 5668cm^{-1}. Calculate anharmonicity constant and equilibrium vibrational frequency.

b) Predict the position of rotational Raman spectral lines for $^{14}N_2$. [B = 1.99cm^{-1}, excitation frequency = 891 TH_2].

c) The energy change in a transition is 4.00×10^{-22}] $molecule^{-1}$. Calculate number of molecules in the excited state at 27°C, if there are 1000 molecules in the ground state.

SECTION - II

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

a) Explain the construction and working of Scintillator counter.

b) Give the different conversions of radiation absorption units.

c) Derive the rate equation for the decay constant of radioactive element. Explain its characteristic of the equation.

d) What is the breeder reactor? Explain the principle of breeding with an example.

e) How to assess the volume of blood in patient by using radiotracer technique.

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

a) Explain the terms G-value, electronic absorption coefficient, spur and δ – ray track.

b) Write a note on Lea Gray-Platzman and Samuel-Maggi model.

c) Explain the three phases in India's nuclear energy programme.

d) Discuss applications of Neutron activation analysis.

e) Enlist different modes of interaction of γ -radiation with matter. Explain one of them.

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

a) The half life period of a radioisotope is 24.5m. How much of it would be left after 30m if its initial amount is 1.0gm?

b) 0.1 gm of a medicinal plant extract containing Mn was irradiated in a neutron flux of $10^{12} n.cm^{-2}s^{-1}$ for 5 minutes. The activity counted after 10h. of cooling period was 2500cpm with a HPGe detector with detection efficiency 20%. Determine the percentage of Mn in the extract.

[Given: σ =13.3b, $t_{½}$= 2.58h for ^{56}Mn, γ -ray abundance = 100%]

c) Assuming no loss of thermal or fast neutrons occurs, calculate the reproduction factor for a reactor for which the fast fission factor is 1.03, the number of fast neutrons generated per thermal neutron used up is 1.32, the resonance escape factor is 0.89 and the thermal utilisation factor is 0.87.

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Total No. of Questions : 12] **SEAT No. :**

P3107 **[Total No. of Pages : 6**

[5223]-22
M.Sc. (Semester -II)
CH - 230: INORGANIC CHEMISTRY -II
(2008 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***

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

3) ***Use of log tables and calculator is allowed.***

4 ***Figures to the right indicate full marks.***

5) ***Draw neat diagrams wherever necessary.***

SECTION - I

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

a) What are selection Rules for electronic transitions? Explain the different selection rules using examples.

b) Calculate the total degeneracy of the following:

i) S^2P^3

ii) ^4H

iii) eg^3

iv) $^6T29$

v) $t29^3$

c) Give the splitting of 5D term in weak cubic field using character table for pure rotational point group 'O'.

d) Prepare a microstate table for Nitrogen atom and find out ground state R-S term for it.

e) Explain Tetrahedral complexes are more intense in colours than octahedral complexes.

P.T.O

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

a) Write a note on Luminescence in TM compounds.

b) Give the full spectroscopic symbol for the G.S. term for the following ions.

i) Sc^{2+}

ii) Ti^{2+}

iii) Co^{2+}

iv) Ni^{2+}

v) Zn^{2+}

c) Explain which of the following complexes show orbital contribution to magnetic moment and justify your answer.

i) $[Fe\ F6]^{3-}$

ii) $[CO(H_2O)_6]^{3+}$

d) Predict the expected electronic transitions in the following complexes using orgel diagrams:

i) $[Cr(en)_3]^{3+}$

ii) $[V(H_2o)_6]^{3+}$

e) Classify the following configurations as A, E or T in complexes having oh symmetry.

i) $t29^5, eg^o$

ii) $t29^3, eg^2$

iii) eg^2

iv) $t29^6, eg^2$

v) $t29^6, eg^4$

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

a) The electronic spectrum of $[Ni(NH_3)_6]cl_2$ shows bands at 10750, 17500 and 28200 cm^{-1} respectively. Calculate the values of Dq, B, β, β^o. Given: $B^o = 1030\ cm^{-1}$.

b) The effective magnetic moment of $[Cu(H_2o)_6]^{2+}$ is 2.02 BM. The spin orbit coupling constant is -830 cm^{-1} for metal ion. Calculate the crystal field splitting parameter.

c) Write a note on charge transfer spectra in complexes.

SECTION - II

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

a) Explain the importance of prophyrin and corrin as ligands in biosystem.

b) Explain the mechanism of detoxification of mercury.

c) What are the binding sites of amino acids in biomolecules?

d) What are the possible pathways of absorption of metal by cell?

e) What are the beneficial and toxic effects of metals?

Q5) Write short notes on <u>any three:</u> **[15]**

a) Zinc finger

b) Dioxygen transport

c) Transferrin

d) Bioinorganic chips

e) Calmodulin

Q6) Draw the structures of <u>any five:</u> **[10]**

a) ADP

b) Vit.B

c) 3 Fe-4S

d) 18-crown-6

e) Deoxyhemoglobin

▲ ▲ ▲

Direct Products

1. **Group of the form G xi or G x σh**
The g, u, or ',' additions to the IR symbol in this group satisfy
g x g = u x u = g, g x u = u, 'x' = "x"=

2. **Product of the form A x A, B x B, A x B**
For all groups:
Letter Symbol: A x A =A, B x B = A , A x B = B
Subscript: 1 x 1 = 1, 2 x 2 = 1, 1 x 2 = 2
Except for the B representations of D_2 and D_2 where
B x B = B, and 1 x 2 = 3, 2 x 3 = 1, 3 x 1 = 2

3. **Products of the forms: A x E, B x E:**
(a) For all groups A X E_k = E_k irrespective of the suffix on A.
(b) For all groups except D_4h, D_4d, S_8:
B x E_1= E_2, B x E_2 = E_1
irrespective of the suffix on B (If the group has only one B representative put E_1=E_2=E)
(c) For D_4h:
B X E_1 = E_3, E x E_2 = E_3, B x E_3 =E_3, B x E_2 = E_2, B x E_3 = E_1
Irrespective of the suffix on B:
(d) For D_4d, S_8:
B x E_1= E_3, B x E_2 =E_2, B x E_3 = E_1
Irrespective of the suffix on B:

4. **Products of the form E x E:**
(For groups which have A, B, or E symbols without suffixes put A_1 = A_2 = A, etc in the equation below)
(a) For Oh, O, T_3, D_6h, D_2, C_6v, C_6h, C_6, S_6, D_2d, D_2h, D_3, C_2, C_3h, C_3:
E_1 x E_1 =E_2 x E_2= A_1+ A_2+ B_2; B_1 x 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 x E = A_1 + A_2 + B_1 + B_2.
(c) For D_6d:
E_1 x E_1 = E_3 x E_3 = A_1 + A_2+ Eg
E_2 x E_2 = E_4 x E_4 = A_1 + A_2+ Eg
E_3 x E_3= A_1 + A_1+ B_1 + B_2
E_1+ E_2= E_4 + E_3 =E_1+E_3,E_1 x E_3 = E_3 x E_1= E_2+ E_1,
E_1+ E_4= E_2 + E_3 =E_3+E_3,E_2 x E_3 = E_3 x E_4= E_1+ E_3,
E_1+ E_3= B_4 +B_2+E4, E_2 x E_4 = B_1+ B_2 + E_2.
(d) D_3d, D_2h, D_3, C_3v, C_3h, C_3:
E_1 x E_1 = A_1 + A_2 + E_2 , E_2 x E_2 = A_1 + A_2 + E_1
E_1 x E_2 = E_1 + E_2
(e) For D_4d,S_8
E_1x E_1= E_3 x E_3 = A_1 + A_2 + E_2
E_2 x E_2 = A_1 + A_2 + B_1+ B_2
E_1 xE_2 = E_2 x E_3= E_1 + E_3, E_1 x E_3 = B_1 + B_2 + E_2

5. **Product involving the T (or F) representation of Oh, O, Td:**
A_1 x T_1= T_1, A_1 x T_2= T_2, A_2 x T_1 = T_2, A_2 x T_2= T_1'
E x T_1= E x T_2= T_1 + T_2,
T_1 x T_2 = A_2 + E+ T_1+ T_2.
$T_1 \times T_1 = T_2 \times T_2 = A_1 + B + T_1 + T_2$

6. **To Complete result 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	$T_1 + T_2$	$A_2 + E + T_1 + T_2$	$A_1 + E + T_1 + T_2$

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		$(x^2-y^2, 2z^2-x^2-y^2)$
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 group Oh

Oh	O	Td	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	Ag
A_2g	A_2	A_2	B_1g	B_1	B_1	A_2	A_2g	A_2	Bg
Eg	E	E	A_1g+B_1g	A_1+B_1	A_1+B_1	A_1+A_2	Eg	E	Ag+ Bg
T_1g	T_1	T_1	A_2g+E_g	A_2+E	A_2+E	$A_2+B_1+B_2$	A_2g+Eg	A_2+E	Ag+ 2Bg
T_2g	T_2	T_2	B_2g+Eg	B_2+E	B_2+E	$A_1+B_1+B_2$	A_1g+Eg	A_1+E	2Ag+Bg
A_1u	A_1	A_1	A_1u	B_1	A_2	A_2	A_1u	A_1	Au
A_2u	A_2	A_1	B_1u	A_1	B_2	A_1	A_2u	A_2	Bu
Eu	E	E	A_1u+B_1u	A_1+B_1	A_2+B_2	A_1+A_2	Eu	E	Au+ Bu
T_1u	T_1	T_2	A_2u+Eu	B_2+E	A_1+E	$A_1+B_1+B_2$	A_2u+Eu	A_1+E	Au+ 2Bu
T_2u	T_2	T_1	B_2u+Eu	A_2+E	B_1+E	$A_2+B_1+B_2$	A_1u+Eu	A_1+E	2Au+Bu

Total No. of Questions :6]

SEAT No. :

P1459

[Total No. of Pages : 5

[5223]-23
M.Sc. - I
ORGANIC CHEMISTRY
CH - 250 : Synthetic Organic Chemistry and Spectroscopy
(2008 Pattern) (Semester - 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) Answer in brief any four of the following questions. **[16]**

a) What is swern Oxidation. Give advantages of swern Oxidation giving suitable example.

b) N-methyl phthalimide does not undergo Hofmann rearrangement to form N-methyl anthranilic acid.

c) Write the mechanism to convert alkene into alkane using wilkinsons cotalyst.

d) Phosphorus ylide forms alkene while sulphur ylide forms epoxide when reacted with Ketone Carbonyl.

e) To synthesis β hydroxy ester Reformatsky reaction is preferred over Grignard reaction.

Q2) Attempt any four of the following. **[12]**

a) Discuss the effect of intramolecular hydrogen bonding on –OH stretching frequency with example of Orthohydroxy benzaldehyde.

P.T.O.

b) Factor affecting stability of carbocation. Further explain 'Non classical Carbocation'.

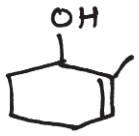
c) Write a note on claisen rearrangement.

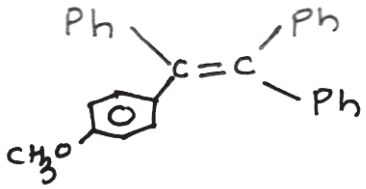
d) Explain Stereo and regioselectivity of Organoboranes in Organic synthesis giving suitable example.

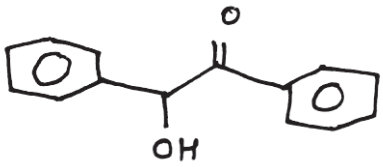
e) Cyclohexanone on Beckmann rearrangement gives E-caprolactum and under Bayer Villiger Oxidation gives E-lactone explain.

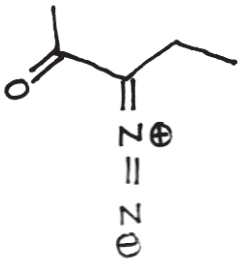
Q3) Predict the products and suggest the mechanism for <u>anyfour</u> of the following: **[12]**

a) 

b) 

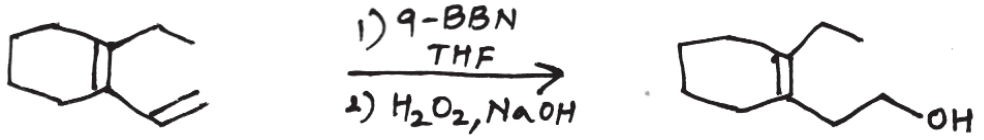
c) 

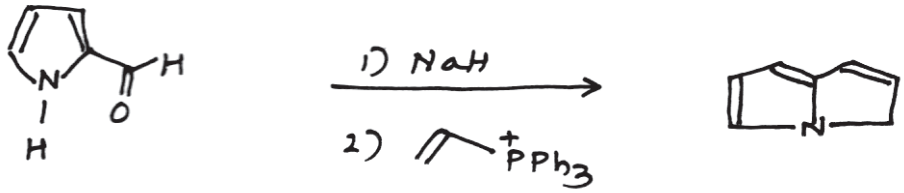
d) 

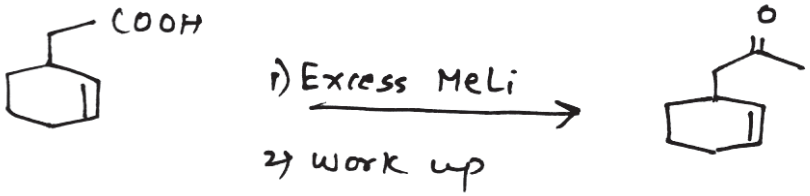
e) 

SECTION-II

Q4) a) Suggest mechanism for any two of the following. **[6]**

i) 

ii) 

iii) 

b) Write notes on anytwo of the following **[6]**

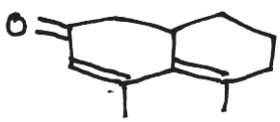
i) MPV reduction

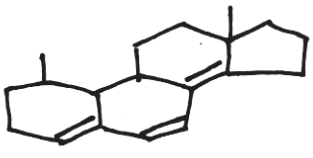
ii) Favorskii rearrangement

iii) Simmon-smith reaction

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

a) Calculate the λ max of the following compounds

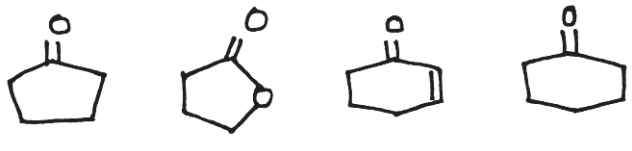
i) 

ii) 

b) Assign PMR values in δ 3.73, 6.96,7.7,9.87 to the protons of P-methoxy benzaldehyde.

c) Applications of IR spectroscopy.

d) Arrange the following in their increasing order of carbonyl frequencies.



e) Define - Chromophore, Auxochrome, Hypsochromic shift & Bathochromic shift.

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

a) Molecular formula $C_9H_8O_2$

IR- 2900 - 3000cm^{-}, 2800cm^{-}, 1740 cm^{-},1500 - 1600cm^{-}, 750 - 770 cm^{-}, ^{1}H NMR in $CDCl_3$ using TMS as internal standard.

3.01 δ	t	2H	6 – 8Hz
4.58 δ	t	2H	6 – 8Hz
7.23-7.92 δ	m	4H	

b) Molecular formula $C_{15}H_{14}O$

IR - 3000 - 3100cm^{-}, 2800 cm^{-}, 1710cm^{-}, 1500 -1600cm^{-}, 690-710 & 730 - 770 cm^{-}

NMR in $CDCl_3$ (integration of protons given in mm)

2.22 δ	s	15mm
5.10 δ	s	5mm
7-7.5 δ	m	50mm

c) Molecular formula - $C_{15}H_{12}O$

UV λ max – 360 nm

IR - 3000 -3100cm^{-},2800 - 2850 cm^{-}, 1650 cm^{-}, 1630cm^{-}, 1500 -1600cm^{-}690 - 710 & 730 - 770cm^{-}

NMR in $CDCl_3$

7.21	δ	m	10H	
7.9	δ	d	1H	J=17Hz
7.56	δ	d	1H	J=17Hz

d) Molecular formula $C_6H_3ClN_2O_4$

IR - 3000 - 3100cm^{-}, 2800cm^{-}, 1400 - 1500cm^{-}NMR in $CDCl_3$

7.79	δ	d,	1H,	J=8H_2
8.52	δ	dd,	1H,	J=8,2 Hz
9.06	δ	d,	1H,	J=2Hz

Total No. of Questions :5]

SEAT No. :

P1460

[Total No. of Pages : 3

[5223]-31
M.Sc.
PHYSICAL CHEMISTRY
CH - 310 :Quantum Chemistry & Solid State Chemistry
(2008 Pattern) (Semester - III) (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 <u>any four</u> of the following: **[20]**

a) Show that the wave functions for a particle in a one dimensionel box are orthogonal

b) Formulate the Hamiltonian operators for

i) He atom

ii) H_2 molecule

iii) H_2^+ ion

c) Explain the properties of quantum mechanical operators.

d) Explain the historical origin of quantum theory.

e) Deduce the eigenvalues for sin$x$, cos$x$, sin$x$ + cos$x$ when $\frac{d^2}{dx^2}$ is the operator, in the cases where possible.

f) Find term symbols for the ground state configuration of He and C atoms.

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

a) State and prove the variation theorem.

b) Obtain an expression of the ground state energy of He atom using first order perturbation theory.

c) Distinguish between variation and perturbation theories.

d) Deduce the Secular equation for butadiene and state the energies of the first two excited states.

e) Write a note on Hückel 's approximations.

f) Derive the expression for the first order perturbation correction to the wave function for a non-degenarate system.

SECTION - II

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

a) Write a note on p-n junction.

b) State and explain the Kirkendall effect.

c) What is a colour centres? Explain the origin of Colour centres in halide crystals.

d) Define defects. Describe the various types of point defects found in crystalline solids.

e) Discuss the conditions for crystal grouth from a moltan salt.

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

a) Derive the expression for the number of Schottky defects present in a crystal at a given temperature.

b) Describe any one experimental method adopted to study the kinetics of decomposition of a single solid.

c) Discuss the mechanism of diffusion in crystalline solids.

d) Write a note on Brillouin zones.

e) Discuss the factors that affect the progress of a chemical change in solid -solid reactions.

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

a) The number of free electrons in a monovalent crystal is 10^{19} per cm^3 at 300K. Evalnate E_0 in eV.

b) Calculate the drift mobility of charge carrier for semiconductor having donor concentration of 10^{22} per metre cube. [Given: Conductivity = 100 mhos m^{-1}]

c) Calculate the mean free time for an electron in semiconductor crystal having drift mobility 625 cm^2/ Volt. Sec.

Total No. of Questions :6]

SEAT No. :

P1461

[Total No. of Pages : 3

[5223]-32
M.Sc.
PHYSICAL CHEMISTRY
CH - 311:Nuclear and Radiation Chemistry (New)
(Semester -III) (2008 pattern)

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

Instructions to the candidates:

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

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5.	1 eV		=	23.06 k cal mol^{-1}
			=	1.602×10^{-12} erg
			=	1.602×10^{-19} J
			=	8065.5 cm^{-1}
6.	Gas Constant	R	=	8.314×10^{7} erg K^{-1} mol^{-1}
			=	8.314 J K^{-1} mol^{-1}
			=	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 any three of the following : **[15]**

a) Discuss the principle and working of breeder reactor

b) Derive Fermi's four factor formula.

c) Discuss with the help of typical fission mass yield curve, the mass distribution of fission fragments.

d) Give the salient features of nuclear shell model.

e) Discuss the similarities between liquid drop and an atomic nucleus.

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

a) Explain periodicity in the properties of nuclei supporting the shell model.

b) Write a note on: Breit– Winger formula.

c) Discuss the various types of nuclear reactions based on the nature of projectile and ejectile..

d) Explain the projectile acceleration and target preparation on PIXE.

e) Write a note on: cyclotron.

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

a) On the basis of semi-empirical mass equation, predict the stable nuclide of the isobaric series A=180.

b) In the fission of $^{235}_{95}U$ the end stable products are $^{94}_{40}Z_r$ and $^{140}_{58}C_e$. What are primary fragments.

c) Calculate the coulomb barrier for the approach of an alpha particle towards $^{66}_{30}Zn$. Take the nuclear radius constant to be 1.4 F.

SECTION - II

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

a) Discuss the difference between somatic and genetic effects.

b) Give an account of Lithium drifted Germanium and silicon detector.

c) Write a note on: Ceric sulphate dosimeter.

d) Explain i) enrichment factor and

ii) retention in szilard chalmer's reaction

e) Describe with a neat diagram linear accelerator.

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

a) List the four stages in the radiation damage process and discuss the time scale involved.

b) Give the important properties of an ideal scintillator. Discuss working of an inorganic scintillator.

c) Describe various modes of nuclear retention .

d) Write a note on: Chernobyl accident.

e) Discuss the natural sources of radiation.

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

a) Calculate activity of sodium -22 source which gives a dose rate of 3 rem/hr at lm.^{22}Na emits one gamma photon of energy 1.28 MeV per disintegration.

b) A certain cobalt source gives a dose rate 40 m rem/hr at one meter. At what distance from the source must a barrier be placed, if the dose rate at the barrier must not exceed 2.5 m rem/hr.

c) Find the recoil energy of an atom with mass number 50 in eV and kcal/mole for 5 MeV proton emission.

& & &

Total No. of Questions : 6]

SEAT No. :

P1462

[Total No. of Pages : 3

[5223]-33
M.Sc. - II
PHYSICAL CHEMISTRY
CH-312 : Advanced Instrumental Methods of Analysis
(2008 Pattern) (Semester - III)

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

Instructions to the candidates:

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

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3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	1 eV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997\times10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051\times10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11\times10^{-31}$ kg

P.T.O.

SECTION-I

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

a) How are X-rays generated? Describe the construction and working of an X-ray tube with a neat labelled diagram.

b) What is gas ionization detector? Describe various regions observed in gas ionization detector.

c) Explain liquid-phase chemiluminescence titration with typical example.

d) Discuss the principle of NAA. What are its advantages and disadvantages?

e) Discuss in brief the applications of mass spectrometry.

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

a) Discuss the choice of post irradiation assay in activation analysis technique.

b) Define soft ionization method. Describe any one method of soft ionization.

c) Draw and explain block diagram of the major components of an instrument used to measure photoluminescence.

d) Write a note on X-ray fluorescence.

e) Write a note on excitation function.

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

a) The ionization energy of argon atom is 9.6×10^{-18} J. The argon gas is irradiated by X-ray photon in ionization chamber having wavelength of 1nm. How many ion-electron pairs will be formed by considering 40% efficiency of ionization.

b) 0.5g of steel sample containing vanadium was irradiated for seven minutes in a neutron flux of 10^7 $ncm^{-2}s^{-1}$. Activity at the end of irradiation was found to be 2460 dpm. Find the percentage of vanadium in steel.

[Given : $t_{½}$ of ^{52}V = 3.75 min, r = 99.75%, σ = 4.88b]

c) A magnet has a field strength of 0.19T. The radius of curvature of the ion path is 10.4cm. Determine the accelerating voltage required to direct a singly charged water molecule through an exit slit of the mass spectrometer.

SECTION-II

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

a) What is the basic difference between DSC and DTA?

b) With a neat labelled diagram explain sample introduction in ICP spectrometer.

c) Discuss the applications of ESCA technique.

d) What is plasma? Explain briefly the principle underlying inductively coupled plasma atomic emission spetroscopy.

e) Define the term, 'quantum efficiency'(ϕ). Derive the relation,

$I_L = \phi\ I_0\ 2.303\ a.b.c$

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

a) Give an account of general technique for performing a coulometric determination at controlled cathode potential?

b) Discuss current-voltage relationship in coulometric technique.

c) Enlist the properties of the ideal instrument for plasma emission spectroscopy.

d) Write a note on pulse voltammetry.

e) Discuss the applications of TGA technique.

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

a) A thermogram of a magnesium compound showed a loss of 80mg from a total of 160mg used for analyte. Identify the compound as MgO, $MgCO_3$ or MgC_2O_4.

b) Nickel ore weighing 2.15g is dissolved in acid and the nickel is electrolysed using constant current of 1.8A for 10 minutes. Calculate the percentage of nickel ore. [At. wt. of Ni = 58.7]

c) Calculate geometrical cross-section for copper atom.

[Given : $R_0 = 1.4 \times 10^{-13}$ cm, Atomic wt. of Cu = 63]

♦ ♦ ♦

Total No. of Questions : 5]

SEAT No. :

P1463

[Total No. of Pages : 3

[5223] - 34
M.Sc. - II
PHYSICAL CHEMISTRY
CH-314 : Polymer Chemistry
(2008 Pattern) (Semester - III) (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) Define the terms :

i) Polymer

ii) Polydispersity index

iii) Copolymer

iv) Heteropolymer

b) Explain what are secondary bond forces in a polymer?

c) Write a note on Zeigler-Natta catalysis.

d) Differentiate between thermosetting and thermoplastic polymers.

e) Define and explain glass transition temperature.

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

a) Explain why the making of a 100% crystalline polymer is not possible.

b) Write a note on crystallinity of Nylon - 6.

c) Explain what are block and graft polymers?

d) Discuss the kinetics of condensation polymer.

e) What is instantaneous composition of a polymer?

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

a) 2 moles of vinyl chloride are copolymerized with 3 moles of 1, 3 butadiene. Find the polymer composition if the reactivity ratios are 0.035 : 8.8 respectively. [At wts. C = 12, H = 1, Cl = 35.5].

b) The extent of reaction for linear step reaction polymerization is 0.9. Estimate the number average degree of polymerization and the weight fraction of the chain having $\bar{X}_m$ repeating units.

c) Calculate viscosity of a polymer having C = 0.3 g/dl Huggin's constant = $\frac{1}{3}$. $k = 1.2 \times 10^{-4}$, m = 1.2×10^5, $\alpha = 0.72$.

SECTION - II

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

a) Write a note on DTA in polymer analysis.

b) Describe the vapour phase osmometry method to determine the molecular weight of a polymer.

c) Discuss radiation effects on polyethylene.

d) Describe the process of dying a fibre.

e) Discuss the viscous flow phenomenon and its mechanisms.

f) Write a note on XRD use in polymer analysis.

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

a) Write a note on NMR and ESR applications in polymer analysis.

b) Explain the terms tenacity, creep, denier and resilience in a fibre.

c) Derive the stress-strain relation for an elastomer.

d) Describe the process of calendering.

e) Explain what are conducting polymers?

f) Discuss the injection molding technique.

Total No. of Questions : 4]

SEAT No. :

P1464

[Total No. of Pages : 3

[5223] - 35
M.Sc. - II
PHYSICAL CHEMISTRY
CH-315: Special Topics in Physical Chemistry
(2008 Pattern) (Semester - III)

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

Instructions to the candidates:

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

Physico - Chemical Constants

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

P.T.O.

SECTION - I

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

a) Discuss adsorption isotherms used in sensors.

b) Write a note on potentiometric sensors.

c) What is the influence of surrounding gas atmosphere on the properties of semiconductor porous ceramics?

d) Derive the expression for enzyme - catalyzed reaction.

e) Explain the dependence of the observed rate constant for oximation of acetone on pH at 20ºC.

f) Define the terms - poison, Hammette acidity function, specific acid catalysis and Michaelis - Menten kinetics.

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

a) Give the classification of sensors according to their purpose and the type of output signals.

b) Explain the catalytic cycle for acetal hydrolysis in aqueous acid solution.

c) Calculate the pH and concentration of all ionic species for 0.01 M CH_3COOH [Given : $k_a = 1.8 \times 10^{-5}$].

d) Write proton condition for NaH_2PO_4 and H_2Se.

e) Calculate the fractions of carbonic acid existing as H_2CO_3, HCO_3^- and CO_3^{2-} in the solution. (Given : pH = 7.98, $k_{a1} = 4.47 \times 10^{-7}$, $k_{a2} = 5.62 \times 10^{-11}$).

f) Write the mass balance on thiosulphate in 0.01 M $H_2S_2O_3$ and oxalate in 0.1 M $H_2C_2O_4$.

SECTION - II

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

a) Describe briefly different analytical techniques where electron microscope is used.

b) Explain the term active smartness with suitable illustration.

c) Write a note on ferrofluids.

d) What are the applications of carbon nanotubes?

e) Explain the technique of lithography.

f) What are intelligent gels? Explain their functioning and applications.

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

a) Write a note on passive smart materials.

b) Draw a neat labelled diagram of atomic force microscope and explain its working.

c) Derive the phase rule and state its limitation.

d) Describe the chemical methods of preparation of nano particles.

e) Write a note on carbon nanotubes.

f) Give an account of Sushi sensor.

Total No. of Questions :4]

SEAT No. :

P1465

[Total No. of Pages :2

[5223] - 36

M.Sc.-II

INORGANIC CHEMISTRY

CH - 326: Organometallic Compounds of Transition Metals and Homogeneous Catalysis

(2008 Pattern) (Semester - III)

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

Instructions to the candidates:

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

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

a) What are the special features in the bonding of carbonyl ligand to transition metals?

b) Explain the bonding in Metal - alkene complexes.

c) Explain the typical reactions of $Mo(CO)_6$.

d) Give an account of the chemistry, structure and bonding of the Π-allyl complexes of transition metals.

e) Describe the systematic classification of η^5 - cyclo -pentadienyl transition metal derivatives along with their preparative methods.

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

a) Explain - "Ni - C bondlength in nickelocene is longer than the Fe – C bondlength in Ferrocene".

b) Discuss in detail production of aldehyde by Wacker process.

c) Propose a structure of $(C_5H_5)_3\ Ni_3(CO)_2$ based on IR data. Does each Ni atom obey the 18 $\overline{e}$ rule?

P.T.O.

d) What do you mean by hydrocyanation reaction? Which catalysts are used for this reaction. Explain with one example.

e) Explain the differences in IR spectra of the following.

i) $Mo(PF_3)_3(CO)_3$ Vs. $Mo(PMe_3)_3\ (CO)_3$

ii) Mn Cp $(CO)_3$ Vs. Mn Cp* $(CO)_3$

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

a) State EAN rule and predict the structure of -

i) $(\eta^5 - C_5H_5)\ (\eta^1 - C_5H_5)\ Fe(CO)_2$ and

ii) $Co_2\ (CO)_8$ (in hexane and solid)

b) Write an account of applications of OMC's in agriculture and horticulture.

c) Explain the catalytic role of alkyl Molybdate (VI) compound in epoxidation reactions.

d) Discuss briefly OMC of group IV in medicine.

e) Comment on the therapeutic properties of

i) Mercurochrome

ii) Salvarsan

iii) Silatrane and

iv) Cisplatin

Q4) Write short notes Any Four. **[20]**

a) Fluxional behaviour of organometallics.

b) Monsanto acetic acid synthesis.

c) Applications of the Suzuki cross-coupling reaction.

d) Tertiary phosphine complexes of TM's.

e) Pianostool compounds.

♦ ♦ ♦

Total No. of Questions : 4]

SEAT No. :

P1466

[Total No. of Pages :2

[5223] - 37

M.Sc. -II

INORGANIC CHEMISTRY

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

(Semester - III) (2008 Pattern)

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

Instructions to the candidates:

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

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

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

b) Explain the terms:

i) Solute – solvent interaction.

ii) Canting.

c) Explain the magnetic moment of the following ions.

Mn^{3+} μB.m. expt = 4.9 B.m.

Co^{2+} μB.m. expt = 4.1 to 5.2 B.m.

Given : atomic no. of Mn =25 and Co = 27

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

e) Explain the difference between antiferromagnetic spin-spin exchange and spin pairing.

P.T.O.

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

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

b) Discuss the various models to account for the anomalous magnetic behaviour of transition metal complexes.

c) Define the terms:

i) Curie temperature.

ii) Paramagnetic material.

iii) Diamagnetic material.

iv) Ferromagnetic material.

v) Ferrimagnetic material.

d) Why is it that oxovanadium (IV) forms complexes which are involved in a weak ferromagnetic exchange?

e) What are mixed valence compounds? How They are classified?

Q3) Answer <u>Any</u> <u>Four</u> of the Following **[20]**

a) Discuss the factors which affects the rate of electron transfer reactions

b) Discuss in brief about the base hydrolysis of Co (III) ammine complexes.

c) Explain in brief the various steps involved in photographic process.

d) Write a note on Reductive elimination reactions.

e) How the solvent plays an important role in substitution reaction of square planar complexes ?

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

a) What is trans effect ? Explain with suitable examples.

b) Write a note on Acid hydrolysis.

c) Discuss in brief recemization of tris– chelate complexes.

d) Write a note on complementary and Non– complementary reactions.

e) Discuss the relationship between 'd' electron configuration of a metalandthelability of its complexes.

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Total No. of Questions : 4]

SEAT No. :

P1467

[Total No. of Pages : 2

[5223]-38
M.Sc. - II
INORGANIC CHEMISTRY
CH-331 : Structural Methods in Inorganic Chemistry
(2008 Pattern) (Semester - III)

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

Instructions to the candidates:

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

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

a) Discuss the ESR-spectrum of bis(salicylaldoxime) Cu(II) complex.

b) How many types of nuclei are present? Which nuclei gives NQR signal?

c) Discuss the factors affecting on "chemical shift" in NMR.

d) How *Mössbauer* spectroscopy is useful technique to understand the structural aspects of $Fe_3(CO)_{12}$ compound?

e) Explain the experimental procedure of cyclic voltametry with the help of neat and labelled diagram.

Q2) Answer the following(Any Four) **[20]**

a) Discuss the principle of *Mössbauer* spectroscopy.

b) Draw the cyclic voltamogram for electrophilic reaction.

c) What is meant by Anisotropic effect in ESR-spectroscopy?

d) Explain the application of SEM.

e) Explain the instrumentation of DSC.

P.T.O.

Q3) Answer the following(Any Four) **[20]**

a) What is DTA? Draw the DTA curves for decomposition $CaC_2O_4.H_2O$ in air and explain it.

b) Explain the ^{31}P-NMR spectra of HPF_2 molecule

Given:- i) $^{J31}P - ^{19}F > ^{J31}P - ^{1}H$

ii) $^{J31}P - ^{1}H > ^{J31}P - ^{19}F$

c) Explain the zero field splitting and Kramer's degeneracy in ESR spectroscopy.

d) What are miller indices? Compute the miller indices for face having intercepts as [100] [111] [110].

e) Calculate the % of $MgCO_3$ and $CaCO_3$ in 40 mg of limestone sample that exhibits thermogram showing weight of 30mg at 500ºC and 18mg at 900ºC.

Q4) Write short note on (Any Four) **[20]**

a) Auger effect

b) Applications of TEM

c) Quadrapole splitting

d) Spin-spin coupling in NMR

e) X-ray photoelectron spectroscopy

♦ ♦ ♦

Total No. of Questions : 4]

SEAT No. :

P1468

[Total No. of Pages : 2

[5223] - 39

M.Sc. - II

INORGANIC CHEMISTRY

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

(2008 Pattern) (Semester - III)

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.***

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

a) Explain the significant role of the following elements in different biological processes Mn, Co, Cu, Zn, Fe, Ni, Ca, Na, K, Mg.

b) What is Cobalamine? Draw its structure. Explain the functions and reactions of cobalamine.

c) Name two enzymes containing Nickel. Exlpain the functions of these enzymes.

d) What is Dopamine? How is it produced in the body?

e) Which metal present in blue and non-blue protein? What are the functions of these protein? Explain with suitable reactions.

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

a) Write an account of on Manganese enzymes.

b) Name the metals that are used for diagnostic and therapeatic purpose. Explain with the help of examples, their role as diagnostic agents.

c) What is meant by "intercalation" of complexes in DNA? Explain with suitable examples and diagrams.

d) Explain the mechanism of nitrate reduction. Which metallo enzyme is involved in the reactions?

e) Which are the metals present in the enzymes

i) Galactose oxidase.

ii) Carbonic anhydrase.

Explain the reaction catalysed by any one of them.

P.T.O.

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

a) Explain the role of metal complexes as

i) Metallo foot printing agents.

ii) Conformational probes.

b) What is meant by MRI? Explain.

c) What are radiopharmaceuticals? Which metal complexes are used as radiopharmaceuticals. Draw their structures.

d) Give an account of biological importance of Manganese.

e) Which metal is responsible for Wilson disease? Give the names and functions of proteins containing this metal.

Q4) Answer the following : **[20]**

a) Write short notes on :

i) Anti cancer drugs.

ii) Chemical nucleases.

b) Fill in the blanks :

i) Superoxide dismutase contains _____ and _____.

ii) Complexes of Gallium and _____ are used as _____ agents.

iii) Dioxygen production from water involves clusters of _____.

iv) Conversion of L-tyrosinc to L-dopa is catalysed by the enzyme _____.

v) Vitamin B_{12} containt cobalt _____ oxidation state.

c) Draw the structures of :

i) Methyl cobalamin.

ii) Type - I, II and III copper centres.

iii) Model compound F Manganese.

Total No. of Questions :6]

SEAT No. :

P1469

[Total No. of Pages :4

[5223] - 40

M.Sc.-II

ORGANIC CHEMISTRY

CH - 350: Organic Reaction Mechanism

(2008 Pattern) (Semester - III)

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

Instructions to the candidates:

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

SECTION - I

Q1) Write short note on Any three. **[12]**

a) Methods of generation of Carbenes.

b) AAc^2 Mechanism.

c) Cross Over Experiment.

d) Pyridoxal Mediated transamination.

Q2) Attempt Any Four of the following. **[12]**

a) Elaborate synthetic applications of enamine with suitable examples.

b) Pyruvic acid reduction by $NaBH_4$ gives racemic lactic acid but the product of enzymatic reduction by NADH is optically active.

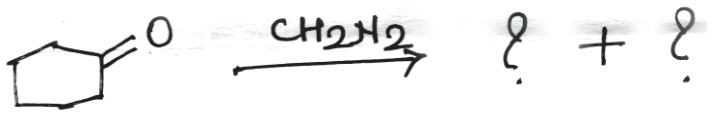
c) Suggest the mechanism for saponification of substituted methyl benzoates if ρ of reaction is 2.38.

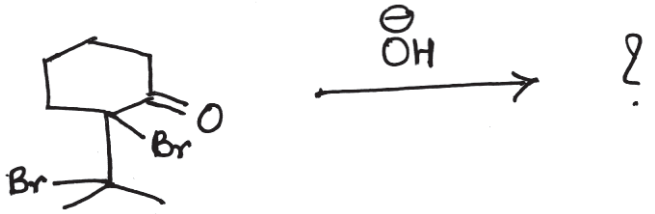
d) Calculate how much fashes p-bromo-benzyl chloride will solvolyse in water than p-nitrobenzyl chloride. (Given $\rho = -1.31$, $\sigma_{p-Br} = 0.23$ and $\sigma_{p-NO_2} = 0.78$). Clearly show the calculations.

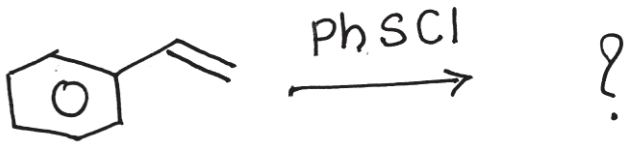
P.T.O.

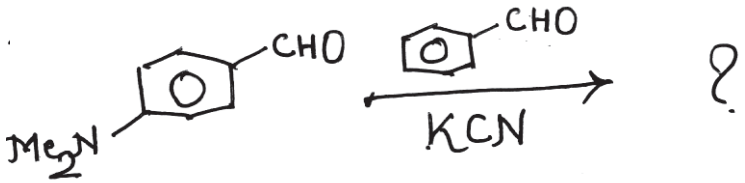
e) The pKa of p–chlorobenzoic acid is 3.98 & pKa of benzoic acid is 4.19. Calculate σ for p – Cl group.

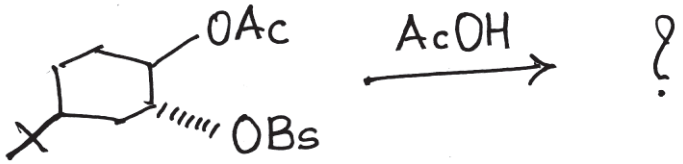
Q3) Predict the proudcts with mechanism in any four of the following. **[16]**

a) 

b) 

c) 

d) 

e) 

SECTION - II

Q4) Attempt Any Four of the following. **[12]**

a) Which of the following is more acidic?

Justify.

b) β-γ unsaturated acids undergo decarboxylation on heating. Explain.

c) Bromination of EMK gives primary bromide in acidic medium but secondary bromide in basic medium. Explain.

d) Explain the role of $NAD^{\oplus}$ in bio-transformation with suitable example.

e) Explain use of isotopes in determination of mechanism of organic reactions.

Q5) Attempt <u>any</u> <u>four</u> of the following. **[12]**

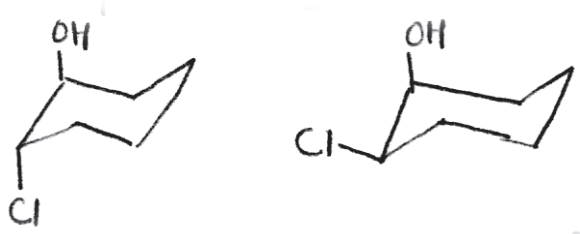
a) Thioester hydrolysis occurs more rapidly than ester hydrolysis. Explain.

b) Hammett equation is a linear free energy relationship. Explain.

c) Explain Sandmeyer reaction with suitable example.

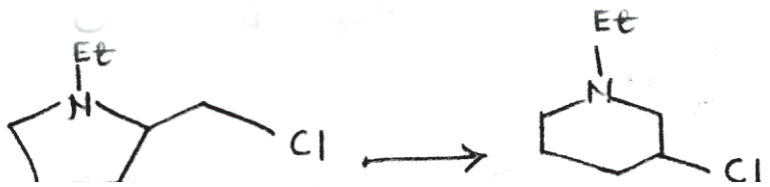
d) Cis –1, 2–dimethyl cyclohexane–1, 2–diol undergoes Pinacol rearrangement & very easily in presence of dilute H_2SO_4 whereas it's trans isomer undergoes ring expansion. Explain.

e) Predict which of the following will undergo epoxide formation easily?

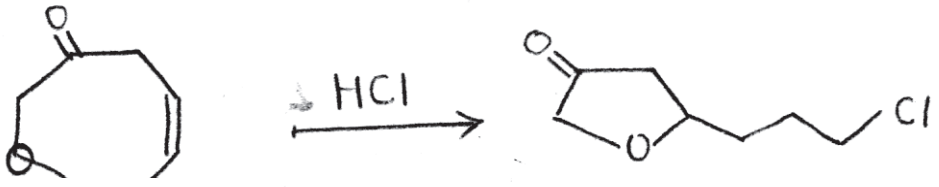


Q6) Suggest the mechanism in <u>any</u> <u>four</u> of the following. **[16]**

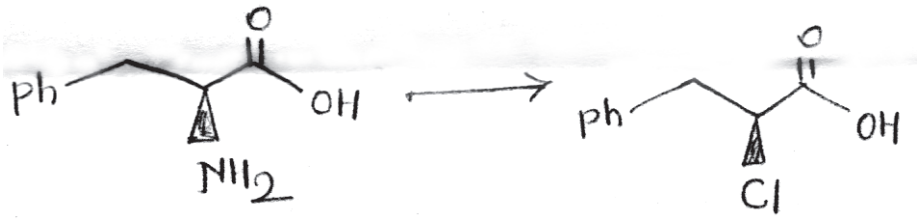
a)

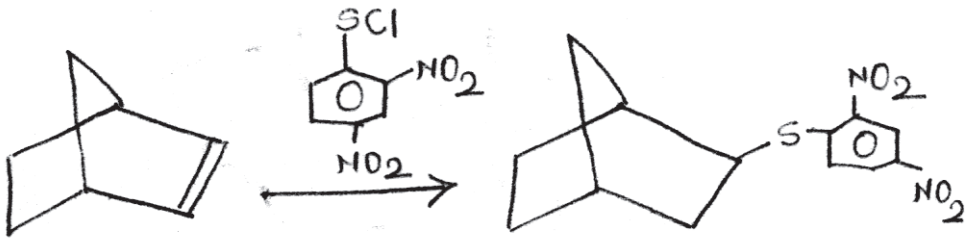


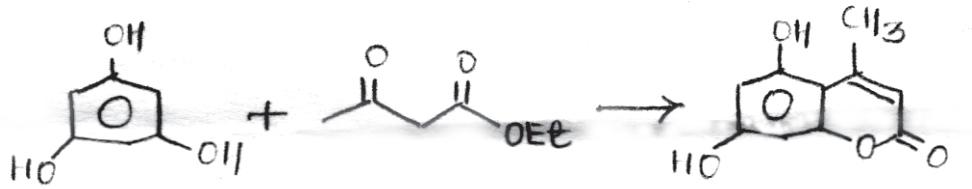
b)



c)



d) 

e) 

Total No. Of Questions : 6]

SEAT No. :

P1470

[Total No. of Pages 6

[5223] - 41

M.Sc. -II

ORGANIC CHEMISTRY

CH–351: Spectroscopic Methods in Structure Determination

(Semester - III) (2008 Pattern)

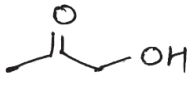
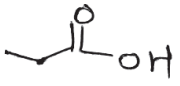
Time : 3 Hours] *[Max. Marks :80*

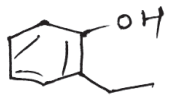
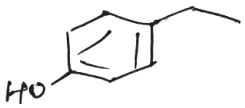
Instructions to the candidates:

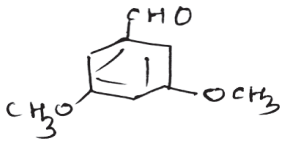
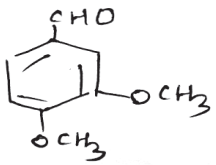
1) ***All question are compulsory***
2) ***Figures to right indicate the maximum marks***
3) ***Answers to the two sections to be written in separate answer sheets.***

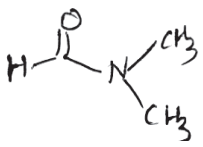
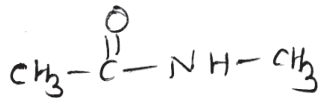
SECTION -I

Q1) a) Distinguish the following pairs of compounds by the spectroscopic method indicated. **[8]**

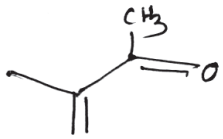
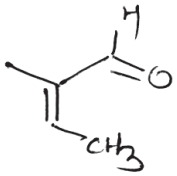
i)  and.  (IR)

ii)  and  (PMR)

iii)  and  (CMR)

iv)  and  (PMR)

P.T.O.

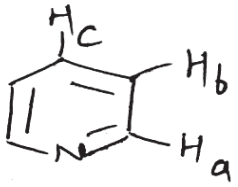
v)  and  CMS)

b) Explain <u>any</u> <u>four</u> of the following: **[8]**

i) The M^+ intensely decreases in going from aromatic to cyclic to branched organic compounds.

ii) Roofing effect can be used to distinguish AB and AX - spin system.

iii) Explain the J-values observed in the given molecule



$J_{ab} = 5\ Hz$

$J_{ac} = 7\ Hz$

iv) DEPT can be used to differentiate between $-CH_3$, $-CH_2$ and $-\overset{|}{\underset{|}{C}}H$ groups

v) Protons attached to the O/N can be detected by D_2O exchange study.

vi) CIMS is used for compounds giving weak or no M^+ by EIMS.

Q2) Predict the structure using spectral data provided. (Any three) **[12]**

a) MF : C_7H_7N

PMR : 5.03 (dd, J = 8 and 1.5 H_2, 4mm)

5.9(dd, J =13 and 1.5 H_2, 4mm)

6.62(dd, J = 13 and 8H_2, 4mm)

7.22 (dd, J = 5.5H_2, 8mm)

8.52 (d, J = 5.5H_2, 8mm)

b) MF: $C_{10}H_{11}NO_2$

IR: 2250, 1600 cm^{-1}

PMR: 3.65 (s, 8mm), 3.85(S, 24mm),

6.36 (t, J = $2H_2$, 4mm),

6.45(d, J = $2H_2$, 8mm)

c) MF : $C_9\ H_{18}\ O_3$

CMR: 135 (d), 114(t), 74(t),72(t) 64(t,strr),

43(s), 22(t), 8(q)

d) MF : $C_8\ H_8\ O$

PMR: 2.75(dd, J = 5.5 and 2.6 H_2, 1H);

3.0_9(dd, J = 5.5 and $4H_2$, 1H) and 3.81

(dd, J = 4 & 2.6 H_2 ,1H), 7.4 (b$_5$ 5H).

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

a) Use of Lanthanide shift reagent in PMR

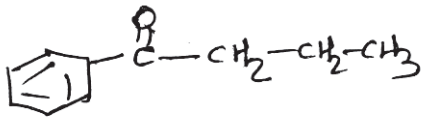
b) Factors affecting geminal coupling

c) Ionization techniques in mass spectrometry

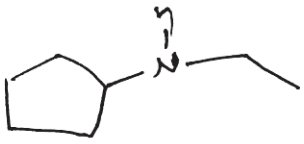
d) Nuclear Overhauser Effect

SECTION-II

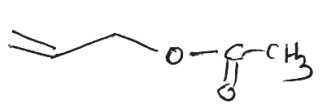
Q4) a) Explain the genesis of any four of the following ions. **[8]**

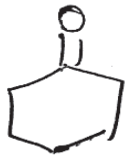
i) 

105, 43, 106, 71

ii) 

98, 84, 70, 56

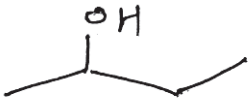
iii)  100, 58, 57, 43, 42, 41

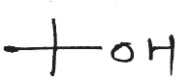
iv)  98, 70, 55, 42

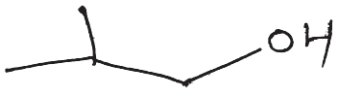
v) CH_2 =CH–CH_2–CH_2–Br 136, 134, 55, 54, 39, 27

b) Predict the major ions in the Ms of the following compounds. **[4]**

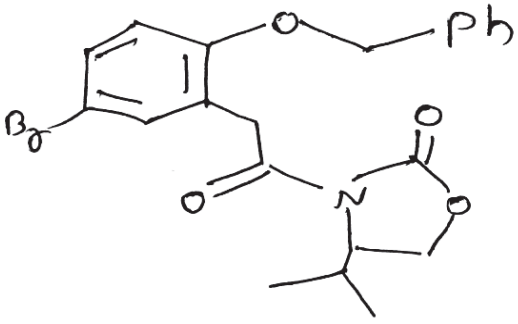
i) 

ii) 

iii) 

iv) 

Q5) a) Assign the given 1H-NMR signals to different protons of compound A. Explain your assignments using the decoupling experimental data shown. **[8]**



7.35–7.25 (m, 7H);

6.79 (d, J = 8.7H_z,1H)

5.05 (d, J = 11.7H_z, 1H)

5.0 (d, J = 11.7H_z,1H)

4.31(m,1H),

4.21(d, J = 17.5H_z 1H)

4.18(d, J = 17.5 H_z,1H)

4.14(dd, J = 9 & 3 H_2 ,1H), 4.07(t, J = 9H_2, 1H),2.29(m, 1H),

0.85(d, J = 7.1H_z, 3H),0.77 (d, J =7.1H_z,3H),

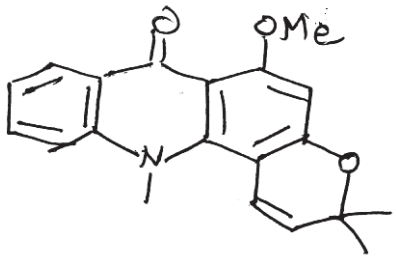
Irradiation at δ 4.31 changes to

i) 2.29 to septet

ii) δ4.14 to d with J = $9H_z$

iii) δ4.07 to d with J = $9H_z$

b) Assign the CMR signals to the various carbons in the following compound. Justify your assignments. **[8]**



27.3(q), 36.3(q), 57.4(q),81.1(s),

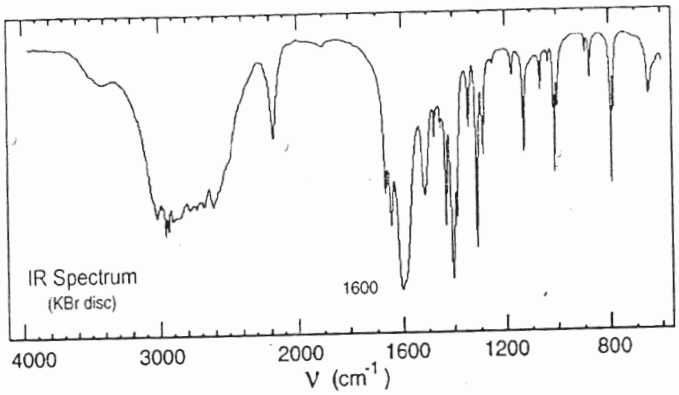
94.3(d), 107(s),111.3(s), 117(d),

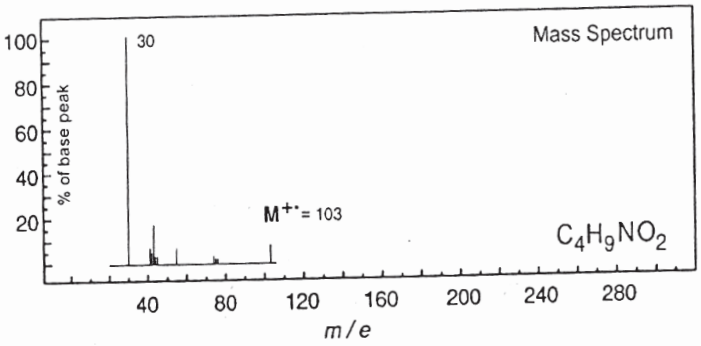
121(d),122.7(d), 125(d), 127.4(s),

134(d), 142.3(s), 144(s),159.9(s),

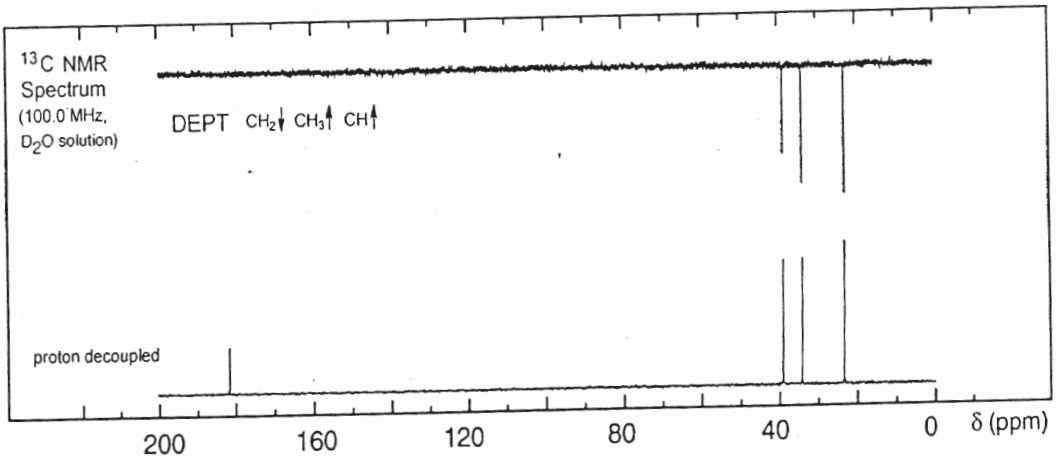
162.3(s),181 (s).

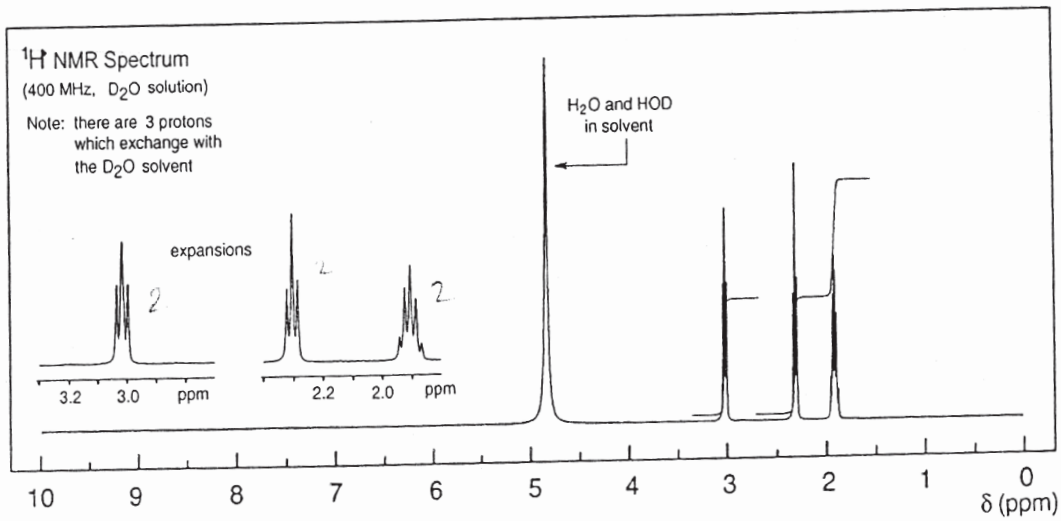
Q6) You are provided with spectra of a compound on the next page Analyze the spectra and arrive at a structure consistent with the data Justify your structure **[12]**





No significant UV absorption above 220 nm





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Total No. of Questions : 6]

SEAT No. :

P1471

[Total No. of Pages : 5

[5223]-42
M.Sc. - II
ORGANIC CHEMISTRY
CH - 352 : Organic Stereochemistry
(2008 Pattern) (Semester - III)

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

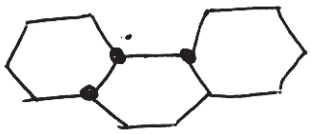
Instructions to the candidates:

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

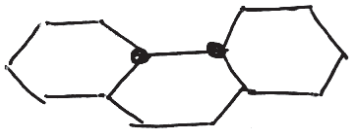
SECTION-I

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

a) Draw conformational structures of compound Ⓘ and Ⓘ Ⓘ. Discuss the optical activity for them.

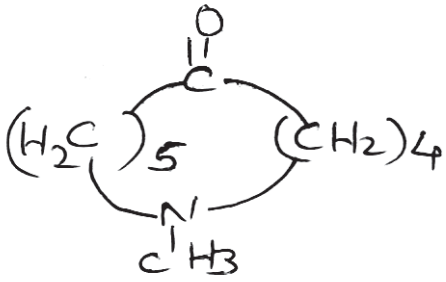


compound Ⓘ



compound Ⓘ Ⓘ

b) The carbonyl frequency at 1700cm^{-1} for compound I disappears on protonation. Explain.



compound I

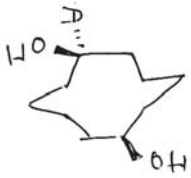
c) Camphor has two asymmetric carbon atoms, but there is only one dl pair. Explain.

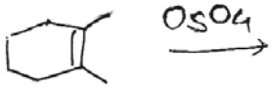
d) "Reduction of cyclobutanone by $NaBH_4$ is much more easy than cyclo-octanone". Explain.

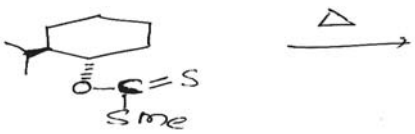
e) Describe the inoculation method for resolution of(±). Sodiumammonium tartarate.

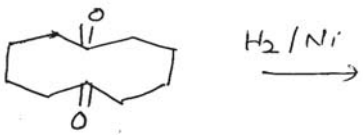
P.T.O.

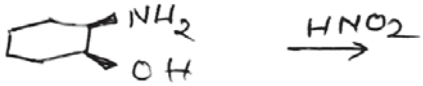
Q2) Predict the product's in <u>any four</u> of the following. **[12]**

a)  ?

b)  ?

c)  ?

d)  ? + ?

e)  ?

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

a) 3-Alkylketone effect.

b) Dipole moment studies of CIS and trans 1,2- dibromocyclohexane.

c) Relative stabilities of CIS and trans-hydrindane.

d) Bredt's rule.

SECTION - II

Q4) Answer <u>any three</u> of the following. **[12]**

a) Find the relative configuration at C_5 and C_6 in dihydrocodeine.

b) How N.M.R. spectroscopy is used to find stereochemistry of lactone fusion in enhydrina.

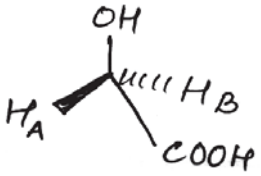
c) Give the evidence to explain the stereochemistry of C_3-Vinyl group in quinine.

d) Give the experimental evidences to establish relative configurations of C_5 and C_6 in Morphine.

Q5) Answer the following questions.(any four) **[12]**

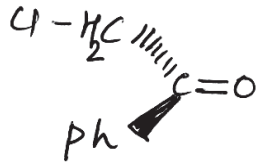
a) Write Pro R and Pro-S for the following compounds.

(I)

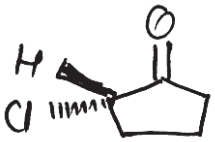


(II)

b) Identify the following compounds as Re/s faces, Pro R/Pro S.



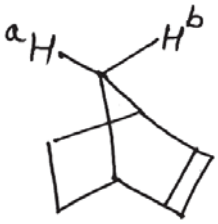
and



c) In the following molecules A,B,C indicates whether the hydrogens marked H^a, H^b are homotpic, enantiotopic or diastereotopic.

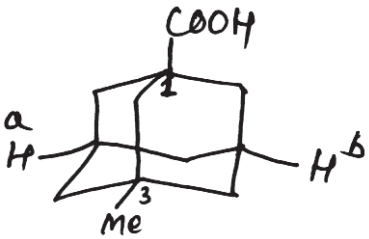
(A)

(B)

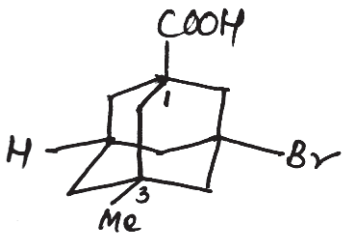


(C)

d) Would you expect the proton H^a and H^b in the following compounds to be enantiotopic. Comment on Chirality.



(I)

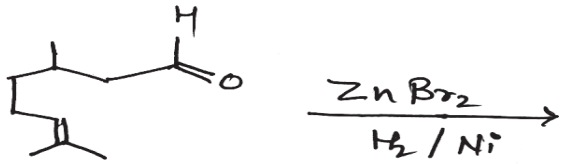


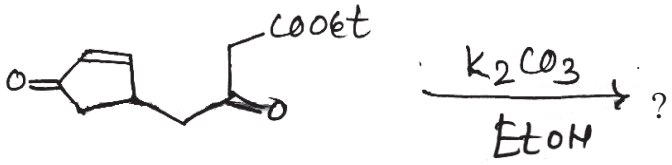
(II)

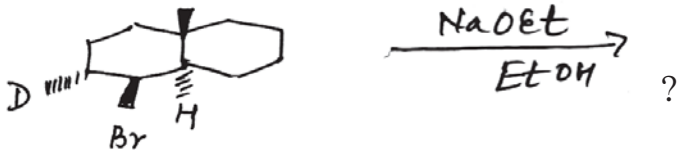
e) Oxidation of Maleic acid with O_sO_4 or $KMnO_4$ gives mesotartaric acid. Whereas similar oxidation of fumaric acid gives(±) tartaric acid. Explain HOOC- (HC = CH) - COOH CIS or trans.

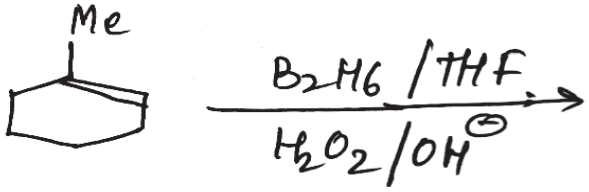
Q6) a) Predict the product/s in the following reactions. Explain the stereochemistry and mechanism in details. (any five) **[10]**

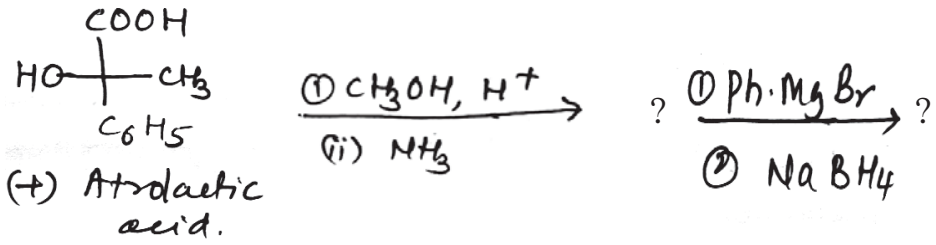
i) 

ii) 

iii) 

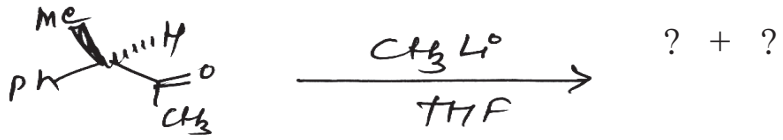
iv) 

v) 

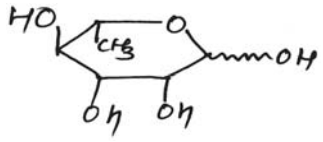
vi) 

b) Answer the following(any two): **[6]**

i) Using Gramer's rule rationalise the following reaction, write major and minor products.



ii) Write chair conformation of the following and discuss the geometry of groups present on ring Carbon atom.



(I)

iii) One isomer(meso) of compound(A) gives two meso alcohols while the other(dl) on reduction gives only one alcohol. Explain

(A)

♦ ♦ ♦

Total No. of Questions : 6]

SEAT No. :

P1472

[Total No. of Pages : 4

[5223] - 43

M.Sc. - II

ORGANIC CHEMISTRY

CH-353 : Free Radicals, Photochemistry and Pericyclic Reactions and their Applications

(2008 Pattern) (Semester - III)

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

Instructions to the candidates:

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

SECTION - I

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

i) Barton Reaction.

ii) Di-π methane rearrangement.

iii) Factors affecting the stability of free radicals.

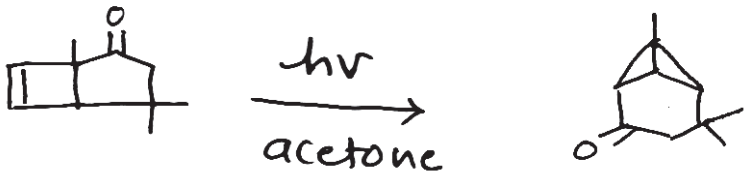
b) Explain any two of the following : **[8]**

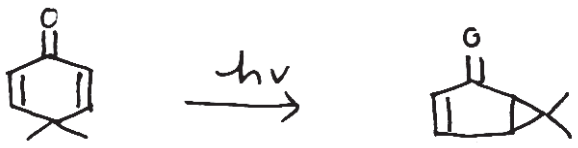
i) Paterno-Büchi reaction with a suitable example.

ii) Dimerisation of alkenes.

iii) Importance of photosensitiser in photochemistry.

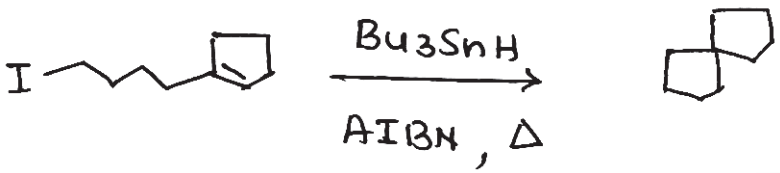
Q2) Suggest the mechanism for any four of the following : **[12]**

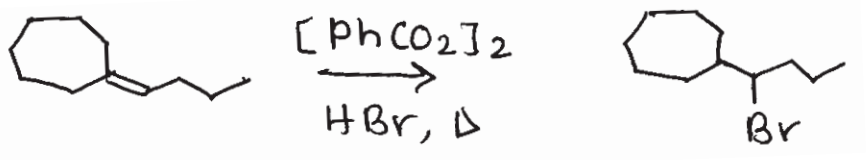
a) 

b) 

P.T.O.

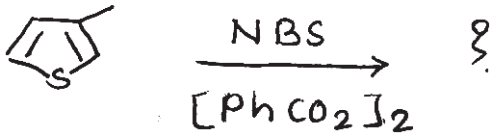
c) 

d) 

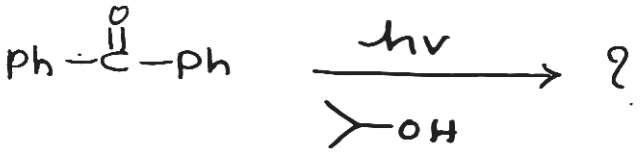
e) 

Q3) Predict the products in any four of the following : **[12]**

a) 

b) 

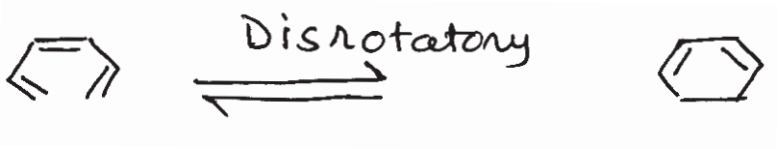
c) 

d) 

e) 

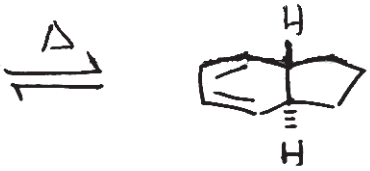
SECTION - II

Q4) a) Construct a correlation diagram for the following transformation. **[4]**

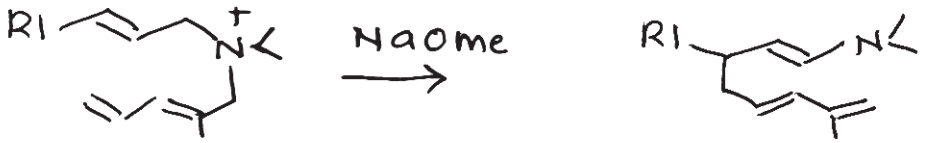


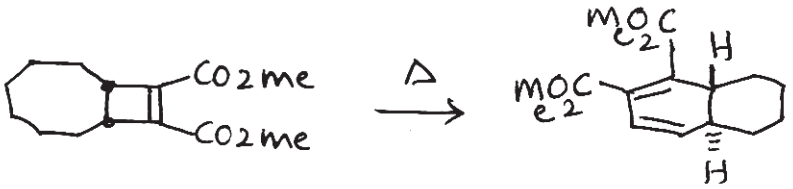
b) Suggest the mechanism for any four of the following : **[12]**

i) 

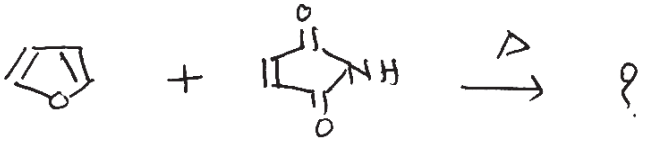
ii) 1,3,5-Cyclononatriene 

iii) 

iv) 

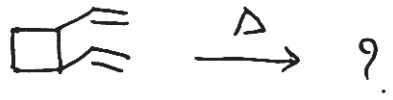
v) 

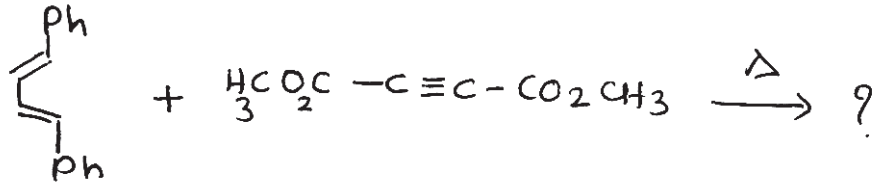
Q5) Predict the products in any four of the following : **[12]**

a) 

b) 

c) 

d) 

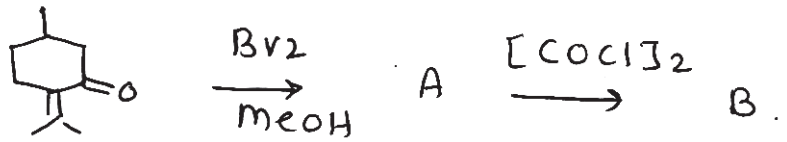
e) 

Q6) Answer any four of the following : **[12]**

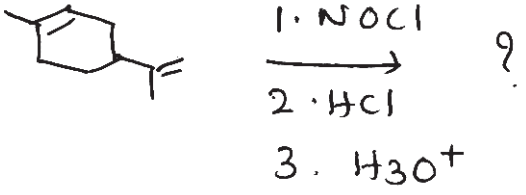
a) Sketch the molecular orbitals of 1, 3, 5 - hexatriene.

b) Write a note on Claisen rearrangement.

c) 

d) 

Give structures of A and B.

e) 

Total No. of Questions :4]

SEAT No. :

P1473

[Total No. of Pages :3

[5223] - 44

M.Sc.-II

ANALYTICAL CHEMISTRY

CH - 390: Electroanalytical and Current Analytical Methods in Industries

(2008 Pattern) (Semester - III)

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

Instructions to the candidates:

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

SECTION - I

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

a) What is supporting electrolyte and what is its role in electrochemistry?

b) Explain the following terms and give their significance in polarographic analysis.

i) Limiting current

ii) Polarographic maxima

iii) Condenser current.

c) Distinguish between voltametry and polarography.

d) The diffusion coefficient for Tl^{+} and Cd^{2+} are 2.00×10^{-5} and 0.72×10^{-5} cm^2/s respectively. If a 1.00×10^{-3} M solution of Cd^{2+} gives a diffusion current of 8.15 μA, predict the diffusion current for 1.5×10^{-3}M Tl^{+} under the same conditions.

P.T.O.

e) A DC Polarogram of an organic compound had a limiting current of 5.00 μA. The following data were obtained from the rising portion of the wave at 25°C.

E / V	i /μA
– 0.475	0.62
– 0.490	1.57
– 0.510	3.48
– 0.525	4.38

Determine the number of electron transferred in the electrochemical reaction and the half - wave potential.

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

a) What is meant by stripping voltametry? Why stripping voltametric methods are more sensitive than other voltametric techniques.

b) Draw schematic diagram of cell used is coulometric titration. Discuss the application of coulometry for complexometric titrations.

c) What are the advantages and disadvantages of amperometric titrations over other methods?

d) Discuss the preparation of nano material by electrochemical deposition method.

e) A controlled - potential coulometric assay was performed at a potential on the Plateau of the voltametric wave of Cd^{2+}. The area under the current-time curve was 21.4 mA min for 25ml. Sample solution was assayed. Calculate the concentration of the Cd^{2+} in the solution.

SECTION - II

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

a) Explain the principle and technique of neutron activation analysis. Mention its limitations.

b) Discuss the isotope dilution analysis. How it can be used to determine the blood volume of an animal.

c) What is the principle of a radiometric titration? Discuss the nature of the titration curve obtained in precipitation reaction where solution is labelled.

d) 1.00 g of unknown steel sample and 0.950 g of known steel sample containing 0.463 percent of Mn were irradiated is a neutron source for 10h. After a cooling period of 40 min the activities for gamma ray-emission were found to be 2542 cpm for unknown and 1984 cpm for the known steel sample. Calculate the percentage of Mn in unknown steel sample .

e) Isotope dilution analysis was employed for determination glycine in 5.38g protein hydrolystate mixture using ^{14}C labeled compound. 5.3 mg labelled compound with an activity of 39850 cpm was added to the mixture. After through mixing the solution was passed through an ion exchange column when 3.7 mg pure glycine was separated showed an activity of 10900 counts in 50 min. using the same counter. Calculate percentage of glycine in the sample. Given: Background counts for the counter = 11790 counts in 90 min.

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

a) Explain the principle and instrumentation of Nephelometry. Give the typical applications of nephelometric method.

b) Explain the principle of DTA technique with suitable example. Describe the terms exotherm and endotherm in DTA.

c) Discuss principle and technique of radio reagent methods of analysis. State its important applications.

d) Calculate the percentage of $MgCO_3$ and $CaCO_3$ in 85 mg of natural dolomite. Dolomite is converted to calcite exhibits thermogram showing 64.68 mg at 750ºC and 44.92 mg at 950ºC by complete decomposition of calcite. [Given: Atomic weights of Ca = 40, Mg = 24, C= 12, O =16].

e) Calculate the concentration of chloride in water sample in ppm having transmittance 54.8 percent is the cell of path length 1.00cm. The turbidity coefficient of the water sample is 205.19 litre $mole^{-1}$ cm^{-1}

[Given: Atomic weight of Cl= 35.5]

Total No. of Questions :4]

SEAT No. :

P1474

[Total No. of Pages : 3

[5223]-45
M.Sc.-II
ANALYTICAL CHEMISTRY
CH - 391 : Environmental and Analysis of Industrial Materials.
(New Course) (2008 Pattern) (Semester - III)

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

Instructions to the candidates:

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

SECTION-I

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

a) What is complete fertilizer? Describe alkalimetric ammonium molybdophosphate method to estimate total phosphorous in the given sample of phosphorous containing fertilizer.

b) Outline the procedure to estimate lead from glass.

c) Give the analytical method for isolation and determination of pigments, binder and Thinner of Latex paints.

d) Explain the term explosive. How is heat of explosion is measured by adiabatic calorimeter?

e) A sample of detergent weighting 8.550 gm was dissolved in water and the solution was diluted to 1000ml in a volumetric flask. 10ml of an aliquot of this solution requried 12 ml of 0.005N CETAB solution for complete reaction. Calculate percentage of combined SO_3 present in the sample. (Given At.wts. O =16,S=32)

P.T.O.

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

a) Describe a general method for determination of water and ethyl alcohol from cosmetics.

b) Explain the analytical method for identification and analysis of Thinner.

c) Explain the term detergents? Describe the analytical method for estimation of Iron.

d) 0.5 gm of shipnail brass sample was dissolved in acid. It gives 0.035 gm SnO_2, 0.120 gm $pbSO_4$. Calculate percentage of sn and pb in the sample.

(Given At.wt O =16, Sn=118.7, pb = 207, S=32)

e) 10 ml 0.01 m $ZnSO_4$ solution required 9.5 ml of ED.TA solution for complete reaction 0.260 gm of the sample containing magnesium was dissolved in 100ml acid. An alignot of 10ml of the same solution required 12ml E.D.T.A. solution. Calculate percentage of magnesium in the sample.

(Given At.wt.s mg = 24.31)

SECTION-II

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

a) Give the composition of Bauxite. Explain the analytical method for estimation silica.

b) What is steel? Explain the analytical procedure for the estimation of manganese from steel.

c) Explain the principle and working of cyclone separator.

d) 0.205 gm cupronickel alloy was dissolved by acid treatment and the solution was diluted to 100ml. In iodometric determination of Cu, 10ml diluted solution required 9.5ml of 0.025N $Na_2S_2O_3$ for complete reaction. In gravimetric estimation of Ni as Ni-DMG 25ml diluted solution gave 0.120 gm of Ni-DMG ppt after removal of Cu. Calculate percentage of Cu and Ni from alloy.

Given:-At.wts.Cu=63.5 Ni =58.6,

Mol.wt of Ni-DMG = 288.6

e) From the following data calculate chemical oxygen demand (COD) for the sample of waste water. 200ml sample was refluxed with 25ml 0.25N $K_2cr_2O_7$ solution and 25 ml conc - H_2 SO_4 solution. The solution was titrated with ferrous ammonium sulphate solution. The burette reading was 12 ml. While 25 ml of the same $K_2cr_2O_7$ solution required 22.4 ml ferrous ammonium sulphate soln.

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

a) Discuss the analytical method for estimation of mercury from waste water.

b) Explain the term dissolved oxygen and discuss winkler's method for estimation of dissolved oxygen from water.

c) Define the terms

i) Aerosole

ii) BOD

iii) COD

iv) Mist

v) Dust

d) How NO_x is generated? Give its hazardous effects? How is it controlled?

e) Write a short note on any one

i) Sludge disposal

ii) Trickling filter

Total No. of Questions : 4]

SEAT No. :

P1475

[Total No. of Pages : 3

[5223]-46
M.Sc. - II
ANALYTICAL CHEMISTRY
CH-392 : Advanced Analytical Techniques
(2008 Pattern) (Semester-III)

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

Instructions to the candidates:

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

SECTION-I

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

a) What are Zener diodes? Explain their use for voltage regulation. How the pinch off potential of a Zener diode can be controlled?

b) Write a note on autotransformers.

c) Explain the term microprocessor. Draw the block diagram of micro-processor-controlled potentiometric titrator.

d) What are amplifiers? Explain feedback in operational amplifier with its characteristics.

e) Perform the following mathematical operations by using binary number system and convert the answer into decimal equivalent.

i) 83 + 17 ii) 456 + 321

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

a) Draw an outline of microprocessor controlled atomic absorption spectrophotometer.

b) Write a short note on discrete-sample analyzers.

c) Explain the term rectification. Describe the working of crystal diode as half wave rectifier.

P.T.O.

d) Draw the schematic diagram of microprocessor controlled liquid chromatograph.

e) Three capacitors of 7µf, 14 µf and 28 µf are connected in parallel. Find the equivalence capacitance.

SECTION-II

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

a) "The radiation source in AAS is usually modulated". Explain.

b) Mention various evaluation methods used in flame emission technique and discuss with a suitable example any one of these methods.

c) What are the types of ionic sources used in Mass spectrometry? Describe one of them in detail.

d) Write a short note on Immunoelectrophoresis.

e) The following data were obtained during the analysis of calcium by AAS at 423-5 nm. Prepare a working curve from the data and determine the concentration of calcium in the sample.

Calcium concentration µg/mL	Absorbance
2.0	0.155
4.0	0.405
6.0	0.605
8.0	0.820
10.0	1.010
Sample	0.560

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

a) Compare inductively coupled plasma emission spectroscopy and direct current plasma emission spectroscopy with respect to their principle and working. Give one important application of each.

b) Explain the term Lasers. Give it's classification with suitable examples.

c) Write a note on Hollow cathode lamp.

d) What is atomization? Explain the working of flame atomizer.

e) Magnesium in blood serum can be determined by AAS. A 1.0ml serum sample was diluted to 50ml and it's absorbance was found to be 0.255. A standard solution containing 2×10^{-5} M magnesium salt gave on absorbance 0.189. Calculate the magnesium concentration in the blood serum as miligrams per 100ml of the serum.

Given : Atomic mass Mg = 24 $gmol^{-1}$

♦ ♦ ♦

Total No. of Questions : 4]

SEAT No. :

P1476

[Total No. of Pages : 2

[5223] - 47
M.Sc. - II
ANALYTICAL CHEMISTRY
CH-380 : Pharmaceutical Analysis
(2008 Pattern) (Semester - III)

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

Instructions to the candidates:

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

SECTION - I

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

a) Describe in brief various sources of impurities in pharmaceutical products.

b) Explain the term - Ointments and creams. Mention the precautions to be taken for their preservation.

c) Discuss in detail the different types of errors encountered during sampling procedures.

d) To 1.7g of castor oil, 25 ml 0.5N ethanolic potassium hydroxide was added and solution was refluxed for 1.5 hours, On cooling, the solution was titrated with 0.5N hydrochloric acid using methyl orange indicator. The titration reading was 12.2 ml. The blank titration reading was 25.1 ml. Determine the saponification value of an oil.

e) Write short note on - "Microbial limit tests".

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

a) Explain the term disintegration and dissolution test for tablet. Give the procedure for dissolution test.

b) What are opthalmic preparation? Give the necessary precautions to be taken at the time of preparation and storage.

c) Explain the importance of limit tests in pharmaceutical analysis. Write in brief the procedure for limit test of chloride and sulfate in a given example.

d) Define the terms - misbranded drug and cosmetics. Discuss in brief the schedule M.

P.T.O.

e) 0.13g β-napthol ($C_{10}H_8O$) sample dissolved in 25 ml previously neutralized ethylene diamine and was titrated with 0.1N potassium methoxide in presence of O-nitroaniline indicator, until colour changes to orange red. The burette reading was 8.5 ml. Determine the percentage of β-napthol in the sample.

SECTION - II

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

a) Explain the biological limit test for titanus antitoxin.

b) Give the method of preparation and standardization of Karl-Fischer reagent.

c) Explain the need of sterilisation. Give an account of sterilisation by filtration.

d) 0.8g Chalk sample containing calcium carbonate was treated with 50 ml 0.5N hydrochloric acid and solution was boiled to expell carbon dioxide. The excess hydrochloric acid was then titrated with 1N sodium hydroxide solution. The titration reading was 31 ml. Calculate the percentage of calcium carbonate in the sample.

e) 50 g curd was vigorously stirred with 200 ml water and was filtered. To the filtrate, 50 ml 0.5 N sodium hydroxide solution was added and flask was immersed in boiling water bath for 20 minutes. On cooling to room temperature, the solution was back titrated with 0.5N hydrochloric acid using methyl orange indicator. The burette reading was 39.9 ml. The blank titration reading was 49.9 ml. Determine the amount of lactic acid in the curd sample.

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

a) Give an account of assay of thiomersal.

b) Explain the term ash. Mention different types of ash. How sulphated ash is determined for aspirin sample.

c) What is pyrogen? Explain pyrogen test in detail.

d) Give brief account of binders and lubricants.

e) Write short note on - Undue toxicity.

Total No. of Questions : 4]

SEAT No. :

P1477

[Total No. of Pages : 2

[5223] - 48

M.Sc. - II

ANALYTICAL CHEMISTRY

CH-381 : Medicinal Chemistry

(2008 Pattern) (Semester - III)

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

Instructions to the candidates:

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

SECTION - I

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

a) Discuss the relationship between Free-Wilson and Hansch - analysis.

b) Define the terms :

i) Soft drug.

ii) Inductive effect.

iii) Harmones.

c) Give an account of chemical assay of drugs.

d) Define the terms :

i) Sedatives.

ii) Antipyretics.

iii) Anaesthetics.

e) Define drug. Give different methods of classification of drugs.

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

a) Give the synthesis of chloramphenical.

b) Explain novel drug delivery system.

c) Discuss the concept of Chiral drug with suitable example.

P.T.O.

d) Define :

i) Drug activity.

ii) Drug receptors.

iii) Pro-drug.

iv) Soft drug.

e) Explain the role of alkylating agents in cancer therapy.

SECTION - II

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

a) What are sedatives and hypnotics? Give their classification.

b) Give the synthesis of attenolol and diazepam.

c) Write a short note on 'Immunological assay'.

d) Discuss the synthesis of any one cardio-vascular drug.

e) Describe in short computer aided drug design.

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

a) Define the terms :

i) Neuro transmitters.

ii) Mitotic inhibitor

iii) Carcinolytic antibiotics.

b) Discuss the suitable examples of antipsychotic drugs and CNS depressants.

c) Give the synthesis of any two of the following :

i) Chlorazepam.

ii) Ethambutual.

iii) 6–mer captopurine.

d) What is a local antifective drug? Discuss with suitable examples.

e) Write a brief account of benzodiazapines.

Total No. of Questions :6]

SEAT No. :

P1478

[Total No. of Pages : 4

[5223]-51
M.Sc.
PHYSICAL CHEMISTRY
CH - 410 :Molecular Structure and Spectroscopy
(2008 Pattern) (Semester - IV) (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 tables, 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 three</u> of the following: **[15]**

a) Explain the factors influencing chemical shift in NMR spectroscopy.

b) What is the need of reference for recording high resolution NMR? Explain the advantages of TMS.

c) Explain the terms: chemical shift, coupling constant, Larmor frequency and spin-spin relaxation in NMR spectroscopy.

d) Discuss the advantages of FT-NMR.

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

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

a) Explain the working of ESR spectrometer using block diagram.

b) Why is ESR spectrum usually recorded in the first derivative mode?

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

d) Explain the basic principle of PAS.

e) How many ESR lines are expected in the ESR spectrum of a anthracene anion? Explain.

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

a) Calculate the NMR frequency of ^{35}Cl in magnetic field of intensity 1.86 Tesla. [Given: I =3/2, μ= 1.06 in units of βn]

b) Calculate the transitional frequency of a free electron placed in magnetic field strength of 1.8 KG.

c) Differentiate among the following compounds from the ^{19}F spectra at high field. $CH_3 - CF_3$, $CH_3 - CH_2F$ and $CH_2F - CH_2F$.

SECTION - II

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

a) Describe in detail the rotating flat crystal method in X-ray diffraction analysis.

b) Compare the usefulness of XRD and electron diffraction techniques.

c) Explain the principle and experimental arrangement of electron diffraction technique.

d) Define the terms:

i) Scattering factor

ii) Structure factor and

iii) X-ray diffraction.

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

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

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

b) Explain the characteristic properties of diamagnetic, paramagnetic and ferromagnetic substances.

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

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

e) Explain the basis for calculations of magnetic susceptibility.

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

a) Calculate the molar susceptibility of acetic acid from following data.

Pascal constants in cgs units:

$C = -6.0\times10^{-6}$, $H = -2.93\times10^{-6}$ and O_2 (Carboxylate) $= -7.95\times10^{-6}$.

b) The separation of the lattice layers in a crystal is 400 pm. At what glancing angle will a reflection occur with Cu-Kα radiation having wavelength 153.9 pm.

c) X-ray diffraction studies of NaCl crystals give the cubic cell dimensions as 564 pm. The density of NaCl is 2.165 gm cm^{-3}. Calculate the number of NaCl units in a unit cell.

[Given: Atomic weight of Na = 23, Cl = 35.5]

♦ ♦ ♦

Total No. of Questions : 6]

SEAT No. :

P1479

[Total No. of Pages : 3

[5223]-52
M.Sc.
PHYSICAL CHEMISTRY
CH-411 : Surface Chemistry and Electro-Chemistry
(2008 Pattern) (Old) (Semester - IV)

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

Instructions to the candidates:

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

Physico-Chemical Constants

1.	Avogadro Number	N	$= 6.022\times10^{23}$ mol^{-1}
2.	Boltzmann Constant	k	$= 1.38 \times 10^{-16}$ erg K^{-1} molecule^{-1}
			$= 1.38 \times 10^{-23}$ J K^{-1} molecule^{-1}
3.	Planck Constant	h	$= 6.626 \times 10^{-27}$ erg s
			$= 6.626 \times 10^{-34}$ J s
4.	Electronic Charge	e	$= 4.803 \times 10^{-10}$ esu
			$= 1.602 \times 10^{-19}$ C
5.	leV		$= 23.06$ k cal mol^{-1}
			$= 1.602 \times 10^{-12}$ erg
			$= 1.602 \times 10^{-19}$ J
			$= 8065.5$ cm^{-1}
6.	Gas Constant	R	$= 8.314 \times 10^{7}$ erg K^{-1} mol^{-1}
			$= 8.314$ J K^{-1} mol^{-1}
			$= 1.987$ cal K^{-1} mol^{-1}
7.	Faraday Constant	F	$= 96487$ C equiv^{-1}
8.	Speed of light	c	$= 2.997 \times 10^{10}$ cm s^{-1}
			$= 2.997\times10^{8}$ m s^{-1}
9.	1 cal		$= 4.184 \times 10^{7}$ erg
			$= 4.184$ J
10.	1 amu		$= 1.673 \times 10^{-27}$ kg
11.	Bohr magneton	β_e	$= -9.274 \times 10^{-24}$ J T^{-1}
12.	Nuclear magneton	β_n	$= 5.051\times10^{-27}$ J T^{-1}
13.	Mass of an electron	m_e	$= 9.11\times10^{-31}$ kg

P.T.O.

SECTION-I

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

a) Explain the term wetting and nonwetting. Explain wetting as a capillary action phenomenon.

b) Describe the microtome method for verification of Gibbs adsorption equation.

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

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

e) What is flotation? Explain its mechanism.

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

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

b) State at least three catalysts with reactions for heterogeneous catalysis. What is the method for naming catalyst?

c) Explain the phenomenon of hysteresis on the basis of capillary condensation.

d) Give the comparison between B.E.T. theory and H-J theory.

e) Write a note on heterohomogeneous catalysis.

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

a) The volume of oxygen gas at 0ºC and 101 kPa adsorbed on the surface of 1.00g of a sample of silica at 0ºC was 0.284 cm^3 at 142.4 Torr and 1.430 cm^3 at 760 Torr. Determine the value of monolayer capacity V_{mon}.

b) An insoluble compound 'X' spreads on water to give a gaseous type film at low concentrations. When 10^{-7}g of 'X' is added to 200 cm^2 surface, the surface tension at 25ºC is lowered by 0.20 dyne cm^{-1}. Calculate the molecular weight of 'X'.

c) The surface tension of an aqueous solution varies with concentration of solute according to equation

γ = 70-350 C, where C = 0.05 M.

Calculation the value of K for the variation of surface excess of solute with concentration, where K is defined as $K = \Gamma.\sqrt{C}$. The temperature is 25ºC.

SECTION-II

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

a) Write Bernal-Fowler equation for heat of solution, explain the terms involved in it.

b) Explain the Gouy-Chapman diffuse layer theory for electrical double layer.

c) Explain different way of transport of ions in solution.

d) Explain the term ionic strength. How does it affect the thickness of ionic atmosphere and mean activity coefficient of an electrolyte?

e) Write a note on electrosynthesis.

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

a) Explain the Wagner and Traud mechanism for corrosion of ultrapure metal.

b) Derive Einstein relation between the absolute ionic mobility and diffusion coefficient.

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

d) What is passivation? Discuss the general mechanism of passivation.

e) Explain the terms

i) Faradic efficiency

ii) Voltage efficiency

iii) Overall efficiency

iv) Maximum efficiency

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

a) The following rection may be made to operate in fuel cell at 300k

$CH_4 + 2O_2 \rightleftharpoons CO_2 + 2H_2O(l)$, $\Delta H_{300} = -890.4$ KJ mol^{-1},

$\Delta G_{300} = -818.0$ KJ mol^{-1} calculate

i) number of electrons transferred in overall cell reaction

ii) reversible emf of cell at 300K

iii) maximum efficiency

b) Calculate the thickness of ionic atmosphere at 27ºC in 0.05 M solution of LiCl.

c) Calculate the ionic strength of mixture of 50ml 0.05 M $ZnCl_2$ and 50 ml 0.15 M NH_4Cl

♦ ♦ ♦

Total No. of Questions : 4]

SEAT No. :

P1480

[Total No. of Pages : 3

[5223] - 53

M.Sc. - II

PHYSICAL CHEMISTRY

CH-414 : Biophysical Chemistry and Related Techniques

(Old) (2008 Pattern) (Semester - IV) (Optional)

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

P.T.O.

SECTION - I

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

a) Compare animal and plant cells.

b) Discuss Osmosis and reverse osmosis.

c) Write a note on Donnan membrane equilibrium.

d) What are flickering clusters?

e) What is the role of the phosphoanhydride bond in energy transfer?

f) Compare chaperones with chaperonins.

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

a) How are nucleic acids important in cell biology?

b) Deduce $\bar{R} = l \times \sqrt{\frac{8N}{3\pi}}$.

c) Discuss the role of smooth muscles.

d) Write a note on blood buffering mechanism.

e) Explain Henderson's equation and its role in buffer preparation.

f) Enlist the functions of proteins. Give thier tests.

SECTION - II

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

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

b) Derive Michaelis-Menton equation for enzyme catalysis.

c) What is all or none law? Explain.

d) Enlist the applications of a cell membrane.

e) State the principle of X-ray diffraction. How is it used to determine the molecular weight of the asymmetric macromolecule?

f) Write a note on oscillatory reactions.

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

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

b) Discuss the theory of optical rotary dispersion.

c) Discuss the application of circular dichroism to study the conformation of biomolecules.

d) Define the terms :

i) Neuron

ii) Resting membrane potential

iii) Voltage gated channels

iv) Action potential and

v) Nerve impulse.

e) Discuss the viscosity method to determine the molecular weight of a biopolymer.

f) Discuss briefly the factors affecting enzyme activity.

Total No. of Questions : 5]

SEAT No. :

P1481

[Total No. of Pages : 3

[5223] - 54

M.Sc. - II

PHYSICAL CHEMISTRY

CH-415: Special Topics in Nuclear Radiation Chemistry

(Old 2008 Pattern) (Semester - IV)

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

Instructions to the candidates:

1) *Answers to the TWO sections should be written in SEPARATE answer books.*
2) *ALL questions are COMPULSORY.*
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} 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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			=	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) Outline the procedure for Li-6 isotope separation.

b) What are the advantages and disadvantages of food irradiation by ionizing radiations?

c) What do you mean by in-vivo and in-vitro diagnosis? Explain any one of them with suitable example.

d) Describe the working of technitium generator.

e) Give an account of solid radioactive waste management.

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

a) Discuss the solar neutrino problem.

b) Draw and explain cosmic & abundance curve.

c) Define maximum permissible dose. How much is the value of MPD for radiation workers for different organs?

d) Write a brief note on pre-mordial nucleosynthesis.

e) Discuss p, r and s processes in nucleosynthesis.

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

a) In technicium generator, activity of loaded $^{99}M_o$ is 12,000 cpm. What will be the activity of $^{99}mT_c$ if extracted after 5 hrs of loading? Given : $t_{½}$ of $^{99}M_o$ = 66h & $^{99}mT_c$ = 6.01h.

b) Find out thickness of lead required to reduce dose from 10 Gy/h to 10 mGy/h. Given : e^{μ} = 0.211 b/e, A of Pb = 207, Z of Pb = 82, density of Pb = 11.35 g/cm^3.

c) Complete the following reactions

i) ^{12}C (P, ν) ☐ (P, ν) ☐

ii) ^{13}C (P, γ) ☐ (P, γ) ☐

SECTION - II

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

a) Discuss radiometric titrations based on β particle absorption.

b) Explain the various phase techniques used in precipitation radiometric titrations.

c) Explain radical scavenging.

d) 10 cc KCl was titrated with 10mM $AgNO_3$. After 2 cc addition, acitivity fell from 1000 cpm to 500 cpm. Find KCl molarity.

e) Discuss chain reactions and their types.

f) How are soft radiation emitters prepared?

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

a) Describe the radiometric curve for titration of a mixture of three ions. Ions precipitating first and last are labelled.

b) Write reactions during radiolysis of methanol.

c) Elaborate the differences in chemical separations of irradiated targets from ordinary analytical procedures.

d) Discuss the procedure to determine beam energy.

e) Describe a titration curve in a precipitation reaction wherein both reagent and substance are labelled.

f) Discuss effect of solute concentration on molecular yield in radiolysis of water.

Total No. of Questions :4]

SEAT No. :

P1482

[Total No. of Pages :2

[5223] - 55

M.Sc.- II

INORGANIC CHEMISTRY

CH - 430: Inorganic Polymers and Heterogeneous Catalysis

(2008 Pattern) (Semester - IV)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Neat diagrams should be drawn wherever necessary.***

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

a) Find out the framwork electron in $Ir_4(CO)_{12}$ and predict it's structure.

b) List out the various methods of preparation of heterogeneous catalyst & explain any one in detail.

c) Explain catalytic hydrogenation of alkenes by using pd as catalyst.

d) Discuss the use of nanomaterial as catalyst in organic synthesis.

e) What are phosphazenes? How are they prepared? Write their structure.

Q2) Answer the following. (Any four) **[20]**

a) What are silicons? Give general method of preparation and mention the use.

b) Explain the use of powder XRD technique for determining the structure of zeolite.

c) Give an account of heteropolyanions of Mo & W.

d) Which type of reactions are catalysed by semiconducting oxides? Explain in detail any one reaction catalysed by these oxides.

e) What is chemical reactor? Name different chemical reactors & explain any one in detail.

P.T.O.

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

a) What is meant by phase transfer catalyst? Describe a reaction catalysed by this type of catalyst.

b) Give an account of temperature programmed techniques for characterisation of heterogeneous catalyst.

c) Discuss in detail the basic principle & steps involved in heterogeneous catalyst.

d) Pyrolysis has a considerable effect on the nuclearity of polynuclear carbonyls. Explain.

e) What are inorganic polymers? Give a method of classification of inorganic polymers.

Q4) Write notes on.(Any Four) **[20]**

a) Clay as a catalyst.

b) Phosphazenes.

c) MCM-41 as a catalyst.

d) Fischer tropsch synthesis.

e) Zeolite as hydrocracking catalyst.

♦ ♦ ♦

Total No. of Questions : 4]

SEAT No. :

P1483

[Total No. of Pages : 2

[5223]-56
M.Sc. - II
INORGANIC CHEMISTRY
CH - 431 : Material Science
(2008 Pattern) (Semester - IV)

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 indicates full marks.***
4) ***Use of logarithmic table and calculator is allowed.***

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

a) State and explain the Ficks law's of diffusion.

b) Explain different types of superconductors.

c) What are ferrites? How they are prepared? Explain soft and hard ferrite.

d) What is reinforced concrete? How it is made?

e) What are Biomaterials? Explain classification of Biomaterials.

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

a) What are different types of magnetism?

b) Explain the mechanism of fluorescences and phosphorances with the energy level diagram.

c) Explain the working of n-p-n transistor with the help of band energy diagram.

d) What is semiconductors? Explain the extrinsic semiconductor with suitable diagram.

e) What is diffusion? Explain the diffusion mechanism in solids.

P.T.O.

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

a) Saturation magnetism of FCC iron is 1750 KA/m^2. Calculate the net magnetic moment per iron atom in crystal. Give : Lattice parameter of BCC iron is 2.87°A.

b) Explain cross section of wood with suitable diagram.

c) What is portland cement? Explain its types.

d) Explain Bardeen-Cooper schrieffer theory of superconductivity.

e) Explain different applications of biomaterials.

Q4) Write short notes on <u>any four</u>. **[20]**

a) Photoconductivity.

b) Schottky and Frenkel defects.

c) Piezo electric material.

d) Sol-gel process.

e) Oil-well cement.

♦ ♦ ♦

Total No. of Questions : 9]

SEAT No. :

P1484

[Total No. of Pages : 3

[5223] - 57

M.Sc. - II

INORGANIC CHEMISTRY

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

(2008 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

SECTION - A

(Applications of Inorganic Materials)

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

a) Explain the role of co-ordination compounds in electroplating.

b) "Azo groups are weak donar, but a large number of metal complexes having arylazo ligand are known". Justify the statement with the help of suitable example.

c) Comment on the important properties of pigments.

d) What are the main types of synthetic fibres? Explain any one with production and properties.

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

a) Explain the methods for electroplating of precious metals.

b) What do you understand by N_{α} - N_{β} isomerism in metal complexes of tridentate azo compounds? Explain with respect to Nickel and copper complexes.

P.T.O.

c) Explain an account of electroplating of Zinc.

d) Calculate the modulus of elasticity, the tensile strength, and the fraction of the load carried by the fibre for the following composite material stressed under iso-strain conditions. The composite consists of a continuous glass-fibre reinforced - epoxy resin produced by using 60% by volume of E-glass fibre having a modulus of elasticity of $E_f = 10.5 \times 10^6$ psi and a tensile strength of 3,50,000 psi and a hardened epoxy resin with a modulus of $E_m = 0.45 \times 10^6$ psi and a tensile strength of 9,000 psi.

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

a) Give in details production of Portland cement.

b) Explain the micro structure of softwood.

c) Write a note on - Luminous and Fluorescent pigments.

SECTION - B

(Environmental Chemistry)

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

a) How do you differentiate between active and passive solar heating systems?

b) Name the instrumental methods for determination of metals such as Hg, Cd, As, Pb. Explain x-ray fluorescence (XRF) method for the determination of lead from polluted water.

c) What is meant by point and non point sources of pollution? Give an example of each.

d) Draw a schematic diagram of an Alkaline Fuel cell (AFC). Write the reaction that occurs at the cathode and anode. Show the overall reaction. What is the electrolyte used in the AFC?

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

a) What does primary and secondary treatment in a sewage treatment plant remove from the waste stream?

b) Define P^E. What is the range of P^E in natural water? A sample from lake gave a $P^E = 10.5$, does the lake favour oxidation?

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

d) Draw a schematic diagram that shows all of the components of an atomic absorption spectrometer (AAS). How is an aqueous sample introduced into AAS? The metal ion analyte has a positive charge. How does it become a neutral atom?

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

a) Wind power.

b) Primary and secondary sludge.

c) Biological oxygen demand.

SECTION - C

(Biotechnology)

Q7) Answer the following (any three) : **[15]**

a) Give a brief overview of the advances in biotechnology.

b) What is the contribution of Robert Koch, Louis Pasteure, Alexander Fleming and Jenner to biotechnology?

c) Give an account of production of Lactic acid.

d) Write an account on the main steps involved in tissue culture.

Q8) Attempt any three : **[15]**

a) "Sewage treatment is possible using microbes". Justify.

b) What is single cell protein? What are its applications?

c) Which principles of genetics are used in biotechnology? Explain.

d) Compare the suspended growth system with supported growth system.

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

a) Antibiotics.

b) DNA mapping.

c) Safety in biotechnological manufacturing.

Total No. of Questions :6]

SEAT No. :

P1485

[Total No. of Pages :5

[5223] - 58

M.Sc.-II

ORGANIC CHEMISTRY

CH - 450: Chemistry of Natural Products

(2008 Pattern) (Semester - IV)

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

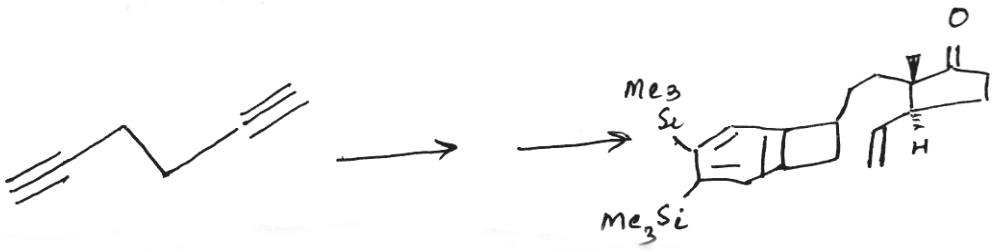
Instructions to the candidates:

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

SECTION - I

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

a)



b)

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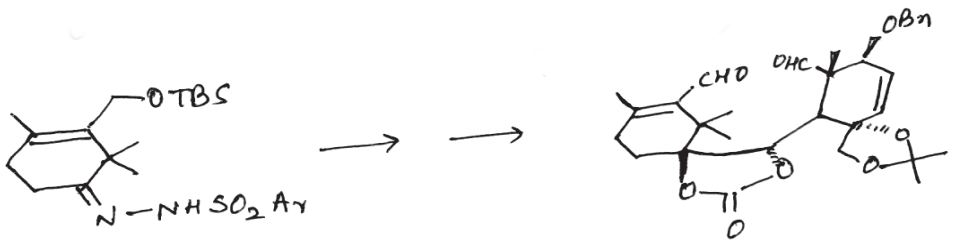

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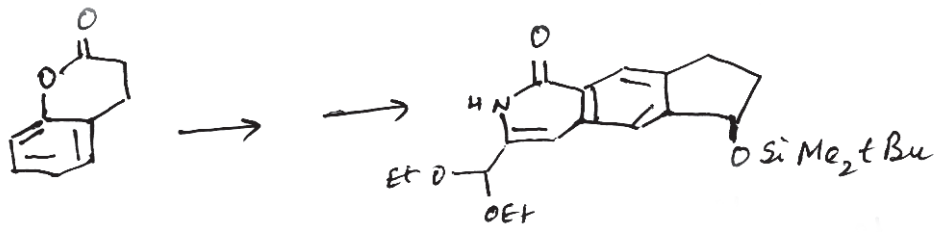
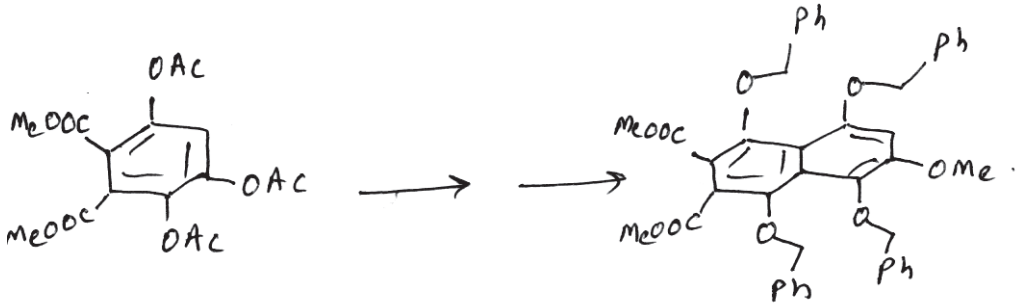
d) 

e) 

Q2) Answer the following. (Any three) **[12]**

a) Describe importance of spectral methods in structure determination of Hardwickiic acid.

b) Give chemical and physical evidences to prove the presence of:

i) Lactone ring

ii) Tertiary –OH group in Camptothecin.

c) How will you prove the presence of:

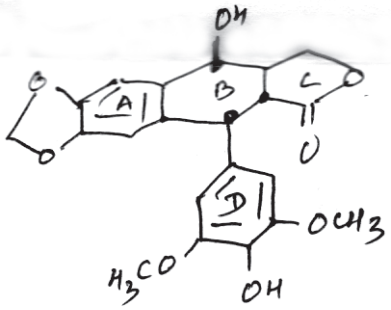
i) free alcoholic –OH group.

ii) absence of phenolic –OH group.

iii) γ - lactone in podophyllotoxin.

d) Give the evidences to show the presence of pyroloquinoline ring in hydroxy camptothecin.

Q3) a) 4'– Der he following structure **[6]**



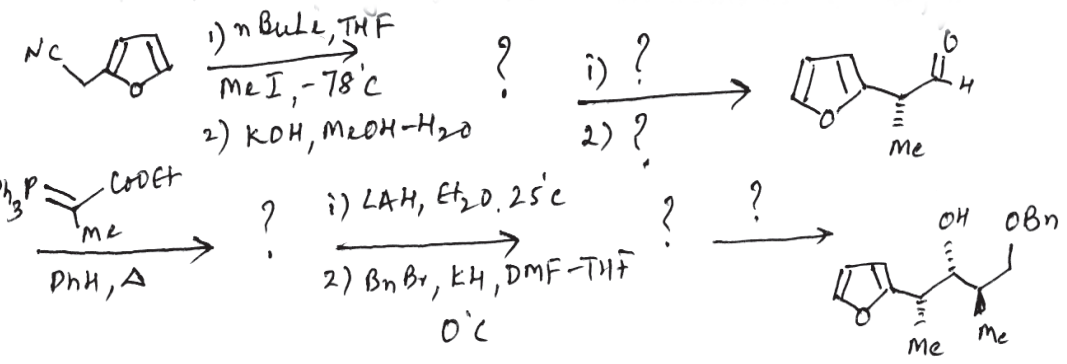
i) How can you prove the trans B/C ring fusion

ii) H  wo methylene groups by

^{1}H NMR.

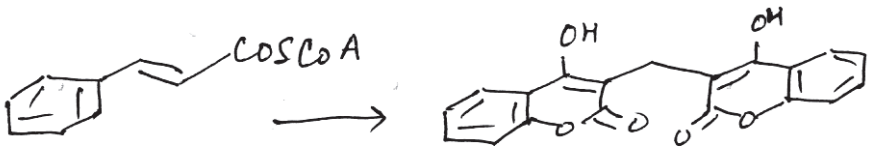
iii) How can we separate a mixture of podophyllotoxin and 4'– demethyl podophyllotoxin by chemical method.

b) C

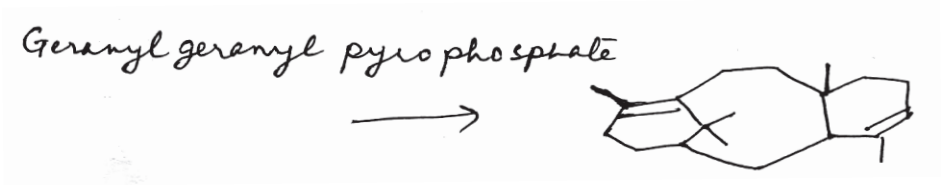


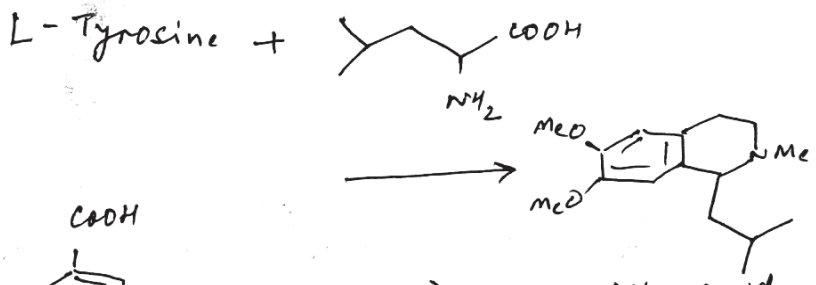
SECTION - II

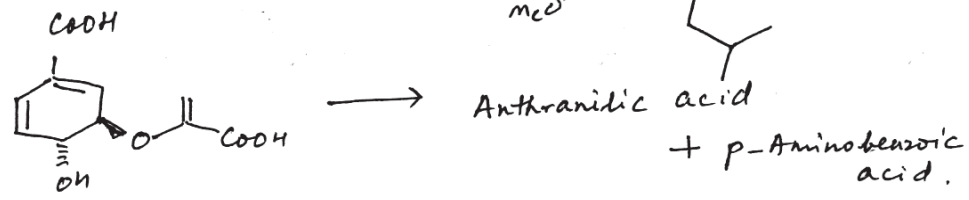
Q4) a) Discuss the role of pyridoxal phosphate in oxidative deamination in biogenesis of alkaloids. **[4]**

b) St  **[12]**

i)

ii) 

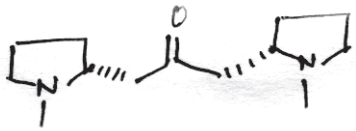
iii) 

iv) 

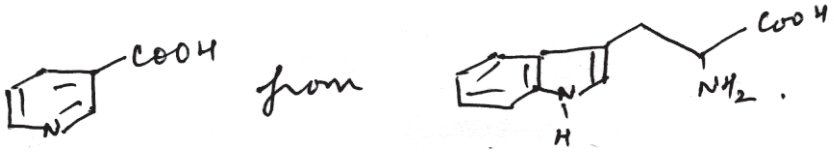
Q5) Answer <u>any two</u> of the following: **[12]**

a) Explain all the steps involved in the biogenesis of Hardwickiic acid from geranyl geranyl pyrophosphate.

b) Suggest the biogenetic pathway for the following compound from L - Ornithine.



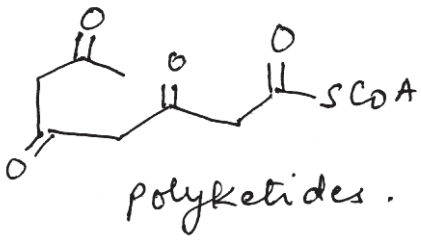
c) Explain the steps involved in the biosynthesis of



Q6) a) Answer <u>any one</u> of the following: **[6]**

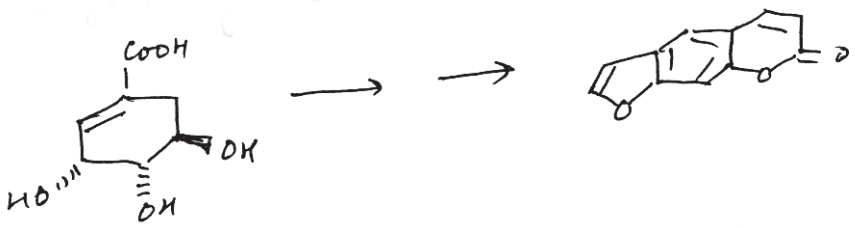
i) Indicate the position of label in each step and in the final product from the following biogenetic conversion.

ii) Outline the biogenetic scheme for the conversion of *CH_3(



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

b) Discuss the biogenetic steps involved in the following conversion: **[6]**



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Total No. of Questions : 6]

SEAT No. :

P1486

[Total No. of Pages : 3

[5223]-59
M.Sc. - II
ORGANIC CHEMISTRY
CH-451 : Synthetic Methods in Organic Chemistry
(2008 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

SECTION-I

Q1) Attempt any three of the following. **[12]**

a) Explain the role of pd(0) catalyst in Heck reaction.

b) Explain the role of $CO_2(CO)_8$ in oxo process.

c) Explain the role of Zeigler-Natta catalyst in polymerization reactions.

d) Synthetic applications of organosilane compounds.

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

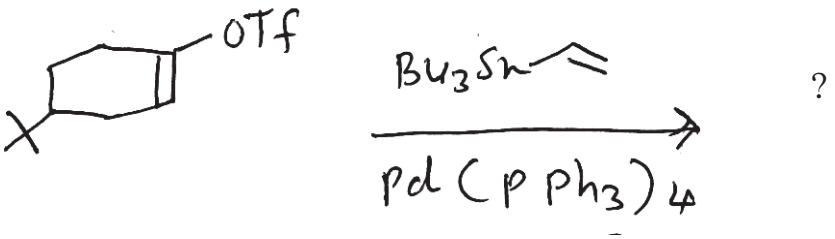
a) Pausan Khand reaction.

b) Use of Collman's reagent in organic synthesis.

c) Suzuki coupling.

d) 9-BBN in organic synthesis.

Q3) Predict the product/s any four of the following with mechanism. **[16]**

a) 

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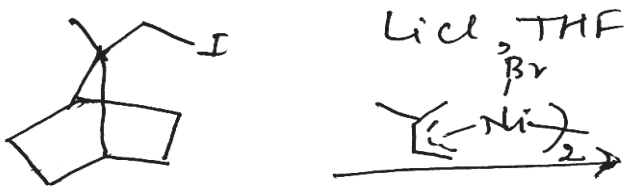
b) 

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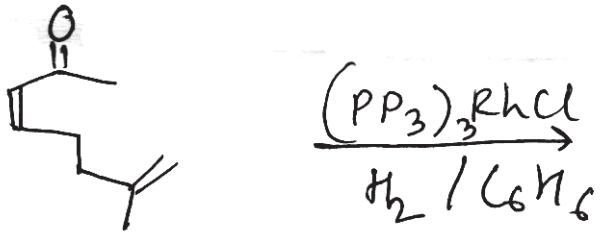
c) 

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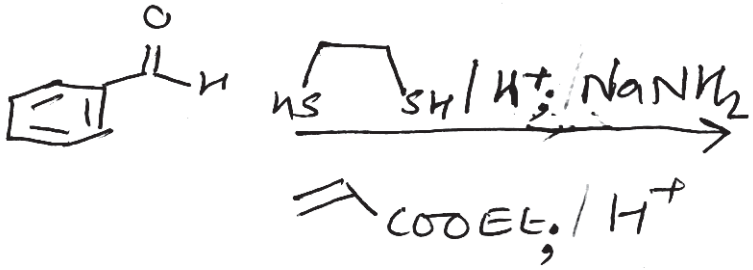
d) 

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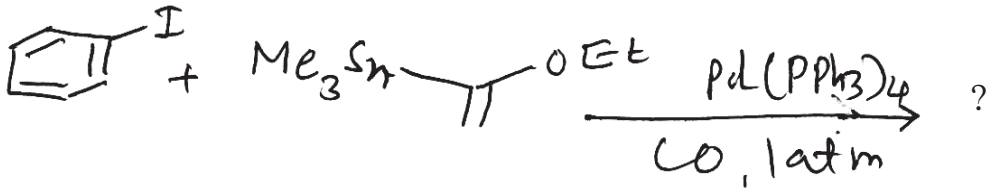
e) 

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SECTION-II

Q4) Explain <u>any three</u> of the following. **[12]**

a) TBDMS group is preferred for protection of primary alcohol.

b) Use of acetylene in organic synthesis.

c) Umpolung approach in synthesis of 1,4 dicarbonyl compounds.

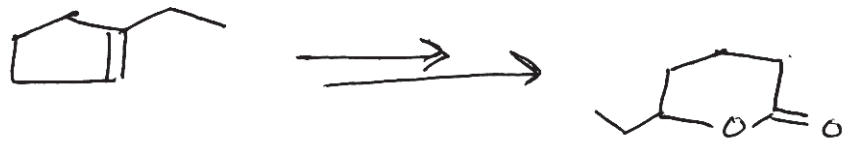
d) Linear and convergent synthesis.

Q5) How will you effect the following conversions using suitable reagents(Any three) **[12]**

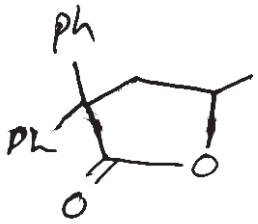
a) 

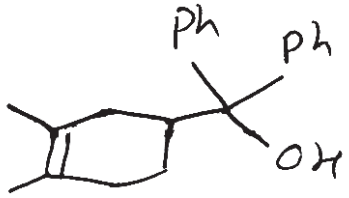
b) 

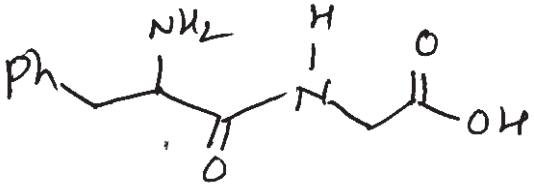
c) 

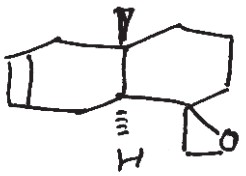
d) 

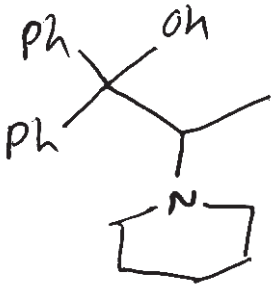
Q6) Using retrosynthetic analysis, suggest convenient route for the synthesis of any four of the following. **[16]**

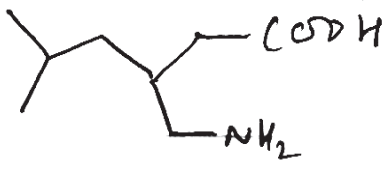
a) 

b) 

c) 

d) 

e) 

f) 

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Total No. of Questions :6]

SEAT No. :

P1487

[Total No. of Pages : 5

[5223]-60

M.Sc. - II

ORGANIC CHEMISTRY

CH - 452 : Heterocyclic Chemistry, Chiron Approach and Medicinal Chemistry

(2008 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

SECTION-I

Q1) a) Explain any three of the following.

i) 1,3-azoles show electrophilic substitution reaction at c-4 where as 1,2-azoles at c-3. **[9]**

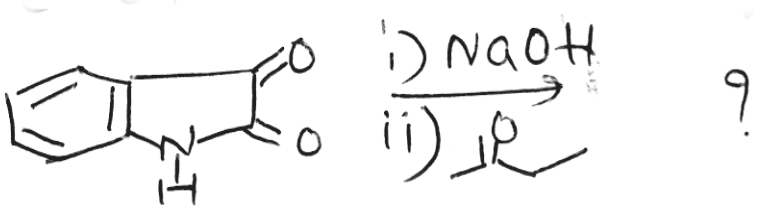
ii) Treatment of 2-methylpyrrole with HCl produces a dimer

iii) Coumarin can react with electrophilic and nucleophilic reagents.

iv) 2-aminoquinoline on diazotization gives 2-quinolone

b) Describe the concept of supramolecular chemistry. What are the applications of supramolecular chemistry. **[3]**

Q2) a) Predict the product/s in any five of the following **[10]**

i) 

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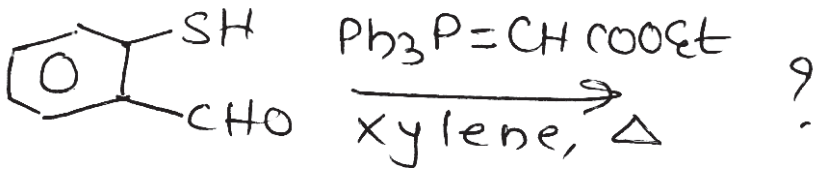
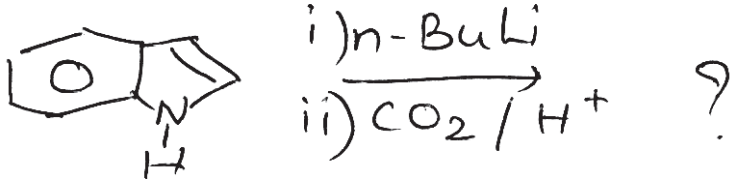
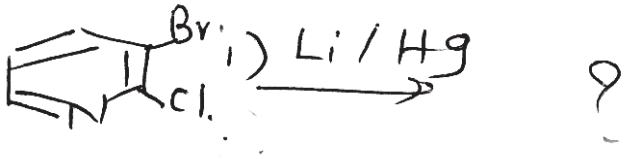
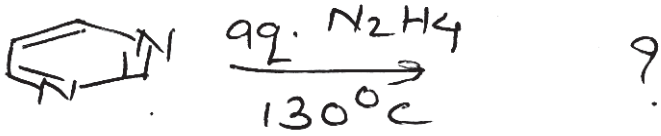
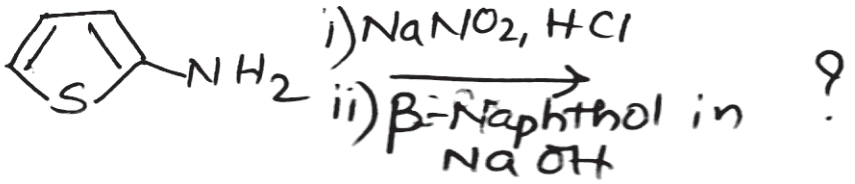
ii) 

iii) 

iv) 

v) 

vi) 

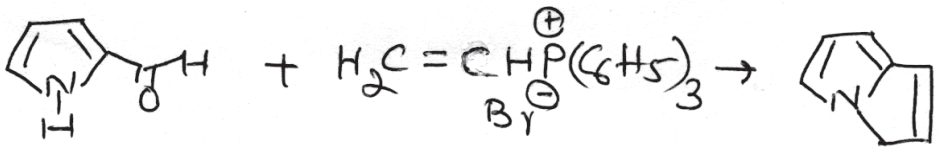
b) Attempt any two of the following. **[6]**

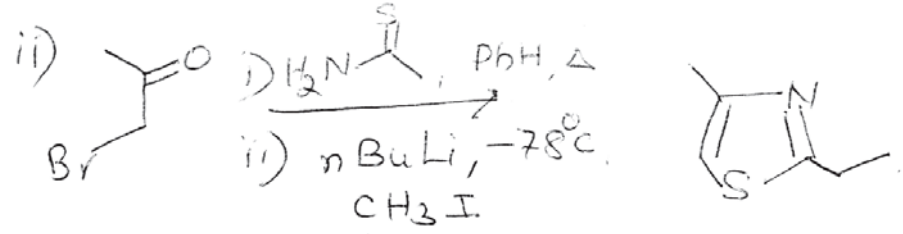
i) Chichibabin reaction in heterocyclic synthesis

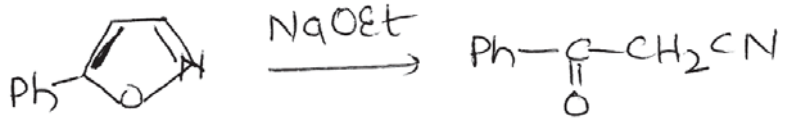
ii) Write a short note on Hantzsch pyrrole synthesis

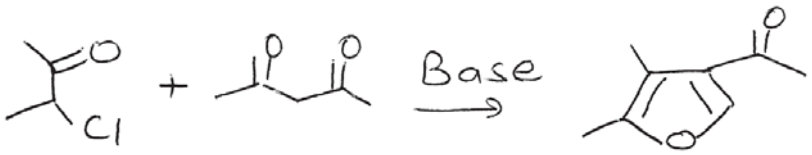
iii) How will you convert thiophenol into benzothiophene?

Q3) a) Suggest a possible mechanism for any three of the following. **[6]**

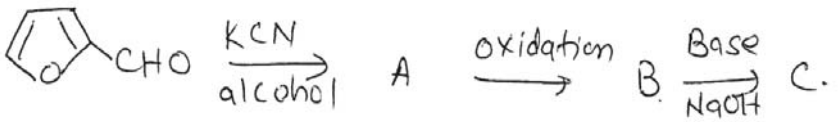
i) 

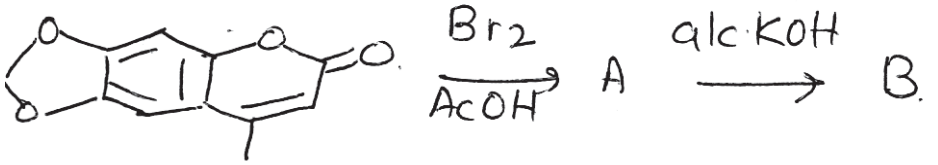
ii) 

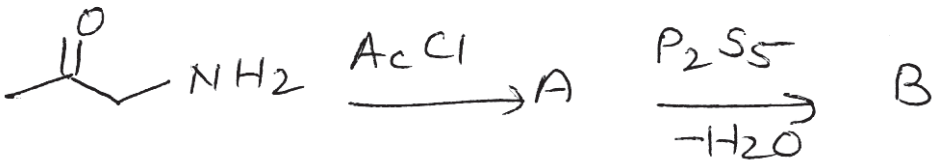
iii) 

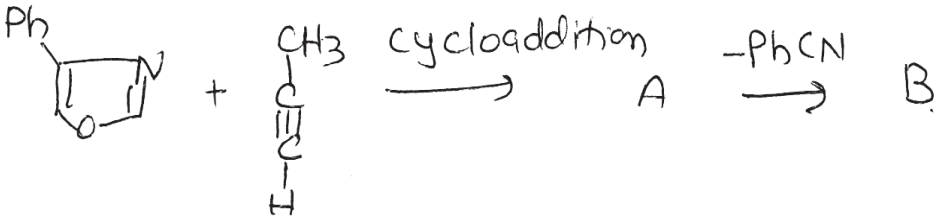
iv) 

b) Complete the sequence of any three of the following reactions. **[6]**

i) 

ii) 

iii) 

iv) 

SECTION - II

Q4) Answer any four of the following. **[16]**

a) Two isomeric compounds A and B having molecular Formula $C_6H1_2O_6$ give following reactions.

i) Both A and B form same Osazone derivatives

ii) Both A and B form penta -o-acetate derivatives.

iii) A does not get oxidised by tollen's reagent while B does.

iv) Both are sweet in taste and are crystalline.-

Identify A and B, and write all the reactions stated above

b) Write the synthesis of shikimic acid.

c) Why carbohydrates are prefered as chiran for synthesis of chiral molecules.

d) Write the killiani fischer synthesis for conversion of aldotriose to aldotetrose.

e) Draw the structural formulae of

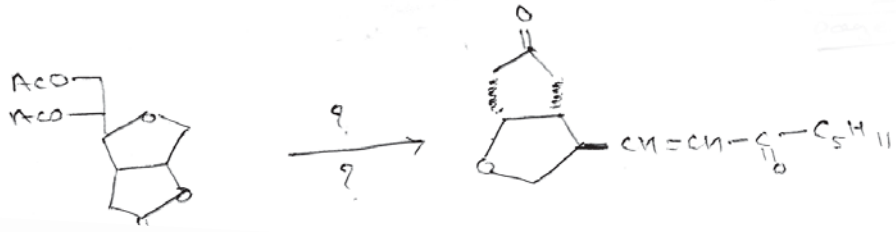
i) α and β - D- fructo Furanose

ii) α and β -D- fructo pyranose.

Q5) Complete the following reaction sequence [Any three] **[12]**

a) D-mannose $\xrightarrow[\text{ii) Acetone/H}^+]{\text{i) NaBH}_4}$? $\xrightarrow[\text{ii) R. Ni}]{\text{i) Pb(OAc)}_4}$?

b)



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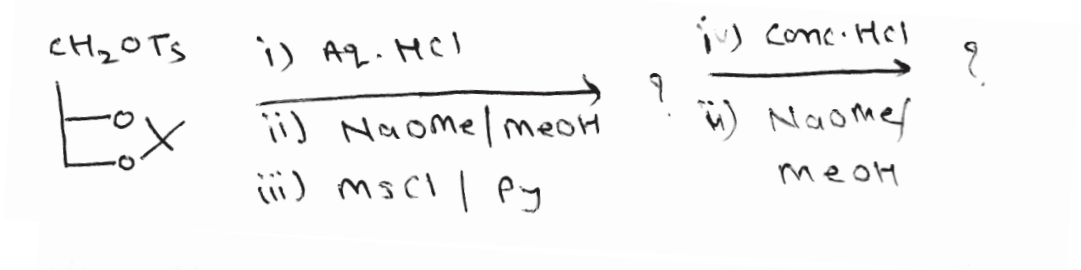

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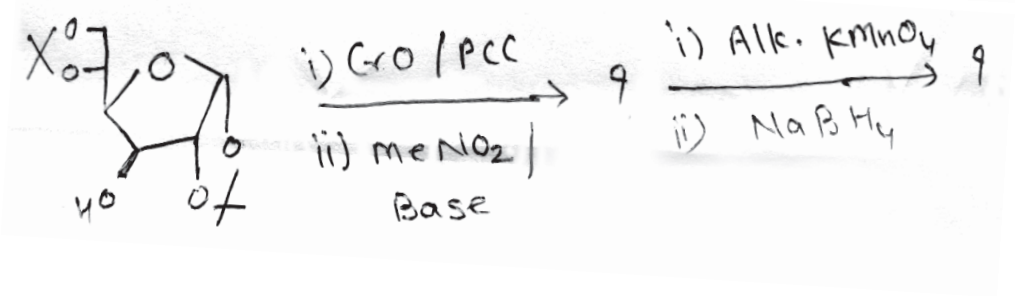

Q6) a) Solve any two of the following **[8]**

i) Write the basic principles of green chemistry.

ii) Write short note on theoretical aspects of drug design.

iii) Explain the intermolecular attractive forces involved in solubilization of organic medicine in body.

b) Answer the following. **[4]**

i) Short note on mutarotation

ii) Retrosynthetic analysis of L(+) alanine.

Total No. of Questions :4]

SEAT No. :

P1488

[Total No. of Pages :3

[5223] - 61

M.Sc. - II

ANALYTICAL CHEMISTRY

CH - 481: Bioanalytical and Forensic science

(2008 Pattern) (Semester - IV)

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

Instructions to the candidates:

1) ***All questions are compulsory and carry equal marks.***
2) ***Answer to the two sections should be written in seperate answer books.***
3) ***Use of logarithmic table/ non-programmable calculator is allowed.***

SECTION - I

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

a) Define the terms:

i) Coca derivatives.

ii) Opium.

iii) Medicinal preparations.

iv) Narcotic drug.

b) Write note on 'LSD'

c) Give the offences and penalties in "Psychotropic substances ACT"

d) Explain the procedure for isolation and identification for amphetamines.

e) Biological sample was determined for net protein utilization digestability and biological value gives following results:

i) Intake nitrogen = 12.1mg.

ii) Faecal nitrogen = 8.1 mg

P.T.O.

iii) Endogenous faecal nitrogen = 4.1 mg

iv) Urinary nitrogen = 6.1mg

v) Endogenous urinary nitrogen = 4.0 mg

Calculate net protein utilization, digestability and biological value.

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

a) Explain the term preservatives. Give some examples of inorganic preservatives. How SO_2 is estimated from food sample.

b) Discuss the steps involved in the identification of coal-tar dye prepared in food-shuff.

c) Write a note on sweeting tables.

d) Explain a suitable method for estimation of caffine content from coffee.

e) A sample of saccharine tablet (1.30g) was subjected to saccharine estimation and it required 1.8 ml of 0.1N NaoH. calculate percentage of saccharin in the sample. [Given: mol-ut-of saccharin 183.2]

SECTION - II

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

a) Explain the term rancidity of oil. Give the method used to determine the peroxide value of an oil.

b) Outline method for the estimation of Ash content of food.

c) Give method for determination of Total carbo hydrate in food sample.

d) What are legislatives regarding the use of colours in food.

e) Calculate the amount of lactic acid in milk sample when 20.0ml of milk required 3.2 ml of 0.1 N NaoH neutralisation. (Given: mol. ut of Lactic acid = 90)

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

a) How is theobromine estimated from coca?

b) Discuss the chemistry of vitamine A, with respect to structure, source and biological function.

c) Write a note on barbiturates.

d) outline the method for the estimation of cocaine hydrochloride.

e) A 4.556 g sample of caffein was subjected to kjeldhal's method. Volatile base was distilled and absorbed in 50.00 ml 0.11 N H_2SO_4. The excess acid was titrated against 0.1 N NaoH and required 6.7 ml of it. (Given : Molecular weight of caffein sulphate = 486). Calculate the percentage of caffein in sample.

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Total No. of Questions : 4]

SEAT No. :

P1489

[Total No. of Pages : 3

[5223]-62
M.Sc. - II
ANALYTICAL CHEMISTRY
CH - 490 : Analytical Spectroscopy
(2008 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

SECTION-I

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

a) What are filters? Distinguish between absorptive and interference filter.

b) Explain the following terms used in instrumental analysis

i) Dispersive power

ii) Molar absorptivity

iii) Limiting law

c) Give the principle of ESCA, with schematic diagram, explain essential components of ESCA instrument.

d) With a neat diagram, describe the construction and working of double beam spectrophotometer.

e) Calculate the molar absorptivity of complex having 3.5×10^{-5} M solution, gave transmittance 40.0% in a cell of 1.00 cm at 745 nm.

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

a) Describe the X-ray absorptive method for crystal analysis.

b) State and explain the principle of ultraviolet photoelectron spectroscopy. Why is UV-photoelectron spectroscopy not used to study core shell electron?

P.T.O.

c) Explain the principle of chemiluminescence. Describe it's analytical applications.

d) The accelerating potential in a X-ray tube was 100 KV. Calculate the short wave-length cut off of the lamp.

(Given : Charge of electron = 1.602×10^{-19} C, Plank's constant = 6.625×10^{-34} Js, Velocity of light = 3×10^{8} m/s)

e) The 1 'S' electron of nitrate ion has binding energy 410.5 ev. Calculate the kinetic energy of measured electron, if the incident radiation is K_{α} line of Mg(9.88 Aº) and the work function of electron spectrometer is 6.8 ev.

SECTION-II

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

a) Give critical account of solvent and chemical shift reagents used in NMR spectroscopy.

b) Write a critical note on 2-D NMR spectroscopy.

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

d) The ^{1}H NMR of a compound with empirical formula $C_9H_{11}Br$ shows singlet at 7.22δ, tripplet at 3.38δ, triplet at 2.57δ and quintet at 2.15δ. The integration of each peak shows 5:2:2:2 ratio respectively. Identify the compound.

e) Determine the ratio of ^{13}C nuclei in the upper energetic level to the lower energetic level at 27ºC in a magnetic field that has flux density 25,000 G.

(Given i) Magnetic moment μ of ^{13}C = 0.70216

ii) $\beta_N = 5.0505\times10^{-31}$ J/G

iii) Boltzmann constant, K = 1.38×10^{-23} JK^{-1} $molecule^{-1}$)

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

a) Draw a schematic diagram of ESR spectrometer. Explain the working of ESR spectrometer.

b) Discuss the following terms in ESR spectroscopy

i) ENDOR

ii) ELDOR

c) Distinguish between NMR and ESR spectroscopy with reference to its principle, sources, reference compounds and applied magnetic fields.

d) Discuss ESR spectrum of benzene anion radical.

e) If a resonance was observed for an unpaired electron at a magnetic flux density 0.33 T and a frequency of 9.5 GHz. Calculate g-factor for unpaired electron.

(Given : Planck's constant = 6.625×10^{-34} Js

Bohr Magneton = 9.285×10^{-24} JT^{-1})

♦ ♦ ♦

Total No. of Questions :4]

SEAT No. :

P1490

[Total No. of Pages : 3

[5223]-63
M.Sc.-II
ANALYTICAL CHEMISTRY
CH - 491 : Polymer Technology
(2008 Pattern) (Semester - IV)

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

Instructions to the candidates:

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

SECTION-I

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

a) Explain with example the classification of polymers on the basis of their behaviour towards heat.

b) Write a short note on Emulsion polymerization.

c) Describe 'Vulcanisation reaction with suitable examples.

d) Explain isotactic syndiotastic and atatic polymers with suitable examples.

e) Write a short note on Ring opening polymerization.

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

a) Write a note on Interfacial condensation polymerisation.

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

i) polyvinyl chloride

ii) Nylon -66.

P.T.O.

c) Discuss curing process in polymers.

d) Describe reactivity ratio and copolymerisation behaviour.

e) A suspension containing equal masses of particles of molecular weights 40,000 and 50,000 respectively. Calculate the number average molecular weight $\left(\overline{M_n}\right)$ and weight average molecular weight $\left(\overline{MW}\right)$.

SECTION-II

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

a) Explain the role of TGA & DTA in structure determination of polymers.

b) Describe in detail an elullometeric method used for determination of number average molecular weight $\left(\overline{Mn}\right)$ of polymer sample.

c) What is fibre spinning? Describe in brief wet spinning process.

d) Explain the terms:

i) Transparency

ii) Gloss

iii) Haze

iv) Vapour permiability

v) Fatigue test.

e) The intrinsic viscosity of myosin is 217 cm^3/gm. Calculate approximate myosin concentration in water in gm/dl with a relative viscosity of 1:5.

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

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

b) Enlist the different -techniques used for the processing of the polymer and explain injection moulding.

c) Explain the term - Reinforcement. Explain the spray - up - technique.

d) Describe in detail the melt spinning process.

e) A 0.793 g CTPB sample was dissolved in a mixture of ethanol and xylene solution and was titrated with 0.280 N alcoholic potassium hydroxide solution. The burette reading was 6.2 ml. calculate number average molecular weight of the polymer (Given - functionlity of polymer is 2)