Total No. of Questions :6]

SEAT No. :

P2904

[Total No. of Pages :3

[5023] - 1001

M.Sc.-I

PHYSICAL CHEMISTRY

CHP - 110 : Fundamentals of Physical Chemistry - I

(2014 Pattern) (Semester - I) (4 Credits)

Time : 3 Hours] *[Max. Marks :50*

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 the following: **[10]**

a) Explain the terms black body radiation, ultraviolet catastrophe and Rayleigh - Jeans law.

b) Define heat capacity. Distinguish between heat capacity and molar heat capacity.

c) Define vapour pressure of liquids. How does it vary with temperature?

d) What are colligative properties? Explain the terms osmosis and osmotic pressure.

e) Define Helmholtz free energy. Show that it is state function.

Q2) Attempt any two of the following: **[10]**

a) Give eigen function and eigen value equation for partical in one dimensional box. Sketch and explain the probability distribution curves for the first four energy levels of a partical in a one dimensional box.

b) Derive the vant - Hoff reaction isotherm. Give its application?

c) Derive the workdone in a reversible isothermal expansion of a perfect gas.

d) Define chemical potential. Explain the phase diagram of solid - liquid boundary with respect to $\frac{dP}{dT}$.

Q3) Solve any one of the following. **[5]**

a) The energy required for the ionisation of a certain atom is 3.44×10^{-18}J. The absorption of a photon of unknown wavelength ionises the atom and eject an electron with velocity $1.03 \times 10^{6} ms^{-1}$. Calculate the wavelength of incident radiation.

b) Calcualate the change in entropy with 2 moles of nitrogen gas are mixed with 8 gm chlorine gas at 25ºC.

[Atomic wts. N = 14, Cl = 35.5]

SECTION -II

Q4) Attempt the following: **[10]**

a) Give second order reaction rate constant equation for equal initial concentration and show that $t_{1/2} = \frac{1}{ak}$.

b) Explain Lineweaver and Eadie plot for enzyme uncompetitive inhibition.

c) State the law of photochemical equivalence and Define the term 'einstein'.

d) What are fast reactions? Distinguish between flow technique and stopped flow technique.

e) Explain Fermi-Dirac statistics.

Q5) Attempt any two of the following. **[10]**

a) What is partition function? Obtain an expression for rotational partition function.

b) Derive the expression for the velocity constant of the bimolecular reactions on the basis of absolute reaction rate theory.

c) What are consecutive reactions? How can the kinetics of such reactions be studied by using steady state principle.

d) Explain the terms initiation, propogation, inhibition and termination. Discuss with suitable examples the phenomenon of chain reaction.

Q6) Solve any one of the following: **[5]**

a) What will be the initial rate of a reaction if its rate constant is 10^{-3} min^{-1} and the concentration of the reactant 0.2 mol dm^{-3}. How much of reactant will be converted in to product in 200 minutes.

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

Total No. of Questions :6]

SEAT No. :

P2905

[Total No. of Pages :3

[5023] - 1002

M.Sc. I

INORGANIC CHEMISTRY

CHI - 130 : Molecular Symmetry and Chemistry of P - Block Elements

(2014 Pattern) (New) (4 Credit) (Semester - I)

Time : 3 Hours] *[Max. Marks :50*

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Answer to the two sections should be written in separate answer books.***
3) ***Figures to the right indicate full marks.***
4) ***Use of log tables / character tables and calculator is allowed.***

SECTION - I

Q1) Answer the following: **[10]**

a) What is the point group symmetry of cyclopentane and cyclobutane?

b) Find the product of $\sigma \times 4 \times c_2^z$ using cartesian coordinates.

c) Write down all the associative operations with S_5 axis.

d) How do you distinguish between C_4v and C_4h point groups. Using suitable examples?

e) Identify and draw different types of planes in No_3^- ion.

Q2) Attempt any two of the following: **[10]**

a) Write the matrices for C_2^x, C_2^y and C_2^z. Find the product of the following using matrix multiplication:

i) $C_2^x \times C_2^y$

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

iii) $C_2^x \cdot C_2^z$

b) Sketch and describe all symmetry operations in MnO_4^- ion. Justify it and find out the point group.

P.T.O.

c) Derive the character table for D_2h point group using great orthogonality theorem.

d) List all the possible symmetry elements for trans dichloroethylene molecule and show that they form a mathematical group.

Q3) Attempt <u>any one</u> of the following: **[5]**

a) For $PC1_5$ considering sigma band as a basis of representation find the reducible representation and find out the arbitals that are offered for sigma banding.

b) Find out the narmalized SALC using projection operator of Eu irreducible representation which operates an σ_1 orbital of the $[Cu(NH_3)_4]^{2+}$ complex ion.

D_4h	E	$2C_4$	C_2	$2C_2^1$	$2C_2^{11}$	i	$2S_4$	σ_h	$2\sigma_v$	$2\sigma_d$
E u	2	0	-2	0	0	-2	0	-2	0	0

SECTION - II

Q4) Answer the following: **[10]**

a) BF_3 is a hard Lewis acid. Explain.

b) Name different Pseudohalogens and corresponding halogens.

c) Mention different crown ethers used for extraction of alkali metals.

d) Borazole is called as inorganic benzene. Explain.

e) What are electron precise hydrides? Explain with example.

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

a) Write a note on molecular sieves.

b) Give an account of oxanions of nitrogen.

c) What are intercalation compounds of graphite? Explain with example

d) Give an account of oxoanions of halogens.

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

a) $B_5 Hg$

b) $Al_2 Cl_6$

c) IF5

d) $Li_4 (CH_3)_4$

e) AS_4O_{10}

f) $S_2 N_2$

g) $B_3 N_3 H_3 Cl_3$

Given :

Character Table for D_3h Point Group

D_3h	E	$2C_3$	$3C_2$	σ_h	$2S_3$	$3\sigma_v$		
A_1^1	1	1	1	1	1	1		$x^2 + y^2 + z^2$
A_2^1	1	1	-1	1	1	-1	R_z	
E^1	2	-1	0	2	-1	0	(x, y)	$(x^2 - y^2, xy)$
A_1^{11}	1	1	1	-1	1	1		
A_2^{11}	1	1	-1	-1	-1	1	z	
E^{11}	2	-1	0	-2	1	0	(Rx, Ry)	(xz, yz)

Total No. of Questions : 6]

SEAT No. :

P2906

[Total No. of Pages : 5

[5023]-1003
M.Sc. - (I)
ORGANIC CHEMISTRY
CHO - 150 : Basic Organic Chemistry
(2014 Pattern) (Semester - I) (4 Credits)

Time : 3 Hours] *[Max. Marks : 50*

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 the following: **[5]**

a) Explain hyperconjugation with suitable example.

b) What is the current concept of aromaticity.

c) Comments on the conformational analysis of cyclic compounds.

d) Discuss in brief stereospecific reactions.

e) Explain enantiomeric relationship.

Q2) Attempt any five of the following: **[10]**

a) Which factors affect acidity of organic compounds?

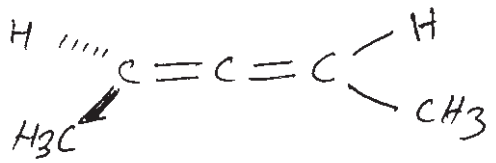
b) Write short note on non-benzeroid compounds.

c) Explain structure and stability of nitrenes.

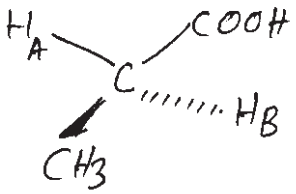
d) Comment on the stability of the following.

P.T.O.

e) Comment on the optical activity of the following with justification.

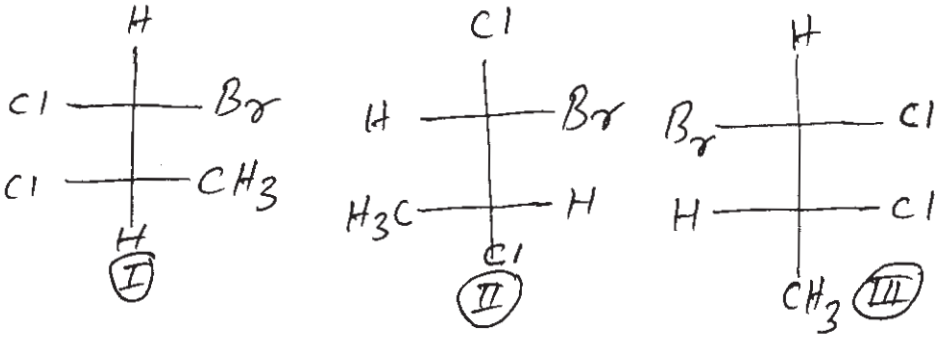


f) Assign pro-R and Pro-S labels to H_A and H_B.



Q2) Attempt any five of the following: **[10]**

a) Identify the diastereomers [if present]

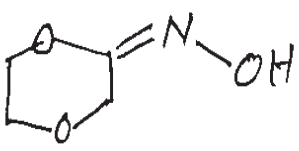


b) Explain which of the following is more basic.

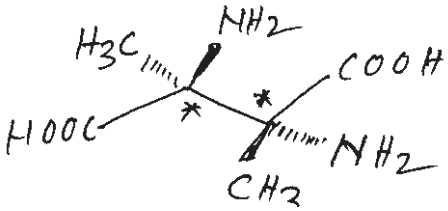
and $(\eta\text{-}C_3H_7)_3\ddot{N}$

c) Assign E/Z designation to the followings.

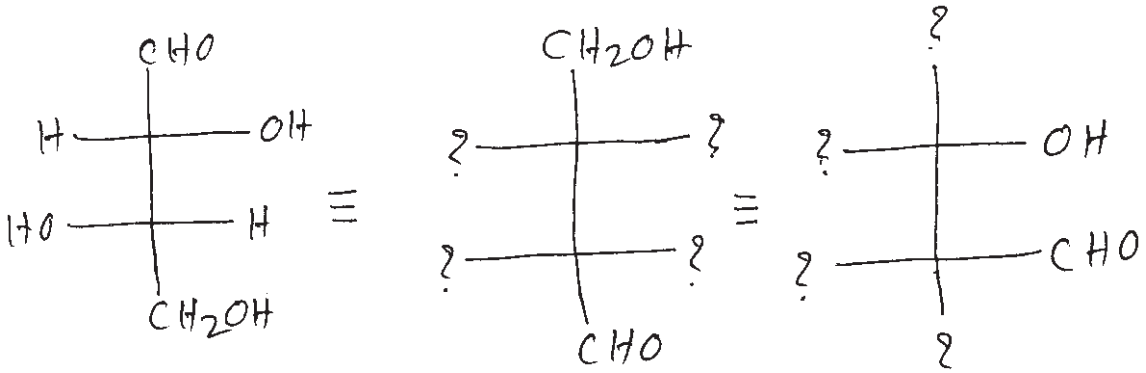
and



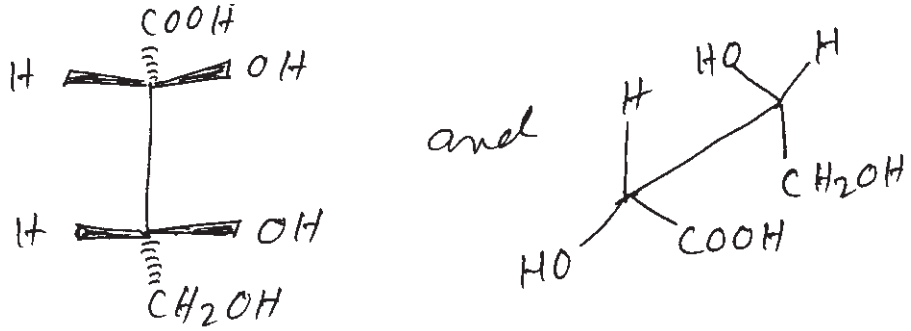
d) Assign R/S label to the chiral carbons.



e) Write equivalent structures.



f) What is the stereochemical relationship between the following compounds?



SECTION - II

Q4) Answer the following: **[5]**

a) Define non-classical carbocation.

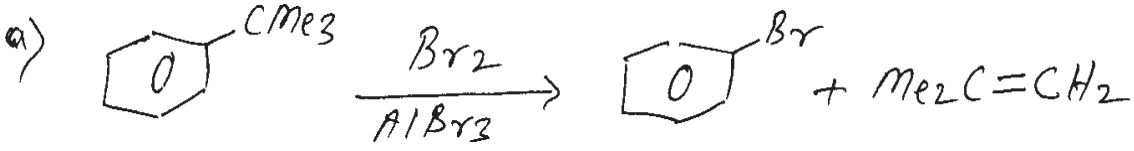
b) What is IPSo attack?

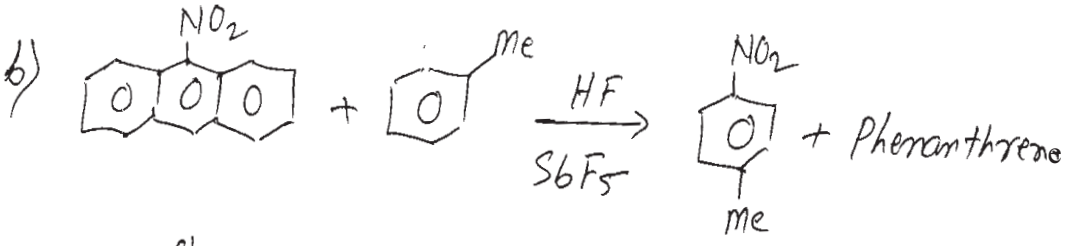
c) Explain regioselectivity in addition reactions.

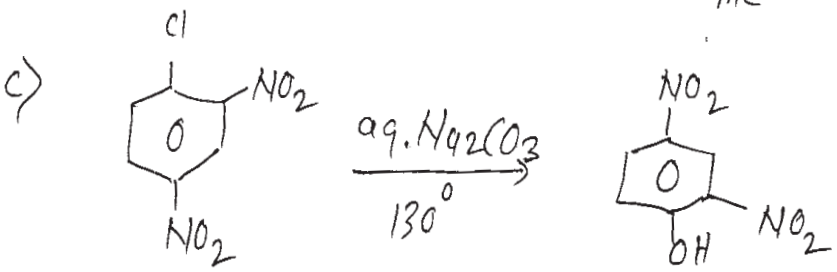
d) What is syn elimination?

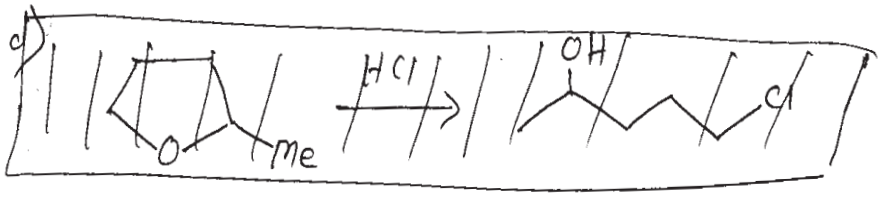
e) Give examples of ambident nucleophile.

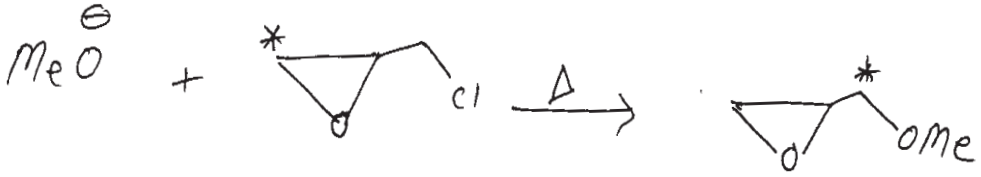
Q5) Suggest the mechanism (Any Five): **[10]**

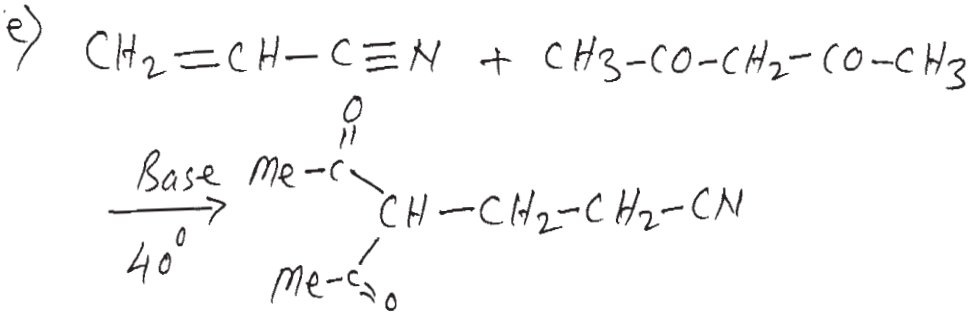
a) 

b) 

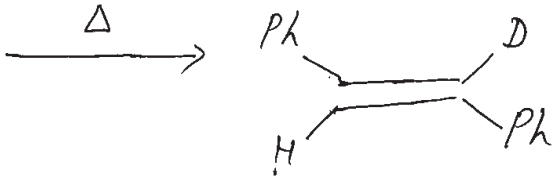
c) 

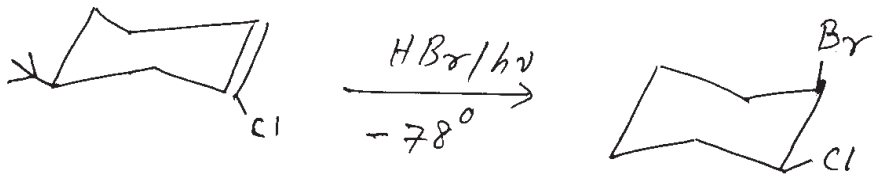
c) 

d) 

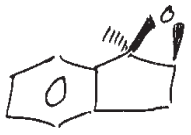
e) 

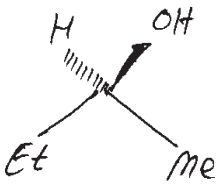
f) Erythro 1-acetoxy - 2- deutereo –1, 2 - diphenylethane.

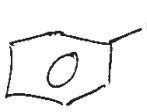


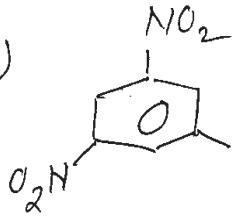
g) 

Q6) Predict the products (ANy five): **[10]**

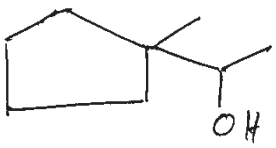
a)  n-PrOH, H⊕ ?

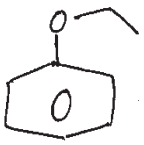
b)  + $SOCl_2$ + Pyridine, dioxane ?

c)  + $Ph-N(CH_3)-CHO$, $POCl_3$?

d)  + KCN ⟶ ?

e)  Perbenzoic acid ⟶ ?

f)  $H^{\oplus}/\Delta$ ⟶ ?

g)  + phthalic anhydride, i) Anhy. $AlCl_3$, ii) $H_2O/H^{\oplus}$?

Total No. of Questions : 6]

SEAT No. :

P2907

[Total No. of Pages : 2

[5023]-1004
M.Sc. - I
ANALYTICAL CHEMISTRY
CHA -190 :Safety in Chemical Laboratory and Good Laboratory Practices
(2014 Pattern)(Semester -I)(Credit System)(4-Credits)(New)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***Answer to the two sections should be written in separate answer books.***
2) ***All questions are compulsory.***
3) ***Neat diagram must be drawn wherever necessary.***

SECTION - I

Q1) Attempt the following: **[10]**

a) Explain the term LD - 50, LD 100.

b) Discuss the term bio-hazardous with suitable example.

c) Explain the responsibility of student in the Laboratory.

d) Discuss the contents in first aid kit.

e) Enlist the hazardous substances that may comes as compressed gases.

Q2) Attempt any two of the following: **[10]**

a) Explain the term green chemistry and discuss the principle of green chemistry.

b) Discuss the factors that affect the in haled material is absorbed by the body.

c) Explain the general guidelines during storage of chemicals.

d) Discuss the steps to establish safety and security management system.

P.T.O.

Q3) Attempt any one of the following: **[5]**

a) Discuss the different types of disposal methods of hazardous chemicals.

b) Explain the term flammable substances and list the characteristics of substances that make more flammable.

SECTION - II

Q4) Attempt the following: **[10]**

a) Explain the term protocol-amendment.

b) Draw pictogram of globally harmonized system.

c) Explain the term waste. Enlist the properties of harzardous waste.

d) Explain the term master-schedule for good laboratory practices.

e) Define fire, give its different types.

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

a) Explain the general precautions when working with electrical equipments.

b) List the fundamental points of good laboratory practices.

c) What are the different methods of disposal of laboratory waste.

d) Discuss the importance of recycling of chemicals.

Q6) Attempt any one of the following: **[5]**

a) Discuss the house keeping rules for safe laboratory.

b) Explain the necessary precautions taken during the handling of highly toxic chemicals.

Total No. of Questions : 6]

SEAT No. :

P2908

[Total No. of Pages : 3

[5023]-2001
M.Sc.
PHYSICAL CHEMISTRY
CHP-210 : Fundamentals of Physical Chemistry - II
(2014 Pattern)(Semester - II)

Time : 3 Hours] *[Max. Marks : 50*

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 the following: **[10]**

a) What is Zero-point energy? What is its significance?

b) Define polarizability ellipsoid.

c) What are symmetric and asymmetric vibrations? Explain with an example.

d) What is a hot band?

e) What is the effect of breakdown of Born-Oppenheimer approximation on the nature of vibrational rotational spectrum?

Q2) Attempt any two of the following: **[10]**

a) What is Raman shift? Explain the occurrence of stokes and antistokes lines with respect to quantum theory.

b) Give the detailed classification of molecules based on moment of inertia with suitable examples.

c) Describe different processes by which an electronically excited molecule can lose energy.

d) Discuss the various factors affecting the band broadening of spectral transitions.

Q3) Attempt any one of the following: **[5]**

a) The rotational Raman spectrum of $CO_2(g)$ shows a series of lines separated by $3.16cm^{-1}$ in the S branch calculate the rotational constant and moment of inertia of CO_2.

b) The fundamental vibrational frequency of HCl is 2990 cm^{-1}. Find the position of first two lines in P and R branches of vibrational-rotational spectrum of HCl.
[bond length of HCl=127.4pm, H=1amu, Cl=35amu]

SECTION - II

Q4) Attempt the following: **[10]**

a) Define dose and dose rate.

b) What is design parameter? Give its significance.

c) Explain the use of radio isotopes to understand friction and wear out of moving machine parts.

d) Define elementary separation factor.

e) Explain gas diffusion to enrich ^{235}U.

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

a) Write a note on compton scattering.

b) How does zone diffusion technique be used to determine the diffusion coefficients of radio-isotopes. Explain with suitable diagram and boundry conditions.

c) Describe the working and mechanism of natural nuclear reactor.

Q6) Solve any one of the following: **[5]**

a) The electronic absorption coefficient is 0.211 $b/\bar{e}$ for 1meV γ-rays. Calculate μ_{linear}, μ_{mass} and μ_a for ethanol.

[Given: ρ for ethanol =0.789 g/cm^3]

b) 0.1 g of Mn sample was irradiated in a thermal neutron flux of $10^7 n.cm^{-2}s^{-1}$ for 1h. What will be the radioactivity induced at the end of irradiation?

[Given: γ=100%, σ=13.3 b, $t_{1/2}$=2.58h for 56 Mn]

❋ ❋ ❋ ❋

Total No. of Questions : 6]

SEAT No. :

P2909

[Total No. of Pages : 6

[5023]-2002
M.Sc. - I
INORGANIC CHEMISTRY
CHI - 230 : Co-ordination and Bioinorganic Chemistry
(2014 Pattern) (New 4 - Credits) (Semester - II)

Time : 3 Hours] *[Max. Marks : 50*

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.***
5) ***Given : Atomic number; Co = 27, Ni = 28, Fe = 26, Ce = 58.***

SECTION - I

Q1) Answer the following questions: **[10]**

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

i) Ni^{2+}

ii) Ce^{3+}

b) Calculate the total degeneracy for the following terms/states/ configurations.

i) $2(p^1d^2)$

ii) ^5H

c) Classify the following transitions as vibronically allowed, orbitally allowed & forbidden in an octahedral complex. Justify your answer.

i) $A_{2g} \rightarrow A_{1g}$

ii) $E_g \rightarrow E_g$

d) How would you account for the magnetic moment listed against the following complex.

$[Co(H_2O)_6]SO_4$, $\mu_{obs} = 5.1$ B.M.

e) Predict the expected electronic transitions in $[FeCl_4]^{2-}$.

P.T.O.

Q2) Attempt any two of the following: **[10]**

a) Derive the allowed R-S terms and hence prepare a table of microstates for nitrogen atom. Find out ground state R-S term.

b) Calculate the effective magnetic moment of $[Ni(H_2O)_6]^{2+}$ using following data.

i) $\lambda = -350 cm^{-1}$

ii) 10 Dq = 8500 cm^{-1}

c) Describe in brief orgel diagram for D and F ground state term.

d) Give the splitting of ^2G R-S term in weak cubic field using character table for pure rotational point group and reduction formula.

Q3) Attempt any one of the following: **[5]**

a) For a complex three absorption bands are observed at 7,730 cm^{-1}, 12972 cm^{-1} and 24,040 cm^{-1}. Calculate Δo and Racah parameter. Comment on nature of M-L bond.

b) Write a note on charge transfer spectra.

SECTION - II

Q4) Answer in short: **[10]**

a) Explain the role of sodium in biological system.

b) Which iron-sulphur cluster compounds are involved in electron transfer reactions.

c) Trans-platin cannot be used as a anticancer drug. Explain.

d) Differentiate between hemoglobin and myoglobin.

e) Explain oxygen transport in Arthropods.

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

a) Give an account of Protein as a ligand.

b) Write a note on Na^+/K^+ ATPase.

c) Write a note on Irving-William series.

d) Explain in detail structure of DNA.

Q6) Attempt <u>any one</u> of the following: **[5]**

a) Draw the structures:

i) Porphyrin.

ii) Cobalmin.

iii) Cardiolyte.

iv) Glutamate.

v) Uracil.

OR

b) Match the following:

i)	K	a)	Photosynthesis
ii)	Mo	b)	Dehydrogenase
iii)	Mn	c)	Rubredoxin
iv)	W	d)	Nitrogen fixation
v)	Fe	e)	Charge carrier

Character Table for O rotational group

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

Correlation Table for the Group O_h

Oh	O	T_2	D_{4h}	D_{2d}	C_4^V	C_2^V	D_{3d}	D_3	C_{2h}
A_{1g}	A_1	A_1	A_{1g}	A_1	A_1	A_1	A_{1g}	A_1	A_g
A_{2g}	A_2	A_2	B_{1g}	B_1	B_1	A_2	A_{2g}	A_2	B_g
E_g	E	E	$A_{1g}+B_{1g}$	A_1+B_1	A_1+B_1	A_1+A_2	E_g	E	A_g+B_g
T_{1g}	T_1	T_1	$A_{2g}+E_g$	A_2+E	A_2+E	$A_2+B_1+B_2$	$A_{2g}+E_g$	A_2+E	A_g+2B_g
T_{2g}	T_2	T	$B_{2g}+E_g$	B_2+E	B_2+E	$A_1+B_1+B_2$	$A_{1g}+E_g$	A_1+E	$2A_g+B_g$
A_{1u}	A_1	A_2	A_{2u}	B_1	A_2	A_2	A_{1u}	A_2	A_u
A_{2u}	A_2	A_1	B_{2u}	A_2	B_2	A_1	A_{2u}	A_1	B_u
E_u	E	E	$A_{2u}+B_{2u}$	A_2+B_2	A_2+B_2	A_2+A_2	E_u	E	A_u+B_u
T_{1u}	T_1	T_2	$A_{2u}+E_u$	B_2+E	A_2+E	$A_2+B_1+B_2$	$A_{2u}+E_u$	A_2+E	A_u+2B_u
T_{2u}	T_2	T_1	$B_{2u}+E_u$	A_2+E	B_2+E	$A_2+B_1+B_2$	$A_{2u}+E_u$	A_2+E	$2A_u+B_u$

=

DIRECT PRODUCTS

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

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

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

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

   For all groups:

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

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

   except for the B representations of D_3 and D_{3h} where

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

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

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

   (*b*) For all groups except D_{2h}, D_{4h}, S_4:

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

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

   (*c*) For D_{2h}:

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

   irrespective of the suffix on B.

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

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

   irrespective of the suffix on B.

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

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

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

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

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

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

   (*c*) For D_{2h}:

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

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

   $E_5 \times E_5 = A_1 + A_2 + B_1 + B_2$,

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

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

   $E_3 \times E_5 = B_1 + B_2 + E_5$, $E_4 \times E_5 = B_1 + B_2 + E_5$.

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

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

$E_1 \times E_2 = E_1 + E_2$.

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

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

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

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

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

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

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

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

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

6. The complete results for O are :

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

Total No. of Questions :6]

SEAT No. :

P2910

[Total No. of Pages : 4

[5023]-2003
M.Sc. - I
ORGANIC CHEMISTRY
CHO - 250 : Synthetic Organic Chemistry and Spectroscopy
(2014 Pattern) (Semester - II) (4 Credit) (New)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

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

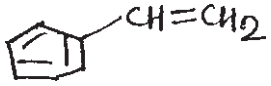
SECTION - I

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

a) Migratory aptitude in Baeyer - Villiger rearrangement.

b) Give the advantages of organolithium compounds over organomagnesium compounds.

c) Give two methods for preparation of



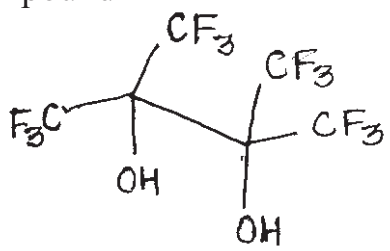
from Wittig reaction.

d) Explain reactivities of $NaBH_4$ and $LiAlH_4$ in reduction of $CH_3COCH_2COOC_2H_5$.

Q2) Explain any four of the following: **[8]**

a) Write note on Claisen Rearrangement.

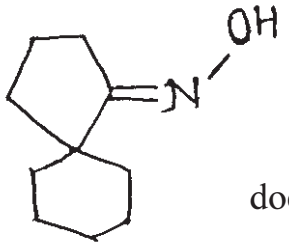
b) The compound



does not undergo Pinacol Rearrangement.

P.T.O.

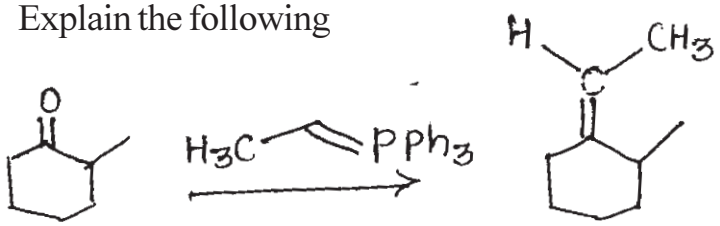
c) The compound



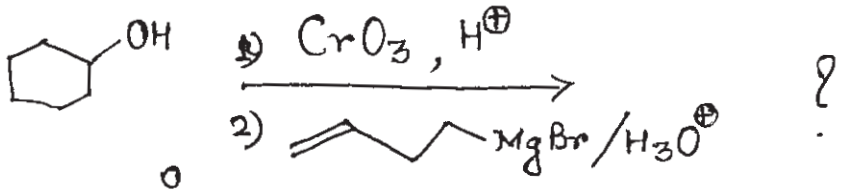
does not undergo Beckmann Rearrangement.

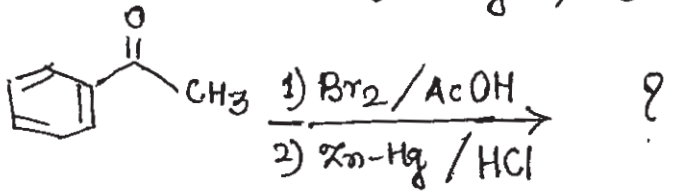
d) Advantages of Swern oxidation over Jones oxidation.

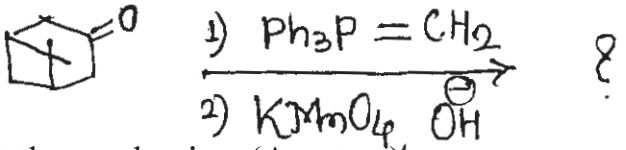
e) Explain the following



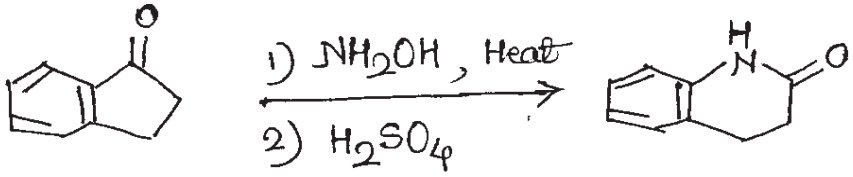
Q3) a) Predict the product (Any two) **[4]**

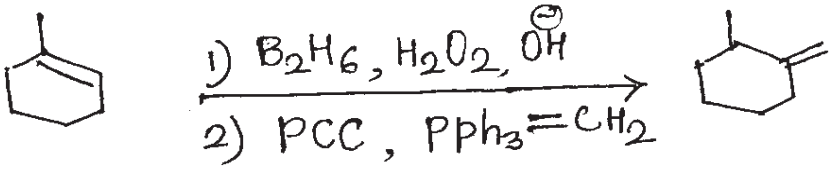
i) 

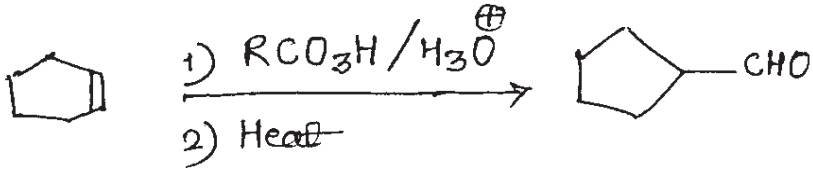
(ii) 

(iii) 

b) Suggest the mechanism (Any two) **[4]**

(i) 

(ii) 

(iii) 

SECTION - II

Q4) Deduce the structure from spectral data and justify your answer (Any three)**[9]**

a) M.F. - $C_6H_{12}O_2$

IR : 1745 Cm^{-1}

PMR: 0.94 δ (t, 3H)

1.39 δ (Sexhtate, 2H)

1.60 δ (quin, 2H)

2.04 δ (S, 3H)

4.06 δ (t, 2H)

b) M.F. - $C_8H_{14}O_3$

IR : 1770, 1810 Cm^{-1}

PMR: 1.00 δ (t, J=6Hz, 6H)

1.69 δ (Sext. J = 6Hz, 4H)

2.43 δ (t, J = 6Hz, 4H)

c) M.F. - $C_7H_{13}ON$

IR : 1675 Cm^{-1}

PMR: 1.54 δ (quin., J = 7 Hz, 4H)

1.64 δ (m, J = 7Hz, 4H)

3.04 δ (quin, J = 7 Hz, 2H)

2.08 δ (s, 3H)

d) M.F. - $C_{12}H_{18}O$

IR : 3600 cm^{-1} (sharp), 1600, 1500cm^{-1}

PMR: 1.5 δ (s, 6H)

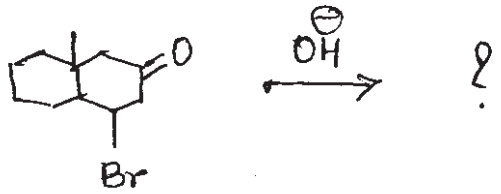
1.8 δ (s, 6H)

2.9 δ (bs, 1H, exchangable)

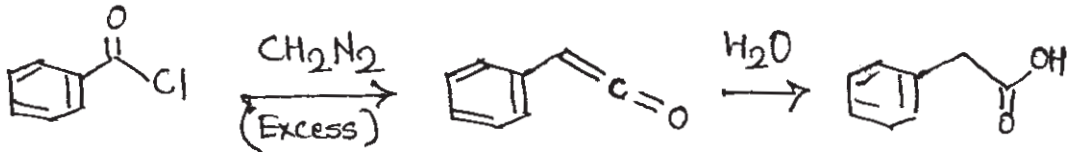
7.3 δ (s, 5H)

Q5) Attempt <u>any four</u> of the following: **[8]**

a) Complete the following reaction & calculate λ_{max} of the product.



b) How will you monitor following reaction by IR spectroscopy?



c) Explain the effect of solvent on chemical shift of hydronyl proton in alcohol.

d) [18]- annulene shows different chemical shift values for protons.

e) Cyclopentenone shows IR frequency at 1720 cm^{-1} whereas cyclopentanone shows IR at 1740 cm^{-1}. Explain.

Q6) Attempt any four of the following: **[8]**

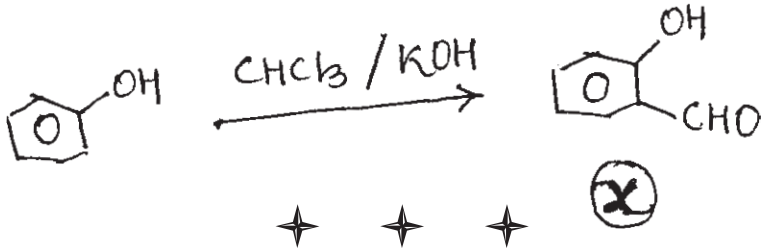
a) Explain MaClafferty Rearrangement with suitable example.

b) What are base peaks and molecular ion peaks in MS?

c) Use of Deuteration technique in PMR spectroscopy.

d) Why CMR spectra are broad?

e) How will you prove the formation of compound (x) by IR and PMR spectroscopy?



Total No. of Questions : 3]

SEAT No. :

P2911

[Total No. of Pages : 14

[5023]-2004

M.Sc. - I (Semester - II)

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry - II (2014 Pattern) (New 4 Credits)

New Course Based on Credit & Semester System

PART - A : Modern Separation Methods and Hyphenated Techniques (2.0 Credit / 25 marks)

PART - B : Basic Biochemistry (4.0 Credit / 50 marks)

PART - C : Concept of Analytical Chemistry (2.0 Credit/25 marks)

PART - D : Industrial Methods of Analysis (2.0 Credit / 25 marks)

PART - E : Organometallic and Inorganic Reaction Mechanism (2.0 Credit / 25 marks)

PART - F : Mathematics for Chemists (2.0 Credit / 25 marks)

PART - G : Pericyclic, Photochemistry and Free Radical Reactions (2.0 Credit / 25 marks)

Time : 3 Hours] *[Max. Marks : 50*

Instructions to the candidates:

1) ***All questions of respective section / part are compulsory.***
2) ***Figures to right hand side indicate full marks.***
3) ***Neat labelled diagram must be drawn wherever necessary.***
4) ***Use of log table / non programmable calculator is allowed.***
5) ***Students should attempt any two parts from Part - A, C, D, E, F and G or full paper of biochemistry (Part - B).***
6) ***Write the answers of <u>two parts</u> on separate answer books.***

<u>PART - A</u>

Modern Separation Methods and Hyphenated Techniques

Q1) Answer the following: **[10]**

a) Give applications of GC-MS technique.

b) Explain the term selectivity factor 'α'. Write it's equation in terms of retention and dead time.

P.T.O.

c) What is the fundamental difference between adsorption and partition chromatography.

d) What is a metastable ion in Mass spectrometry.

e) Give the principle of size exclusion chromatography.

Q2) Attempt any two of the following: **[10]**

a) Write a short note on FTIR-MS.

b) Give a brief account of columns used and carrier gases used in Gas chromatography.

c) With a labelled schematic diagram explain the working of the HPLC instrumentation.

d) Differentiate between isocratic and gradient elutions in HPLC and give an account of different pressure pumps used in HPLC.

Q3) Answer any one of the following: **[5]**

a) Give a brief account of the following:

i) Time of flight analyser in MS.

ii) Ion cyclotron analyser in mass spectrometry.

b) On a 1000cm wall coated open tubular column of 0.25mm bore, helium carrier gas velocity is 37cm/sec. The retention time t_R for decane is 1.27min, peak width at half height is 0.88 sec. The retention time for non-retained compound t_m is how much?

Total No. of Questions : 6]

P2911

[5023]-2004
M.Sc. - I (Semester - II)
CHEMISTRY
CH - 290 B : Basic Biochemistry
(2014-15 Pattern) (4 Credits)
PART - B

Time : 3 Hours] ***[Max. Marks : 50***

Instructions to the candidates:

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

SECTION - I

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

a) How are proteins classified on the bases of their functions?

b) What do you mean by essential and nonessential amino acids?

c) Give the structure and function of nucleus and lysosomes.

d) Describe the role of each organelle in prokaryote.

Q2) Attempt any four of the following: **[8]**

a) Write short account on amino acid therapy.

b) Why water is called as universal solvent and discuss its role in the body?

c) Mitochondria is said to be energy house of the cell. Explain.

d) Write a note on supersecondary structure.

e) Describe salient features of fluid mosaic model of biological membrane.

f) Briefly illustrate how protein engineering increases protein stability.

Q3) Answer any two of the following: **[5]**

a) What is β-oxidation with respect to lipids? Give significance of the same.

b) Define glycolysis. Discuss the pathway in detail.

c) Comment on tertiary structure of protein.

SECTION - II

Q4) Answer any three of the following: **[12]**

a) What is Lineweaver Burk equation? Explain its significance.

b) How does pH and temperature affect the enzyme catalyzed reaction?

c) Give the salient features of Watson-Crick model of DNA.

d) Discuss Translation with an overview of the steps involved.

Q5) Attempt any four of the following: **[8]**

a) Explain the structure and function of tRNA.

b) What is thyroid hormone? List out disorders in hypo and hyper thyroidism.

c) Give the structure and reaction catalyzed by coenzyme FAD.

d) Write a note on different forms of DNA.

e) Explain the following terms:

i) exons

ii) introns

f) Write a short account on inhibitors of protein synthesis.

Q6) Answer any two of the following: **[5]**

a) Explain the following:

i) Therapeutic uses of enzymes.

ii) Immobilization of enzymes.

b) Classify vitamins and enlist the deficiency diseases.

c) What is promoter sequence? Discuss its significance for the initiation of transcription process.

Total No. of Questions : 3]

P2911

[5023]-2004
M.Sc. - I (Semester - II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
(2014 Pattern) (2.0 Credits)
PART - C
Concept of Analytical Chemistry

Q1) Answer the following: **[10]**

a) What is meant by test of significance.

b) What is determinate error? Give an example.

c) Calculate the proper number of significant figures in each of the following:

i) 0.00617

ii) 23.0023

d) What is the principle of solvent extraction?

e) Explain in brief student 'T' test.

Q2) Attempt any two of the following: **[10]**

a) Give the principle of separation of ions by ion exchange technique. What are ion-exchange resins? Give their classification.

b) Draw a neat labelled diagram of fractionating column and explain it's principle and working.

c) Explain any two techniques for characterization of nano materials.

d) Explain the following terms:

i) Accuracy.

ii) Precision.

iii) Propagation of errors.

Q3) Attempt <u>any one</u> of the following: **[5]**

a) Describe various steps involved in sampling operations.

b) The following results were obtained in the replicate determination of the lead content of a blood sample: 0.700, 0.705, 0.706, 0.708 and 0.710 ppm. Calculate the mean and standard deviation of this set of data.

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Total No. of Questions : 3]

P2911

[5023]-2004
M.Sc. - I (Semester - II)
ANALYTICAL CHEMISTRY
CH A- 290 : General Chemistry
(2014 Pattern) (2.0 Credits)
PART - D
Industrial Methods of Analysis

Q1) Answer the following: **[10]**

a) Explain the concept of stepwise formation constants.

b) 0.28 g of NaOH is dissolved in 250 ml water. What is the concentration of solution in ppm.

c) Differentiate between acidic and basic buffer.

d) Mention various bulk properties used in process analyzer.

e) What are chemical sensors?

Q2) Attempt any two of the following: **[10]**

a) Explain the term automatic chemical analyser. Explain any one in detail.

b) Explain the terms:

i) millimoles

ii) ppb

iii) pH

c) Write a short note on quality systems in chemical laboratories.

d) Explain the terms:

i) Theoretical yield.

ii) Limiting reactants.

Q3) Answer <u>any one</u> of the following: **[5]**

a) Discuss the working of:

i) Online potentiometric analysers.

ii) Oxygen analysers.

b) Solve the following:

i) Calculate the millimoles present in 0.28g of $CaCO_3$?

(Given At. wt. Ca = 40, C = 12, O = 16)

ii) How will you prepare 0.25 N $K_2Cr_2O_7$ and 0.2M $K_2Cr_2O_7$.

(Given: At. wt. K = 39.068, Cr = 51.96, O = 15.99)

Total No. of Questions : 3]

P2911

[5023]-2004
M.Sc. - I (Semester - II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
(2014 Pattern) (2.0 Credits)
PART - E
Organometallic and Inorganic Reaction Mechanism

Q1) Answer the following: **[10]**

a) Complete the reaction

$H_3C–Mn(CO)_5 + SO_2 \rightarrow ?$

b) Which of the following square planar complexes have $16e^-$ valence configuration.

$[RhCl(PPh_3)_3]$ $[Ni(CN)_4]^{2-}$

c) Explain the important properties of organometallic compounds.

d) Explain the term oxidative addition with suitable example.

e) Rate of hydrolysis of $[Co(NH_3)_5Cl]^{2+}$ is faster than the rate of hydrolysis of $[Co(Py)_5Cl]^{2+}$.

Q2) Attempt any two of the following: **[10]**

a) Write a note on base hydrolysis.

b) What is trans effect?

c) IR spectroscopy is useful to predict structure of organometallic compounds.

d) Explain the bonding in ferrocene.

Q3) Answer <u>any one</u> of the following: **[5]**

a) Explain formation of aldehyde by Hydroformylation process.

b) Explain electron counting in the following complexes by neutral ligand method.

i) $(\eta^5 - C_5H_5)\ Fe(CO)_5$

ii) $Fe_2\ (CO)_9$

iii) $ClMn(CO)_5$

iv) $[Co(CO)_3PPh_3Cl]$

v) $HMn(CO)_5$

Total No. of Questions : 3]

P2911

[5023]-2004
M.Sc. - I (Semester - II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry - II
(2014 Pattern) (2.0 Credits)
PART - F
Mathematics for Chemists

Q1) Answer the following: **[10]**

a) Define unit and diagonal matrices with suitable examples.

b) Differentiate with respect to x.

$y = x \sin x$.

c) Find differential coefficients of the following:

$(2x + 3)(3 - x)$

d) If $A=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$ $B=\begin{bmatrix}-1 & 5\\ 5 & 9\end{bmatrix}$.

evaluate $5(A + B) = 5A + 5B$.

e) Enlist properties of a determinant.

Q2) Attempt <u>any two</u> of the following: **[10]**

a) Enlist rules of partial differentiation and give suitable examples.

b) Evaluate the following:

i) $\int x^{-7/2}\, dx$

ii) $\int (\cos x - 3\sin x)\, dx$

c) What is a cusp? Describe different types of cusps.

d) What is limit? Explain right hand limit and left hand limit with suitable examples.

Q3) Attempt <u>any one</u> of the following: **[5]**

a) Evaluate the following:

Differentiate:

i) $y=\frac{x^2+2x+2}{x+4}$

ii) $y=\frac{e^x}{e^x+1}$

b) Find the minimum and maximum values of $2x^3-15x^2+36x+10$

Total No. of Questions : 3]

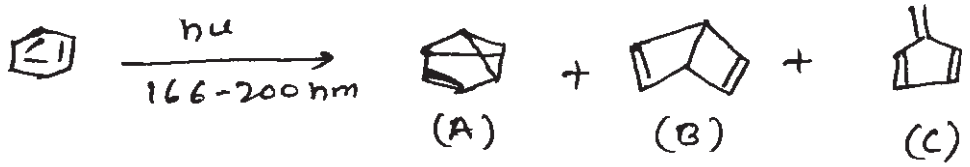
P2911

[5023]-2004
M.Sc. - I (Semester - II)
ANALYTICAL CHEMISTRY
CHA - 290 : General Chemistry
(2014 Pattern) (2.0 Credits)
PART - G
Pericyclic, Photochemistry and Free Radical Reactions

Q1) Attempt any two of the following: **[8]**

a) Explain with the help of FMO approach $\pi^2 s + \pi^2 s$ cycloaddition reaction and predict whether this reaction will be thermally allowed or photochemically allowed.

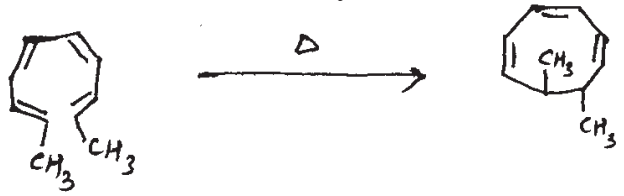
b) Explain, irradiation of benzene yields a mixture of three products (A), (B) and (C).



c) With the help of suitable example, explain Norrish type I and II photochemical reaction.

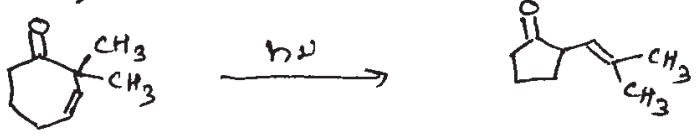
Q2) Explain the mechanism for <u>any three</u> of the following: **[9]**

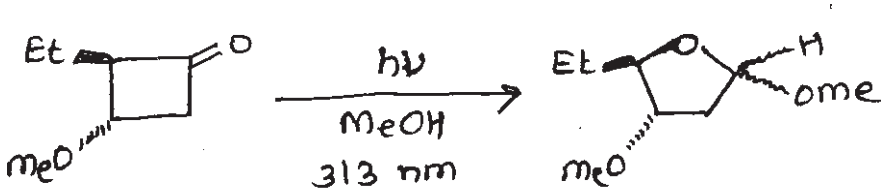
a)



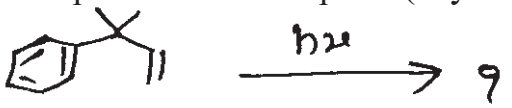
b)

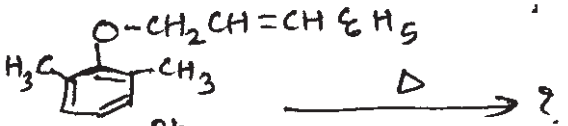
c)

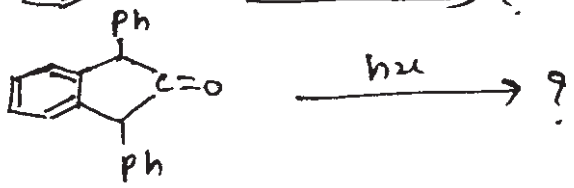


d) 

Q3) a) Predict the product/s and explain (any two): **[4]**

i) 

ii) 

iii) 

iv) 

b) Answer Any two of the following: **[4]**

i) Why on thermal reaction of cis-3, 4 dimethylcyclobutene gives (2E, 4Z) -2, 4- hexadiene while the trans isomer gives the (2E, 4E)-2, 4-hexadiene.

ii) Discuss the mechanism of the photoreduction of benzophenone leading to the formation of benzpinacol.

iii) Distinguish between Heterolytic and Homolytic reactions.