Total No. of Questions :3]

SEAT No. :

P1887

[Total No. of Pages :12

[5323] - 204

M.Sc. - I

ANALYTICAL CHEMISTRY

CHA - 290 : General Chemistry

(2014 Pattern) (Semester - II) (New 4 Credits)

Part - A - Modern Separation Methods and Hyphenated Techniques (2.0 credits / 25 marks)

Part - B - Basic Biochemistry (4.0 Credits / 50 marks)

Part - C - Concept of Analytical Chemistry (2.0 credits / 25 marks)

Part - D - Industrial Methods of Analysis (2.0 credits / 25 marks)

Part - E - Organometallic and Inorganic Reaction Mechanism (2.0 credits / 25 Marks)

Part - F - Mathematics for Chemists (2.0 credits / 25 marks)

Part - G - Pericyclic, Photochemistry and Free radical reactions (2.0 credits / 25 marks)

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

Instructions to the candidates:

1) ***All questions of the respective section/part are compulsory.***
2) ***Figures to right hand side indicate full maks.***
3) ***Neat diagramsmust be drawn wherever necessary.***
4) ***Use of logarithmic 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 Basic Biochemistry (Part B).***
6) ***Write the answers of two parts in separate answer books.***

P.T.O.

PART - A

Modern Separation Methods and Hyphenated Techniques

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

a) Define

i) Molecular ion peak

ii) Metastable ion

b) Give the applications of GLC.

c) How cis and trans isomers are identified using mass spectrometry?

d) State and explain size exclusion chromatography.

e) Distinguish between isocratic elution and gradient elution in HPLC.

Q2) Answer any two of the following. **[10]**

a) Draw a schematic diagram of mass spectrometer and explain the working of its essential components.

b) Describe the construction and working of FID.

c) Explain the mechanism involved in ion-pair chromatography.

d) Explain the Time of flight mass analyzer.

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

a) Enlist the different types of ionisation methods in MS. Explain any one in detail.

b) A xylen chromatogram was obtained and recorded. The recorder speed was 3.68cm/min. The gas flowrate was 50.0 ml/min. The retention time for xylenc was 54.0cm and for the air it was 6.2 cm.

Calculate:

i) Uncorrected retention time in min.

ii) Uncorrected retention volume in ml.

iii) The adjusted retention time in min

iv) The adjusted retention volume in ml.

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PART - B

Basic Biochemistry

Instructions to the candidates:

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

SECTION - I

Q1) Answer any four of the following. **[12]**

a) Classify proteins based on their biological roles.

b) How aminoacid sequence in a protein is determined by Edman dagradation?

c) Explain in brief fibrous proteins.

d) What is meant by active transport? How do Na^+K^+ pump operate in membranes?

e) Compare and Contrast structural and functional properties of starch and Glycogen.

Q2) Disuss any two of the following. **[8]**

a) Reactons of TCA cycle.

b) Quaternary structure of protein.

c) Essential and Non essential amino acids with structures.

Q3) Explain the following terms. (any five) **[5]**

a) β- Oxidation.

b) Conjugated lipids.

c) Nonstandard aminoacids.

d) Nucleocytoplasmic Communication.

e) Drug transport.

f) Optical isomerism (in carbohydrates)

g) Glycolysis.

SECTION - II

Q4) Answer any four of the following. **[12]**

a) Give experimental evidences for semiconservative replication of DNA.

b) Explain the basic features of Genetic Code.

c) Discuss major components of balanced diet.

d) What are fat soluble vitamins? Add a note on visual cycle.

e) What is non competitive inhibition of enzyme? Discuss with suitable example.

Q5) Attempt any two of the following. **[8]**

a) Give an account on protein synthesis. (Translation Process) in prokaryotes.

b) Explain factors affecting rate of enzyme activity.

c) Write a note on different types of RNA With their structures & functions.

Q6) Explain the following terms (any five) **[5]**

a) Active site of enzyme.

b) Okazaki fragments.

c) Cofactors.

d) Scurvy.

e) Transcription bubble.

f) Template DNA.

g) Exons.

PART - C

Concept of Analytical Chemistry

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

a) Define term sampling and sample handling.

b) Give the procedure for sampling of metals and alloys.

c) What is F test?

d) What is determinate error?

e) What are the methods of improving column performance?

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

a) Explain addition and substration with suitable example.

b) What is least - squares method of calibration? Give its assumptions.

c) Describe the principles of separation by extraction.

d) Explain the term propagation of error with suitable example.

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

a) What is confidence limit? Explain tests of significance.

b) Calculate the uncertainty in the number of millimoles of chloride contained in 250 ml of a sample. When three equal aliquots of 25ml are titrated with silver nitrate gave the following results 36.78, 36.82 and 36.75 ml. The molarity of $AgNO_3$ solution is $0.1167 \pm 0.0002M$.

PART - D

Industrial Methods of Analysis

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

a) Explain the term stability constant. List the factors affecting stability of the complex.

b) Calculate the molar concentration of ethanol in an aqueous solution that contains 2.30 grams of C_2H_5OH in 3.50 liter of solution.

(Molecular weight : $C_2H_5OH = 46.07$ g/mole)

c) What is buffer capacity of a buffer solution? Give examples of acidic and basic buffer solutions.

d) Why H_2S is employed in presence of dilute HCl in qualitative analysis of II-group metal ions?

e) Explain theoretical yield and pratical yield.

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

a) What is solubility product? Explain any two applications of solubility product in qualitaive analysis.

b) To a solution of 0.1 M ammonium hydroxide, a solution of 0.1M ammonium chloride is added. Calculate hydroxyl ion concentration before and after addition of ammonium chloride. ($K_b = 1.8 \times 10^{-5}$)

c) Explain the types of quality standards for chemical laboratories.

d) Explain cost and benefits of quality system.

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

a) Explain automatic chemical analyzer and automatic elemental analyzer.

b) A precipitate of lead sulphate is washed with 200 ml of distilled water. Calculate how many milligrams of the precipitate will be lost in washing operation.

(Molecular weight = 303.2, solubility Product = 2.2×10^{-6}).

PART - E

Organometallic and Inorganic Reaction Mechanism

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

a) Determine the number of metal-metal bonds in the following complex which obey the 18 electron rule and draw the structure.

$(CO)\ (\eta^5 - C_5H_5)\ Fe(\mu\text{–}CO)_2Fe(\eta^5\ \text{–}C_5H_5)\ (CO)$

b) Predict the type of reaction.

$(\eta^5 - C_5H_5)_2\ TaH_3 \longrightarrow (\eta^5\text{–}C_5H_5)_2TaH$

c) What is Zeiglar-Natta polymerisation?

d) What is meant by inert and labile complex? Give suitable example.

e) DescribeTolman angle and its effect on dissociation of ligands.

Q2) Answer any two of the following. **[10]**

a) Explain hydroformylation reaction in detail.

b) Explain the bonding in Π - ethylene complexes.

c) Write a note on trans effect.

d) Explain the difference in IR spectra of $Mo(PF_3)_3(CO)_3$ versus $Mo(pme_3)_3(CO)_3$.

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

a) Write a short note on kinetic chelate effect.

b) Explain the formation of acetaldehyde by Wacker process.

PART - F

Mathematics for Chemists

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

a) If $A=\begin{bmatrix}1 & 2\\ 3 & 4\end{bmatrix}$ $B=\begin{bmatrix}2 & 1\\ 4 & 2\end{bmatrix}$ $C=\begin{bmatrix}5 & 1\\ 7 & 4\end{bmatrix}$ then verify that A(B + C) = AB + AC.

b) Define:-

i) Point of inflexion

ii) Cusps.

c) Define and illustrate:

i) Unit matrix

ii) Vector matrix

d) Give derivatives of the following:-

i) Sec x

ii) a^x

iii) cos x

iv) x^n

v) tan x.

e) Give differential coefficients of the following w.r.t. x.

i) 10^x

ii) $3x^4$

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

a) Differentiate the following functions w.r.t. x.

i) $Y=\dfrac{x^2+2x+2}{x-4}$

ii) $Y=\dfrac{Sinx}{Cosx}$

b) What is the maxima and minima of a function of single independent variable? Give the rules.

c) With a suitable example explain the Taylor and McLaurin theorem.

d) Evaluate the following:-

i) $\int \frac{\tan x}{\sec x + \tan x} dx$

ii) $\int \left(x^3 + x + 5\right) dx.$

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

a) What are exact and inexact differentials? Give their applications in thermodynamics.

b) Solve the linear equations by Cramer's rule.

i) $2x - 2y = 1,\ x + 2y = 2$

ii) $3x + 4y = 27,\ 5x - 3y = 16$

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PART - G

Pericyclic, Photochemistry and Free radical reactions

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

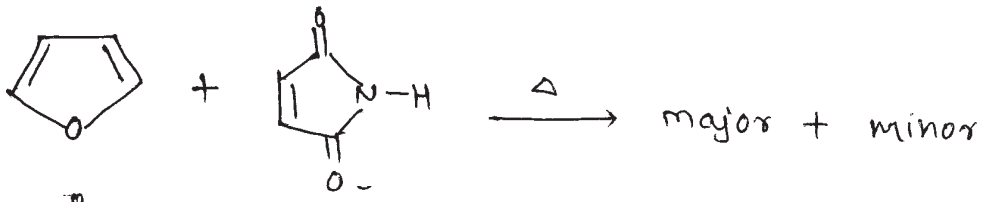
a) Construct a correlation diagram for the conrotatary opening of the cyclohexadiene to hexatriene. Predict whether these transformation are allowed thermally or photochemically.

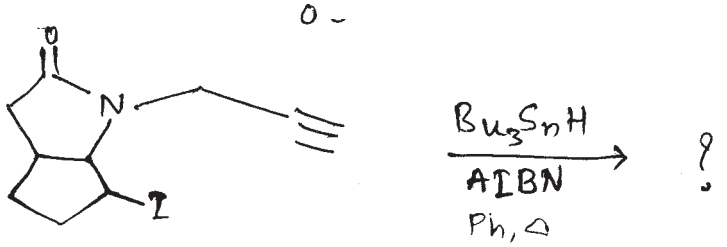
b) Give mechanism of Norrish Type II reaction with the help of gas phase irradiation of 2 - pentanone.

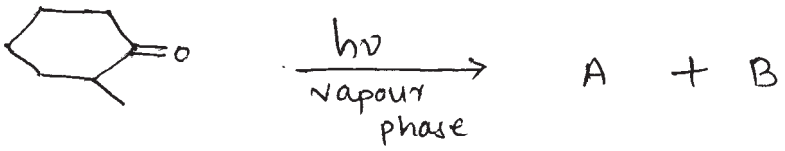
c) Explain free radical arylation of aromatic rings.

d) Discuss the mechanism of claisen rearrangment.

Q2) a) Predict the product/s and explain (any two) **[4]**

i) 

ii) 

iii) 

b) Explain any two of the following. **[4]**

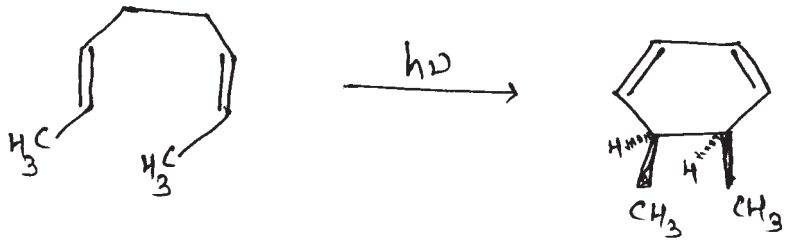
i) Reaction of 6-bromo-1-hexene on heating with Bu_3SnH and AIBN gives mixture of 1 - hexene, methylcyclopentane and cyclohexane.

ii) Why [1.5] sigmatropic shift of hydrogen is thermally allowed process.

iii) Irradiation of O-xylene yields a mixture at m-xylene and p-xylene.

Q3) a) Explain the mechanism for the following reaction (any two) **[4]**

i)



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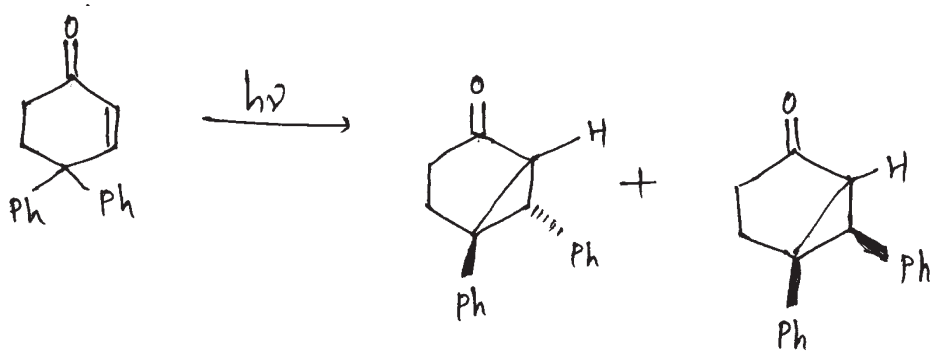

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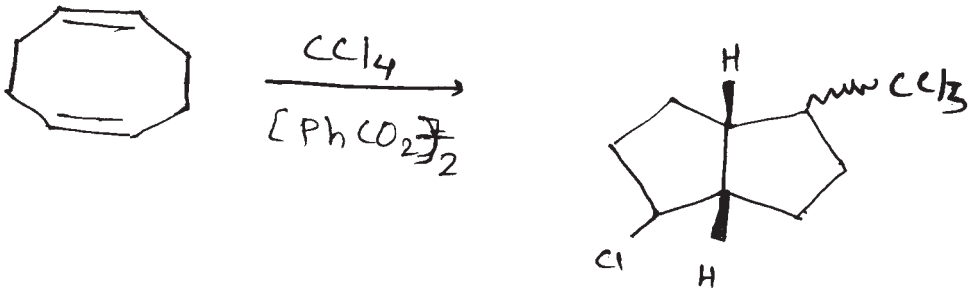

b) Write a short note on any two of the following. **[4]**

i) Telomerisation

ii) Paterno-Buchii reaction

iii) 1, 4, Photoaddition of benzene.

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