

First Semester M.Sc., (Hon's) Degree Examinations

August 2022

(CBCS Scheme)

Chemistry

HC : 1.4 : Physical Chemistry - I

Time: 3 hrs]

[Max.Marks: 75

Instructions to candidate :

Answer any TEN questions from Part – A, any TWO questions from Part- B and any THREE questions from Part - C.

PART - A

I. Answer any TEN of the following questions. (10X2=20)

1. a) What is an Eigen equation? Give an example.
- b) What is an operator? Explain.
- c) Mention the characters of a wave function.
- d) Define the term Free energy. Mention its significance.
- e) Give the mathematical statement of first law of thermodynamics.
- f) State and explain Trauton's rule.
- g) What is a decomposition potential ?
- h) What are the differences between primary and a secondary battery?
- i) Write the electrochemical reactions in H₂-O₂ fuel cell.
- j) Define the term quantum yield.
- k) What are actinometers? Give an example.
- l) What are ion-selective electrodes? Give an example.

PART - B

II. Answer any TWO of the following questions. (2X8=16)

2. a) Derive the combined form of First and Second laws of thermodynamics.
- b) Explain the Bhor's atomic model of hydrogen atom. Mention the limitations.

(4+4=8)

Contd...2

3. a) Discuss the Debye-Huckel theory of strong electrolyte. (4+4=8)
b) Write a note on charging and discharging of lead-acid battery.
4. a) Write a note on Nemst's heat theorem. Mention its consequences. (4+4=8)
b) Derive Classius-Clapeyron thermodynamic equation.

PART - C

III. Answer any THREE of the following questions.

(3X13=39)

5. a) Derive and explain the De-Broglie concept on wave particle duality.
b) Explain the postulates of quantum mechanics. (5+4+4)
c) Derive the wave equation for a particle in one dimensional box.
6. a) Derive any four Maxwell's relations.
b) How the third law of thermodynamics is verified? Explain.
c) Discuss the thermodynamic criteria for equilibrium and spontaneity of a reaction. (5+4+4)
7. a) With a suitable example, explain the construction and working principle of alkaline storage battery.
b) Discuss the thermodynamics of an electrochemical cell.
c) Write a brief note on electrochemical energy storage devices. (5+4+4)
8. a) Describe the methods of accelerating the nuclear particles.
b) Write a note on solar energy conversion and storage.
c) Discuss the mechanism and working of Fricke dosimeter. (5+4+4)

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First Semester M.Sc., (Hon's) Degree Examinations**August 2022***(CBCS Scheme)***Chemistry****HC : 1.1 : Analytical Chemistry - I**

Time: 3 hrs]

[Max.Marks: 75

Instructions to candidate :

Answer any TEN questions from Part – A, any TWO questions from Part- B and any THREE questions from Part - C.

PART - A

I. Answer any TEN of the following questions. (10X2=20)

1. a) Differentiate between precision and accuracy.
- b) A chemist analyzed paracetamol in a tablet repeatedly and obtained the following data: 50.4; 50.8; 49.6 and 49.8 mg. Calculate the standard deviation for the set of measurements.
- c) Analysis of Vitamin C sample repeatedly yielded following results: 20.5; 19.6; 21.2; 20.2 mg. Find whether the third result in the set of measurement may be retained or rejected for further analysis at 95% confidence level. (Given Q value at 95% confidence level = 0.829)
- d) List the factors influencing the solubility of the precipitate.
- e) A 50 ml of waste water sample consumed 2.5 mL of 0.02 N AgNO₃. Calculate the amount of chloride present in water sample. (Given equivalent weight of Cl = 35 amu).
- f) Write the structure of Erichrome Black – T. Why it is called as metal ion indicator ?
- g) Calculate the number of theoretical plates of column which showed retention time of 2 min 40 seconds for a sample with width of the peak at base of 05 seconds.
- h) Give the mechanism of ion exchange in cation and anion exchangers?

Contd...2

Q.P. Code No.76701

- i) Name any two visualization reagents employed in Thin layer chromatography.
- j) Differentiate between normal phase and reverse phase chromatography.
- k) Why the GC columns are longer than HPLC columns?
- l) Name any two mobile phases used in GC and mention their properties.

PART - B

II. Answer any TWO of the following questions.

(2X8=16)

2. a) Describe the application of least squares method in the construction of calibration plots.
- b) A 0.25 g of dolomite sample was dissolved in 100 mL of water. To 10 mL of this solution, 5 mL buffer pH 10 was added and then it consumed 8.8 mL of 0.025 M EDTA solution for Eriochrome black T endpoint. Further, to fresh 10 mL of dolomite solution, 5 mL of 4N KOH was added and titrated to Pattison and Reeder's endpoint which consumed 4.5 mL of 0.025 M EDTA. Calculate the Ca and Mg present in the dolomite sample in terms of CaCO_3 . (Molecular weight of $\text{CaCO}_3 = 100$ amu). (4+4)
3. a) Write the Van-Deemter's equation and explain the factors responsible for band broadening.
- b) With a neat schematic, discuss the construction and working of TCD detector. (4+4)
4. a) What is sampling? Account on the sampling hazards with suitable examples.
- b) Briefly explain the theories of precipitation. (4+4)

PART - C

III. Answer any THREE of the following questions.

(3X13=39)

5. a) A chemist developed a new method for the analysis of iron present in curry leaves. And repeated measurements showed following results: 20.2; 20.4; 19.8; 21.0 mg. If the theoretical value is 20.0 mg, find whether the newly developed has any significant difference at 99% confidence level. (Given t-value at 99% confidence level = 4.604).

Contd...3



- b) What is an error? How it can be minimized in the analytical laboratory? Explain.
- c) Illustrate the application of six sigma concept in total quality management. (4+4+5)
6. a) Write the structure of phenolphthalein and explain the mechanism of its indicator action in an acid - base titration.
- b) What are non-aqueous solvents? Give example and mention their properties.
- c) Write short notes on : i) theory of redox titration and ii) PFHS. (4+4+5)
7. a) Explain the principle and types of paper chromatographic techniques.
- b) What is R_F value and mention its significance? The TLC analyses of three samples A, B and C showed their movement from origin in TLC plate as 2.6 cm, 3.2 cm and 3.8 cm, respectively. If the distance moved from the solvent is 4.5 cm and the desired compound has a R_F value 0.711, identify which is the desired compound among the analyzed samples.
- c) Discuss the principle and application of ion - exchange chromatography in the separation of amino acids. (4+4+5)
8. a) Briefly explain the working and applications of GC - MS in the analysis of volatile organic compounds.
- b) Describe the advantages and applications of derivative chromatography.
- c) With a neat schematics, explain the principle and working of HPLC. (4+4+5)

QP CODE 76073

Third Semester M.Sc., Degree Examinations
OCTOBER/NOVEMBER 2022

(C.B.C.S Scheme)

CHEMISTRY**Paper: Ch. SC 3.3: ORGANIC CHEMISTRY - III**

Time: 3 hrs]

[Max. Marks: 75

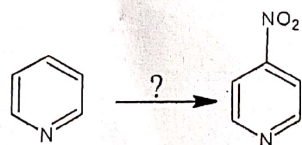
- Note :** 1) Answer **Part - A** and any **FIVE** questions from **Part - B**
 2) Figures to the right indicate marks.

PART - A

1. Answer the following:

10 x 2 = 20

- Give an example of mannich reaction.
- What is aldol?
- What is Fischer indole synthesis?
- Mention the reagents/conditions in the following reaction.



- What is McMurry coupling reaction?
- What is Norrish type I reaction?
- Give an example for photoaddition reaction.
- Illustrate the protection and deprotection of carbonyl group.
- What is one group C-X disconnection?
- Give an example for [3,3] sigmatropic rearrangement.

PART - BAnswer any **FIVE** of the following questions:

- Discuss the applications of Dieckmann condensation
 - Explain the construction of C-C bond using Robinson annulations.

6 + 5 = 11

Contd.....2

3. Account for the following reactions.
a) Baeyer — Villiger reaction, b) Bucherer reaction. 6 + 5 = 11
4. a) Discuss the electrophilic substitution reactions in pyrrole.
b) Explain any two methods for the synthesis of thiophene. 6 + 5 = 11
5. a) What are mesoinonic compounds? Write the synthesis of sydnone.
b) Outline the synthesis of quinoline by Skraup method. 6 + 5 = 11
6. Discuss the following:
a) Photochemistry of arenes.
b) FMO approach for [4 + 2] cycloaddition reaction. 5 + 6 = 11
7. a) Explain the terms Con-rotatory, disrotatory, suprafacial and antarafacial. Write the Frontier molecular orbitals for 1,3,5-hexatriene.
b) Discuss Cope and Claisen rearrangements with suitable examples. 7 + 4 = 11
8. a) Write the Retrosynthesis of benzocaine.
b) Explain the disconnection approach in 1,1-difunctionalized compounds. 5 + 6 = 11
9. a) What are synthons, synthetic equivalents? Illustrate with suitable examples the functional group interconversions.
b) Discuss the Disconnection approach in Benzyl benzoate and isopentyl benzyl ether. 6 + 5 = 11

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QP CODE 76074

Third Semester M.Sc., Degree Examinations

OCTOBER/NOVEMBER 2022

(C.B.C.S Scheme)

CHEMISTRY**Paper: Ch. SC 3.4: PHYSICAL CHEMISTRY - III**

[Max. Marks: 75]

Time: 3 hrs]

Note : 1) Answer **Part - A** and any **FIVE** questions from **Part - B**
2) Figures to the right indicate marks.

PART - A

10 x 2 = 20

1. Answer the following:

- What is the basic difference between perturbation and variation methods?
- What are linear oscillators? Explain.
- Write the expression for Slater orbital's of 2s and 2p.
- Give the salient features of VBT.
- Write the important characteristics of catalytic reactions.
- What is an oscillatory reaction? Give example.
- What is EXAFS? Explain its principle in surface characterization.
- Define a gel; give the major difference between elastic and a non-elastic gel.
- What is micellar catalysis? Give example.
- What is zeta potential? Write its significance.

PART - BAnswer any **FIVE** of the following questions:

- State and prove variation theorem.
 - Write the ϕ equation for H atom and give its solution (5 + 6)
- Calculate the first four rotational energy levels of a rigid rotator and also find the energy difference between each energy level.
 - Describe in detail how perturbation method is applied for the hydrogen atom in ground state (5 + 6)

Contd.....2



QP CODE 76074

4. a) State the Slater's rules for calculation of ENC and calculate for N atom.
b) Using Huckel's Molecular Orbital theory setup the energy level diagram and calculate the delocalization energy for 1,3-butadiene. (5 + 6)
5. a) Compare the MO and VB theories of bonding.
b) State the assumptions of HMO theory, set up the secular equation for the benzene using this theory and find its resonance energy. (5 + 6)
6. a) Explain the Freundlich theory of adsorption. Give its limitations.
b) i) Derive BET equation for multilayer adsorption
ii) Explain the effect of temperature and pH on enzyme catalysis. (5 + 6)
7. a) Derive Michaelis-Menten equation governing the enzyme catalysis.
b) i) Discuss Gibbs adsorption isotherm.
ii) Explain the theory of unimolecular surface reactions (5 + 6)
8. a) Write the classification of colloids and explain their preparation by different methods.
b) i) Explain the DLVO theory of stability of colloids.
ii) Differentiate between electrophoresis and electro-osmosis. (5 + 6)
9. a) Discuss in detail how the size of colloidal particles and surfactants is determined?
b) i) Write a note on thermodynamics of CMC.
ii) Explain the mass action model explaining the formation of micelles. (5 + 6)

Third Semester M.Sc., Degree Examinations

MAY 2022

(C.B.C.S Scheme)

CHEMISTRY

Paper: Ch.SC 3.3: ORGANIC CHEMISTRY – III

Time: 3 hrs]

[Max. Marks: 75

Note : 1) Answer **Part – A** and any **FIVE** questions from **Part – B**

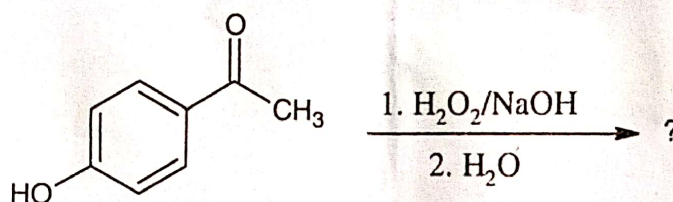
2) Figures to the right indicate marks.

SECTION – A

1. Answer the following:

10 x 2 = 20

- Define Knoevenagel reaction with an example.
- Give the product with mechanism:



- Formulate a method for the synthesis of benzofuran.
- Between pyrrole and pyridine, which one is more basic? Give reason.
- Define protecting group. What are the characteristic features of good protecting Group?
- Sketch the mechanism of di- π methane rearrangement.
- Define the terms conrotatory and disrotatory ring closure used in electrocyclic reactions.
- Define Cope rearrangement with an example.
- What are synthons and synthetic equivalents? Give the synthons and synthetic equivalents for cyclohexanol.
- What is Suzuki coupling reaction?

SECTION – B

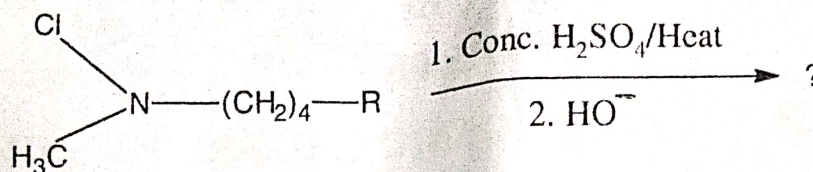
Answer any **FIVE** of the following questions:

- Sketch the mechanism of Stobbe condensation reaction.
 - Explain Hunsdiecker-Borodin reaction.

Contd.....2

c) Predict the product with possible mechanism:

(5 + 3 + 3 = 11)



3. a) Give an account on Fischer indole synthesis. (5 + 6 = 11)
- b) Write a note on synthesis and reactions of sydnone. (5 + 6 = 11)
4. a) Draw the molecular orbital diagram of 1,3-butadiene and label HOMO and LUMO under both thermal and photochemical condition along with its symmetry. (4 + 4 + 3 = 11)
- b) With illustrative example, discuss the mechanism of Norrish type-1 reaction.
- c) Write Woodward-Hoffmann rules for pericyclic reactions. (4 + 4 + 3 = 11)
5. a) Explain protection of hydroxyl group with suitable examples. (6 + 5 = 11)
- b) Discuss the retro synthesis of 4-methoxy acetophenone. (6 + 5 = 11)
6. a) Explain the mechanism of Baeyer-Villiger reaction.
- b) Give an account on McMurry coupling and Bhcherer reaction. (5 + 6 = 11)
7. a) Formulate any two methods for the synthesis of pyridine and discuss its nucleophilic substitution reactions. (5 + 6 = 11)
- b) Discuss Bischler-Napieralski synthesis of isoquinoline. (5 + 6 = 11)
8. a) Compound (2E,4Z,6E) – octatriene always forms *cis* - 5,6 dimethyl -1,3 – cyclohexadiene under thermal condition and *trans*-5,6-dimethyl-1,3 – cyclohexadiene under photochemical condition. Explain.
- b) With the help of Jablonski diagram, explain the following terms:
 i. Fluorescence ii. Phosphorescence ii. Inter system crossing
- c) Give the classification of cycloaddition reactions with suitable examples. (4 + 4 + 3 = 11)
9. a) Give an account on one group C-X disconnections. (6 + 5 = 11)
- b) Discuss retrosynthetic analysis of benzocaine. (6 + 5 = 11)

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Third Semester M.Sc., Degree Examinations

May / June 2022

(CBCS Scheme)

Industrial Chemistry

Paper : IC.SC 3.03 : Polymer Chemistry and Technology

[Max. Marks: 75

Time: 3 hrs]

Note : 1. Answer any TEN subdivisions from Part – A. Any TWO full questions from Part – B. Any THREE full questions from Part- C.

2. Marks are indicated at the right side.

PART – A

10 x 1 = 10

Answer any TEN questions.

1. a) Give the structure of monomer of Teflon.
- b) Write the formula of number-average molecular mass of a polymer.
- c) How to express the degree of polymerization?
- d) Give the various configurations of polymers.
- e) What is glass transition temperature?
- f) Give one example of cross-linking polymer.
- g) Give the significance of creep in polymers.
- h) How thermal conductivity of polymer is expressed?
- i) Define T_c .
- j) What is meant by compounding of plastics?
- k) What are electomers? Give their significance.
- l) Mention two important properties of epoxy resins.

PART – B

2 x 10 = 20

Answer any TWO of the following.

2. a) Give a brief note on classification of polymers. (5 + 5)
- b) What is condensation polymerization? Explain steps involved. (5 + 5)
3. a) Explain in detail relationship between melting point (T_m) and glass transition temperature (T_g) of polymers. (5 + 5)
- b) Give a brief note on thermal analysis of polymers. (5 + 5)

Contd...2

4. a) Discuss any two testing specification protocols available for polymer testing. (5 + 5)
b) Give a brief note on calendaring techniques. (5 + 5)
5. a) Explain injection molding with a neat diagram. (5 + 5)
b) Give a brief note on biomedical applications of polymers. (5 + 5)

PART – C

Answer any THREE of the following.

3 x 15 = 45

6. a) What is addition polymerization? Discuss its mechanism. (4+6+5)
b) Give application of X-ray diffraction in the analysis of polymer. (5+5+5)
c) How to determine molecular-mass of a polymer by weight-average molecular mass method? (5+5+5)
7. a) With suitable examples explain the glass transition temperature of polymers. (4+6+5)
b) Give a detailed note on Fiber Spinning. (5+4+6)
c) Explain property requirements for polymer utilization. (5+4+6)
8. a) Explain in detail Flory - Huggins theory of polymer solutions. (5+4+6)
b) Discuss the differences between tensile strength and flexural strength of polymers. (5+4+6)
c) Give a brief note on thermodynamics of mixing of polymers. (5+4+6)
9. a) Give a brief note on the following polymer processing techniques:
(i) Extrusion molding and (ii) Blow molding (5+5+5)
b) Discuss in detail conduction mechanism of electrically conducting polymers. (5+5+5)
c) Explain the properties of phenolic resins and silicone polymers. (5+5+5)

Fourth Semester M.Sc., Degree Examinations

October / November 2022

Industrial Chemistry

Paper : IC SC : 4.03 : Advanced Analytical Techniques

Time: 3 hrs]

[Max. Marks: 75

Note : 1. Answer any TEN subdivisions from Part - A, Any TWO full questions from Part - B, Any THREE full questions from Part- C.

2. Figures to the right indicate marks.

PART - A**Answer any TEN questions.**

10 x 1 = 10

1. a) Predict the number of signals in ^1H NMR of dimethyl ether.
- b) What are the solvents used in NMR spectroscopy?
- c) Why TMS is used as reference standard in NMR?
- d) Define degeneracy.
- e) List the factors affecting 'g' value.
- f) Why derivative curve is recorded in ESR spectrophotometer?
- g) What is meta stable peak in mass spectroscopy?
- h) Mention the relative intensity of peak signals for chlorine and bromine isotopes in the mass spectrum.
- i) Distinguish between molecular ion peak and base peak.
- j) Calculate the Miller Indices of the plane which intercepts on X and Y -axes at (a,0,0), (0,a,0) and parallel to Z-axis.
- k) Mention the significance of Cotton effect.
- l) What is isomer shift? Explain.

PART - B**Answer any TWO of the following.**

2x10=20

2. a) Discuss the principle and applications of Nuclear Overhauser Effect.
- b) Write a note on proton decoupled and off resonance decoupled ^{13}C -NMR spectra.

(5+5=10)

Contd...2

3. a) Show that the ESR spectrum of methyl radical consists of a quartet with relative intensities of 1:3:3:1. (5+5=10)
- b) Discuss the applications of ESR.
4. a) With suitable examples, explain the fragmentation process based on McLafferty Rearrangement reaction and Retro Diels Alder reaction. (5+5=10)
- b) Mention FT-NMR instrumentation in NMR.
5. a) With suitable examples, explain the principle and Mossbauer spectra of tin halides.
- b) With neat schematics, explain the production of X-rays from Coolidge X-ray tube. (5+5=10)

PART - C

Answer any THREE of the following.

3x15=45

6. a) What is chemical shift? Explain the various factors that influence the chemical shift value.
- b) Mention the applications of NMR in structure elucidation of simple organic molecules.
- c) Discuss the theory of ^1H NMR spectroscopy. (5+6+4=15)
7. a) What is hyperfine splitting? Sketch and explain the ESR spectra of 1,4-benzosemiquinone.
- b) Electron spin resonance is observed for hydrogen atom with an instrument operating at 9.5 GHz. If g value for electron in hydrogen atom is 2.0026, what is the magnetic field applied?
- c) Discuss the instrumentation of ESR. (5+4+6= 15)
8. a) Illustrate the applications of mass spectroscopy.
- b) Write the modes of fragmentations in Mass spectrometry
- c) An organic compound containing C, H, O showed following spectra data.
 $\text{UV}(\lambda_{\text{max}}, \text{nm}) = 230$ and 260
 $\text{FTIR}(\nu_{\text{max}}, \text{cm}^{-1}): 1710$
 $^1\text{HNMR}(\delta, \text{ppm}): 7.2(5\text{H}, \text{s}), \text{ and } 3.55(2\text{H}, \text{s})$
 $\text{Mass}(m/z) = 136(\text{M}^+), 91, 45$
 Deduce the structure of the compound. (5+5+5= 15)

Contd...3

9. a) Discuss the various factors influencing the position and intensity of Mossbauer spectral lines.
- b) How plane polarized light is obtained? Explain its application in studying the concentration of optically active compounds.
- c) Discuss the principle of X-ray diffraction spectroscopy. Explain its applications in the analysis of internal structure of molecules. (5+5+5=15)

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Fourth Semester M.Sc., Degree Examinations
October / November 2022

(CBCS Scheme)

Industrial Chemistry

IC HC : 4.02 Organometallic and Bioinorganic Chemistry

Time: 3 hrs]

[Max.Marks: 75

Instructions : 1) Answer any TEN subdivisions from Part - A, any TWO questions from Part- B and any THREE questions from Part - C.
2) Marks are indicate at the right side.

PART - A

(1X10=10)

Answer the following questions.

1. a) What are sandwich compounds? Give example.
- b) Differentiate between active and passive transport.
- c) Write any two methods of preparation of metal carbonyls.
- d) What are water gas shift reactions? Give its applications.
- e) What are the laminations of synthetic oxygen carriers?
- f) What is Xanthin Oxidase? Write its functions.
- g) What are quantum dots? Mention their preparation.
- h) Comment on the deficiency of Cu and Co in biological system.
- i) Write the structure of Zeise's Salt. Mention its structural features.
- j) Why the molecular nitrogen is inert? Explain.

PART - B

Answer any TWO questions.

(2X10=20)

2. a) Discuss Ziegler - Natta polymerization process.
- b) Write a note on gold and silver nanoparticles for photodynamic therapy. 5+5
3. a) Discuss the mechanism of drug action of cisplatin as an anticancer drug. What are its side effects?
- b) Discuss the structural features of nitrogenase. Give the nitrogen fixation by it.

5+5

Contd...2

3. a) Explain Newton's law of convection. (5+5=10)
b) Explain the heat transfer phenomena through a hollow cylinder. (5+5=10)
4. a) Explain the diffusion phenomena through a sphere. (5+5=10)
b) Write a note on the diffusion with chemical reaction at a boundary. (5+5=10)
5. a) Explain the principle and working of simple distillation. (5+5=10)
b) Write a note on rate of drying curves. (5+5=10)

PART - C

Answer any THREE questions. (15X3=45)

6. a) Explain the overall mechanical balance equation and it's applications. (15)
b) Write the various types of frictions encountered in industrial pipelines. (5)
c) Show that the discharge velocity of a fluid through a nozzle at the bottom of a tank is proportional to the square root of the head. (5+5+5=15)
7. a) Write the significance of Grashof number. (4)
b) With the help of neat diagram explain the working principle of a double pipe heat exchanger. (5+6=11)
c) Explain the heat transfer by radiation. (4+5+6=15)
8. a) Explain the convective mass transfer phenomena. (5)
b) Discuss the principle of equimolar counter diffusion phenomena. (5)
c) Write a note on diffusion through biological gels. (5+5+5=15)
9. a) Discuss the principle and working of multiple effect evaporators. (5)
b) Explain the basic theory of crystallization. (5)
c) Write a note on flash and rectification method of distillation. (5+5+5=15)

Fourth Semester M.Sc., Degree Examinations**October / November 2022***(CBCS Scheme)***Industrial Chemistry****IC HC : 4.02 Organometallic and Bioinorganic Chemistry**

Time: 3 hrs]

[Max.Marks: 75

Instructions : 1) Answer any TEN subdivisions from Part - A, any TWO questions from Part- B and any THREE questions from Part - C.
2) Marks are indicate at the right side.

PART - A

Answer the following questions.

(1X10=10)

1.
 - a) What are sandwich compounds? Give example.
 - b) Differentiate between active and passive transport.
 - c) Write any two methods of preparation of metal carbonyls.
 - d) What are water gas shift reactions? Give its applications.
 - e) What are the laminations of synthetic oxygen carriers?
 - f) What is Xanthin Oxidase? Write its functions.
 - g) What are quantum dots? Mention their preparation.
 - h) Comment on the deficiency of Cu and Co in biological system.
 - i) Write the structure of Zeise's Salt. Mention its structural features.
 - j) Why the molecular nitrogen is inert? Explain.

PART - B

Answer any TWO questions.

(2X10=20)

2.
 - a) Discuss Ziegler - Natta polymerization process.
 - b) Write a note on gold and silver nanoparticles for photodynamic therapy. 5+5
3.
 - a) Discuss the mechanism of drug action of cisplatin as an anticancer drug. What are its side effects?
 - b) Discuss the structural features of nitrogenase. Give the nitrogen fixation by it.

5+5

Contd...2

4. a) Explain any four biochemical functions catalyzed by Vitamin B₁₂ coenzyme.
b) Describe the various steps involved in Wacker's process of oxidation of olefins. 5+5
5. a) What is the significance of ion transport across cell membranes? Explain how the concentration of Na⁺ and K⁺ in the intracellular fluids is regulated?
b) Discuss the preparation of bis ferrocene complexes. Explain their structure and reactivity. 5+5

PART - C**Answer any THREE questions.****(15X3=45)**

6. a) Discuss hydrogenation of olefins with suitable example.
b) Define oxidative addition reaction. Explain its radical and ionic mechanism.
c) Discuss the Fischer – Tropsch process and the mechanism involved in the reaction. 5+5+5
7. a) Discuss the significance of synthetic oxygen carrier with examples.
b) Describe the role of PSI and PS II in cleavage of water.
c) Discuss the structural features of Hemoglobin and myoglobin. 5+5+5
8. a) Discuss the structure properties of catalase and peroxidases. How do they function?
b) What are ferredoxins? Discuss the structural features of any two ferredoxins.
c) Discuss the clinical symptoms due to deficiency and excess of the metals iron and magnesium. 5+5+5
9. a) Discuss the Nickel and Cobalt nanoparticles in diagnostic and cancer treatment.
b) What are the structural features of cytochrome P-450? Discuss the mechanism of activity.
c) Discuss the stability of organometallic complexes on the basis of 16 and 18 – electron rules. Explain the limitations of 18 – electron rule with suitable examples. 5+5+5

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Fourth Semester M.Sc., Degree Examinations

OCTOBER/NOVEMBER 2022

(C.B.C.S Scheme)
CHEMISTRY

Paper: Ch. SC 4.1: ANALYTICAL CHEMISTRY – IV

Time: 3 hrs]

[Max. Marks: 75

Note : 1) Answer Part – A and any FIVE questions from Part – B

2) Figures to the right indicate marks.

SECTION – A

1. *Answer the following:* 10 x 2 = 20
- a) State nitrogen rule and give its significance in structural elucidation.
 - b) How can you differentiate p-nitroaniline from m-nitroaniline using ¹HNMR spectroscopy?
 - c) Define hydrogen deficiency index, write the general formula to predict the H-index in molecules.
 - d) State Bragg's law, give its mathematical equation.
 - e) Calculate the Miller indices for the following planes with intercepts are (a,-2b,-3c) and (2a,2b, 3c)
 - f) Write Wierl equation, give its significance
 - g) List the advantages and disadvantages of automation in chemical analysis
 - h) Differentiate between static and dynamic thermogravimetry.
 - i) Write the principle of Auger electron spectroscopy (AES).
 - j) Define the term solid surface and write the principle of AFM.

SECTION – B

Answer any FIVE the following questions:

5 × 11 = 55

2. a) With illustrative examples, explain the sequential steps involved in the structural elucidation of organic compounds.

Contd..... 2

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- b) An organic compound containing C, H and O only showed abundant MS peaks at M^+ (m/z 136), base peak (m/z 91) and fragment ion (m/z 45). Other spectral data is given below:
 UV (λ_{\max} , nm): 229 and 257.
 IR (ν_{\max} , cm^{-1}): 1710
 1H NMR (δ ppm): 7.2(5H, s), and 3.5(2H, s).
 Deduce the structure of the compound and predict the principal ions in its MS. (5 + 6 = 11)
3. a) A hydrocarbon A, containing 85.7% carbon and 14.3% hydrogen, gave the following spectral data. Deduce the structure of the hydrocarbon.
 UV: Transparent above 210 nm.
 IR (ν_{\max} , cm^{-1}): 3022(m), 1656(m), 965(s)
 1H NMR (δ ppm): 1.60 (d), 5.55 (q), Integration ratio 3:1.
- b) An organic compound A (Mol. Formula $C_9H_{10}O_2$) exhibits the following spectral data:
 IR (cm^{-1}): 1745 (s), 1225 (br, s), 749 (s), 697(s)
 UV (λ_{\max} in nm): 268, 264, 262, 257
 1H NMR (δ ppm): 1.96(3H, s), 5.00(2H, s), 7.22(5H, s).
 Deduce the structure of the compound. (5 + 6 = 11)
4. a) Explain the structural analysis of NaCl using rotating crystal method.
 b) Discuss the elucidation of structure of simple gas phase molecules using electron diffraction. (5 + 6 = 11)
5. a) Write a note on Ramachandran diagram.
 b) Explain the elucidation of structure of magnetically ordered unit cell using electron diffraction. (5 + 6 = 11)
6. a) Write the principle of flow injection analysis and explain any one application.
 b) Explain the instrumentation of DSC. (5 + 6 = 11)
7. a) Write the construction and working of CHN analyser.
 b) Taking suitable examples, discuss application of TGA in analysis of polymers and inorganic compounds. (5 + 6 = 11)

Contd.....3



- 8. a) Write a note on scanning tunneling microscope.
- b) Discuss the instrumentation and applications of X-ray photoelectron spectroscopy (XPS) (5 + 6 = 11)

- 9. a) Write a note on laser microprobe mass spectrometry.
- b) Discuss the basic principle, instrumentation and applications of scanning electron microscopy (SEM). (5 + 6 = 11)

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Fourth Semester M.Sc., Degree Examinations**OCTOBER/NOVEMBER 2022**

(C.B.C.S Scheme)

CHEMISTRY**Paper: Ch. SC 4.1: ANALYTICAL CHEMISTRY – IV**

Time: 3 hrs]

[Max. Marks: 75

- Note :** 1) Answer **Part – A** and any **FIVE** questions from **Part – B**
2) Figures to the right indicate marks.

SECTION – A1. **Answer the following:**

10 x 2 = 20

- State nitrogen rule and give its significance in structural elucidation.
- How can you differentiate p-nitroaniline from m-nitroaniline using $^1\text{H NMR}$ spectroscopy?
- Define hydrogen deficiency index, write the general formula to predict the H-index in molecules.
- State Bragg's law, give its mathematical equation.
- Calculate the Miller indices for the following planes with intercepts are (a,-2b,-3c) and (2a,2b, 3c)
- Write Wierl equation, give its significance
- List the advantages and disadvantages of automation in chemical analysis
- Differentiate between static and dynamic thermogravimetry.
- Write the principle of Auger electron spectroscopy (AES).
- Define the term solid surface and write the principle of AFM.

SECTION – B**Answer any FIVE the following questions:**

5 x 11 = 55

- With illustrative examples, explain the sequential steps involved in the structural elucidation of organic compounds.

Contd.....2

- b) An organic compound containing C, H and O only showed abundant MS peaks at M^+ (m/z 136), base peak (m/z 91) and fragment ion (m/z 45). Other spectral data is given below:

UV (λ_{\max} , nm): 229 and 257.

IR (ν_{\max} , cm^{-1}): 1710

1H NMR (δ ppm): 7.2(5H, s), and 3.5(2H, s).

Deduce the structure of the compound and predict the principal ions in its MS.

(5 + 6 = 11)

3. a) A hydrocarbon A, containing 85.7% carbon and 14.3% hydrogen, gave the following spectral data. Deduce the structure of the hydrocarbon.

UV: Transparent above 210 nm.

IR (ν_{\max} , cm^{-1}): 3022(m), 1656(m), 965(s)

1H NMR (δ ppm): 1.60 (d), 5.55 (q), Integration ratio 3:1.

- b) An organic compound A (Mol. Formula $C_9H_{10}O_2$) exhibits the following spectral data:

IR (cm^{-1}): 1745 (s), 1225 (br, s), 749 (s), 697(s)

UV (λ_{\max} in nm): 268, 264, 262, 257

1H NMR (δ ppm): 1.96(3H, s), 5.00(2H, s), 7.22(5H, s).

Deduce the structure of the compound.

(5 + 6 = 11)

4. a) Explain the structural analysis of NaCl using rotating crystal method.

- b) Discuss the elucidation of structure of simple gas phase molecules using electron diffraction.

(5 + 6 = 11)

5. a) Write a note on Ramachandran diagram.

- b) Explain the elucidation of structure of magnetically ordered unit cell using electron diffraction.

(5 + 6 = 11)

6. a) Write the principle of flow injection analysis and explain any one application.

- b) Explain the instrumentation of DSC.

(5 + 6 = 11)

7. a) Write the construction and working of CHN analyser.

- b) Taking suitable examples, discuss application of TGA in analysis of polymers and inorganic compounds.

(5 + 6 = 11)

8. a) Write a note on scanning tunneling microscope.
b) Discuss the instrumentation and applications of X-ray photoelectron spectroscopy (XPS) (5 + 6 = 11)
9. a) Write a note on laser microprobe mass spectrometry.
b) Discuss the basic principle, instrumentation and applications of scanning electron microscopy (SEM). (5 + 6 = 11)

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Fourth Semester M.Sc., Degree Examinations**OCTOBER/NOVEMBER 2022**

(C.B.C.S Scheme)

CHEMISTRY**Paper: Ch. SC 4.1: ANALYTICAL CHEMISTRY – IV**

Time: 3 hrs]

[Max. Marks: 75

Note : 1) Answer **Part – A** and any **FIVE** questions from **Part – B**

2) Figures to the right indicate marks.

SECTION – A1. **Answer the following:**

10 x 2 = 20

- State nitrogen rule and give its significance in structural elucidation.
- How can you differentiate p-nitroaniline from m-nitroaniline using $^1\text{H NMR}$ spectroscopy?
- Define hydrogen deficiency index, write the general formula to predict the H-index in molecules.
- State Bragg's law, give its mathematical equation.
- Calculate the Miller indices for the following planes with intercepts are (a,-2b,-3c) and (2a,2b, 3c)
- Write Wierl equation, give its significance
- List the advantages and disadvantages of automation in chemical analysis
- Differentiate between static and dynamic thermogravimetry.
- Write the principle of Auger electron spectroscopy (AES).
- Define the term solid surface and write the principle of AFM.

SECTION – B**Answer any FIVE the following questions:**

5 x 11 = 55

- a) With illustrative examples, explain the sequential steps involved in the structural elucidation of organic compounds.

Contd.....2

- b) An organic compound containing C, H and O only showed abundant MS peaks at M^+ (m/z 136), base peak (m/z 91) and fragment ion (m/z 45). Other spectral data is given below:

UV (λ_{\max} , nm): 229 and 257.

IR (ν_{\max} , cm^{-1}): 1710

1H NMR (δ ppm): 7.2(5H, s), and 3.5(2H, s).

Deduce the structure of the compound and predict the principal ions in its MS.

(5 + 6 = 11)

3. a) A hydrocarbon A, containing 85.7% carbon and 14.3% hydrogen, gave the following spectral data. Deduce the structure of the hydrocarbon.

UV: Transparent above 210 nm.

IR (ν_{\max} , cm^{-1}): 3022(m), 1656(m), 965(s)

1H NMR (δ ppm): 1.60 (d), 5.55 (q), Integration ratio 3:1.

- b) An organic compound A (Mol. Formula $C_9H_{10}O_2$) exhibits the following spectral data:

IR (cm^{-1}): 1745 (s), 1225 (br, s), 749 (s), 697(s)

UV (λ_{\max} in nm): 268, 264, 262, 257

1H NMR (δ ppm): 1.96(3H, s), 5.00(2H, s), 7.22(5H, s).

Deduce the structure of the compound.

(5 + 6 = 11)

4. a) Explain the structural analysis of NaCl using rotating crystal method.

- b) Discuss the elucidation of structure of simple gas phase molecules using electron diffraction.

(5 + 6 = 11)

5. a) Write a note on Ramachandran diagram.

- b) Explain the elucidation of structure of magnetically ordered unit cell using electron diffraction.

(5 + 6 = 11)

6. a) Write the principle of flow injection analysis and explain any one application.

- b) Explain the instrumentation of DSC.

(5 + 6 = 11)

7. a) Write the construction and working of CHN analyser.

- b) Taking suitable examples, discuss application of TGA in analysis of polymers and inorganic compounds.

(5 + 6 = 11)

Contd.....3

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8. a) Write a note on scanning tunneling microscope.
b) Discuss the instrumentation and applications of X-ray photoelectron spectroscopy (XPS) (5 + 6 = 11)
9. a) Write a note on laser microprobe mass spectrometry.
b) Discuss the basic principle, instrumentation and applications of scanning electron microscopy (SEM). (5 + 6 = 11)

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Fourth Semester M.Sc., Degree Examinations

OCTOBER/NOVEMBER 2022

(C.B.C.S Scheme)

CHEMISTRY

Paper: Ch. SC 4.4: PHYSICAL CHEMISTRY – IV

Time: 3 hrs]

[Max. Marks: 75

Note : 1) Answer **Part – A** and any **FIVE** questions from **Part – B**

2) Figures to the right indicate marks.

PART – A

1. Answer the following:

10 x 2 = 20

- How can you separate semiconducting carbon nanotubes from the mixture of semiconducting and conducting nanotubes.
- Explain the term 'Photo – fragmentation'.
- What are magic numbers? Explain with examples.
- Outline the basic principle of electroplating.
- What is limiting current density? Explain.
- Explain the importance of hydrogen overvoltage in the electrodeposition of metals.
- State and explain phase rule for one-component two phase system.
- With suitable examples differentiate between dry corrosion and wet corrosion.
- Mention any two advantages and two limitations of electroorganic synthesis over conventional synthesis.
- Indicate the variables in electrosynthesis of an organic compound.

PART – BAnswer any **FIVE** of the following questions:

5 x 11 = 55

- What are nanoparticles? Discuss the theoretical modeling of nanoparticles
 - With neat labeled diagrams explain the laser evaporation and pulsed laser methods to synthesize nanoparticles.

5 + 6 = 11

Contd.....2



3. a) Discuss the synthesis and structure of carbon nanotubes.
b) Describe the various steps involved in the synthesis of nanomaterials using sol-gel method. 5 + 6 = 11
4. a) With a neat labeled diagram explain the Hull-cell experimental method for the optimization of electroplating bath solutions.
b) Write a note on pre-plating process and surface preparation. 5 + 6 = 11
5. a) Describe the experimental procedures for electroplating of Cu and Zn.
b) Explain any four experimental methods to testify the corrosion inhibition of electroplates. 5 + 6 = 11
6. a) What is corrosion? With illustrative examples, classify the types of corrosion.
b) Discuss any four methods for the prevention of corrosion. 5 + 6 = 11
7. a) Draw and explain phase diagram for sulphur system.
b) With suitable example, discuss the phase diagram for three component system (two solids + one liquid). 5 + 6 = 11
8. a) What is electroorganic synthesis? Elaborate the basic laboratory setup used for electro-synthesis.
b) Discuss the role of electrode potential, solvent and supporting electrolyte in electro-organic synthesis. 5 + 6 = 11
9. a) Explain in detail the electro-organic synthesis of carboxylic acid from primary alcohols.
b) With illustrative examples explain the electro-oxidation and electro-reduction reactions of sulphur and nitro compounds. 5 + 6 = 11

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Fourth Semester M.Sc., Degree Examinations
OCTOBER/NOVEMBER 2022

(C.B.C.S Scheme)

CHEMISTRY

Paper: Ch. SC 4.2: INORGANIC CHEMISTRY – IV

Time: 3 hrs]

[Max. Marks: 75

Note : 1) Answer **Part – A** and any **FIVE** questions from **Part – B**

2) Figures to the right indicate marks.

PART – A

1. *Answer the following:*

10 x 2 = 20

- a) What is PAN? Mention its toxic effects.
- b) What are molecular switches? Write their significances.
- c) What is Wilson's disease? Comment on its treatment.
- d) What are blue copper proteins? Write their functions.
- e) Name any two enzymes that contain molybdenum and mention their functions.
- f) Comment on the thermodynamic and kinetic aspects of nitrogen fixation.
- g) Define the terms K^+ potential and Na^+ potential.
- h) What is magnetic levitation?
- i) Why Singlet oxygen is toxic but not triplet oxygen ?
- j) What is the role of carbonic anhydrase in biological system?

PART – B

Answer any FIVE of the following questions:

5 × 11 = 55

2. a) Write a note on metal complexes in diagnosis - Gd complexes in magnetic resonance imaging (MRI).
- b) Explain the mechanism of conduction, doping, properties, engineering and biological applications of polypyrrole polymer (PPP). (5 + 6 = 11)

Contd.....2

3. a) Discuss the clinical symptoms due to deficiency and excess of the metals Fe, Cu and Mn.
- b) Write the structure of chlorophyll. Explain the role of Mg^{2+} in photosynthesis
(5 + 6 = 11)
4. a) Discuss the biochemical effects of As, Cd and Hg.
- b) Discuss the structural features of nitrogenase. Give the nitrogen fixation by it.
(5 + 6 = 11)
5. a) Classify the ionophores in terms of the mechanism of ion transport. How do you distinguish them?
- b) Describe the role of PS I and PS II in cleavage of water.
(5 + 6 = 11)
6. a) Discuss the role of haemoglobin in oxygen Transport from lungs to tissues
- b) Discuss the structural features of hemerythrin and hemocyanin.
(5 + 6 = 11)
7. a) Name any two synthetic oxygen carriers and give their structural features.
- b) Discuss the structural and biochemical aspects of cytochrome c-oxidase.
(5 + 6 = 11)
8. a) Explain any four biochemical functions catalyzed by vitamin B_{12} coenzyme.
- b) Distinguish between type -I and II superconductors. Discuss the preparation and applications of $Y_1Ba_2Cu_3O_8$.
(5 + 6 = 11)
9. a) What are ferredoxins? Discuss the structural features of any two ferredoxins.
- b) Define BOD and COD. Explain the three processes of water purifications.
(5 + 6 = 11)

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