(101CH24)

M.Sc. DEGREE EXAMINATION, JUNE/JULY 2025.

First Semester

Chemistry

INORGANIC CHEMISTRY – I

Time : Three hours Maximum : 70 marks

Answer ALL questions.

UNIT I

1. (a) Use VSEPR theory to explain the molecular geometries of SF_4 and ClF_3. (4)

Or

(b) Discuss symmetric and unsymmetric hydrogen bonding in inorganic molecules with suitable examples. (4)

2. (a) Draw and explain Walsh diagrams for BeH_2 and H_2O molecules. What do they indicate about molecular structure? (10)

Or

(b) Discuss the nature and evidence of $p\pi - d\pi$ bonding in transition metal oxoanions. (10)

UNIT II

3. (a) What are tetragonal distortions? Explain with an example. (4)

Or

(b) Define the spectrochemical series. How is it experimentally determined? (4)

4. (a) For an octahedral complex of a d^7 ion, compare CFSE values in high-spin and low-spin states. (10)

Or

(b) Explain the Jahn-Teller effect and its impact on the geometry and stability of coordination complexes. (10)

UNIT III

5. (a) How does the presence of π-acceptor ligands affect the splitting parameter Δ_0? (4)

Or

(b) Describe the concept of resonance in NO_2^- and O_3 molecules. (4)

6. (a) Describe Molecular Orbital Theory for square planar complexes with emphasis on σ and π interactions. (10)

Or

(b) Compare the predictions of MOT and CFT for tetrahedral complexes. (10)

UNIT IV

7. (a) What is meant by the statistical effect in stepwise stability constants? (4)

Or

(b) Explain how HSAB theory helps in predicting the stability of metal-ligand complexes. (4)

8. (a) Explain the procedure of determining formation constants using pH-metric (Bjerrum's) method. (10)

Or

(b) Discuss the selectivity of crown ethers and cryptands in complexation reactions. (10)

UNIT V

9. (a) State Wade's rules. Apply them to determine the structure of B_5H_9. (4)

Or

(b) What are S-N ring compounds? Explain their synthesis and structure briefly. (4)

10. (a) Describe the preparation and applications of P-N ring systems in inorganic chemistry. (10)

Or

(b) Write a note on the preparation and structure of isopoly and heteropoly anions of molybdenum and tungsten. (10)

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M.Sc. DEGREE EXAMINATION, JUNE/JULY 2025.

First Semester

Chemistry

ORGANIC CHEMISTRY – I

Time : Three hours Maximum : 70 marks

Answer ALL questions.

UNIT I

1. (a) Apply Huckel's rule to explain the aromaticity of cyclopentadienyl anion and tropylium cation. (4)

Or

(b) Write a note on antiaromatic and non-aromatic compounds with suitable examples. (4)

2. (a) Discuss the structure, aromatic character, and bonding in ferrocene. (10)

Or

(b) Explain the concepts of homoaromaticity and annulenes with examples. (10)

UNIT II

3. (a) Describe the Skraup synthesis of quinoline. (4)

Or

(b) Compare the aromaticity of pyrrole, furan, and thiophene. (4)

4. (a) Discuss the synthesis, structure determination and isoprene rule in relation to camphor. (10)

Or

(b) Explain the structure and synthesis of β-carotene. How do terpenes follow the isoprene rule? (10)

UNIT III

5. (a) Explain D-L and R-S nomenclature with suitable examples. (4)

Or

(b) Differentiate between stereospecific and stereoselective reactions with examples. (4)

6. (a) Explain molecular symmetry and chirality. Illustrate with appropriate symmetry elements. (10)

Or

(b) Discuss geometrical isomerism. How is the E/Z configuration of aldoximes and ketoximes determined? (10)

UNIT IV

7. (a) Define torsion angle. Use Klyne-Prelog terminology to describe the conformers of butane. (4)

Or

(b) Describe steric and stereoelectronic effects in the conformational stability of diastereomers. (4)

8. (a) Explain conformational preferences of 1, 2-dihalobutanes and ethylene glycol. (10)

Or

(b) Discuss the use of spectral methods in conformational analysis. (10)

UNIT V

9. (a) What is the significance of chair and boat conformations in cyclohexane? Draw their energy profiles. (4)

Or

(b) Write a note on conformational analysis of 1-butene. (4)

10. (a) Discuss the conformational analysis of decalin isomers. (10)

Or

(b) Explain the conformation and steric strain in sugars. (10)

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M.Sc. DEGREE EXAMINATION, JUNE/JULY 2025.

First Semester

Chemistry

FOUNDATION FOR CHEMISTRY

Time : Three hours Maximum : 70 marks

Answer ALL questions.

UNIT I

1. (a) Explain the working principle and indicator used in complexometric titration. (4)

Or

(b) Discuss secondary standards with examples and their preparation. (4)

2. (a) Describe complexometric and redox titrations. Compare their principles and indicators. (10)

Or

(b) Explain precipitation titrations with Mohr's and Volhard's method. (10)

UNIT II

3. (a) What are random and systematic errors? How are they minimized? (4)

Or

(b) Define mean deviation and standard deviation. How are they calculated? (4)

4. (a) Describe the t-test and its application in chemical data analysis. (10)

Or

(b) Discuss the classification of errors and explain their effects on results. (10)

UNIT III

5. (a) Define carbanions and discuss their stability factors. (4)

Or

(b) What are nucleophilic and electrophilic species? Give two examples each. (4)

6. (a) Discuss the generation, stability, and structure of nitrenes and free radicals. (10)

Or

(b) Differentiate between localized and delocalized bonding with suitable examples. (10)

UNIT IV

7. (a) What is a point group? Give examples for C_n and D_n groups. (4)

Or

(b) Define a group and a subgroup. Give one example of each in chemical symmetry. (4)

8. (a) How are matrices used to represent symmetry operations? Illustrate with C_{2v}. (10)

Or

(b) Write any character table and explain how it helps in spectroscopic analysis. (10)

UNIT V

9. (a) What is global warming? List its causes and consequences. (4)

Or

(b) Define lipids. Mention their types and biological functions. (4)

10. (a) Discuss the chemistry and biological importance of purines and pyrimidines. (10)

Or

(b) Explain the structure, types, and functional roles of carbohydrates. (10)

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M.Sc. DEGREE EXAMINATION, JUNE/JULY 2025.

First Semester

Chemistry

PHYSICAL CHEMISTRY – I

Time : Three hours Maximum : 70 marks

Answer ALL questions.

UNIT – I

1. (a) State and explain the Clausius-Clapeyron equation. Discuss its significance. (4)

Or

(b) What is entropy of mixing? Derive the expression for the entropy of mixing of ideal gases. (4)

2. (a) Derive the Gibbs-Helmholtz equation. How is it used to determine the temperature dependence of free energy? (10)

Or

(b) Derive the Van't Hoff reaction isotherm. Explain its significance in determining equilibrium constants. (10)

UNIT – II

3. (a) Derive the Young-Laplace equation for pressure difference across a curved surface.

(4)

Or

(b) Explain the principle and application of ESCA in surface analysis. (4)

4. (a) Derive the BET equation and explain how it is used to estimate surface area. (10)

Or

(b) Explain the Gibbs adsorption isotherm and its significance in surface chemistry. (10)

UNIT – III

5. (a) Define critical micelle concentration (CMC). Mention factors affecting CMC. (4)

Or

(b) What are microemulsions? How do they differ from regular emulsions? (4)

6. (a) Describe the process of micellization. Explain the thermodynamic factors involved. (10)

Or

(b) Discuss reverse micelles and their applications. (10)

UNIT – IV

7. (a) What is liquid junction potential? How is it determined experimentally? (4)

Or

(b) Define activity and activity coefficient. How are they determined using EMF methods? (4)

8. (a) State and derive the Debye Hückel limiting law. Discuss its verification and limitations. (10)

Or

(b) What are conductometric titrations? Describe one example with suitable explanation. (10)

UNIT – V

9. (a) Differentiate between primary and secondary salt effects. (4)

Or

(b) Explain the term "steric factor" in collision theory. (4)

10. (a) Describe the Lindemann-Hinshelwood theory of unimolecular reactions. (10)

Or

(b) Explain the Rice-Herzfeld mechanism for the decomposition of acetaldehyde. (10)

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