

Dissemination of Education for Knowledge, Science and Culture”

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Vivekanand College, Kolhapur
(An Empowered Autonomous Institute)



DEPARTMENT OF CHEMISTRY

M. Sc. Entrance Examination 2025

SYLLABUS

(M. Sc. Organic and Analytical Chemistry)

Nature of Question Paper

- Entrance focuses on chemical science with 50 compulsory questions of an objective nature.
- Each question carries 2 marks and no negative marks.
- Total Marks: 100
- Duration of examination is 60 minutes.
- There are 50 Multiple Choice Questions (MCQs), each carries 2 marks.
- M. Sc. Entrance Examination syllabus will be based syllabus given bellow.
- Candidates are advised to prepare accordingly.
- Entrance will arrange in **ONLINE** mode

Syllabus

- 1) Atomic Structure:** Bohr's theory of hydrogen atom and its limitations, Wave particle duality, Heisenberg uncertainty principle, Quantum numbers and their significance, Shapes of s, p and d atomic orbitals, Electrons filling rules in various orbitals: Aufbau's principle, Hund's rule of maximum multiplicity, Pauli's exclusion principle.
- 2) Valence Bond Theory:** Formation of co-ordinate covalent bond in $\text{BF}_3\text{-NH}_3$ and $[\text{NH}_4]$, double salt and complex salt, Postulates of Werner's theory, ligands, co-ordination compounds, Coordination number; IUPAC system of nomenclature, Structural and stereoisomerism in complexes with coordination numbers 4 and 6; Geometrical isomerism, Optical isomerism, structural isomerism- Ionization isomerism, hydrate isomerism, coordination isomerism, linkage isomerism and co-ordination position isomerism, postulates of VBT.
- 3) Solid State Chemistry:** Structures of Solids, Importance of solid state chemistry, Crystals: size and shape of crystals, interfacial angles in crystals, Designation of planes in crystals: Miller indices, Classification of solids on the basis of bonding, Explanation of terms viz. crystal lattice, lattice points, unit cells and lattice constants, Closest packing of rigid spheres (hcp, ccp) packing density in simple cubic, bcc, fcc and hcp lattices (numerical problems expected), Structures of metallic solids,

Tetrahedral and octahedral interstitial voids in ccp lattice, tetrahedral holes, Defects in crystal structures; effects of Schottky and Frenkel defects.

- 4) **Bio-Inorganic Chemistry:** Essential and trace elements in biological process, Metalloporphyrins: hemoglobin and myoglobin, Role of metal ions present in biological systems with special reference to Na^+ , K^+ , Mg^{2+} and Ca^{2+} ions, Na/K pump, Role of Mg^{2+} ions in energy production and chlorophyll, Role of Ca^{2+} in blood clotting, stabilization of protein structures and structural role (bones)
- 5) **Stereochemistry:** Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations, Concept of chirality, Configuration: Geometrical and Optical isomerism; Enantiomers, Diastereomers and Meso compounds. D and L, R/S, and E / Z Nomenclature, Conformations with respect to ethane, butane and cyclohexane,
- 6) **Name Reactions:** Beckmann, Benzilic acid, Baeyer Villiger, Diels -Alder reaction, Mannich Reaction, Michael Reaction, Fries, Dienone-Phenol rearrangement.
- 7) **Synthetic Reagents:** DDQ, OsO_4 , N-bromosuccinamide, Zn-Hg, DCC, LiAlH_4 , CAN, Raney Ni, Diazomethane.
- 8) **Ultra-Violet (UV) Spectroscopy:** Beer-Lamberts law, absorption of U.V. radiation by organic molecule leading to different excitation, Terms used in U.V. Spectroscopy- Chromophore, Auxochrome, Bathochromic shift, hypsochromic shift, hyperchromic and hypochromic effect, Modes of electromagnetic transitions. Effect of conjugation on position of U.V. band, Calculation of λ -max by Woodward and Fisher rules for dienes and enones systems.
- 9) **Infra-Red (IR) SpectroscopyL:** Principle, Instrumentation, Fundamental modes of vibrations, Condition for absorption of IR radiations, Regions of I.R. Spectrum, fundamental group region, finger print region, Hooks Law for Calculation of vibrational frequency, IR Sampling, Factors affecting on IR absorption frequency, Characteristic of I.R. absorption of following functional groups Alkanes, alkenes, alkynes, Alcohol and phenols, Ethers, Carbonyl compounds, Amines, Nitro com, Aromatic Compounds.
- 10) **Thermodynamics:** Basic terms used in thermodynamic, study, Zeroth law of thermodynamic, First law of thermodynamics: Mathematical equation, sign conventions, statements of first law and its limitations. Spontaneous and non-spontaneous processes, Second law of thermodynamics. Heat engine, Carnot's Cycle and efficiency of heat engine.

11) Chemical Kinetics: The concept of reaction rates, order and molecularity of a reaction, zero, first order reaction (Derivation not expected). Second order reactions (both for equal and unequal concentrations of reactants) of general equations for rate constants, Characteristic properties of second order reaction, examples. General methods for determination of order of a reaction, Concept of activation energy: Activated complex theory and Collision Theory and calculation of activation energy by Arrhenius equation.

12) Photochemistry: Laws of photochemistry: Grothus-Draper law, Lambert law, Lambert-Beer's law, Stark-Einstein law. Quantum yield, reasons for high and low quantum yield, Factors affecting Quantum yield, Photosensitized reactions–dissociation of H_2 , photosynthesis, Photo-dimerization of anthracene, decomposition of HI and HBr, Photophysical and photochemical processes, Jablonaski diagram depicting various processes occurring in the excited state: Qualitative description of fluorescence and phosphorescence, Chemiluminescence, Electroluminescence.
