

RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE POST OF ASSISTANT PROFESSOR IN CHEMISTRY FOR COLLEGE EDUCATION DEPARTMENT

PAPER – II

1 Chemistry of Non-Transition and Inner Transition Elements:

(i) Preparation, properties and bonding in diborane and higher boranes, polyhedral borane anions and carboranes, borazines, borane nitrile. Silicones and silicates, phosphonitrilic compounds, interhalogen Xenon compounds.

(ii) Lanthanides and actinides Contraction, oxidation states, super heavy elements, analytical and Medicinal applications.

2 Organometallic Compounds: Synthesis, structure, bonding, reactions and reactivity, Applications in homogeneous catalysis.

Cage and Cluster Compounds.

3 Bioinorganic and Supra Molecular Chemistry: Iron storage and transport, oxygen carriers and transport, electron transfer reactions, Metalloenzymes; Zinc Iron and Copper enzymes, Vita B₁₂ Co-enzyme. Metal deficiency and disease.

Supra molecular reactions and Catalysis, supra molecular devices.

4 Group Theory: Symmetry elements and operations, point groups, Mulliken symbol, Character Table, Great Orthogonality Theorem and application hybridization and vibrational Spectroscopy. Concepts of inorganic ESR, Mass and IR Spectroscopy.

5 Statistical Data Analysis and Analytical Technique: Mean, Mode, Median, Standard Deviation, Regression analysis and Correlation principles and applications of AAS, DTA, TGA. Partition and adsorption chromatography.

- 6 **Pericyclic Reactions:** Molecular orbital symmetry, Frontier orbitals of ethylene, buta-1,3-diene, hexa- 1,3,5-triene. Classification of pericyclic reactions. Woodward Hoffmann correlation diagrams. electrocyclic and cycloaddition reactions and sigmatropic rearrangements, eg. Cope, Claisen, Aaza-Cope, Sommllet-Hauser rearrangements.
- 7 **Organic Transformation and Reagents:** Functional group interconversions, oxidative and reductive processes. Common catalyst and reagents (organic, inorganic organometallic and enzymatic like LiAlH_4 , NaBH_4 , iodobenzene diacetate, thallium (III) nitrate RuO_4 , OsO_4 , CH_3Li , $(\text{CH}_3)_2\text{Hg}$, $(\text{CH}_3)_2\text{Zn}$ etc.
- 8 **Synthetic Application of Organometallics and Reactive Methylene Compounds:** Grignard reagent, Organo lithium compounds, Aceto acetic ester and Malonic ester. Their Synthesis, identification, estimation and important applications in the Synthesis of organic compounds.
- 9 **Organic Photochemistry:** Jablonski diagram, photochemistry of alkenes, carbonyl compounds and aromatic compounds, photodegradation of polymers, singlet molecular oxygen reactions. Paterno-Buchi reaction, Norrish Type I and II reactions and Barton reaction.
- 10 **Natural Products and Medicinal Chemistry:** Classification and structure of Carbohydrates, proteins, nucleic acids and fatty acids. Classification, Nomenclature and isolation techniques of Terpenoids, Carotenoids, Alkaloids and terpenes. Drug design and introduction to pharmacodynamics, Some Cardio Vascular Psychotic and Antipsychotic drugs.
- 11 **Quantum Chemistry:** Basic principles and application of quantum mechanics. Schrodinger equation, hydrogen atom, hydrogen molecule ion and angular momentum. Variational and Perturbational method, term symbols and spectrascopic status. Atomic structure and its theoretical treatment.
- 12 **Solid State:** Types of solids, Bravis lattices, determination of unit cell parameters, defects in solids- Frenkel, Schottky, Point, Line and Plane defects.

Structural classification of binary and ternary compounds, diffraction techniques, bonding, thermal, electrical and magnetic properties. Insulators, Semiconductors and Super conductors.

- 13 Statistical Thermodynamics and Phase equilibria:** Boltzmann distribution law, kinetic theory of gases, partition function: vibrational, rotational, translational and electronic properties and applications of partition functions and the relation with thermodynamic quantities. Basic principles of phase equilibria.
- 14 Physical Chemistry of Polymers:** Molecular weight determination of polymers: Number average and Weight average molecular weights, End-group analysis, Sedimentation, Light scattering and Viscosity methods. Stereochemistry and mechanism of polymerization. Crystallisation and melting in polymers. Relation between T_m and T_g .
- 15 Colloids and Surface Chemistry:** Absorption and Adsorption, Adsorption isotherms and surface area analysis, Types and properties of colloids, Micelles, Micelle action and Critical Micelle Concentration. Applications of colloids.

Note :- Pattern of Question Paper

1. Objective type paper
2. Maximum Marks : 75
3. Number of Questions : 150
4. Duration of Paper : Three Hours
5. All questions carry equal marks.
6. Medium of Competitive Exam: Bilingual in English & Hindi
7. There will be Negative Marking.