

RAJSTHAN PUBLIC SERVICE COMMISSION, AJMER
SYLLABUS FOR SCREENING TEST FOR THE POST OF
LECTURER - CHEMISTRY
TECHNICAL EDUCATION DEPARTMENT

1. Chemistry of Transition elements : Electronic configuration, variable oxidation states, magnetic properties, charge transfer spectra, metal atom clusters, Stereochemistry of co-ordination compounds, their IUPAC names, metal-ligand bonding, Ligand field theory of complexes, CFSE, Jahn-Teller effect, spectral and magnetic properties of complexes. Metallic corrosion, its chemistry and prevention, corrosion control methods.
2. Lanthanides and Actinides : General characteristics, Electronic configuration, Oxidation states, complex forming tendency, magnetic and spectral properties, Lanthanide contraction, Lanthanides and Actinides as shift reagent and use in Industry, super heavy elements.
3. Chemistry of non-transition elements: Preparation, properties and bonding in diborane and higher boranes, polyhedral borane anions and carboranes, Borazines, Silicones and Silicates (structure and applications in Industry and Technology), phosphonitrilic compounds (phosphazenes), Interhalogen compounds.
4. Non –aqueous solvents : Classification of solvents, Physical properties and uses of solvents like DMSO, THF and DMF. Role of solvent in chemical reactions. Reaction and solvent action in liquid sulphur dioxide liquid ammonia, Dinitrogen tetroxide and Hydrogen fluoride, The solvosystem in acids and bases.
5. Organometallic chemistry of Transition & Non-transition elements: Organometallic compounds of Alkenes, Cyclopentadienyls, Arenes, their synthesis, structure and bonding-homogenous catalytic reaction, hydrogenation, hydroformylation, isomerisation and polymerization reactions.
6. Nuclear and radio chemistry :- Stability of the nucleus, Mass- Energy relationship for nuclear reaction, properties of nucleus, Nuclear models (The shell model, the liquid drop model , the fermi gas model, the collective model and the optical model). Nuclear reaction- (Specific nuclear reactions, photonuclear reactions and thermonuclear reactions), Energetics of nuclear reaction, fission and fusion reactions, spallation, fragmentation, stripping and pick up reactions, chemical effects of nuclear transformations, applications in chemical investigations and synthesis, radioisotopes – a source of electricity, radiation hazards and protection.
7. Water quality and Treatment of Waste Water : Determination of TDS, D.O., B.O.D., C.O.D., hardness, Nitrates , and Fluorides, pollution due to pesticides, detergents, fertilizers and petroleum, Principles of analytical methods of monitoring and control of pollutant sources, sewage disposal and treatment, primary, secondary and tertiary treatments, treatment of industrial Waste water, desalination, water management in arid and non-arid regions.
8. Inorganic Materials : Chemical composition and manufacturing methods of Glass, Ceramics, High-Tech Advanced Inorganic materials, superconductors, cement and marine chemicals.
9. IUPAC Nomenclature of organic compounds, Stereochemistry and conformational analysis, D-L notation, R-S notation, E-Z notation, conformations of alkanes and cycloalkanes, Enantiotropic and diastereotopic atoms, groups and faces, Racemisation, Resolution, retention & Walden Inversion, Stereospecific and stereoselective synthesis, Asymmetric synthesis.
10. Pericyclic Reactions : Molecular orbital theory, Electro cyclic reactions, Cycloadditions- antarafacial and suprafacial additions, Sigmatropic re-arrangements: Claisen, cope and aza-cope re-arrangement reactions.
11. Alcohols and Phenols : Preparations, chemical properties and uses of alcohols and phenols.
12. Aldehydes and Ketones : Preparations & chemical properties of aliphatic and aromatic carbonyl compounds, condensation – Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions, Hydrolysis of esters and amides, ammonolysis of esters.
13. Carboxylic acids and their derivatives: Preparation, properties and uses. Effect of substituents on acidity of Aliphatic & Aromatic carboxylic acids, Synthetic applications of aceto acetic ester and malonic ester.
14. Nitrogen containing organic compounds : Preparation, properties & uses of Aliphatic and aromatic nitro compounds. Aliphatic and aromatic amines: Basic nature of aliphatic and aromatic amines. Diazo compounds and their applications, azo dyes.

15. Spectroscopy : IR, UV, NMR and Mass spectroscopy – individual and combined applications for structural elucidation of organic / inorganic compounds. X-ray diffraction, Basic principles. Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density. Electron spin resonance spectroscopy. Basic principles, application to transition metal complexes (having one unpaired electron) including biological systems.
16. Organic photo chemistry : Jablonskii diagram, photochemistry of alkenes, carbonyl compounds and aromatic compounds. Paterno – Buchi reaction, Norrish type I & II reactions and Barton reaction.
17. Solid State : Elements of symmetry, crystal systems, Weiss and Miller indices, Law of rational indices, diffraction of X-rays from crystals, Bragg's equation, crystal structure of KCl and NaCl, Diamond and Graphite. Crystal defects. Distinction between metal, insulators and semi-conductors, super conductors, super conductivity and BCS theory of super conductivity.
18. Solution : Solubility of Gas in liquids, Henry's law and its applications. Solutions of solids in liquids. Nernst distribution law, its applications and limitations.
19. Thermodynamics : First law of thermodynamics, Joules law, Joule Thomson coefficient, inversion temperature. Expansion of ideal gases under isothermal and adiabatic condition for a reversible process. Second law of thermodynamics, Entropy, criteria of spontaneity, entropy changes in ideal gases and mixing of gases. Third law of thermodynamics, concept of fugacity and determination of fugacity.
20. Quantum Chemistry : Schrodinger equation to some model systems viz. particle in one dimensional box, particle in a three dimensional box, one dimensional simple harmonic oscillator, the rigid rotor, the hydrogen atom. Applications of variation method and perturbation theory to the Helium atom.
21. Electro Chemistry : Debye-Huckel-Onsager equation for strong electrolytes. Transport number. Determination of degree of dissociation, dissociation constant of weak acids and solubility product of sparingly soluble salts. Types of electrodes, electrode reactions and Nernst equation. Single electrode potential and Nernst hydration theory of electrode potential. Liquid junction potential. Determination of pH of the solution using quinhydrone and glass electrode by potentiometric method, polarography, methods of investigating electrode kinetics, electro chemical corrosion of metals.
22. Chemical Dynamics : Zero-order, First order and Second order integrated rate equation. Various methods of determination of order of the reaction. Half life of a reaction. Collision theory and transition state theory. Steady state treatment. Enzyme catalysed reactions. Michaelis Menten kinetics. Michaelis constant and its determinations, chain reactions and reactions of H_2-Br_2 . Fast reaction and methods to follow fast reactions.
23. Environmental Chemistry: Definition, principles and scope of Environmental Science, Chemistry of Air pollutants, Photochemical smog, Air and thermal pollution, Acid rain, sources of Noise pollution, water pollution, Green House effect, ozone layer depletion.

* * * * *

Pattern of Question Paper

1. Objective type paper
2. Maximum marks- 100
3. Number of questions 100
4. Duration of paper - 2 hours
5. All question carry equal marks
6. There will be negative marking

* * * * *