

RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR COMPETITIVE EXAMINATION FOR THE POST OF LECTURER IN CHEMISTRY FOR COLLEGE EDUCATION DEPARTMENT PAPER – I

- 1 **Chemical periodicity:** Periodic properties and group trends.
- 2 **Theories of chemical bonding:** VSEPR theory, LCAO, types of molecular orbitals, molecular orbital diagrams of homo and heteronuclear (diatomic and polyatomic) molecules.
- 3 **Acid and Bases :** Concepts of acids and bases, hard and soft acid base concepts.
- 4 **Transition metal chemistry:** 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, high and low spin complexes, CFSE, Jahn-Teller effect, spectral and magnetic properties of complexes.
- 5 **Nomenclature:** IUPAC nomenclature of organic compounds.
- 6 **Electronic displacements and aromaticity:** Inductive, electromeric, mesomeric and hyperconjugative effects, electrophiles, nucleophiles, free radicals. Resonance and its applications to organic compounds. Effect of structure on the dissociation constants of organic acids and bases. Hydrogen bond and its effects on the properties of organic compounds. Aromaticity, Huckel's rule and its applications. Annulenes and heteroannulenes.
- 7 **Reaction mechanisms:** Addition, substitution, elimination and rearrangements (carbon to carbon, carbon to nitrogen). Reactive intermediates like benzyne, carbenes and nitrenes. Non-classical carbonium ion, neighbouring group participation. Some name reactions: Aldol, Cannizzaro's, Perkin, Stobbe, Dieckmann condensations, Hoffmann, Schmidt, Lossen, Curtius, Beckmann and Fries rearrangement. Reformatsky, Wittig, Favorskii, Shapiro and Baeyer-Villiger reaction, Michael addition.

- 8 **Aromatics, heteroaromatics and dyes:** Synthesis and important reactions of anthracene, phenanthrene, biphenyl, furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline and indole. Modern theories of colour and constitution. chemistry of indigo and alizarin.
- 9 **Stereochemistry and conformational analysis:** Elements of symmetry. Optical and geometrical isomerism. E,Z and R,S notations, Conformations of alkanes and cycloalkanes and their effect on reactivity. Asymmetric synthesis, stereoselective and stereospecific synthesis.
- 10 **Spectroscopy:** Rotational and vibrational spectra of diatomic molecules , selection rules. Principles and applications of electronic, IR, NMR and Mass spectroscopy and their combined applications for structural elucidation of organic compounds.ESR, Raman, photoacoustic and photoelectron spectroscopy.
- 11 **Nuclear chemistry:** Radioactive decay, mass defect and binding energy, nuclear reactions, nuclear transformation, fission and fusion, neutron activation analysis, applications of isotopes.
- 12 **Chemical kinetics:** Rates of chemical reactions, methods of determining rate laws, Arrhenius equation, collision theory of reaction rates, steric factor, theory of absolute reaction rates, theory of unimolecular reactions, salt effect, kinetics of photochemical reactions.
- 13 **Thermodynamics:** First law, relation between C_p and C_v , enthalpies of physical and chemical changes, temperature dependence of enthalpies, second law, entropy, Gibbs and Helmholtz functions, evaluation of entropy and Gibbs function, Gibbs-Helmholtz equation, Maxwell relations. Thermodynamics of ideal and non-ideal gases and solutions. Third law of thermodynamics.
- 14 **Electrochemistry and ionic equilibria:** Theory of strong electrolytes, equilibria in electrochemical cells, cell reactions, Nernst equation, applications of cells, e.m.f. measurements, concentration cells, fuel cells, electrolysis, corrosion and its prevention.

- 15 **Environmental Chemistry:** Atmospheric layers. Vertical temperature profile, heat/radiation budget of the earth atmospheric systems, lapse rate. Temperature inversion. Pressure variation in atmosphere and scale height. Sources of nitrogen dioxide, sulphur dioxide, carbon oxides, chlorofluorocarbon, methane and other hydrocarbons in atmosphere, air pollution. Mechanism of photochemical decomposition of NO_2 and formation of ozone, hydroperoxy and organic radicals. Reactions of hydroxyl radical with methane, SO_2 and NO_2 . Photochemical smog. Stratospheric ozone depletion, Green house effect.

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. There will be Negative Marking.