RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR SCREENING TEST FOR THE POST OF TECHNICAL ASSISTANT- CHEMISTRY GROUND WATER DEPARTMENT

1. Schrodinger wave equation, Quantum numbers, Aufbau Principle, Pauli's exclusion Principle, Hund's multiplicity rule, (n+l) rule, electronic configuration of elements, atomic and ionic radii, ionization energy, electron affinity and electronegativity.

2. Chemical bonding:- Valence Bond Theory and its limitations, various types of hybridization and shapes of simple inorganic molecules and ions, VSEPR Theory of NH_3, H_3O^+, SF_4, H_2O, $SnCl_2$, ClF_3, XeO_4. Molecular Orbital Theory of Homonuclear and Heteronuclear diatomic molecules, multicentered bonding in electron deficient compounds, Ionic, Covalent, Coordinate, Hydrogen bonding and vander Waals forces.

3. Chemistry of Transition & Inner Transition elements:- Electronic configuration, variable oxidation states, magnetic properties of transition elements, charge transfer spectra, metal atom clusters, Stereochemistry of Coordination Compounds, their IUPAC names, metal ligand bonding, Ligand field theory of complexes, CFSE, Jahn Teller effect, Spectral and magnetic properties of complexes.
   Lanthanides and Actinides- magnetic and spectral properties and their applications in industry, super heavy elements.

4. Inorganic Materials:- Composition, manufacturing methods and applications of Glass, Ceramics, Superconductors, cement and fullerene. Chemistry of setting and hardening of cement and role of gypsum, annealing of glass.

5. 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 and Walden Inversion, Stereospecific and Stereoselective synsthesis, Asymmetric synthesis.

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. Aromaticity, Huckels Rule and its applications. Annulenes and Heteroannulenes.

7. Reaction Mechanism:- Addition, substitution, elimination and rearrangements reactions (Carbon to carbon, carbon to nitrogen) Reactive intermediate like benzynes, carbenes and nitrenes. Non-classical carbonium ion, neighbouring group participation. Name reaction- Aldol, Perkin, Stobbe, Dieckmann condensations, Hofmann, Schmidt, Curtius, Reformatsky, Wittig, Diels-elder, friedel crafts and Baeyer-villiger reaction, Beckmann and Fries rearrangement, Micheal addition.

8. Spectroscopy-I:- Principles of UV/Visible, IR, NMR and Mass spectroscopy and their applications for structural elucidation of organic compounds.
   Spectroscopy-II:- Principles and applications of ESR, Raman, Mossbauer and photoelectron spectroscopy.

9. 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, Salt effect, Kinetics of photo chemical and unimolecular reaction, Half life.

10. Thermodynamics:- First law, relation between Cp and Cv, enthalpies of physical and chemical changes, temperature dependence of enthalpies, second law, entropy, Gibbs and Helmoltz functions, evaluation of entropy and Gibbs function. Third Law of Thermodynamics, Gibbs-Helmoltz equation.

11. Electrochemistry and Ionic Equilibria:- Theory of strong electrolytes, Debye-Huckel theory of activity co-efficient, equilibria in electrochemical cells, cell reactions, Nernst equation and its application to chemical cells, E.M.F. measurements, relation between Gibbs energy change and EMF of a cell, concentration cells. Fuel cells, Kohlrausch's law, electrolysis.

12. Water and Water Analysis:- Requisite of drinking water, purification of water by sedimentation, filtration and disinfection. Water quality standards and their analysis- pH, hardness, alkalinity, turbidity, TDS, DO, BOD, COD, Nitrates, Flourides and residual chlorine. Water pollution, causes, its impact and mitigation of pollution, waste water management, Softening of water by lime soda and ion exchange process, rain water harvesting.

13. Sources, detrimental effects and control of soil and air pollution, fertility management of soils, physical and chemical analysis of soil pollution. Green House Effect, Global warming, acid rain, ozone hole phenomenon.
   Green Chemistry- Environment acts and regulations, Renewable and non renewable natural resources, use of alternative biofuels, green solvents, green polymer chemistry, Biomass conversion, ecofriendly pesticides.

14. Definition of Terms:- Mean, Median, precision, standard deviation, relative standard deviation. Accuracy, absolute error, relative error, types of errors, statistical evaluation of data, indeterminate errors.
   Principle and process of solvent extraction, the distribution law and the partition coefficient, batch extraction, continuous extraction and counter current extraction, applications of solvent extraction.

15. Principle, instrumentation and applications of:-
   (i) Gas Chromatography (ii) Ion exchange chromatography
   (iii) Thin layer chromatography (iv) Paper chromatography (v) HPLC

16. Corrosion:- Mechanism of chemical and electrochemical corrosion, galvanic, concentration and pitting corrosion, protection methods from corrosion.

Lubricants - Classification, properties and applications of lubricants, viscosity and viscosity index, steam emulsion number.

Polymers- Preparation, properties & uses of polyethylene, polyethylene terephthalate (PET), nylon 6 and Bakelite.

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Pattern of Question Papers:

1. Objective Type Paper
2. Maximum Marks : 150
3. Number of Questions : 150
4. Duration of Paper : 2:30 Hours
5. All Questions carry equal marks
6. Medium of Screening Test: Bilingual in English & Hindi
6. There will be **Negative Marking**

(For every wrong answer, one-third of marks prescribed for that particular question will be deducted).

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