

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, Hydrogen bonding and vander Waals forces.

3. **Chemistry of Transition elements**:- Electronic configuration, variable oxidation states, magnetic properties, 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, Metallic corrosion, its chemistry and prevention.

Lanthanides and Actinides- magnetic and spectral properties and their applications in industry, super heavy elements.

4. **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), Fullerenes, Inter halogen compounds and chemistry of noble gases.

5. **Nuclear and Radiochemistry**:- Stability of nucleus, Nuclear reactions, Energetics of nuclear reaction, fission and fusion, fragmentation, Chemical effect of nuclear transformations, applications of radioisotopes, radiation hazards and protection.

6. **Inorganic Materials**:- Chemical composition and manufacturing methods of Glass, Ceramics, High-Tech Advanced Inorganic materials, Superconductors, cement and marine chemicals.

7. 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 synthesis, Asymmetric synthesis.

8. **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, Huckels rule and its applications. Annulenes and Heteroannulenes.

9. **Reaction Mechanism:-** Addition, substitution elimination and rearrangements (Carbon to carbon, carbon to nitrogen) Reactive intermediate like benzynes, carbenes and nitrenes. Non classical carbonium ion, neighbouring group participation. Some familiar name reaction. Aldol, Perkin, Stobbe, Dieckmann condensations, Hofmann, Schmidt, Lossen, Curtius, Beckmann and Fries rearrangement, Reformatsky, Wittig, Favorskii Shapiro and Baeyer-villiger reaction, Micheal addition.

10. **Spectroscopy-I:-** Principles of Electronic, IR, NMR and Mass spectroscopy and their applications for structural elucidation of organic compounds.

Spectroscopy-II:- Principles and applications of ESR, Raman, Mossbauer and photoacoustic and photoelectron spectroscopy.

11. **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.

12. **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. Third law of thermodynamics, Gibbs-Helmoltz equation.

13. **Electrochemistry and Ionic equilibria:-** Theory of strong electrolytes, Debye-Huckel theory of activity co-efficient, equilibria in electrochemical cells, cell reactions, Nernst equation, applications of cells, e.m.f. measurements, concentration cells. Fuel cells, electrolysis.

14. **Water analysis and Treatment of Waste-** Water quality standards and their analysis-hardness, alkalinity, turbidity, TDS, D.O., B.O.D., C.O.D., Nitrates, Flourides and sulphates. Water pollutants classification, their effect and control of pollutant sources. Treatment of Industrial waste water desalination, water management in arid and non-arid region.

15. Heavy metal pollution, instrumental technique of analysis of heavy metals in aqueous systems, pesticides as water pollutants, purification and treatment of water, water pollution laws and standards.

Sources, detrimental effects and control of soil and air pollutions, fertility management of soils, physical and chemical analysis of soil pollution. Green House Effect, acid rain, ozone hole phenomenon, thermal inversion.

16. 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.

17. 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.

18. Principle, instrumentation and applications of:-

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| (i) Gas Chromatography | (ii) Ion exchange chromatography | |
| (iii) Thin layer chromatography | (iv) Paper chromatography | (v) HPLC |

19. Principles and applications of AAS, DTA, TGA, polarography, RIA (Radio Immuno Assay) and NAA (Neutron Activation Analysis).

20. **Introduction to Computers and Computing-** Basic structure and functioning of computers with a PC as an illustrative example. Memory, I/O devices. Secondary storage. Computer language. Operating systems with DOS as an example. Introduction to UNIX and WINDOWS. Data Processing, principles of programming. Algorithms and flow-charts.

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Pattern of Question Papers:

1. Objective Type Paper
2. Maximum Marks : 100
3. Number of Questions : 100
4. Duration of Paper : Two Hours
5. All Questions carry equal marks
6. There will be Negative Marking

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