RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR SCREENING TEST FOR THE POST OF

JUNIOR CHEMIST

(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, ICl_2^-, Molecular Orbital Theory of homonuclear and heteronuclear diatomic molecules, multicentered bonding in electron deficient compounds. Hydrogen Bonding and vander Waals forces.

3. Werner's Theory, Valence Bond Theory and Crystal Field Theory to explain bonding in transition metal complexes, limitations of CFT, Magnetism, Geometry (Tetrahedral octahedral and square planar complexes) spectral behaviour and colour of coordination complexes, charge transfer spectra. Spin free and spin paired complexes, stereochemistry of different coordination numbers.

4. Types of inorganic polymers, application of silicones, silicates, zeolites, ceramics and ceramic glasses. Hydrides of Boron. Diborane and higher boranes, borazines; Carboranes. Fullerenes, fluorocarbons. Chemistry of noble gases e.g. Xenon.

5. Definition,classification, preparations, properties, structure and applications of organometallic compounds of Lithium, Magnesium, Mercury, Iron, Rhodium and Tin. Preparation, properties and nature of bond in Metal Carbonyls and Nitrosyls.

6. Arrhenius, Bronsted-Lowary and Lewis Concepts of acids and bases, Theory of Hard and Soft Acids and Bases and its applications.

7. Physical properties of solvent, types of solvents and their general characteristic. Reactions in non-aqueous solvents with reference to liquid NH_3, HF and liquid SO_2.

8. Representation of nuclides, isotopes, isobars and isotones, natural and artificial radioactivity, half life periods, average life, artificial transmutations, nuclear reactions, nuclear fission and fusion. Applications of radioisotopes.

9. Modern theories of corrosion, types of corrosion and prevention. Green Inhibitors.

10. 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.

11. 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.

12. Principle, instrumentation and applications of
    (i) Gas chromatography (ii) ion exchange, (iii) Thin layer (iv)Paper chromatography (v) HPLC

13. Water pollutants, classification, their effects and control. Sampling of water. Sources of water pollution, water quality parameters hardness, alkalinity, turbidity, DO, BOD, COD, TDS, metals, content of chloride, sulphate, nitrate and microorganisms, water quality standards and their analysis.

14. 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.

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

16. Analysis of major and minor components of food, common adulterants in food, microscopic examination of foods for adulteration, pesticides analysis in food products,
17. Screening of drugs by gas and thin layer chromatography and spectrophotometric measurements.
18. Principle, instrumentation and applications of:

    (i) AAS (ii) TGA (iii) DTA (iv) DSC (v) spectrophotometry (vi) polarimetry (vii) NAA (Neutron Activation analysis) (viii) RIA (Radio Immuno Assay)

19. General awareness of computer hardware e.g. CPU and other peripheral devices (Input/output and auxiliary storage devices). Basic knowledge of computer systems, software, opening system and programming language e.g. Machine language, assembly language and higher level languages. Data processing, principles and programming, flow-charts.
20. Basic principles of UV-visible, IR, NMR, mass, ESR and Mossbauer spectroscopy and their application in identification of compounds.
21. Introduction of photochemical reactions, types of excitations; fate of excited molecules, quantum yield, transfer of excitation energy.

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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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