

RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS FOR SCREENING TEST FOR THE POST OF JUNIOR CHEMIST, PUBLIC HEALTH ENGINEERING DEPARTMENT

I

- 1 **Atomic structure** : Bohr model, Sommerfeld extension, Quantum numbers, Atomic spectra, Uncertainty principle, De Broglie equation, Aufbau principle
- 2 Electronic configuration, Periodicity in the properties of elements, Atomic and Ionic radii, Ionization potential, Electron affinity and electronegativity.
- 3 Hybridization related to linear, triangular, tetrahedral, square planar, trigonalbipyramidal and octahedral shapes, M.O. theory for homonuclear and heteronuclear diatomic molecules.
- 4 Ionic bond, Lattice energy, Born-Haber cycle, Crystal structures, Covalent bond and Fajan's rule.
- 5 Electron deficient compounds, Interhalogen compounds, Oxy acids of Nitrogen, Phosphorous, Sulfur and Halogens, Compounds of Xenon.
- 6 Transition elements-Electronic configuration, General characteristics like oxidation states, tendency to form complexes, magnetic properties, Nomenclature of coordination compounds, Isomerism, VBT and CFT theories, Splitting of orbitals in octahedral and tetrahedral fields, Explanation of colour, Geometry, Limitations of CFT and VBT, Achievements of M.O. theory.
- 7 Lanthanides and Actinides, Electronic configurations, Lanthanide contraction and its consequences, Super heavy elements.

II

- 1 **Reaction mechanisms** – Inductive and hyperconjugative effects, Electrophiles, Nucleophiles, Carbocations, Carbanions, Radicals, Arynes, Carbenes, Nitrenes Radical additions and substitutions, Electrophilic-addition and substitution reactions, Nucleophilic reactions, Elimination reactions (Alpha and Beta, E^1 and E^2 , SN^1 and SN^2).
- 2 Preparations, reactions and structures of the following :
 - A **Hydrocarbons**-Alkanes, alkenes and alkynes (upto five carbons) Benzene, Naphthalene, Anthracene, Aromaticity.
 - B **Halides** - Alkyl, Aryl and Allyl halides.
 - C **Acids**-Formic, acetic, oxalic, lactic, tartaric, benzoic, Citric Acid.
 - D **Alcohols and phenols** - Methanol, Ethanol, Benzyl Alcohol, glycol, glycerol, phenol, resorcinol, catechol, quinol, alpha and beta naphthols.
 - E **Nitro compounds**- Nitroalkanes, nitrobenzenes, nitrophenols, including picric acid, nitronaphthalenes.
 - F **Amines**-Alkyl amines, aniline, Benzylamine, anisidines, naphthylamines,
 - G Benzenediazonium chloride- Its preparation, structure and synthetic applications.
 - H **Heterocyclics** - Pyrrole, thiophene, furan, pyridine, quinoline and isoquinoline.
 - I **Carbohydrates** – Classification, properties and structures of glucose and fructose.
 - J **Biomolecules** – proteins, classification, their structures and Amino Acids.
 - K **Reactive methylene compounds** - Like acetoacetic ester and diethylmalonate and cyano acetic ester.

- L **Drugs-** Sulpha Drugs., Antibiotics and their applications.
- M **Oils and fats** – Classification, Properties, Acid value, saponification value, Iodine value, R.M. value, soaps and detergents.
- N **Aldehyde and ketones** – Formaldehyde, Acetaldehyde, Acetone, Acetophenone, Benzophenone, Anthraquinone.
- O **Photochemistry** – Principles of Photochemistry, Ground state and excited states of molecules, photophysical and photochemical processes.

III

- 1 **Acids and bases** – Arrhenius, Bronsted & Lowry and Lewis concepts, HSAB concept and its limitations, p^H , Ionic product of water, Buffer solutions, Common ion effect, Solubility Product, Acid Base Indicators and titrations.
Electrochemical cells, Fuel cells, electrode potentials, measurement of emf, potentiometric titrations. Conductance, cell constant, specific and equivalent conductivity, Kohlrausch Law and its applications, equivalent conductivity at infinite dilution of weak electrolytes, hydrolysis and hydrolysis constant, Nernst equation,
- 2 **Chemical Kinetics** – Order and molecularity of reactions, zero, first and second order of reactions, effect of temperature on reaction, rates, collision theory and activated complex theory, Arrhenius equation and evaluation of energy of activation.
- 3 **Chemical Thermodynamics** – Intensive and extensive properties, isolated, closed and open systems, Concept of heat and work, First law and Second law of thermodynamics, internal energy, enthalpy, relation between C_p and C_v , Applications of First law, Hess law of constant heat of summation, entropy as state function, calculation of entropy changes in different processes. Molecular interpretation of entropy.
- 4 **Nuclear Chemistry** – Radioactive rays, theory of radioactivity, Nuclides, Isotopes, Isotones, Nuclear Isomers, Nuclear masses and binding energy, Nuclear Fission and Fusion process, packing fraction, nuclear stability, production and application of radioisotopes, radioactive disintegration series, half life and average half life.
- 5 **Spectroscopy** – Absorption, Lambert-Beers law, Chromophores, auxochromes, brief outlines of UV, visible, IR, NMR and Mass spectroscopy and their applications.

IV

- 1 **Analytical Chemistry** – Accuracy, precision and errors, significant figures, Fundamental Principles involved in neutralization, redox, precipitation and complexometric titrations, Fundamental principles of gravimetric analysis, coprecipitation, post-precipitation. Instrumental methods of analysis like colorimetry, Flame photometry, Analysis of acidic and basic radicals, Detection of elements and functional groups in organic compounds.
- 2 **Chromatography** – Paper, Thin Layer, Gas and HPLC.
- 3 **Water Chemistry** - Temporary and permanent hardness of water, fluorides, chlorides, nitrates, nitrites, ammonium salts and organic matter in water, pollutants in potable and industrial water and their estimation, Storage of water and its safety.

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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**.