

RAJSTHAN PUBLIC SERVICE COMMISSION, AJMER

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

- 1. Atomic Structure** : Schrodinger wave equation(No mathematical derivation), Quantum numbers, Aufbau and Pauli's exclusion principle, Electronic configurations of the elements.
- 2. Periodicity in the properties of elements**: Atomic and Ionic radii, Ionization potential, Electron affinity and electronegativity.
- 3. Chemical behaviour** :Hybridization related to linear, triangular,tetrahedral, square planer, trigonal bipyramidal and octahedral shapes, Valence shell electron pair repulsion (VSEPR) theory, M.O. theory for homonuclear and heteronuclear diatomic molecules.
- 4. Ionic solids** : Ionic structures, radius ratio effect and coordination number, Lattice energy, Born-Haber cycle, Crystal structures, Solubility of ionic solids, Fajan's rule, Hydrogen bonding, Vanderwalls forces.
- 5. Transition elements** : Electronic configuration, General characteristics like Oxidation states, magnetic and spectral properties, tendency to form complexes, Nomenclature of coordination compounds, Isomerism, VBT and CFT , Splitting of d orbitals in octahedral and tetrahedral fields.
- 6. Lanthanides and Actinides** : Electronic structure, Oxidation states and ionic radii, spectral and magnetic properties, Lanthanide contraction and its consequences.
- 7. Reaction mechanisms** : Reactive intermediates- Carbocations, Carbanions, free radicals, carbenes, arynes and nitrenes.
Electrophillic – addition and substitution reactions, Nucleophillic substitution (SN^1 And SN^2) reactions.
- 8. Preparation, reactions and structures of following** :
 - a. Acids-Formic, acetic, oxalic, lactic, succinic, citric and benzoic acid.
 - b. Alcohols and phenols
 - c. Carbohydrates-Glucose, Fructose, Lactose and Starch.
 - d. Nitro compounds-Nitroalkanes, Nitrobenzenes, Nitrophenols and Nitronaphthalenes.
 - e. Amines-Alkyl and aryl amines Benzene diazonium chloride- its preparation, structure and synthetic applications
 - f. Heterocyclics – Pyrrole, thiophene, furan, pyridine, quinoline and isoquinoline.
 - g. Biomolecules – Peptide and proteins, their classification and structure determination.
 - h. Aldehydes and Ketones.
- 9. Fats, oils and detergents** : Classification, properties, acid value, saponification value, iodine value, R.M. value, soaps, synthetic detergents, alkyl and aryl sulphonates.
- 10. Synthetic polymers**: Addition or chain-growth polymerization, polyester, polyamides, phenol formaldehyde resins, Natural and synthetic rubbers.
Spectroscopy.
Basis principles and application of UV- visible, IR and Nuclear magnetic resonance (NMR) spectroscopy.
- 11. Photo chemistry**: Principles of photochemistry, ground state and excited states of molecules, photophysical and ptochemical processes laws of photochemistry.
- 12. Acids and bases**: Arrhenius, Bronsted & Lawry and Lewis concepts, HSAB concept and its limitations, pH, ionic product of water, buffer solutions, common ion effect, solubility product, acid-base indicators and titrations.
Electrochemical cells, fuel cells, electrode potential, measurement of EMF, potentiometric titrations. Conductance, cell constant, specific and equivalent conductivity, Kohlrausch law and its application, Nernst equation.

- 13. Chemical Kinetics** : Rate order and molecularity of a reaction. Zero, first and second order of reaction, effect of temperature on reaction rates, collision theory and activated complex theory, Arrhenius equation and evaluation of energy of activation.
- 14. Chemical Thermodynamics** : First, second and third law of thermodynamics.
- 15. Nuclear chemistry**: Radioactive rays, theory of radio- activity, nuclides, isotopes, isotones, nuclear isomers, nuclear masses and binding energy, nuclear fission and fusion processes, packing fraction, nuclear stability, production and application of radio isotopes, radioactive disintegration series, half life and average half life period.
- 16. Stereo chemistry of organic compounds** : Concept of optical and geometrical isomerism.
- 17. Errors and Evolutions** : Accuracy, precision and errors, significant figures. Fundamental principles of gravimetric analysis, co-precipitation and 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.
- 18. Chromatography**: Classification of chromatographic methods. Application of paper, Thinlayer, Gas and HPLC.
- 19. Water Analysis**: Determination of alkalinity, temporary and permanent hardness, chloride, sulphate, nitrate, nitrite, fluoride.
Measurement of D.O., C.O.D. and B.O.D.
Water pollutants - Their classification and health effects.

Role of metal ions in biological systems – structure and function of haemoglobin, myoglobin, metalloproteins, peroxidases and catalases, cytochromes and nitrogenases.

- 20.** General awareness of computer hardware i.e. CPU and other peripheral devices (Input, Output and Auxiliary storage devices).
Basic knowledge of computer system, software, operating system and programming language i.e. machine language, assembly language and higher level languages.

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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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