RAJASTHAN PUBLIC SERVICE COMMISSION, AJMER

SYLLABUS OF COMPETITIVE EXAMINATION FOR THE POST OF JUNIOR CHEMIST (PUBLIC HEALTH ENGINEERING DEPARTMENT)

Part-A - 40 Questions

General Knowledge of Rajasthan

Unit-I: History, Culture & Heritage of Rajasthan -

Pre & early history of Rajasthan. Age of Rajputs: Major dynasties of Rajasthan and the achievements of prominent rulers. Emergence of Modern Rajasthan: factors of socio-political awakening of 19th century; Peasants and tribal movements of 20th century; Political struggle of 20th century and the integration of Rajasthan.

Visual Art of Rajasthan - Architecture of forts and temples of Rajasthan; Sculpture traditions of Rajasthan and various schools of painting of Rajasthan.

Performing Arts of Rajasthan - Folk music and musical instruments of Rajasthan; folk dance and folk drama of Rajasthan.

Various religious cults, saints and folk deities of Rajasthan.

Various dialects and its distribution in Rajasthan; literature of Rajasthani language.

Unit-II: Geography, Natural Resource & Socio-Economic Development of Rajasthan -

Geography of Rajasthan: Broad physical features- Mountains, Plateaus, Plains & Desert; Major rivers and lakes; Climate and Agro-climatic regions; Major soil types and distribution; Major Forest types and distribution; Demographic characteristics; Desertification, Droughts & Floods, Deforestation, Environmental Pollution and Ecological Concerns.

Economy of Rajasthan: Major Minerals- Metallic & Non- Metallic; Power Resources- Renewable and Non-Renewable; Major agro based industries- Textile, Sugar, Paper & Vegetable oil; Poverty and Unemployment; Agro food parks.

Unit-III: Current Events and Issues of Rajasthan and India -

Important Persons, Places and Current events of the State. National and International events of importance. New Schemes & Initiatives taken recently for welfare & development in Rajasthan.

PART-B -110 Questions

1. **Atomic Structure :**
   Quantum numbers, Aufbau and Pauli's exclusion principle, Hund's rule, Electronic configuration of the elements, Periodicity in the properties (Atomic and Ionic radii, Ionization Enthalpy, Electron Gain Enthalpy, Electronegativity) of s, p, d and f - block elements.
2. **Chemical bonding :**
   Concept of hybridization, Theories of chemical bonding: VBT, MOT for homonuclear and heteronuclear diatomic molecules. H-bonding, Polarity in covalent compounds, Vander-Waals forces.
3. **Transition Metal Chemistry :**
   Electronic configuration of transition elements. General characteristics of transition elements like oxidation states, magnetic and spectral properties, tendency to form complexes, IUPAC nomenclature and isomerism in co-ordination compounds, Ligand field theory, high and low spin complexes, CFT and Jahn-Teller effect.
4. **Lanthanides and Actinides:**
   Electronic configuration, Oxidation states, colour, Magnetic and spectral properties, Lanthanide contraction and its consequences, Super heavy elements.
5. **Green Chemistry and Nano Chemistry:**
   Principles of Green Chemistry, Green reagents and Green Synthesis, Basic concepts of Nano Science and Nano Technology, Chemical and Physical properties of Nanoparticles, Techniques used for the characterization of Nanomaterials.
6. **Environmental Chemistry:**
   International standards of drinking water, water quality parameters- alkalinity, hardness, chloride, fluoride, sulphate, nitrate, nitrite, D.O., C.O.D, B.O.D., TDS, pH, microorganisms etc. and their measurement. Water pollutants and their effects on human health, water purification and disinfection techniques, Nanotechnology for water purification.
7. **Chromatography:**
   Principle and applications of TLC, Paper chromatography, Ion exchange chromatography, Gas chromatography (GC) and GC-MS, HPLC.
8. **Basic concepts of Concentration:**
   Mole concept, Normality, Molarity, Molality, mole fraction, ppm, ppb, ppt, weight percentage, weight by volume, weight by weight, mass conversion between different units, Primary and Secondary standard solutions, preparation of percent solutions, dilution and serial dilutions.

9. **Basic principles of Organic Chemistry and reaction mechanism:**

Types of reactions; Types of reagents; Reactive intermediates-carbocations, carbanions, carbenes, Nitrenes, Free redicals, Arynes; Inductive, electromeric, mesomeric effects, Hyperconjugation and resonance effects.

10. **Stereochemistry:**

Concept of Chirality, Geometrical and Optical stereoisomerism, E/Z and R/S nomenclature, Resolution of enantiomers, Inversion, Retention and Racemization, Asymmetric synthesis, Stereoselective and Stereospecific reactions.

11. **Structure, synthesis and properties of following organic compounds:**

i. Alcohols, phenols and ethers.
ii. Aldehydes and Ketones.
iii. Acids-Formic, acetic, oxalic, lactic, succinic, citric and benzoic acid.
iv. Carbohydrates-Glucose, Fructose, Lactose and Starch.
v. N-containing compounds-Nitroalkanes, Nitrobenzenes, Nitrophenols, alkyl and aryl amines, Diazonium salt.
vi. Heterocyclics compounds– Pyrrole, thiophene, furan, pyridine, quinoline and isoquinoline.
vii. Biomolecules – Amino acids, Peptides, Proteins, Nucleic acids.

12. **Polymers-**

Types and classification of polymers, addition or chain- growth polymerization, polyester, polyamides, Phenol - formaldehyde resins, Natural and synthetic rubbers.

13. **Fats, oils and detergents :**

Classification, properties, Acid value, saponification value, Iodine value, R.M. value, Soaps, Synthetic detergents, Alkyl and Aryl sulphonates.

14. **Spectroscopy:**

Basic principles, instrumentation and applications in identification of compounds by IR, UV-visible, NMR spectroscopy and Mass spectrometry. Combined problems.

15. **Photochemistry:**

Principles of Photochemistry, Jablonski diagram, photochemistry of alkenes and carbonyl compounds, Paterno-Buchi reaction, Norrish Type I and II reactions.

16. **Acids - bases and Non-aqueous Solvents:**

Basic theories, HSAB concept. Non aqueous solvents: DMSO, THF and Liquid NH_3, their reactions and solvent action.

17. **Electrochemistry and Ionic Equilibrium**:

Theory of strong and weak electrolytes, pH, Buffer and Buffer action, Electrolysis and electrolytic Cell, Electrochemical cells and reactions, Nernst equation, emf measurement. Primary and Secondary cells, fuel cell, corrosion and its prevention.

18. Chemical Kinetics:

Rate, order and molecularity of a reaction. Zero, first and second order reactions, Effect of temperature on reaction rates, collision theory and activated complex theory, Acid-base and enzyme catalysis.

19. Thermodynamics:

First law: relation between Cp and Cv, enthalpies of physical and chemical changes, temperature dependence of enthalpies, Joules Law, Joules Thomson coefficient, Second law: entropy, Criteria of Spontaneity, Gibbs and Helmholtz functions, evaluation of entropy and Gibbs function, Gibbs-Helmholtz equation, Maxwell relations. Thermodynamics of ideal and non-ideal gases and solutions. Third Law of Thermodynamics.

20. Nuclear Chemistry:

Radioactive decay, mass defect, binding energy, fission and fusion, packing fraction isotopes, isobars, isotones, radioactive disintegration series, half-life and average life period, applications of isotopes in medical science.

21. Basic knowledge of computers:

CPU and other peripheral devices – input/output/auxiliary storage devices, software, opening system and programming language e.g. Machine language, assembly language and higher-level languages. Data processing, principles and programming, flow-charts.

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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. There will be Negative Marking

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