

# Rajasthan Public Service Commission, Ajmer

## RAJASTHAN STATE AND SUBORDINATE SERVICES COMBINED COMPETITIVE EXAMINATION

### SYLLABI OF THE PAPER/SUBJECTS PRESCRIBED FOR THE MAIN EXAMINATION

#### OPTIONAL SUBJECT

#### **CHEMISTRY PAPER-I (Code No. 05)**

1. Structure of an atom; Bohr model, Somerfield extension, Quantum numbers, Atomic spectra. Uncertainty principle, de Broglie equation.
2. Electronic configuration and long form of Periodic table; Types of elements, Atomic and ionic radii, Ionisation potential, Elector affinity and Electronegativity, periodicity in their properties.
3. Hybridisation, Shapes of simple molecules (involving s, p and d orbitals) Molecular orbital theory for simple homonuclear diatomic ( $O_2$ ,  $F_2$ ,  $N_2$ ,  $B_2$  &  $C_2$ ) & heteronuclear (HF, CO) molecules.
4. Ionic bond, Lattice energy Born-haber cycle, Solubility of ionic compounds, Crystal structure (AB and  $AB_2$  type), Covalent bond, Fajan's rule, Metallic bond.
5. Zero group elements, position in periodic table isolation, compounds of Xenon.
6. p-Block elements: Electron deficient compounds(Diborane) Elementary idea of carbonyls, Interhalogen compounds, Chemical fertilizers, Oxyacids of sulphur & Phosphorous.
7. Transition elements, Electronic configuration, General characteristics viz. colour, Oxidation state, tendency to form complexes magnetic properties.
8. f-Block elements. Lanthanides & Actinides, Electronic configuration, Lanthanide contraction & its consequences, Super heavy elements.
9. Chemical industries in Rajasthan : Cement, Super phosphate, Zinc & Copper based industries in Rajasthan.
10. Nuclear Chemistry : Radioactive rays. Half life period, Mean life statistical aspects of nuclear disintegration, parent daughter decay growth relationship, Radioactive equilibrium,  $\alpha$ ,  $\beta$  and  $\gamma$  decay, Nuclides, Isotopes Isobars, Isotones, Isomers. Nuclear masses & Binding energy. Nuclear stability. Types of Radiation, Radiation detection & measurement, Nuclear reactions, Production of Radio isotopes.

11. Nomenclature IUPAC names of organic compounds. Isomerism Position, Functional, Optical and geometrical isomerism. E-Z system of nomenclature, chirality, enantiomers and distereo isomers, D.L. and R.S. system of Nomenclature.
12. Aliphatic compounds: Hydrocarbons. Alkanes, Alkenes and Alkynes (upto five carbon atoms). Alkyl halides, Grignard reagent, Alcohol; Methyl & Ethyl alcohol, Glycol and Glycerols. Aldehydes and Ketones. Formadehyde, Acetaldehyde and Acetone. Carboxylic acids : Formic Acetic, Oxalic, Lactic, Tartaric acid. Carbohydrate : Glucose, Fructose their structure and general reactions.
13. Aromatic Compounds : Aromaticity, Huckel's rule. Aromatic hydrocarbons : Benzene Napthalene and Anthracene. Alkenyls halides, Aromatic halides and Aromatic nitro compounds, Aliphatic, aromatic amines and diazonium compounds. Phenols : Phenol, Cresols, Catechols, Resorcinol and Hydroquinone, Aromatic sulphonic acids.
14. Aromatic carbonyl compounds and carboxylic acids. Benzaldehyde, Benzophenone, Acetophenone, Benzoic acid, Salicylic acid, Cinamic acid, Phthalic acid, Phenyyl acetic acid, and Anthranilic acid. Benzene sulphonic acid. Benzene sulphonyl chloride, Sulphonamides, Synthetic detergents. Sulpha drugs : Sulphadizine, Sulphaguanidine, Sulphathiazine. Proteins and Nucleic acids, Amino acids & Nucleotides.

### **CHEMISTRY PAPER-II (Code No. 05)**

1. Coordination compounds : Nomenclature, Werner's theory, Isomerism, Valence bond theory, Crystal Field theory , Splitting of d orbitals, in octahedral and tetrahedral fields, stabilization energy (CFSE), Factors affecting CFSE. Magnetic properties, Geometry, Explanation of colour in complexes, limitations of VBT and CFT.
2. Acid and Bases : Arrhenius, Bronsted & lowry, Lewis concept, HSAB concept ion effect. Solubility product and theory and Acid Base indicators.
3. Types of Solvents : Nonaqueous solvents General study of ionizing solvents with special reference to liq. Ammonia, Sulphur dioxide, Anhydrous sulphuric acid.
4. Bio-Inorganic Chemistry : Role of bulk and trace metal ions in biological system with special reference to Mg. Ca., Fe and Cu.
5. Reaction Mechanism : Inductive, Mesomeric & Hyper conjugation, Addition and substitution : Electrophyls & Nucleophyls. Electrophillic

addition and substitution reactions, Nucleophilic substitution reactions ( $SN_1$  and  $SN_2$ ), Elimination reaction.

6. Reactive methylene compounds ; Acetoacetic ester and diethyl malonate.  
Dyes : Classification, Nitro and Nitroso dyes, Triphenyl methane, phthalein, Azo dyes. (Malachite green, Martins yellow, Fast green 'O' Methyl red & Methyl orange) Theory of colour and chemical constitution.
7. Chemotherapy (Drugs) : Antimalarials, Antibiotics, Drug action and pharmacological properties.
8. Molecular structural determinations : Magnetic Radiation. Electromagnetic spectrum. Interaction of electro magnetic radiation with matter, Principles of Atomic spectroscopy, Molecular spectroscopy, Infra Red spectroscopy, Visible spectrophotometry and Colorimetry, Ultraviolet spectroscopy & Nuclear Magnetic spectroscopy.
9. Phase rule & its applications : One & two component systems (Water system, sulphur system, Lead-silver System)
10. Chemical kinetics : Order and Molecularity of reactions, first and second order reactions and their rate expressions (no derivation), Zero and Pseudo order reactions (simple examples), effect of temperature on reaction rates, Collision theory and activated complex theory.
11. Electrochemistry : Electrochemical cells, electrode potentials, measurement of emf, potentiometric titrations. Conductance : cell constant, specific and equivalent conductivity, Kohlrausch's Law and its application., solubility and solubility product, equivalent conductivity at infinite dilution of weak electrolytes, hydrolysis and hydrolysis constant.
12. Chemical Thermodynamics : Definition of thermodynamic terms, intensive and extensive variables, Isolated, Closed and Open system. Thermodynamic processes. Cyclic processes, Reversible and irreversible process. Concept of heat and work. First law of thermodynamics and internal energy (U). Enthalpy (H), relation between  $C_p$  and  $C_v$ .  
Application of First Law of Thermodynamics. Hess's law of constant heat summation. Enthalpy of solution, enthalpy of dilution, enthalpy of neutralization, enthalpy of ionization and enthalpy of formation of ions. Spontaneous processes, heat engine Carnot cycle and its efficiency. Statements of Second Law. Refrigeration cycle. Thermodynamics scale of temperature. Entropy as a state function. Calculation of entropy changes in different processes. Molecular interpretation of entropy.

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