Download Bihar Public Service Commission (BPSC Mains)

Optional Subject - Chemistry

CHEMISTRY

Section- I

1. Atomic structure and Chemical bonding: Quantum theory, Haisenberg's uncertainty principle, Schrodinger wave equation (time independent). Interpretation of the wave function, particle in a one-dimensional box, quantum members, hydrogen atom wave functions. Shapes of s p and d orbitals Ionic bond; Lattice energy, Born- Haber Cycle, Fajan's Rule dipole moment, characteristics of ionic compounds, electronegativity differences covalent bond and its general characteristics valence bond approach. Concept of resonance and resonance energy. Electronics configuration of H2+H2. N2, O2, F2, NO, CO and HF molecules in terms of molecular orbital approach. Sigma and pibonds. Bond order, bond strength and bond length.

2. Thermodynamics – Work heat and energy. First law of thermodynamics. Enthalpy, heat capacity Relationship between Cp and Cv. Laws of thermochemistry, Kirchoff's equation. Spontaneous and nonspontaneous changes, second law of thermodynamics. Entropy changes in gases for reversible and irreversible processes. Third law of thermodynamics. Free energy, variations of free energy of a gas with temperature, pressure and volume. Gibbs-Helmbolty equation. Chemical potential. Thermodynamic criteria for equilibrium. Free energy change in chemical reactions and equilibrium constant. Effect of temperature and pressure on chemical equilibrium. Calculation of equilibrium constants from thermodynamic measurements.

3. Solid State—Forms of solids, law of constancy of interfacial angles. Crystal systems and crystal classes (crystallorgaphi groups) Designation of crystal faces, lattice structure and unit cell. Laws of rational indices. Bragg's law, X-ray diffraction by crystals. Defects in crystals. Elementary study of liquid crystals.

4. Chemical kinetics- Order and molecularity of reaction. Rate equations (differential and intergrated forms) of zero, first and second order reaction. Half life of a raction. Effect of temperature, pressure and catalysts on reaction rates. Collission theory of reaction rates of bimolecular reactions. Absolute reaction rate theory. Kinetics of polymerçation and photo chemical reactions.

5. Electrochemistry – Limitations of Arrhenius theory of dissociation, Debye Muckel theory of strong electrolytes and its quantitative treatment. Electrolytic conductance theory and theory of activity coefficients. Derivation of limiting laws for various equalibria and transport properties of electrolyte solutions.

6. Concentration cells, liquid junction potential, application of e.m.f. measurements of fuel cells.

7. Photochemistry- Absorption of light. Lambert-Beer's law, Laws of photo chemistry. Quantum efficiency. Reasons for high and low quantum yields. Photoelectric cells.

8. General Chemistry of 'd' block elements:

(a) Electronic configuration: Introduction to theories of bonding in transition metal complexes, crystal field Theory and its modification; applications of the theories in the explanation of magnetism and electronic spectra of meta complexs.

(b) Metal Carbonyls: Cyclopentadienyl, Olefin and acetylene complexes.

(c) Compoundes with metal- metals bonds and metal atom clusters.

9. General Chemistry of 'f ' block elements: Lanthanides and actinides; separation, Oxidation, states, magnetic and spectral properties.

10. Reactions in non-aqueous solevent (liquid ammonia and sulphur dioxide).

Section- II

1. Reaction mechanisms; General methods (both kinetic and non-kinetic) of study of mechanisms of organic reactions illustrated by examples. Formation and stability of reactive intermediates (carbocations, carbanious free radicals. carbenes, nitrenes and beæynes). SN1 and SN2 mechanisms. – H, E2 and E1 CB eliminations-cis and trans addition to carbon to carbon double bonds mechanisms of addition to carbon-oxygen double bonds-Micheal addition addition to conjugated carboncarbon double bonds aromatic electrophillic and nuclephilic substitutions allylic and beæylic substitutions.

2. Pericyclic reactions: classification and examples an elementary study of Woodward Hoff-mann rules of pericylic reactions.

3. Chemistry of the following name reactions: aldol condensation, Claysen condensation, Dieck mann reaction, Perkin reaction, Reimer-Tiemann reaction, Cannçzaro reaction.

4. Polymeric Systems:

(a) Physical chemistry of polymers; End group analysis, Sedimentation, Light Scattering and Viscosity of polymers.

(b) Polythylene Polystyrene, Polyvinyl Chloride, Ziegler Natta Catalysis, Nylon, Terylene.

(c) Inorgenic Polymeric Systems; Phosphonitric halide compounds; silicones; Borazines. Friedel- Craft reaction Reformatsky reaction, pinacol-pinacilone wagner Meerwein and Backman rearrangements and their mechanisms uses of the following reagents in organic synthesis O5 O4, HIO4, NBS dibocrane, Naliquid ammonia NaBH4, LiAN4.

5. Photochemical reactions of organic and inorganic compounds types of reactions and examples and synthetic uses- Mehods used in structure determination: Prinicples and applications of uv- Visible IR, IH, NMH and mass spectra for structure determination of simple organic and inorganic molecules.

6. Molecular structural deter mination; Prinicples and application to simple organic and inorganic Molecules.

(i) Rotational spectra of diatomicmolecules (Infrared and Raman) isotopic substitution and rotational constants.

(ii) Vibrational spectra of diatomic, linear symmetric, linear asymmetric and bent tri-atomic molecules (Infrared and Raman).

(iii) Specificity of the funcational groups (Infrared and Raman)

(iv) Electronic Spectra singlet and triplet states, conjugated double bonds, unsaturated carbonyl compounds.

(v) Nuclear Magenetic Reasonance; chemical shift, spin-spin coupling.

(vi) Electron Spin Reasonance, Study of inorganic complexes and free radicals.