

PPU B.Sc. CHEM First Year syllabus

Part - I CHEMISTRY (HONOURS)

Part - I:- CHEMISTRY (HONOURS)

GROUP-A: THE STATES OF MATTER:

1. Gaseous State: Kinetic theory of gases, derivation or kinetic gas equation, deduction of gas laws, calculation of gas constant and kinetic energy. Maxwell Boltzmann distribution law of velocities (derivation not needed) and energy, distribution curves at different temperatures, calculation of most probable; average and root mean square velocities of molecules. Real gases, compressibility factor, derivation from ideality, various equations of state for real gases with special emphasis on Van der Waals equation of state and its application to the calculation of Boyle's temperature.
2. Liquid State: Qualitative treatment of the structure of the liquid state including various approaches to the structure of liquids, radial distribution function, physical properties of liquids (molar volume, vapour pressure, surface tension, parachor).
3. Solid State: Types of solid, crystal forces, law of constancy of angles, seven crystal systems, law of rational indices, labelling the planes, Miller indices, qualitative idea of point and space groups, elementary idea of symmetry, symmetry elements.
4. Colloidal State: Definitions, classification, preparation of colloidal solution and their purification, properties of colloids, protection of colloids, application of colloids.

GROUP-B: EQUILIBRIUM:

1. Chemical Equilibrium: Reversible and irreversible reaction, statement of law of mass action and its kinetic derivation, equilibrium constant for homogeneous and heterogeneous reaction, relationship between K_c , K_p and K_x . Le Chatelier's Principle and its applications.
2. (a) The First in Action: Thermochemistry: Heats of chemical reactions, reaction enthalpy, standard enthalpy changes, Hess's Law, Kirchoff's law, Relation between enthalpy H and internal energy U , bond energies and their determination, enthalpies of ions in

solutions.

(b) Thermodynamics I: Thermodynamic terms: systems, extensive and intensive properties, thermodynamic process, state functions and exact differentials.

3. Thermodynamics II: Work done in a system, internal energy, first law of thermodynamics, heat capacities, relation between C_p and C_v , isothermal and adiabatic

processes for ideal gas, relation between P-V, V-T and P-T for ideal gas, adiabatic processes for ideal gas, adiabatic reversible expansion of ideal gas, Elementary idea of entropy and Clausius inequality.

4. Ionic Equilibrium: Ionic product of water, pH, pK_a , pK_b and pK_h buffer solution, buffer index, buffer capacity, buffer range, pH of buffer solution, idea of role of buffer solutions in day to day life, Dissociation constant of acids and bases, solubility product and its applications in salt analysis, Common effect, HSAB concept.

GROUP-C: CHANGES: 1. Chemical Kinetics: Rate of reaction, order and molecularity, expression for specific rate constant of first order reaction, half life period, unit, experimental determination of order or reaction.

2. Dilute Solutions and Changes of State-I: Colligative properties, Osmosis, Osmotic pressure and its experimental determination, van't Hoff factor, vapour pressure, Rault's Law of lowering of vapour pressure. Experimental determination of relative lowering of vapour pressure and molecular weight determination, relation between osmotic pressure and lowering of vapour pressure.

3. Dilute Solutions and Changes of States-II: Elevation of boiling point of solution, depression of freezing point of solutions, experimental determination of colligative properties, abnormal colligative properties of solutions.

4. Processes at Solid Surface: Elementary idea of crystal growths, Adsorption: Physisorption and chemisorption, chemisorbed species. Idea of catalytic activity at surfaces, anti catalytic processes such as hydrogenation, oxidation, cracking and reforming.

Inorganic Chemistry

PAPER-IB - (Inorganic Chemistry) GROUP-A: FOUNDATION

1. Atomic Structure:

(a) Features of H-spectra and Bohr's interpretation of H-spectra and

limitation, refinement of Bohr theory. Bohr-Sommerfeld theory.

(b) Shapes of orbitals and their labellings, idea of quantum numbers, Pauli's exclusion principle, Hund's rules, Aufbau principle, Electronic configuration of elements.

2. Bonding Models in Inorganic Chemistry

(a) Ionic bond: Energetics involved in ionic bond formation. Born Haber cycle, Radius ratio rule, different types of crystal lattice, Fajan's rule, I.P., Inert pair effect.

(b) Covalent Bond: Exceptions to the octet rule, idea of orbital overlap, hybridization of orbitals.

(c) Van der Waal's forces, H-bonding.

3. (a) Nomenclature of Inorganic Compounds: Acquaintance with IUPAC

use of multiplying affixes, enclosing marks, numbers and letters.

Names for ions and radicals, isopoly and heteropoly anions.

(b) Acid-Base Chemistry: Bronsted-Lowry definition, solvent system definition, Lowers concept, aqua acids, periodic trends in aqua acid strength, HSAB concept.

4. Periodicity: Pauli's exclusion principle and periodic table.

Fundamental trends of atomic/ionic radii, ionization energy, electron affinity, electronegativity, hardness and softness, first and second row anomalies, Idea of ct -orbital participation by non-metals and its influence on their reactivity. Periodic anomalies of non-metals and post transition metals.

GROUP-B SYSTEMATIC CHEMISTRY OF THE ELEMENTS

1. Hydrogen and hydrides: Position in P.T., isotopes of hydrogen, ortho and para hydrogen. Hydrides: ionic, covalent, metallic and intermediate. Hydrogen ion. H_2O_2 : preparation, properties, structure and uses.

2. Principles of Metallurgy: (a) Idea of Mohs' scale of hardness of minerals, Holme's classification of metals into five groups, general methods of extraction their position in electrochemical series and extraction, Gibbs free energy. (b) Principles of various concentration methods: Calcination, roasting and smelting, Role of carbon and other reducing agents. Electrolytic reduction, hydrometallurgy, methods of refining and purification, electrolytic, chromatographic, ion exchange solvent extraction, oxidative refinings. Zone refining, Kroll's process, Van Arkel de Boer method, Mond's process.

3. Chemistry of the following metals: (a) Li, Be, Ra (b) Sn, Pb.

4. Chemistry of halogens with reference of extraction, oxidation

states and halides.

GROUP-C: MISCELLANEOUS TOPICS

- 1. (a) Molecular Symmetry:** An Introduction: Symmetry elements and symmetry operations, centre of symmetry, axis of symmetry and plane of symmetry (definitions). (b) Elementary Magnetochemistry: Types of magnetic behaviours, paramagnetism, diamagnetism and ferromagnetism, dependence of paramagnetism on S & L.
- 2. Principles involved in the volumetric estimations** of Ag⁺ ion, Cu⁺⁺ ion and Ca⁺⁺ ion.
- 3. Principles involved in the gravimetric estimation** of Cu⁺⁺ ion, Ni⁺⁺ ion, Mg⁺⁺ ion, Ba⁺⁺ ion, SO₄⁻⁻ ion.
- 4. Isotopes:** Detection and separation. Tracer technique and applications, radiocarbon dating.

Inorganic Chemistry - GROUP-B: SYSTEMATIC CHEMISTRY OF THE ELEMENTS

PAPER-IB - (Inorganic Chemistry)

Inorganic Chemistry - GROUP-C: MISCELLANEOUS TOPICS

PAPER-IB - (Inorganic Chemistry)