SEMESTER – II

CORE – II GENERAL CHEMISTRY – II (90 Hrs, 5 Credits)

OBJECTIVE: To impart basic knowledge in solid state chemistry, thermodynamics, chemical bonding, s- block elements, aromatic and halogen compounds.

Unit 1 SOLID STATE CHEMISTRY (15 HOURS)

1.1 Theories of Metallic bonding.

1.2 Crystalline solids, space lattice, unit cell, seven crystal system, Bravaise lattices, close packing of crystals.

1.3 Packing fraction, radius ratio calculation, stability of ionic crystals- density of crystals, Miller indices, interplanar spacing- X-ray diffraction, Laue method and Debye-Scherrer (powder) method-intensities and structural determination of sodium chloride.

1.4 Bragg's equation, application of Bragg's equation to cubic crystal systems (simple cubic, BCC and FCC).

1.5 Classification of materials based on electrical conductivity- Metallic conductors- Theories of metallic bonding- Electron gas, Pauling and band theories-Semi conductors-n-type and p-type-applications- rectifiers, transistors, LED.

1.6 Super conductors-Meissner effect- applications (Levitation only)

Unit 2 THERMODYNAMICS 2 (15 HOURS)

2.1 Relation between heat of reaction at constant volume (q_v) and at constant pressure (q_p) –heat of reactions-heat of formation and standard states

2.2 Hess law and its relationship with first law of thermodynamics –applications-calorimetry-determination of heat of reactions-

2.3. Temperature dependence of heat of reaction – Kirchoffs equation – calculation from heat capacity data – problems.

2.4. Bond energy and resonance energy - calculation from thermo chemical data

2.5. Integral and differential heats of solution and heat of dilution.

Unit 3 CHEMICAL BONDING (15 HOURS)

3.1 Ionic bond – conditions for the formation of ionic bond-characteristic of ionic compounds-Lattice energy – Born-Haber cycle, Born-Lande equation (no derivation)-factors affecting lattice energy, solubility comparing hydration and lattice energy – Covalent bond – bond polarity- characteristics of covalent compounds- polarizing power and polarisability- Fajan's rule-deviation from the octet rule-incomplete octet-expansion of the octet (hyper valence).

3.2 Coordinate valency - General characteristics of compounds containing coordinate compounds.

3.3 VB theory – assumptions-limitations-principles of hybridization – shapes of simple inorganic molecules – BeF_2, BCl_3, NH_3, PCl_5, SF_6, H_2O, IF_5 and IF_7.

3.4 MO theory –conditions for the combination of atomic orbitals -LCAO-energy levels of MOs-rules for the filling of electrons in MOs- MO energy level diagrams of homo diatomic molecules- H_2, He_2, C_2, N_2, O_2, hetero diatomic molecules –HF, NO and CO.

3.5 Comparison of VB and MO theories, Hydrogen bonding – types, nature of hydrogen bond-effects of hydrogen on properties of substances. (H_2O and H_2S, HCl and HF, o-nitro phenol and p-nitro phenol).

Unit 4 CHEMISTRY OF S-BLOCK ELEMENTS (15 HOURS)

4.1 General characteristics of IA and II A group elements-electronic configuration – atomic and ionic radii- ionization potential-metallic character- electro negativity-polarising power- hydration ion and hydration energy-flame coloration- diagonal relationship-action with water, halogens and ammonia-formation of hydrides, oxides and complex compounds.

4.2 Extraction- sodium by Down's process-magnesium by electrolysis of fused magnesium chloride. Properties and uses of Li, Na, K, Be, Mg and Ca.

4.3 Properties and uses of plaster of paris, bleaching powder and sodium bi-carbonate. Comparison of stability of II group carbonates and solubility of sulphates.

4.4 Position of hydrogen in the periodic table- resemblance with alkali metals -special position of hydrogen.

Unit 5 CHEMISTRY OF BENZENE, AND POLY NUCLEAR AROMATIC HYDROCARBONS. (15 HOURS)

5.1 Aromaticity – Huckel's rule – Examples aromatic ,non-aromatic and antiaromatic compounds - Non benzenoid aromatic compounds.

5.2 Aromatic electrophilic substitution – mechanism – nitration – sulphonation – halogenations – Friedel-Crafts alkylation and acylation - orientation and reactivity in mono – and di – substituted benzenes – o/p ratio

5.3 Polynuclear hydrocarbons – Orientation and reactivity of naphthalene - structural elucidation and Haworth synthesis– chemical properties.

5.4 Orientation and reactivity of Anthracene and phenanthrene - Importance of 9- and 10-positions. Anthracene – oxidation, Diels-Alder reaction and reaction with Benzyne

UNIT 6 HALOGEN DERIVATIVES (15 HOURS)

6.1 Preparation of Halogen derivatives from alcohols using HX, PX_3, PX_5 and $SOCl_2$.

6.2 S_N1, S_N2 and S_Ni reactions – illustration & mechanism with examples – Effect of substrate, base, temperature, solvent and nucleophiles in S_N1 & S_N2 reactions-Basicity Vs nucleophilicity.

6.3 Reactions of halogen derivatives-hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation, thiocyanide and isothiocyanide. Williamson's ether synthesis- Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides

6.4 Polyhalogen derivatives - Geminal and vicinal halides - Preparation of 1,1 and 1,2-dichloroethane from acetaldehyde & Phosporous halides , percarbonate and perborates

6.5 Aromatic nucleophilic substitution – S_NAr and Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$)–Addition - elimination and Elimination – addition mechanism.

6.6 Preparation of aryl halides by Schiemann reaction, chloro and bromo - Sandmeyer & Gattermann reactions.

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9. Physical Chemistry, J. Moore- 4th edn

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14. Puri B.R., Sharma L.R., Kalia K.K Principles of Inorganic chemistry, (23 rd edition), New Delhi, Shoban Lal Nagin Chand * Co 1993.

15. Gopalan R, Subramanian P.S, Rangarajan K, Analytical Chemistry.

16. Morrison R.T. and Boyd R.N., Organic chemistry (6th edition) Ny, Allyn & Beecon Ltd (1976).

17. Pillai C. N., Organic chemistry, for undergraduates, 2008, university press.

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