

CORE COURSE IV – GENERAL CHEMISTRY III

Unit I: Chemistry of p-Block Elements – B,C and N Families

General characteristics of p-block elements – general characteristics of elements of Group III A-diagonal relationship between B and Si-extraction of boron – Physical and chemical properties of B- uses – chemistry of some compounds of boron: Boric acid, Borax, Diborane, Boron nitride – Extraction of Al – physical and chemical properties – uses – chemistry of some compounds of Al: Al_2O_3 , $AlCl_3$, Alums – Alloys of aluminum.

General characteristics of elements of Group IVA – difference of carbon and silicon from the rest of the family- allotropic forms of carbon – Chemistry of charcoal – Chemistry of oxides of carbon (CO & CO_2) – use of CO_2 in fire extinguishers – fuel gases – preparation of silicon – physical and chemical properties of Si – uses - oxides of silicon – structures of silicates – chemistry of silicones – manufacture of glass – type of glasses – extraction of lead – physical and chemical properties – uses – lead pigments.

General characteristics of elements of V A Group – the unique features of nitrogen from the rest of the family – preparation of nitrogen – physical and chemical properties of N_2 – uses – industrial preparation of ammonia – physical and chemical properties – uses – chemistry of some compounds of nitrogen: Hydrazine, Hydroxylamine, Hydrazoic acid, Nitric acid – nitrogen cycle – artificial fixation of nitrogen – preparation of phosphorous – physical and chemical properties – uses – chemistry of PH_3 , PCl_3 , PCl_5 , $POCl_3$, P_2O_5 and oxyacids of phosphorus – fertilizers.

Unit 2: Chemistry of p-Block elements – O,X and Noble Gas Families

Anomalous behaviour of oxygen – paramagnetic nature of oxygen, Preparation, properties, structure and uses of oxyacids of sulphur, classification of oxides based on their chemical behaviour – acidic oxide, amphoteric oxide and neutral oxides. Classification of oxides based on oxygen content – normal oxides, peroxides, super oxides, dioxides, sub oxides and mixed oxides. Chemistry of selenium and tellurium.

General characteristics of halogen with reference of electro negativity, electron affinity, oxidation states and oxidizing power. Peculiarities of fluorine, Hydrides, oxides and oxo acids of halogens. Inter halogen compounds and pseudo halogens – basic nature of iodine.

Noble gases : Position in the periodic table – isolation from atmosphere – General characteristics – structure and shape of xenon compounds – XeF_4 , SeF_6 , XeO_3 and $XeOF_4$ – uses of noble gases

Unit 3: Organohalogen Compounds

Nomenclature – general methods of preparation of haloalkanes – physical and chemical properties – uses – nucleophilic substitution mechanisms (SN_1 , SN_2 and SN_3) – evidences – stereochemical aspects of nucleophilic substitution mechanisms – general methods of preparation of halobenzenes

– physical properties – chemical properties – uses mechanisms of electrophilic and nucleophilic substitution reactions – theory of orientation and reactivity.

Unit IV: Stereochemistry

Stereoisomerism – types – optical isomerism – chirality's based on symmetry elements (C_n , σ , i and S_n) – idea of asymmetry and dissymmetry – optical activity – measurement of optical activity – concept of enantiomerism, diastereomerism – axial chirality in substituted allenes and spiranes – atropisomerism in substituted biphenyls – R,S and D, L notations to express configurations – erythro, threo conventions – meso and dl – forms of tartaric acid – stereoselectivity and stereospecificity in organic reactions with suitable examples – resolution of racemic mixture using chiral reagent – Walden inversion – asymmetric synthesis – asymmetric induction.

Unit V – Solidstates, Liquid Crystals and Colloids

Classification of solids – Isotropic and anisotropic crystals. Laws of crystallography – representation of planes – Miller indices, space lattice, crystal systems – seven primitive, unit cells – X – ray diffraction – derivation of Bragg's equation – determination of structure of NaCl by Debye Scherrer (powder method) and rotating crystal method – determination of Avogadro's number – discussion of structure of KCl & CsCl – defects in crystals – stoichiometric and non stoichiometric – methods of growing crystals – from melt and from solution (hydrothermal method, Gel method – packing of ions in crystals – radius ratio rules and its limitations. Liquid crystals – types, theories and applications.

Definitions – types of colloids – sols – preparation, purification and properties – Kinetic, Optical and electrical stability of colloids, gold number, associated colloids, Emulsion – types of emulsions, preparation, properties and application, Gels – types of gels, preparation, properties and applications. Donnan membrane equilibrium – osmosis, reverse osmosis, dialysis and desalination – macromolecules – molecular weight of macromolecules – determination of molecular weight by osmotic pressure method and light scattering methods.

Books for Reference:

1. Puri B.R. Sharma, L.R., Kalia K.K. Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., 1993
2. Lee. J.D. Concise Inorganic Chemistry, UK, Black well science (2006)
3. Puri B.R. Sharma L.R. Pathania M.S. Principles of Physical Chemistry
4. Glasstone S., Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co. Ltd
5. Morrison R.T. and Boyd R.N. Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976)
6. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997)