

Jivan Vikas Shikshan Sanstha Risod's
Late Pushpadevi Patil Arts & Science College Risod, Dist-Washim (M.S.) 444506
NAAC Accredited with 'B' grade, Recognized with 2(f) status by UGC
(Affiliated to Sant Gadge Baba Amravati University, Amravati)

Department of Chemistry

Syllabus

Semester-III

UNIT- I: **14L**

A] Covalent Bonding:

Molecular Orbital Theory. Postulates of MO theory. LCAO approximation. Formation of bonding and antibonding MOs. Rules for LCAO. MO energy level diagram. Concept of bond order. MO structure of homonuclear diatomic molecules of namely He₂, H₂, N₂ and O₂. Stability sequence of species of O₂ i.e. O₂, O₂⁺, O₂²⁺, O₂⁻ and O₂²⁻. Paramagnetic nature of O₂. MO structure of heteronuclear diatomic molecules viz. NO, HF and CO (Coulson's structure). Explanation of important properties of CO viz. – triple bond, almost nonpolar nature, electron donor and acceptor behaviour. Comparison of VB and MO theories. [6]

B] Metallic Bonding:

Free electron theory and properties of metals such as electrical and thermal conduction, malleability, ductility and metallic lustre. VB theory or Resonance theory of metals. Band theory to explain nature of conductors, insulators and semiconductors (both intrinsic and extrinsic). [3]

C] VSEPR Theory:

Various rules under VSEPR theory to explain molecular geometry (following examples may be taken to explain various rules- BeCl₂, BF₃, CH₄, NH₄⁺, PCl₅, SF₆, IF₇, SnCl₂, NH₃, H₂O, SF₄, ClF₃, BrF₅, XeF₆, SOF₄, COF₂, PCl₃,). Limitations of VSEPR theory. [5]

UNIT- II: Theory of Quantitative Inorganic Analysis **14L**

A] Volumetric Analysis:

(a) Introduction: Volumetric analysis, titrant, titrate, end point, equivalence point, indicator etc. Requirements of volumetric analysis. Definition of standard solution, primary standard substance. Requirements of primary standard substance. Terms to express concentrations namely- molarity, normality, molality, mole fraction and percentage. (Simple numericals expected).

(b) Acid-Base titrations: Types of acid base titrations. pH variations during acid base titration. Acid base indicators. Modern theory (Quinoniod theory) of acid base indicators. Choice of suitable indicators for different acid base titrations.

(c) Redox Titrations: General principles involved in redox titrations (redox reactions, redox potentials, oxidant, reductant, oxidation number). Brief idea about use of KMnO_4 , $\text{K}_2\text{Cr}_2\text{O}_7$ as oxidants in acidic medium in redox titrations. Use of I_2 in iodometry and iodimetry. Redox indicators-external and internal indicators. Use of starch as an indicator. Iodometric estimation of Cu (II). [8]

B] Gravimetric Analysis:

Definition. Theoretical principles underlying various steps involved in gravimetric analysis with reference to estimation of barium as barium sulphate. Coprecipitation and post precipitation. (Definition, types and factors affecting). [6]

UNIT- III:

14L

A] Aldehydes and Ketones:

Preparation of acetaldehyde from ethanol, ethylidene chloride and acetylene. Preparation of benzaldehyde from benzene (Gattermann-Koch reaction) and toluene. Preparation of acetone from isopropyl alcohol, isopropylidene chloride and propyne. Preparation of acetophenone from benzene and ethyl benzene. Structure of carbonyl group, acidity of α -hydrogen in carbonyl compounds. Reactions of aldehydes &/or ketones: Cannizzaro's, Reformatsky, Perkin with mechanism, Mannich reaction, Benzoin and Aldol condensations. Clemmensen, Wolf-Kishner, MPV and LiAlH_4 reductions. [8]

B] Carboxylic acids:

Structure and reactivity of carboxylic groups. Acidity of carboxylic acids, effects of substituents on acids strength. Oxalic acid: Preparation from ethylene glycol and cyanogen. Reactions: Reaction with ethyl alcohol, ammonia, glycerol and action of heat. Lactic acid: Preparation from acetaldehyde and pyruvic acid. Reactions: Reaction with ethanol, PCl_5 , action of heat, oxidation and reduction. Benzoic acid: Preparation from toluene, benzylalcohol, phenyl cyanide and benzamide. Reactions: Reaction with ethanol, PCl_5 and ammonia. Salicylic acid: Preparation by Reimer-Tiemann reaction. Reactions: Reaction with CH_3COCl , CH_3OH and $\text{C}_6\text{H}_5\text{OH}$. [6]

UNIT- IV: 14L

A] Optical isomerism:

Element of symmetry, chirality, asymmetric carbon atom, enantiomers, diastereoisomers, relative and absolute configurations, DL and RS nomenclature, racemisation and resolution (by chemical method). [4]

B] Geometrical isomerism:

Cis-trans & E-Z nomenclature, Methods of structure determination. [3]

C] Conformational isomerism:

Bayer's Strain theory and its limitations. Stability of cycloalkanes, conformational isomers of ethane, n-butane and cyclohexane, their energy level diagrams. Newman & Sawhorse projection formulae. [7]

UNIT- V: 14L

A] Thermodynamics and Equilibrium:

(i) Gibb's and Helmholtz's free energy function. Physical significance of Gibb's free energy, Change in free energy as a criteria of spontaneity and equilibrium. Variation of free energy G with P & T. Gibb's-Helmholtz's equation in terms of G and its application. (ii) Partial molal function, chemical potential, derivations of Gibb's-Duhem equation. Chemical potential of an ideal gas in gaseous mixture. Derivation of vant Hoff's isotherm and its application to equilibrium state. Derivation of vant Hoff's equation and its applications. (iii) Numericals. [10]

B] Phase Equilibrium:

(i) Immiscible liquids, Nerst distribution law and its application to association and dissociation of solute in one of the solvent. Process of extraction, derivation of formula for the amount of solute left unextracted after nth extraction. (ii) Phase transition - Clausius- Clyperon equation (only qualitative statement). (iii) Partially miscible liquids - Phase diagram of phenol-water, triethyl amine - water and nicotine-water systems. (iv) Numericals. [4]

UNIT- VI:**14L****A] Liquid state:**

(i) Surface tension, determination and its S.I. Unit. Effect of temperature on surface tension, derivation of expression for relative surface tension by Drop number method. Application of surface tension. (ii) Viscosity, determination and its S.I. Unit. Effect of temperature on viscosity, derivation of expression for relative viscosity by Ostwald's viscometer method. Applications of viscosity. [4]

B] Electrochemistry:

(i) Conductance of electrolyte solution. Specific, equivalent and molar conductance. Determination of conductance of electrolyte solution, variation of specific and equivalent conductance with dilution for strong electrolyte. Conductometric titrations. Applications of conductometric titration. (ii) Migration of ions under the influence of electric field. Transport number of ions. Determination of transport number by Hottorf's method and Moving boundary method (iii) Kohlrausch's law of independent migration of ions. Determination of λ^∞ and degree of dissociation of a weak electrolyte. Determination of dissociation constant of weak electrolyte. (iv) Numericals. [10]