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[Prerequisites: Physical and chemical adsorption, Factors affecting adsorption, Adsorption isotherms: Freundlich and Langmuir isotherms (derivation not required) - BET equation - BET equation (not needed) and its applications to surface area measurements. Applications of homogeneous and heterogeneous catalysis - Theories of homogeneous and heterogeneous catalysis - Enzyme catalysis - Michaelis-Menten equation (derivation not required), References th 1. B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, 46 Edn., Vishal Publishing Company, New Delhi, 2013. 2. P. W. Atkins, J. de Paula, Atkin's Physical Chemistry 8th Edn., Oxford University Press (2006). 373. Donald A. McQuarrie, John D. Simon, Physical Chemistry: A Molecular Approach University Science Books: Sausalito, CA; 1997. rd 4. K. Laidler, Chemical Kinetics, 3 Edn., Pearson Education, New Delhi, 2004. rd 5. P. L. Soni, O. P. Dharmarha, U. N. Dash, Textbook of Physical Chemistry, 23 Edn., Sultan Chand & Sons, New Delhi, 2011. 6. K. L. Kapoor, Physical Chemistry, Volumes II and III, Macmillan Publishers, Noida, 2004. Further reading th 1. Gordon M. Barrow, Physical Chemistry, 5 Edition, Tata McGraw Hill Education, New Delhi, 2006. nd 2. S. Glasstone, D.H. Lewis, Elements of Physical Chemistry, 2 Edn., Macmillan & Company, UK, 1962. th 3. F. Daniels, R.A. Alberty, Physical Chemistry, 5 Edn., John Wiley and Sons, Canada, 1980. 4. P. W. A t k i n s , J . d e P a u l a The Elements of Physical Chemistry 7th Edn., Oxford University Press, Oxford, 2016. Module III: Phase Equilibria (10 hrs) [Prerequisites: Concept of phase- solid, liquid and gas-homogeneous and heterogeneous phase- component and degree of freedom]. Gibbs phase rule and its derivation. Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications. One component systems: Water and sulphur systems: Simple eutectic system (lead-silver system) - Pattinson's process - Two component systems involving formation of compounds with congruent melting points (zinc-magnesium system and ferric chloride-water system) - Two component systems involving formation of compounds with incongruent melting points (sodium sulphate-water system). Freezing mixtures - Thermal analysis - Cooling curve method - Deliquescence and efflorescence. Liquid-liquid equilibria - Partially miscible and immiscible liquid systems - CST - Upper CST and lower CST - Steam distillation. Nernst distribution law: Derivation and applications. References th 1. B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, 46 Edn., Vishal Publishing Company, New Delhi, 2013. 2. P. W. Atkins, J. de Paula, Atkin's Physical Chemistry 8th Edn., Oxford University Press, 2006. 3. Donald A. McQuarrie, John D. Simon, Physical Chemistry: A Molecular Approach University Science Books: Sausalito, CA; 1997. 38rd 4. P. L. Soni, O. P. Dharmarha, U. N. Dash, Textbook of Physical Chemistry, 23 Edn., Sultan Chand & Sons, New Delhi, 2011. Further reading th 1. Gordon M. Barrow, Physical Chemistry, 5 Edn., Tata McGraw Hill Education, New Delhi, 2006. 2. K. L. Kapoor, Physical Chemistry, Volumes II and III, Macmillan Publishers, Noida, 2004. nd 3. S. Glasstone, D. H. Lewis, Elements of Physical Chemistry, 2 Edn., Macmillan & Company, UK, 1962. th 4. F. Daniels, R. A. Alberty, Physical Chemistry, 5 Edition, John Wiley and Sons, Canada, 1980. 5. P. W. A t k i n s , J . d e P a u l a The Elements of Physical Chemistry 7th Edn., Oxford University Press, Oxford, 2016. Module IV: Molecular Spectroscopy I (12 hrs) [Prerequisites: Electromagnetic spectrum- wavelength, frequency, wavenumber]. Interaction of electromagnetic radiation with matter - Qualitative aspects, Einstein, absorption-emission and factors affecting line width and intensity of signal (elementary idea) - Energy levels in molecules - Born-Oppenheimer approximation. Rotational Spectroscopy: Introduction - Rigid rotor - Expression for energy - Selection rules - Intensities of spectral lines - Determination of bond lengths of diatomic molecules. Vibrational Spectroscopy: Simple harmonic oscillator - Energy levels - Force constant - Selection rules Anharmonicity - Fundamental frequencies - Overtones - Fingerprint region - Group frequency concept - Degree of freedom for polyatomic molecules - Modes of vibrations of CO2 and H2O. Raman Spectroscopy: Basic principles - Qualitative treatment of rotational Raman effect - Vibrational Raman spectra - Stokes & anti-stokes lines and their intensity difference - Selection rules - Mutual exclusion principle. Electronic Spectroscopy: Basic principles - Frank-Condon principle - Electronic transitions - Beer Lambert's law. Dissociation energy of diatomic molecules - Chromophore and auxochrome - Bathochromic and hypsochromic shifts. Module V: Molecular Spectroscopy II (4 hrs) Nuclear Magnetic Resonance (NMR) Spectroscopy: Proton NMR and <sup>13</sup>C NMR - Principle - Number and position of signals - Chemical shift - Different scales - Spin-spin coupling (qualitative idea). Eg. NMR spectra of simple molecules. Electron Spin Resonance (ESR) Spectroscopy: Principle - Hyperfine structure - ESR of methyl, phenyl and cycloheptatrienyl radicals. References 39th 1. B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, 46 Edn., Vishal Publishing Company, New Delhi, 2013. 2. P. W. Atkins, J. de Paula, Atkin's Physical Chemistry 8th Edn., Oxford University Press (2006). 3. Donald A. McQuarrie, John D. Simon, Physical Chemistry: A Molecular Approach University Science Books: Sausalito, CA; 1997. 4. C. N. Banwell, Fundamentals of molecular spectroscopy, McGraw-Hill, 1994. 5. G. M. Barrow, Introduction to Molecular Spectroscopy, McGraw Hill, London, 1962. Further reading th 1. Gordon M. Barrow, Physical Chemistry, 5 Edn., Tata McGraw Hill Education, New Delhi, 2006. 2. K. L. Kapoor, Physical Chemistry, Volumes II and III, Macmillan Publishers, Noida, 2004. nd 3. S. Glasstone, D. H. Lewis, Elements of Physical Chemistry, 2 Edn., Macmillan & Company, UK, 1962. th 4. F. Daniels, R. A. Alberty, Physical Chemistry, 5 Edn., John Wiley and Sons, Canada, 1980. 5. P e t e r A t k i n s , J u l i o d e P a u l a , The Elements of Physical Chemistry, 7th Edn., Oxford University Press, Oxford, 2016. 6. P. R. Singh, S. K. Dixit, Molecular Spectroscopy: Principles and Chemical Applications, S. Chand & Company, New Delhi 1980. 7. P. K. Bhattacharya, Group Theory and its Chemical Applications, Himalaya Publishing House, New Delhi, 1986. rd 8. F. A. Cotton, Chemical Applications of Group Theory, 3 Edn., John Wiley & Sons, New Delhi. Module VI: Photochemistry (6 hrs) [Prerequisites: Introduction - Difference between thermal and photochemical processes - Beer Lambert's law]. Laws of photochemistry: Grothuss-Draper law and Stark-Einstein's law of photochemical equivalence. Quantum yield and its explanation -Photophysical processes: Jablonski diagram - Fluorescence - Phosphorescence. Non-radiative processes: Internal conversion and inter system crossing. Photosensitization - Chemiluminescence - Photochemical reactions. (hydrogen-chlorine and hydrogen-bromine). References th 1. B. R. Puri, L. R. Sharma, M. S. Pathania, Principles of Physical Chemistry, 46 Edn., Vishal Publishing Company, New Delhi, 2013. 2. P. W. Atkins, J. de Paula, Atkin's Physical Chemistry 8th Edn., Oxford University Press, 2006. 403. Donald A. McQuarrie, John D. Simon, Physical Chemistry: A Molecular Approach University Science Books: Sausalito, CA; 1997. 38rd 4. P. L. Soni, O. P. Dharmarha, U. N. Dash, Textbook of Physical Chemistry, 23 Edn., Sultan Chand & Sons, New Delhi, 2011. Further reading th 1. Gordon M. Barrow, Physical Chemistry, 5 Edn., Tata McGraw Hill Education, New Delhi, 2006. 2. K. L. Kapoor, Physical Chemistry, Volumes II and III, Macmillan Publishers, Noida, 2004. nd 3. S. Glasstone, D. H. Lewis, Elements of Physical Chemistry, 2 Edn., Macmillan & Company, UK, 1962. th 4. F. Daniels, R. A. Alberty, Physical Chemistry, 5 Edition, John Wiley and Sons, Canada, 1980. 5. P e t e r A t k i n s , J u l i o d e P a u l a , The Elements of Physical Chemistry, 7th Edn., Oxford University Press, Oxford, 2016. rd 6. K. Laidler, Chemical Kinetics, 3 Edn., Pearson Education, New Delhi, 2004. 41SEMESTER VI Course Code: CHE6B09 Core Course IX: INORGANIC CHEMISTRY - IV Total Hours: 48; Credits: 3; Hours/Week: 3; Total Marks 75 (Internal 15 & External 60) CHE6B09 INORGANIC CHEMISTRY - IV LT P C 30 0 3 Objective (s) To gain detailed knowledge of the electronic configuration and properties of transition and inner transition elements and their role in biological systems. To understand the importance of different instruments used in analysis. Course outcome (s) CO1 To understand the principles behind different instrumental methods CO2 To distinguish between lanthanides and actinides CO3 To appreciate the importance of CFT CO4 To understand the importance of metals in living systems CO5 To distinguish geometries of coordination compounds Module I: Instrumental Methods of Analysis (8 hrs) [Prerequisites: Beer- Lambert's law] Atomic absorption spectroscopy, Flame Emission Spectroscopy- Colorimetry- Spectrophotometry- laws of Spectrophotometry- Beer- Lambert's law. -; XRD, Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM). References 1. D. A. Skoog, F. James Holler, S. R. Crouch, Principles of Instrumental Analysis, 6th Edn., Cengage Learning; Noida, 2004. 2. H. H Willard, L. L. Merritt, J. A. Dean, F. A. Settle, Instrumental methods of Analysis, CBS Publishers & Distributors, Delhi, 1996. 3. H. Willard, L. L. Merritt, J. A. Dean, F. A. Steptoe, Instrumental Methods of Analysis, 7th Edn. Wadsworth Publishing Co. Ltd., Belmont, California, USA, 1988. 4. D. A. Skoog, F. J. Holler, T. A. Nieman, Principles of Instrumental Analysis, Cengage Learning India Ed. Further reading 1. D. A. Skoog, D. M. West, F. J. Holler, Fundamentals of Analytical Chemistry, 6th Edn., Saunders College Publishing, Fort Worth (1992). 2. D. C. Harris, Quantitative Chemical Analysis, 5th Edn., W H Free-man and Company, NewYork, 1999. Module II: Transition and Inner Transition Elements (8 hrs) 42[Prerequisites: Transition Metals: General characteristics: Metallic character, oxidation states, size, density, melting points, boiling points, Lanthanides: Electronic configuration and general characteristics.] Transition Metals: ionization energy, colour, magnetic properties, reducing properties, catalytic properties, non-stoichiometric compounds, complex formation and alloy formation. Difference between first row and other two rows. Lanthanides: Occurrence of lanthanides - Importance of beach sands of Kerala - Isolation of lanthanides from monazite sand - Separation by ion exchange method. Lanthanide contraction: Causes and consequences. Industrial importance of lanthanides. Actinides: Electronic configuration and general characteristics - Comparison with lanthanides. References 1. J. D. Lee, Concise Inorganic Chemistry, 5th Edn., Wiley India Pvt. Ltd. 2008. 2. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi 2010. 3. J. E. Huheey, E. A. Keiter, R. L. Keiter, O. K. Medhi, Inorganic Chemistry, Pearson 2006. Further reading 1. F. A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 6th Edn., John Wiley, New York. 1999. 2. D. F. Shriver, P. W. Atkins, Inorganic Chemistry, 3rd Edn., Oxford University Press. 2009. Module III: Coordination Chemistry (16 hrs) Bonding theories: Review of Werner's theory and Sidgwick's concept of coordination - EAN rule - Valence Bond theory - Geometries of coordination numbers 4 and 6 - Limitations of VBT. Crystal field theory - Splitting of d-orbitals in octahedral, tetrahedral, tetragonal and square planar complexes - Factors affecting crystal field splitting - CFSE of low spin and high spin octahedral complexes - Spectrochemical series - Explanation of geometry, magnetism and colour - Distorted octahedral complexes- Jahn- Teller Theorem. CFSE - calculation and its applications. Merits and demerits of Crystal field theory. Molecular orbital theory for octahedral complexes (with sigma bonds only). Stability of complex: Inert and labile complexes - Factors influencing stability. Application of complexes in qualitative and quantitative analysis. Refererces 1. R. Gopalan, V. Ramalingam, Concise Coordination Chemistry, 1st Edn., Vikas Publishing House, New Delhi, 2001. 432. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, 31st Edn., W H Free-man and Company, NewYork, 1999. Module IV: Organometallic Compounds (8 hrs) Definition - Classification based on the nature of metal-carbon bond - Zeise's salt. 18- Electron rule. Metal carbonyls - Mononuclear and Polynuclear carbonyls of Fe, Co and Ni (structure only) - Bonding in metal carbonyls. Ferrocene: Preparation, properties and bonding (VBT only). Catalysis: Zeigler Natta catalyst in the polymerization of alkene and Wilkinson catalyst in the hydrogenation of alkene. References 1. P. Powell, Principles of Organometallic Compounds, 2nd Edn., Chapman and Hall, London, 1988. 2. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, 31st Edn. Milestone Publishers, New Delhi 2010. 3. G. L. Meissler, D. A Tarr, Inorganic Chemistry, 3rd Edn., Pearson Education, 2004. 4. J. E. Huheey, E. A. Keiter, R. L. Keiter, O. K. Medhi, Inorganic Chemistry, Pearson 2006. Further reading 1. R. C. Mehrothra, A. Singh, Organometallic chemistry, New age publishers. Module V: Bioinorganic Chemistry (8 hrs) [Prerequisites: Metal ions in biological system - Trace and bulk metal ions.] Haemoglobin and Myoglobin (elementary idea of structure and oxygen binding mechanism) - Chlorophyll and photosynthesis (mechanism not expected) - Sodium-potassium pump-4p-Biochemistry of Ca, Zn and Co - Toxicity of metal ions (Pb, Hg and As). Anticancer drugs: Cis-platin, oxaliplatin and carboplatin - Structure and significance. References 1. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, New Delhi, 2010. 2. G. L. Meissler, D. A Tarr, Inorganic Chemistry, 3rd Edn. Pearson Education, 2004. 3. J. E. Huheey, E. A. Keiter, R. L. Keitor, O K Medhi, Inorganic Chemistry,5th Edn. Pearson, 2009. 4. F. A.Cotton, G. Wilkinson, P. L. Gaus, Basic Inorganic Chemistry, 3rd Edn, John - Wiley,1995. Further reading 1. B. Douglas, D. Mc Daniel, J. Alexander, Concepts and models of Inorganic Chemistry, 3rd Edn., John Wiley, 2. I. Bertini, H. B Gray, S. J. Lippard, J. Selvertone Valentine, Bioinorganic Chemistry, Viva Books Pvt Ltd. 2007. 45SEMESTER VI Course Code: CHE6B10 Core Course X: INORGANIC CHEMISTRY - III Total Hours: 48; Credits: 3; Hours/Week: 3; Total Marks 75 (Internal 15 & External 60) CHE6B10 ORGANIC CHEMISTRY - III LT P C 30 0 3 Objective(s) To gain detailed knowledge of the chemistry of different bio molecules. To give a basic understanding of different spectral techniques and to apply them in simple molecules. To differentiate diverse pericyclic reactions. Course outcome (s) CO1 To elucidate structure of simple organic compounds using spectral techniques CO2 To understand the basic structure and tests for carbohydrates CO3 To understand the basic components and importance of DNA CO4 To understand the basic structure and applications of alkaloids and terpenes CO5 To distinguish different pericyclic reactions Module I: Structure Elucidation Using Spectral Data (11 hrs) [Prerequisites: Electromagnetic spectrum- wavelength, frequency and energy relation. Beer- Lambert's law-chromophore and auxochrome. functional groups.] Applications of spectral techniques in the structural elucidation of organic compounds. UV-Visible Spectroscopy: Electronic transitions in molecules (σ→σ\*, n→σ\*, n→n\* and n→π\*) - Chromophore and auxochrome. Study of the UV spectra of butadiene, acetone, methyl vinyl ketone and benzene. Amax calculation for dienes and α,β-unsaturated carbonyl compounds. IR Spectroscopy: Concept of group frequencies -fingerprint region - IR spectra of alcohols, phenols, amines, ethers, aldehydes, ketones, carboxylic acids, esters and amides. <sup>1</sup>H NMR: Chemical shift - Spin-spin splitting - Interpretation of <sup>1</sup>H NMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, acetone, 1, 1, 2-tribromoethane, propanoic acid, ethyl acetate, toluene and acetophenone. Structure elucidation of simple organic compounds using UV, IR and <sup>1</sup>H NMR spectroscopic techniques (ethanol, acetone, acetophenone, acetaldehyde, acetic acid, propanoic acid and ethyl acetate only). Purification of organic compounds: Column, paper and thin layer chromatography. Gas Chromatography. References 1. R. M. Silverstein, F. X. Webster, Spectrometric Identification of Organic Compounds, 6th Edn., John Wiley and Sons, New York, 2004. 2. Y. R. Sharma, Elementary Organic Spectroscopy, 4th Edn., S. Chand & Company Ltd., New Delhi, 3. D. L. Pavia, G. M. Lampman, G. S. Kriz, Introduction to Spectroscopy, Thomson Brooks Cole, 464. Paula Y. Bruice, Organic Chemistry, 3rd Edn. Pearson Education, Asia. Further reading 1. P. S. Kalsi, Applications of Spectroscopic Techniques in Organic Chemistry, 6th Edn., New Age International (P) Ltd., New Delhi, 2004. 2. William Kemp, Organic Spectroscopy, 2nd Edition, Macmillan, New York, 1987. 3. R. T. Morrison, R. N. Boyd, Organic Chemistry, 6th Edn. - Prentice Hall of India. 4. I. L. Finar, Organic Chemistry, Vol - I, 6th Edn., Pearson education. Module II: Carbohydrates (8 hrs) [Prerequisites: Classification. Monosaccharides: Fischer projection - D, L configuration. cyclic structure of ribose, deoxy ribose, glucose and fructose.] Epimers and anomeres - Mutarotation - Reactions of glucose - Killiani-Fischer synthesis and Ruff degradation - Conversion of aldoses to ketoses and vice versa - Osazone formation. Disaccharides: Cyclic structure of maltose, lactose and sucrose - Inversion of cane sugar. Reducing and non-reducing sugars. Polysaccharides: Structure of cellulose, starch and glycogen (structure elucidation not required). Test for carbohydrates: Chemistry of Tollen's test, Fehling's test, Benedict's test, and Molisch test - Tests for urine sugar and blood sugar. References 1. I. L. Finar, Organic Chemistry - Volume I & II - Pearson Education. 2. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, 3rd Edn., Vishal Publishing Company Co. 3. K. S. Tewari, N. K. Vishnoi, Organic Chemistry, 3rd Edn., Vikas Publishing House. 4. R. T. Morrison, R.N. Boyd, Organic Chemistry, 6th Edn., Prentice Hall of India. Further reading 1. J. P. Rohy, Essentials of Carbohydrate Chemistry, Springer. 2. S. P. Bhutani, Chemistry of Biomolecules, Ane Books Pvt Ltd. Module III: Proteins and Nucleic acids (11 hrs) [Prerequisites: Amino acids - Classification - Structure of amino acids - Zwitter ion formation - Isoelectric point.] Amino acids: Synthesis (Strecker synthesis and amino malonate synthesis). Peptides and Proteins - Structure determination of peptides; Edmann degradation and Sanger's methods. Peptide synthesis: Solid phase synthesis. Denaturation of proteins. Enzymes - characteristics and examples. Tests for proteins: Chemistry of Xanthoprotein test, Biuret test and Ninhydrin test. Nucleic acids: Introduction, constituents of nucleic acids - nitrogenous bases, nucleosides and nucleotides. Double helical structure of DNA. Codon and genetic code - DNA replication - Difference between DNA & RNA - DNA finger printing and its applications. Polymerase chain reaction. References 47 1. I. L. Finar, Organic Chemistry - Volume I & II - Pearson Education.2. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, 3rd Edn., Vishal Publishing Company Co. 3. K. S. Tewari, N. K. Vishnoi, Organic Chemistry, 3rd Edn., Vikas Publishing House. 4. R. T. Morrison, R. N. Boyd, Organic Chemistry, 6th Edn. - Prentice Hall of India. Further reading 1. O. P. Agarwal, Chemistry of Natural Products - Goel Publications. Module IV: Biomolecules (5 hrs) Lipids: Classification - Fats and oils - Hydrogenation -Analysing fats and oils- Acid-value, Saponification value, Iodine value. Phospholipids: Structure of Lecithin. Biological functions of lipids. Steroids: Classification - Structure and biological functions of Cholesterol, testosterone, estradiol and progesterone - Elementary idea of HDL and LDL. Hormones: Definition, examples and functions of steroid, peptide and amine hormones. Vitamins: Classification - Sources and deficiency diseases - Structure of vitamin C. Note: Structural elucidation not expected in any case. References 1. I. L. Finar, Organic Chemistry - Volume I & II - Pearson Education. 2. M. K. Jain and S. C. Sharma, Modern Organic Chemistry, 3rd Edn., Vishal Publishing Company Co. 3. K. S. Tewari, N. K. Vishnoi, Organic Chemistry, 3rd Edn., Vikas Publishing House. Further reading 1. John McMurry, Organic Chemistry, 5th Edn., Thomson Asia Pvt Ltd. 2. C. N. Pillai, Organic Chemistry, Universities Press. 3. S. P. Bhutani, Chemistry of Biomolecules, Ane Books Pvt Ltd. 4. O. P. Agarwal, Chemistry of Natural Products, Goel Publication. 5. R. T. Morrison, R. N. Boyd, Organic Chemistry, 6th Edn., Prentice Hall of India. Module V: Natural products (5 hrs) [Prerequisites: Heterocyclic systems- nitrogen heterocycles.] Alkaloids: Extraction. Classification based on structure of heterocyclic ring, physiological actions of nicotine, quinine, coniline. Terpenes: Classification - Isoprene rule - Essential oils - Isolation of essential oils by steam distillation and Enlfleurage process - Uses of lemongrass oil, eucalyptus oil- Isolation of terpenes from essential oils (elementary idea) - Source, structure and uses of citral, geraniol, limonene and menthol. Structure of natural rubber - Vulcanization and its advantages. Note: Structural elucidation not expected in any case. References 1. I. L. Finar, Organic Chemistry, Volume I & II, Pearson Education. 2. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, 3rd Edn., Vishal Publishing Company Co. 483. K. S. Tewari, N. K. Vishnoi, Organic Chemistry, 3rd Edn., Vikas Publishing House. 4. R. T. Morrison, R.N. Boyd, Organic Chemistry, 6th Edn., Prentice Hall of India. Further reading 1. S. P. Bhutani, Chemistry of Biomolecules, Ane Books Pvt Ltd. 2. O. P. Agarwal, Chemistry of Natural Products, Goel Publications. Module VI: Pericyclic Reactions (8 hrs) [Prerequisites: Formation of molecular orbitals-bonding and antibonding Mos, nodes. Conjugated, cumulated and isolated double bonds.] Introduction - Molecular orbitals of conjugated n systems (C2, C3, C4, C5 and C6 systems). Frontier Molecular Orbitals (FMOs). Types of pericyclic reactions. Electrocyclic reactions: Butadiene-cyclobutene and hexatriene-cyclohexadiene interconversions. Dis and con rotation. Cycloaddition reactions: Dimerisation of ethylene and Diel's-Alder reaction. Supra-supra and supra-antara interactions. Sigmatropic reactions: [1,3], [1,5] and [3,3] rearrangements. FMO explanations and Woodward-Hoffmann selection rules for the above reactions. Cope and Claisen rearrangements (mechanism expected). Pericyclic reactions in human body - Vitamin D from cholesterol (elementary idea). References 1. P. Sykes, A Guide book to Mechanism in Organic Chemistry, 6th Edn., Orient Longman. 2. P. S. Vishnoi, Organic Chemistry, 3rd Edn., Vikas Publishing House. 4. R. T. Morrison, R.N. Boyd, Organic Chemistry, 6th Edn., Prentice Hall of India. Further reading 1. J. P. Rohy, Essentials of Carbohydrate Chemistry, Springer. 2. S. P. Bhutani, Chemistry of Biomolecules, Ane Books Pvt Ltd. Module III: Proteins and Nucleic acids (11 hrs) [Prerequisites: Amino acids - Classification - Structure of amino acids - Zwitter ion formation - Isoelectric point.] Amino acids: Synthesis (Strecker synthesis and amino malonate synthesis). Peptides and Proteins - Structure determination of peptides; Edmann degradation and Sanger's methods. Peptide synthesis: Solid phase synthesis. Denaturation of proteins. Enzymes - characteristics and examples. Tests for proteins: Chemistry of Xanthoprotein test, Biuret test and Ninhydrin test. Nucleic acids: Introduction, constituents of nucleic acids - nitrogenous bases, nucleosides and nucleotides. Double helical structure of DNA. Codon and genetic code - DNA replication - Difference between DNA & RNA - DNA finger printing and its applications. Polymerase chain reaction. References 47 1. I. L. Finar, Organic Chemistry - Volume I & II - Pearson Education.2. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, 3rd Edn., Vishal Publishing Company Co. 3. K. S. Tewari, N. K. Vishnoi, Organic Chemistry, 3rd Edn., Vikas Publishing House. 4. R. T. Morrison, R. N. Boyd, Organic Chemistry, 6th Edn., Prentice Hall of India. Further reading 1. S. P. Bhutani, Chemistry of Biomolecules, Ane Books Pvt Ltd. 2. O. P. Agarwal, Chemistry of Natural Products, Goel Publications. Module VI: Pericyclic Reactions (8 hrs) [Prerequisites: Formation of molecular orbitals-bonding and antibonding Mos, nodes. Conjugated, cumulated and isolated double bonds.] Introduction - Molecular orbitals of conjugated n systems (C2, C3, C4, C5 and C6 systems). Frontier Molecular Orbitals (FMOs). Types of pericyclic reactions. Electrocyclic reactions: Butadiene-cyclobutene and hexatriene-cyclohexadiene interconversions. Dis and con rotation. Cycloaddition reactions: Dimerisation of ethylene and Diel's-Alder reaction. Supra-supra and supra-antara interactions. Sigmatropic reactions: [1,3], [1,5] and [3,3] rearrangements. FMO explanations and Woodward-Hoffmann selection rules for the above reactions. Cope and Claisen rearrangements (mechanism expected). Pericyclic reactions in human body - Vitamin D from cholesterol (elementary idea). References 1. P. Sykes, A Guide book to Mechanism in Organic Chemistry, 6th Edn., Orient Longman. 2. P. S. Vishnoi, Organic Chemistry, 3rd Edn., Vikas Publishing House. 4. R. T. Morrison, R.N. Boyd, Organic Chemistry, 6th Edn., Prentice Hall of India. Further reading 1. J. P. Rohy, Essentials of Carbohydrate Chemistry, Springer. 2. S. P. Bhutani, Chemistry of Biomolecules, Ane Books Pvt Ltd. 4. O. P. Agarwal, Chemistry of Natural Products, Goel Publication. 5. R. T. Morrison, R. N. Boyd, Organic Chemistry, 6th Edn., Prentice Hall of India. Module V: Natural products (5 hrs) [Prerequisites: Heterocyclic systems- nitrogen heterocycles.] Alkaloids: Extraction. Classification based on structure of heterocyclic ring, physiological actions of nicotine, quinine, coniline. Terpenes: Classification - Isoprene rule - Essential oils - Isolation of essential oils by steam distillation and Enlfleurage process - Uses of lemongrass oil, eucalyptus oil- Isolation of terpenes from essential oils (elementary idea) - Source, structure and uses of citral, geraniol, limonene and menthol. Structure of natural rubber - Vulcanization and its advantages. Note: Structural elucidation not expected in any case. References 1. I. L. Finar, Organic Chemistry, Volume I & II, Pearson Education. 2. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, 3rd Edn., Vishal Publishing Company Co. 483. K. S. Tewari, N. K. Vishnoi, Organic Chemistry, 3rd Edn., Vikas Publishing House. 4. R. T. Morrison, R.N. Boyd, Organic Chemistry, 6th Edn., Prentice Hall of India. Further reading 1. S. P. Bhutani, Chemistry of Biomolecules, Ane Books Pvt Ltd. 2. O. P. Agarwal, Chemistry of Natural Products, Goel Publications. Module IV: Biomolecules (5 hrs) Lipids: Classification - Fats and oils - Hydrogenation -Analysing fats and oils- Acid-value, Saponification value, Iodine value. Phospholipids: Structure of Lecithin. Biological functions of lipids. Steroids: Classification - Structure and biological functions of Cholesterol, testosterone, estradiol and progesterone - Elementary idea of HDL and LDL. Hormones: Definition, examples and functions of steroid, peptide and amine hormones. Vitamins: Classification - Sources and deficiency diseases - Structure of vitamin C. Note: Structural elucidation not expected in any case. References 1. I. L. Finar, Organic Chemistry - Volume I & II - Pearson Education. 2. M. K. Jain and S. C. Sharma, Modern Organic Chemistry, 3rd Edn., Vishal Publishing Company Co. 3. K. S. Tewari, N. K. Vishnoi, Organic Chemistry, 3rd Edn., Vikas Publishing House. Further reading 1. John McMurry, Organic Chemistry, 5th Edn., Thomson Asia Pvt Ltd. 2. C. N. Pillai, Organic Chemistry, Universities Press. 3. S. P. Bhutani, Chemistry of Biomolecules, Ane Books Pvt Ltd. 4. O. P. Agarwal, Chemistry of Natural Products, Goel Publication. 5. R. T. Morrison, R. N. Boyd, Organic Chemistry, 6th Edn., Prentice Hall of India. Module V: Natural products (5 hrs) [Prerequisites: Heterocyclic systems- nitrogen heterocycles.] Alkaloids: Extraction. Classification based on structure of heterocyclic ring, physiological actions of nicotine, quinine, coniline. Terpenes: Classification - Isoprene rule - Essential oils - Isolation of essential oils by steam distillation and Enlfleurage process - Uses of lemongrass oil, eucalyptus oil- Isolation of terpenes from essential oils (elementary idea) - Source, structure and uses of citral, geraniol, limonene and menthol. Structure of natural rubber - Vulcanization and its advantages. Note: Structural elucidation not expected in any case. References 1. I. L. Finar, Organic Chemistry, Volume I & II, Pearson Education. 2. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, 3rd Edn., Vishal Publishing Company Co. 483. K. S. Tewari, N. K. Vishnoi, Organic Chemistry, 3rd Edn., Vikas Publishing House. 4. R. T. Morrison, R.N. Boyd, Organic Chemistry, 6th Edn., Prentice Hall of India. Further reading 1. S. P. Bhutani, Chemistry of Biomolecules, Ane Books Pvt Ltd. 2. O. P. Agarwal, Chemistry of Natural Products, Goel Publications. Module IV: Biomolecules (5 hrs) Lipids: Classification - Fats and oils - Hydrogenation -Analysing fats and oils- Acid-value, Saponification value, Iodine value. Phospholipids: Structure of Lecithin. Biological functions of lipids. Steroids: Classification - Structure and biological functions of Cholesterol, testosterone, estradiol and progesterone - Elementary idea of HDL and LDL. Hormones: Definition, examples and functions of steroid, peptide and amine hormones. Vitamins: Classification - Sources and deficiency diseases - Structure of vitamin C. Note: Structural elucidation not expected in any case. References 1. I. L. Finar, Organic Chemistry - Volume I & II - Pearson Education. 2. M. K. Jain and S. C. Sharma, Modern Organic Chemistry, 3rd Edn., Vishal Publishing Company Co. 4. P. Y. Bruice, Organic Chemistry, 3rd Edn., Pearson Education. 5. Jagdamba Singh, Jaya Singh, Photochemistry and Pericyclic Reactions, 3rd Edn., New Age Science Ltd., New Delhi, 2009. Further Reading 1. R. Bruckner, Advanced Organic Chemistry, Elsevier. 2. J. March, Advanced Organic Chemistry, 4th Edn, John Wiley & Sons, NY. 3. S. H. Pine, Organic Chemistry, McGraw Hill. 4. J. Clayden, N. Greeves, S. Warren, P. Wothers, Organic Chemistry, Oxford University Press. 49SEMESTER VI Course Code: CHE6B11 Core Course XI: PHYSICAL CHEMISTRY - III Total Hours: 48; Credits: 3; Hours/Week: 3; Total Marks 75 (Internal 15 & External 60) CHE6B11 PHYSICAL CHEMISTRY - III LT P C 30 0 3 Objective (s) To get a thorough knowledge of electrochemistry, colligative properties and solid state Course outcome (s) CO1 To understand the basic concepts of electrochemistry CO2 To realize the importance of colligative properties CO3 To relate the properties of material/solids to the geometrical properties and chemical compositions Module I: Electrochemistry - I (12 hrs) [Prerequisites: Fundamentals of Electrochemistry. Introduction (Faradays law, types of conductance) - Measurement of equivalent conductance - Variation of conductance with dilution - Kohlrausch's law - Arrhenius theory of electrolyte dissociation and its limitations.] Weak and strong electrolytes - Ostwald's dilution law, its uses and limitations - Debye- Huckel-Onsager's equation for strong electrolytes (elementary treatment only, derivation is not required) - Debye-Falkenhagen and Wein effects - Migration of ions and Transport number (work out problems) and its determination by Hittorf's and moving boundary methods. Applications of conductivity measurements: Determination of degree of dissociation, ionic product of water and solubility product of sparingly soluble salts (work out problems) - Conductometric titrations, strong acid - strong base, weak acid-strong base, strong acid -weak base and weak acid -weak base. Module II: Electrochemistry - II (10 hrs) [Prerequisites: Module I - Electrochemistry. Basics of thermodynamics.] Introduction - types of cell and electrodes (Reversible- SHE, calomel and quinhydrone electrode) - Standard electrode potential - Electrochemical series - Nernst equation for electrode potential and EMF of a cell (Review) - Relationship between free energy and electrical energy (work out problems). Gibbs Helmholtz equation to galvanic cells. Concentration cells. Concentration cells with and without transference - Liquid junction potential. Application of EMF measurements: Solubility of sparingly soluble salts - Determination of pH - pH measurement using glass electrode - Potentiometric titrations - Hydrogen-oxygen fuel cell - Electrochemical theory of corrosion of metals. 50





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