

[I] Lecture Notes / Study Materials for Chemistry Honours Students (CEMA), CBCS, CC-12, ORGANIC CHEMISTRY

1. CYCLIC STEREOCHEMISTRY

- (i) Study Material-1 (Part-1, PPT-1) is available [here](#). **Contents:** Conformation-I: Introduction; Classification and ring strains of monocyclic systems; Baeyer's strain theory; Stability of cyclic compounds; Geometries of cyclopropane, cyclobutene and cyclopentane; Internal strain (I-Strain) [uploaded on 15. 08. 2022]
- (ii) Study Material-2 (Part-2, PPT-2) is available [here](#). **Contents:** Conformation-II: Ease of cyclisation as a function of ring size; Conformational aspects of cyclohexane [uploaded on 15. 08. 2022]
- (iii) Study Material-3 (Part-3, PPT-3) is available [here](#). **Contents:** Conformation-III: Interactions and potential energies in nonplanar cyclohexanes; Cyclohexane ring inversion [uploaded on 20. 08. 2022]
- (iv) Study Material-4 (Part-4, PPT-4) is available [here](#). **Contents:** Conformation-IV: Conformational analysis of monosubstituted cyclohexane; Conformational analysis of 1,1-disubstituted cyclohexane [uploaded on 20. 08. 2022]
- (v) Study Material-5 (Part-5, PPT-5) is available [here](#). **Contents:** Conformation-V: Non-geminal disubstituted cyclohexanes; Conformational analysis of 1,2-disubstituted cyclohexane; *cis*-preference for 1,2-disubstituted cyclohexane; Conformation and physical properties in cyclohexane derivatives [uploaded on 21. 08. 2022]
- (vi) Study Material-6 (Part-6, PPT-6) is available [here](#). **Contents:** Conformation-VI; 1,3-disubstituted cyclohexane: Conformational analysis, optical Activity, thermodynamic data and conformational reactivity [uploaded on 21. 08. 2022]
- (vii) Study Material-7 (Part-7, PPT-7) is available [here](#). **Contents:** Conformation-VII; Conformational analysis of 1,4-disubstituted cyclohexane; Cyclohexane rings in flexible forms; Conformational analysis of di-*t*-butylcyclohexanes; Conformation and chemical reactivity in cyclohexane [uploaded on 28. 08. 2022]
- (viii) Study Material-8 (Part-8, PPT-8) is available [here](#). **Contents:** Conformation and reactivity in cyclohexane-I; Steric effects and stereoelectronic effects; Saponification of anancomeric ethyl 4-*t*-butylcyclohexanecarboxylates and 4-*t*-butylcyclohexyl alkanoates; Esterification reaction of cyclohexane carboxylic acids; Oxidation of anancomeric cyclohexanols [uploaded on 28. 08. 2022]
- (ix) Study Material-8 (Part-9, PPT-9) is available [here](#). **Contents:** Conformation and reactivity in cyclohexane-II; Unimolecular nucleophilic substitution (S_N1); Unimolecular elimination (E1) reactions; Bimolecular nucleophilic substitution (S_N2); Stereoelectronic requirement in E2 reactions; Elimination bimolecular (E2) [uploaded on 28. 08. 2022]
- (x) Study Material-10 (Part-10, PPT-10) is available [here](#). **Contents:** Conformation and reactivity in cyclohexane-III; S_Ni reaction in cyclohexanes; Merged substitution and elimination reactions; Comparison of diaxial and axial-equatorial elimination; Ring formation, rearrangement, NGP and fragmentation reactions in cyclohexanes; Acetolysis of 2-acetoxycyclohexyl tosylates; 1,4-Participation across a six-membered ring [uploaded on 04. 09. 2022; revised on 18. 09. 2022]
- (xi) Study Material-11 (Part-11, PPT-11) is available [here](#). **Contents:** Conformation and reactivity in cyclohexane-IV; Deamination of 2-aminocyclohexanols by HNO₂; Rearrangement of cyclohexane-1,2-diols in acidic medium; 1,4-Elimination (Grob fragmentation) reactions in cyclohexanes; Pyrolytic *cis*-elimination in cyclohexyl system; Base catalyzed elimination of tosylates [uploaded on 04. 09. 2022]

2. PERICYCLIC REACTIONS

- (i) Study Material-1 (Part-1, PPT-12) is available [here](#). **Contents:** Introduction; Characteristics; Conservation of molecular orbital symmetry; Frontier Molecular Orbital (FMO) approach; Stereoselectivity; Symmetry properties of molecular orbitals [uploaded on 12. 09. 2022]
- (ii) Study Material-2 (Part-2, PPT-13) is available [here](#). **Contents:** Classification of pericyclic reactions; Characteristics of (i) Cycloaddition reactions, (ii) Electrocyclic reaction, (iii) Sigmatropic rearrangements (iv) Group transfer reactions; Summary; Mechanisms of pericyclic reactions; The Woodward – Hoffmann generalized rules [uploaded on 12. 09. 2022]

(iii) Study Material-3 (Part-3, PPT-14) is available [here](#). **Contents:** Cycloaddition reactions-I: Theory of cycloadditions and cycloreversions; Analysis of cycloaddition Reactions and selection rules; Application of the Woodward-Hoffmann generalized rules; ' $4n+2$ ' electron system: The Diels-Alder reaction; ' $4n$ ' electron system: [2+2] cycloaddition of alkenes; Analysis of retro-cycloaddition reactions; FMO approach; Photochemical reactions in general; Application of FMO approach in [2+2] cycloadditions [uploaded on 18. 09. 2022]

(iv) Study Material-4 (Part-4, PPT-15) is available [here](#). **Contents:** Cycloaddition reaction II; Diels-Alder reaction-I: The Diels-Alder reaction: Introduction; Energetics and reversal (retro Diels-Alder reaction); Conformation of the diene; Cyclic vs acyclic diene; Steric effects; Nature of dienophiles; Frontier orbital control and reactivity; Normal Electron Demand Diels-Alder reaction; Inverse Electron Demand Diels-Alder reaction [uploaded on 18. 09. 2022]

(v) Study Material-5 (Part-5, PPT-16) is available [here](#). **Contents:** Diels-Alder reaction-II: The product in Diels-Alder reaction; The regioselectivity of Diels-Alder reactions: '*ortho/para*' orientation; Stereochemistry of [4+2] Diels-Alder reaction; Stereospecificity: The '*cis*' principle'; Stereoselectivity: The *endo* rule; Cycloaddition of Maleic anhydride to cyclopentadiene; Dimerization of dienes by cycloaddition reactions; Dimerization of cyclopentadiene: Diels-Alder reactions; Effect of Lewis acids on stereoselectivity [uploaded on 27. 10. 2022]

(vi) Study Material-6 (Part-6, PPT-17) is available [here](#). **Contents:** Electrocyclic reactions-I: Analysis of electrocyclic reactions and selection rules; FMO approach; ($4n+2$)-electron system: ERC of hexa-1,3,5-triene; $4n$ electron system: Electrocyclic Ring Opening (ERO) of cyclobutene; ERC of buta-1,3diene: One-component and two-component frontier orbital analyses; Selection rules for electrocyclic reactions; Electrocyclic reactions: Summary [uploaded on 27. 10. 2022; revised on 13. 11. 2022]

(vii) Study Material-7 (Part-7, PPT-18) is available [here](#). **Contents:** Electrocyclic reactions-II: Stereochemistry and torquoselectivity; Torquoselectivity; Electrocyclic reactions in neutral systems; Stereochemistry of ERO; Mandal's stereochemical rule; Conversion of Dewar benzene to benzene; Synthesis of Dewar benzene; 6-electron electrocyclic process; Mixed electrocyclic and cycloaddition reactions [uploaded on 31. 10. 2022]

(viii) Study Material-8 (Part-8, PPT-19) is available [here](#). **Contents:** Sigmatropic rearrangement-I: Analysis of sigmatropic rearrangements and selection rules; Analysis of the [1,*j*] H-shifts; ($4n+2$) electron system: [1, 5] H-shift; ($4n$) Electron System: [1, 3] H-shifts; Selection rules for [1, *j*] H-shifts; Analysis of [*i*, *j*] rearrangements; Analysis of the [3,3] sigmatropic rearrangements; Cope rearrangement; Claisen rearrangement; Evidence in Favour of the Chair TS in [3,3] Sigmatropic Rearrangements; Selection Rules for [*i*,*j*] Rearrangements [uploaded on 31. 10. 2022]

(ix) Study Material-9 (Part-9 PPT-20) is available [here](#). **Contents:** Pericyclic reactions: Sigmatropic rearrangement-II: [1,5] H-shifts in neutral systems; [1,3] H-shifts in neutral systems; [3,3] Cope rearrangement; The Oxy-Cope rearrangement; Stereochemistry of Cope rearrangement; Asymmetric Cope rearrangement; Claisen rearrangement; Stereospecificity and stereoselectivity of Claisen Rearrangement [uploaded on 06. 11. 2022]

3. BIOMOLECULES

(i) Study Material-1 (Part-1, PPT-21) is available [here](#). **Contents:** Amino acids-I: Synthesis; Introduction; Structures and names of α -amino acids; General methods of preparation of the α -amino acids; Method I: α -amino acids by amination of α -halogenated acids; Method II: α -amino acids by Gabriel's method; Method III: The Strecker synthesis; Method IV: Malonic ester synthesis; Method V: Erlenmeyer azlactone synthesis; Method VI: α -amino acids using hydantoins; Method VII: Bücherer hydantoin synthesis; Method VIII: Synthesis of α -amino acid using 2,5-diketopiperazine; Resolution of DL-amino acids: Enzymatic method [uploaded on 13. 11. 2022]

(ii) Study Material-2 (Part-2, PPT-22) is available [here](#). **Contents:** Amino acids-II: Properties; Dipolar ions; Isoelectric point; Electrophoresis [uploaded on 13. 11. 2022]

(iii) Study Material-3 (Part-3, PPT-23) is available [here](#). **Contents:** Amino acids-III: Reactions; Resolution of racemic amino acids; Reaction of amino acids with ninhydrin; Dakin-West reaction; Estimation of amino acid by Sørensen formol titration; Van Slyke method: Analysis of mixture of amino acids; Formation of hydantoins; Dimerization of α -amino acids [uploaded on 20. 11. 2022]

(iv) Study Material-4 (Part-4, PPT-24) is available [here](#). **Contents:** Peptides-I, Properties; Peptide linkage and its geometry; Hydrolysis of peptide linkage; Nomenclature of peptides; The primary structure of peptide: Introduction [uploaded on 20. 11. 2022]

(v) Study Material-5 (Part-5, PPT-25) is available [here](#). **Contents:** Peptides-II: Reactions, end group analysis; The primary structure of peptide/determination of peptide sequence; Hydrolysis of peptide to amino acids;

Separation, identification and quantification of amino acids; End-group analysis; Determination of NTAA; Edman degradation; Sanger N-terminal analysis; DANSYL method; Enzymic method; Determination of CTAA; Hydrazinolysis method; Reduction method; enzymic method [uploaded on 27. 11. 2022]

(vi) Study Material-6 (Part-6, PPT-26) is available [here](#). **Contents:** Peptides-III, Proteins; Partial hydrolysis of peptides; Site specific cleavage of peptides; Use of CNBr; Protein subunits, cyclic structures, and disulfide bonds; Summary of primary structure determination; General nature of proteins; Classification of proteins [uploaded on 27. 11. 2022]

(vii) Study Material-7 (Part-7, PPT-27) is available [here](#). **Contents:** Peptide-IV: Synthesis-I: Protecting groups; Methods of peptides synthesis; Problems in peptide synthesis; Planning in peptide synthesis; N-protecting groups in peptide synthesis: Their introduction and removal; Benzyloxycarbonyl (PhCH-O-CO-) group; *t*-Butyloxycarbonyl (Me-C-O-CO-) group; 9-Fluorenylmethoxycarbonyl (Fmoc) group; Phthaloyl as *N*-protecting group [uploaded on 04. 12. 2022]

(viii) Study Material-8 (Part-8, PPT-28) is available [here](#). **Contents:** Peptides-V: Synthesis-II; Carboxyl group protection; Activation of the carboxyl group; Synthesis of the peptide, Ala-Leu; Role of DCC in peptide synthesis; Synthesis of peptides: Phe-Gly, Ala-Phe-Gly and Phe-Gly-Ala; Synthesis of higher peptides [uploaded on 04. 12. 2022]

(ix) Study Material-9 (Part-9, PPT-29) is available [here](#). **Contents:** Peptides-VI: Synthesis-III; Solid-Phase Peptide Synthesis (Merrifield); SPBS using Boc as N-protecting group; Use of protecting groups and the use of active esters in SPPS; Solid-phase peptide synthesis using fmoc as N-protecting group [uploaded on 07. 12. 2022]

(x) Study Material-10 (Part-10, PPT-30) is available [here](#). **Contents:** Nucleic Acids-I: Nucleic Acids: Introduction; Structure of the nucleic acids; Sugars present in nucleic acids; Bases present in nucleic acids: Pyrimidine and purine bases; Nucleotides and nucleosides; Nucleotides and nucleosides corresponding to RNA and DNA; Nucleosides in different projections and orientations; Cyclic adenosine monophosphate and its alkaline hydrolysis [uploaded on 07. 12. 2022]

(xi) Study Material-11 (Part-11, PPT-31) is available [here](#). **Contents:** Nucleic Acids-II: Hydrolysis of nucleosides: Mechanism for acid catalyzed hydrolysis of nucleosides (both pyrimidine and purine types); Primary structure of DNAs and RNAs; Comparison of alkaline hydrolysis of DNA and RNA; Elementary idea of double helical structure of DNA (Watson-Crick model); Complementary base pairing in DNA; Secondary structure of RNAs [uploaded on 07. 12. 2022]

4. PREVIOUS YEARS QUESTIONS (PYQ) / MODEL QUESTIONS / ASSIGNMENTS

[A] PREVIOUS YEARS QUESTIONS (PYQ) / MODEL QUESTIONS

(i) PYQ (15 years) on Cyclic Stereochemistry: Questions (uploaded on 01. 10. 2023) are available [here](#).

(ii) PYQ (15 years) on Biomolecules (Amino acids, Proteins and Nucleic acids): Questions (uploaded on 01. 12. 2023) are available [here](#).

(iii) PYQ (15 years) on Pericyclic Reactions: Questions (uploaded on 26. 12. 2023) are available [here](#).

[B] ASSIGNMENTS

(i) ASSIGNMENT-1 on CYCLIC STEREOCHEMISTRY: Questions (uploaded on 16. 02. 2021) are available [here](#).

[II Lecture Notes / Study Materials for Chemistry Honours Students (CEMA), CBCS, CC-12P, SPECTROSCOPIC PRACTICAL, ORGANIC CHEMISTRY

(i) Spectral analysis of 4'-Bromoacetanilide, 2-Bromo-4'-methylacetophenone and Vanillin (Part-1, PPT-1) is available [here](#). [uploaded on 24. 08. 2020]

(ii) Spectral analysis of 2'-Methoxyacetophenone and 4-Aminobenzoic acid (Part-2, PPT-2) is available [here](#). [updated on 06. 10. 2023; uploaded on 24. 08. 2020]

(iii) Spectral analysis of Salicylamide and 2'-Hydroxyacetophenone (Part-3, PPT-3) is available [here](#). [uploaded on 31. 08. 2020]

(iv) Spectral analysis of 1,3-Dinitrobenzene and *trans*-Cinnamic acid (Part-4, PPT-4) is available [here](#). [uploaded on 14. 09. 2020]

(v) Spectral analysis of Diethyl Fumarate and 4-Nitrobenzaldehyde (Part-5, PPT-5) is available [here](#). [uploaded on 22. 09. 2020]

(vi) Spectral analysis of 4'-Methylacetanilide and Mesityl oxide (Part-6, PPT-6) is available [here](#). [uploaded on 29. 09. 2020]

(vii) Spectral analysis of 2-Hydroxybenzaldehyde and 4-Nitroaniline (Part-7, PPT-7) is available [here](#). [uploaded on 10. 11. 2020]

(viii) Spectral analysis of 2,3-Dimethylbenzotrile, Pent-1-yn-3-ol, 3-Nitrobenzaldehyde, 3-Aminobenzoic acid, Ethyl 3-aminobenzoate, Ethyl 4-aminobenzoate and

3-Nitroanisole (Part-8, PPT-8) is available [here](#). [uploaded on 30. 10. 2022]

(ix) Unlabelled spectra for Part-8 can be downloaded from [here](#). [uploaded on 30. 10. 2022]

(x) IR Spectroscopic Analysis – Assignment and explanations for 15 samples (uploaded on 21. 01. 2020) can be found [here](#).

(xi) NMR Spectroscopic Analysis – Assignment and explanations for 15 samples (uploaded on 21. 09. 2020) can be found [here](#).