

[1] Lecture Notes / Study Materials for Chemistry Honours Students (CEMA), CC-7, CBCS

1. Carbonyl and Related Compounds

[A] Addition to C=O

- (i) Study Material-1 (Part-1, PPT-1) is available [here](#). (Contents: Introduction; Nomenclature of aldehydes and ketones; Classification of carbonyl compounds; The structure of the carbonyl group; General properties of aldehydes and ketones; Physical properties of aldehydes and ketones) [uploaded on 18. 08. 2022]
- (ii) Study Material-2 (Part-2, PPT-2) is available [here](#). (Contents: General methods of preparation; Nucleophilic addition to the carbonyl group; Cyanohydrins of aldehydes and ketones; The nucleophilic approach: Bürgi-Dunitz trajectory) [uploaded on 18. 08. 2022]
- (iii) Study Material-3 (Part-3, PPT-3) is available [here](#). (Contents: Formation of hydrates; Formation of bisulphite compounds) [uploaded on 20. 08. 2022]
- (iv) Study Material-4 (Part-4, PPT-4) is available [here](#). (Contents: Formation of acetal/ketal; Formation of thioacetal) [uploaded on 20. 08. 2022]
- (v) Study Material-5 (Part-5, PPT-5) is available [here](#). (Contents: Reaction with nitrogen nucleophiles: Addition-elimination reaction; Enamine formation; Application of enamines) [uploaded on 21. 08. 2022]
- (vi) Study Material-6 (Part-6, PPT-6) is available [here](#). (Content: Benzoin condensation) [uploaded on 21. 08. 2022]
- (vii) Study Material-7 (Part-7, PPT-7) is available [here](#). (Contents: Cannizzaro reaction; Tischenko reaction) [uploaded on 28. 08. 2022]
- (viii) Study Material-8 (Part-8, PPT-8) is available [here](#). (Contents: Ylides; Wittig reaction; Corey-Chaykovsky reaction) [uploaded on 28. 08. 2022]
- (ix) Study Material-9 (Part-9, PPT-9) is available [here](#). (Contents: Acyloin condensation; Rupe rearrangement) [uploaded on 28. 08. 2022]
- (x) Study Material-10 (Part-10, PPT-10) is available [here](#). (Contents: Oxidations: Oppenauer oxidation; Oxidation of alcohols with PCC and PDC; Periodic acid and lead tetraacetate oxidation of 1,2-glycols) [uploaded on 18. 09. 2022]
- (xi) Study Material-11 (Part-11, PPT-11) is available [here](#). (Contents: Reductions-I: Types of reductions and nature of reducing agents; Meerwein-Ponndorf-Verley (MPV) reduction; Clemmensen reduction; Wolff-Kishner reduction) [uploaded on 18. 09. 2022]
- (xii) Study Material-12 (Part-12, PPT-12) is available [here](#). (Contents: Reductions-II: Reductions using LiAlH₄; Reductions using NaBH₄; Bouveault-Blanc reduction; Dissolving metal reduction in aprotic solvents) [uploaded on 18. 09. 2022]

[B] Exploitation of acidity of α -H of C=O

- (i) Study Material-13 (Part-13, PPT-13) is available [here](#). (Contents: Enols, Enolates and Alkylation: Formation of enols; Formation of enolates; C- to O-alkylation; Enolization of acid derivatives; Enolates from nitroalkanes and nitriles) [uploaded on 27. 10. 2022]
- (ii) Study Material-14 (Part-14, PPT-14) is available [here](#). (Contents: KCP/TCP and Alkylation: Kinetic and Thermodynamic enolates; Diverse reactivity of carbonyl groups; Alkylation of nitriles and nitro alkanes; Alkylation of active methylene compounds; Base catalyzed hydrolysis of β -ketoesters and β -diesters) [uploaded on 27. 10. 2022]
- (iii) Study Material-15 (Part-15, PPT-15) is available [here](#). (Contents: Enolates and Alkylations: Lithium enolates of carbonyl compounds; Alkylations of lithium enolates: Alkylations of esters, ketones and carboxylic acids; Lithium enolates of aldehydes; Specific enol equivalents to alkylate aldehydes and ketones) [uploaded on 31. 10. 2022]

(iv) Study Material-16 (Part-16, PPT-16) is available [here](#). (Contents: Regioselectivity, Nitrosation and Riley Oxidation: Regioselectivity in ketone alkylation; Alkylation using activating groups; Alkylation of 1,3-dicarbonyl compound at the less activated position; Nitrosation of carbonyl compounds; Riley oxidation) [uploaded on 31. 10. 2022]

(v) Study Material-17 (Part-17, PPT-17) is available [here](#). (Contents: Halogenation and H-V-Z Reaction: Halogenation of carbonyl compounds; Hell-Volhard-Zelinsky (H-V-Z) reaction) [uploaded on 06. 11. 2022]

(vi) Study Material-18 (Part-18, PPT-18) is available [here](#). (Contents: Condensations-I: Aldol condensation; Mixed aldol condensations; Directed aldol condensation; Intramolecular aldol condensation; Reversibility of aldol condensation) [uploaded on 06. 11. 2022]

(vii) Study Material-19 (Part-19, PPT-19) is available [here](#). (Contents: Condensations-II: Claisen-Schmidt reaction; Tollens' reaction; Claisen condensation; Comparison of the Claisen ester condensation with the aldol reaction; Crossed Claisen condensation) [uploaded on 06. 11. 2022]

(viii) Study Material-20 (Part-20, PPT-20) is available [here](#). (Contents: Condensations-III: Dieckmann condensation; Stobbe condensation; Knoevenagel condensation; Perkin reaction) [uploaded on 06. 11. 2022]

(ix) Study Material-21 (Part-21, PPT-21) is available [here](#). (Contents: Favorskii rearrangement; Quasi-Favorskii rearrangement; Wallach degradation) [uploaded on 20. 11. 2022]

(x) Study Material-22 (Part-22, PPT-22) is available [here](#). (Contents: Mannich reaction; Preparation and synthetic applications of diethyl malonate and ethyl acetoacetate (Part I); Modes of hydrolysis and decarboxylation of diethyl malonate and ethyl acetoacetate) [uploaded on 20. 11. 2022]

(xi) Study Material-23 (Part-23, PPT-23) is available [here](#). (Contents: Synthetic applications of ethyl acetoacetate: Introduction of (a) *tert*-butyl (-CMe₃) group into methylene carbon, (b) phenyl group into methylene carbon, (c) alkyl group into terminal carbon; Synthesis of (a) ketones, (b) monocarboxylic acids, (c) 1,3-diketones (d) 1,4-diketones, (e) dicarboxylic acids and (f) alicyclic compounds) [uploaded on 27. 11. 2022]

(xii) Study Material-24 (Part-24, PPT-24) is available [here](#). (Contents: Synthetic Applications of Diethyl malonate; Synthesis of (a) monocarboxylic acids, (b) dicarboxylic acids, (c) ketones, (d) alicyclic compounds, (e) α,β -unsaturated acids; Assignments) [uploaded on 27. 11. 2022]

[C] Nucleophilic Addition to α,β -Unsaturated Carbonyl System

(i) Study Material-25 (Part-25, PPT-25) is available [here](#). (Contents: Conjugate addition to α,β -unsaturated carbonyl system (Part-I): Basic principle; General mechanism for 1,4-conjugate addition; Direct (1,2-) addition vs conjugate (1,4-) addition; Addition of Gilman's Reagents to α,β -unsaturated carbonyls; Molecular orbitals control conjugate additions) [uploaded on 04. 12. 2022]

(ii) Study Material-26 (Part-26, PPT-26) is available [here](#). (Contents: Conjugate Addition to α,β -Unsaturated Carbonyl System (Part-II): Factors affecting direct addition or conjugate addition to carbonyl group; Reaction conditions; Structural factors; The nature of the nucleophile: Hard and soft; Reaction of α,β -unsaturated ketones with organometallic reagents in presence of traces of Copper(I) salts; Stable enolate ions: Nucleophiles promoting conjugate addition) [uploaded on 04. 12. 2022]

(iii) Study Material-27 (Part-27, PPT-27) is available [here](#). (Contents: Additions of Enolates: Michael Reaction: Michael retrogression reaction: Reversal of Michael reaction; Abnormal of Michael reaction; Problems) [uploaded on 07. 12. 2022]

(iv) Study Material-28 (Part-28, PPT-28) is available [here](#). (Contents: Robinson Annulation: Synthesis of Hagemann's ester; Stefter reaction; Synthesis of 1,4-dicarbonyl compounds) [uploaded on 07. 12. 2022]

[D] Substitution at sp Carbon (C=O system)

(i) Study Material-29 (Part-29, PPT-29) is available [here](#). (Contents: Substitution at sp Carbon (C=O System) (Part I): General reactions of the monocarboxylic acids and their derivatives: Mechanism of carboxyl esterification and hydrolysis of carboxylic esters: Introduction; Bimolecular base-catalyzed hydrolysis with Acyl-Oxygen

heterolysis (B⁻2) of carboxylic esters; Bimolecular acid-catalyzed hydrolysis and esterification with Acyl-Oxygen heterolysis (A⁻2 mechanism)) [uploaded on 11. 12. 2022]

(ii) Study Material-30 (Part-30, PPT-30) is available [here](#). (Contents: Substitution at *sp* Carbon (C=O System) (Part II): Unimolecular acid-catalyzed hydrolysis and esterification with Acyl-Oxygen heterolysis (A⁻1 mechanism); Unimolecular acid-catalyzed hydrolysis and esterification with Alkyl-Oxygen heterolysis (A⁻1 mechanism); Hydrolysis of carboxylic acid derivatives: Comparative study; Preparation of acid derivatives: Acid chlorides, Acid anhydrides and Acid amides; Problems) [uploaded on 11. 12. 2022]

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

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

PYQs (15 years) (uploaded on 01. 10. 2023) can be downloaded from [here](#).

[B] ASSIGNMENTS

(i) ASSIGNMENT-1 on CARBONYL COMPOUNDS: Questions (uploaded on 17. 02. 2021) are available [here](#).