

Reagents and Reactivity (CY 20206)

- **Nucleophilic addition to C=X (X = O, NR): 12h**

Simple addition/elimination reactions: Structure and reactivity, explanation in terms of MO theory, Burgi Dunitz Trajectory. addition of alcohols, thiols, hydrogen cyanide, bisulphite and other anions, Enamine Chemistry, Mannich reaction. Reductive transformation of carbonyl groups: Grignard reagents (Umpolung), acetylide anions, organo lithium reagent, stereoselectivity (Cram's Rule; Felkin and related models); aldol reactions and its stereoselectivity (Zimmerman Traxler). Claisen ester condensation, Dieckmann reaction, Michael reaction (1,4-conjugate addition) to C=C-C=O systems, Robinson annulation, Baylis-Hillmann reaction, Reformatsky reaction, McMurry coupling.

- **Electrophilic and nucleophilic addition reaction to C=C, C≡C: 6h**

Electrophilic addition reactions via halonium & carbocation intermediate, hydroboration (regio- & stereochemistry), alkyne hydroboration, electrophilic addition to conjugated dienes, oxymercuration-demercuration.

- **Oxidation and Reduction: 12h**

Definition and carbon oxidation number, understanding oxidation and reduction via electron count, examples. Cr(VI) based oxidation: (Jones reagent, Collins Reagent, PCC, PDC) Oxidation using RuO₄, MnO₂, Oppenauer oxidation, Pinnick oxidation of alcohols to aldehydes (Pfitzner-Moffatt, Corey-Kim, Swern Oxidation). Oxidation using hypervalent iodine reagent (IBX, Dess-Martin Periodinane), KMnO₄. Epoxidation reaction, mCPBA (Baeyer-Villiger oxidation), H₂O₂-NaOH, Oxone, TiCl₄-^tBuOOH. Dihydroxylation (KMnO₄, OsO₄, Ozonolysis, reductive vs. oxidative cleavage), Prevost reaction, Woodward modification, diol cleavage using periodate.

Reduction using hydride donors ((NaBH₄, NaBH₄-CeCl₃ (LiBH₄, NaBH₃CN, NaBH(OAc)₃); aluminum hydride (LAH, DIBAL-H) their reaction and mechanism. Pd, Pt, Ni based reduction of alkene and alkyne (Pd/C-H₂, Pt-C/H₂, Raney Nickel, Lindlar catalyst, Clemmensen reduction, Wolf-Kishner reduction, MPV reduction, Birch reduction.

- Protection-deprotection groups; simple transformation reactions. **2h**

- **Active methylene compounds:** alkylation, conjugate addition, synthesis of different structural unit using active methylene compounds; **4h**

Books:

1. Organic Chemistry by J. Clayden, S. Warren, N. Greeves, P. Wothers
2. A guidebook to mechanism in organic chemistry by Peter Sykes
3. Stereochemistry of Organic Compounds, D. Nasipuri
4. Modern Methods of Organic Synthesis by William Carruthers and Ian Coldham
5. Advanced Organic Chemistry by Jerry March
6. Organic Chemistry by Paula Y. Bruice
7. Protecting Group in Organic Synthesis, by Green