Organic Chemistry-III
CH-423

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Syllabus

CH-423 (2013)/Chem/IIT-B Dr. Kaliappan, Krishna P.
Organic Chemistry III

Classification of reactions: A brief introduction to substitution, elimination, addition, oxidation, reduction, rearrangement and pericyclic reactions.

Functional group transformations: alcohols to alkylating agents, Mitsunobu and related reactions, introduction of functional groups by nucleophilic substitution at saturated carbon, nucleophilic cleavage of C-O bonds in ethers and esters and inter-conversion of carboxylic acid derivatives.

Oxidation: Metal based oxidizing reagents: A review and detailed discussion of chromium, manganese, ruthenium, silver and other metal-based reagents. Non-metal based oxidizing reagents: DMSO, peroxide, peracid and oxygen based oxidation. Miscellaneous oxidizing reagents like IBX, DMP, CAN, DDQ, periodate etc.

Syllabus

CH-423 (2013)/Chem/IIT-B
Organic Chemistry III

Dr. Kaliappan, Krishna P.

Reduction: Homogeneous and heterogeneous hydrogenations; Discussion on borane based racemic and chiral reagents, aluminum, tin, silicon based reducing agents. Dissolving metal reductions.

Selectivity and protecting groups: Illustration of chemoselectivity, regioselectivity and stereoselectivity with examples; protecting groups for alcohols, amines, acids, ketones and aldehydes.

Cycloaddition reactions: Diels-Alder reaction; general features, dienes, dienophiles, selectivity, intramolecular and intermolecular reactions, hetero-Diels Alder reaction. 1,-3-dipolar cycloaddition reactions; general features, dipoles, dipolarophiles. [2+2] cycloaddition reactions; general features, selected examples.

Molecular rearrangements: Illustration of electron deficient and electron rich skeletal rearrangements with examples; Sigmatropic rearrangements-Claisen and related rearrangements, Cope and oxy-Cope rearrangements; 2,3-sigmatropic rearrangements and ene reaction.

Syllabus

Suggested Books/Reviews:

Jerry March, "Advanced Organic Chemistry", Fifth Ed., Wiley, 2007.
F. A. Carey and R. J. Sundburg, "Advanced Organic Chemistry, Part B", Fifth Ed., Plenum Press, 2007.

J. Clayden, N. Greeves, S. Warren and P. Wothers, "Organic Chemistry", First Ed., Oxford University Press, 2001.

W. Carruthers, "Some Methods of Organic Synthesis", Cambridge University Press

K. Peter C. Vollhardt and Neil E. Schore "Organic Chemistry" W. H. Freeman and Company, 1999.

Evaluation Pattern

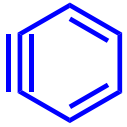
Mid-Semester	30%
End Semester + Assignment	50%
Quiz (2 Nos)	20%

-There will be a total of 36 (1h) lectures, and 7 tutorials

Functional Groups

Only with carbon and hydrogen

C=C 

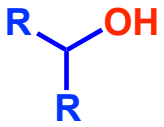
C≡C 

With heteroatoms

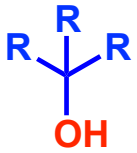
With one oxygen atom:

1. Alcohol

Primary alcohol

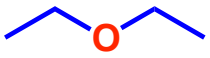


secondary alcohol

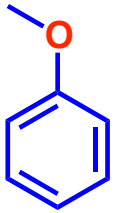


tertiary alcohol

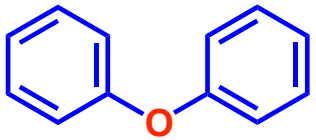
2. Ether



Diethyl ether



anisole

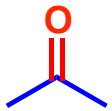


diphenyl ether

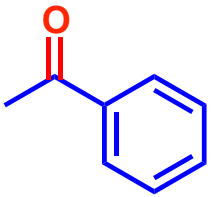
Functional Groups

With one oxygen atom:

3. Ketone

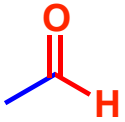


Acetone

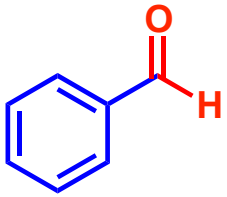


Acetophenone

4. Aldehyde



Acetaldehyde



Benzaldehyde

5. Epoxide, Cyclic ethers

Epoxide

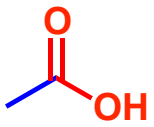
Oxetane

Functional Groups

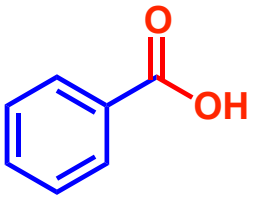
With heteroatoms

With two oxygen atoms:

1. Acid

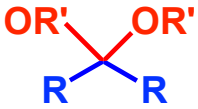


Acetic acid

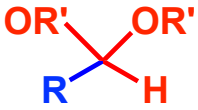


Benzoic acid

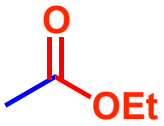
2. Ketal



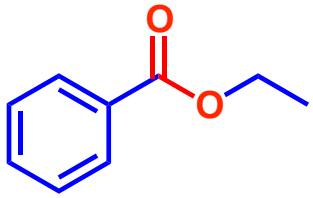
3. Acetal



4. Ester



Ethyl acetate



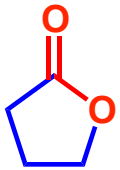
Ethyl benzoate

Functional Groups

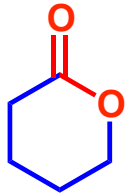
With heteroatoms

With two oxygen atoms:

5. Lactone (Cyclic ester)

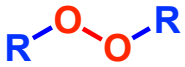


γ-lactone



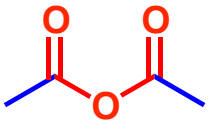
δ-lactone

6. Peroxides



With three oxygen atoms:

1. Anhydrides



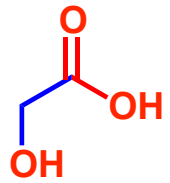
Acetic anhydride

Functional Groups

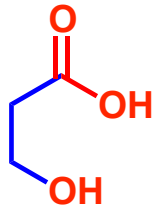
With heteroatoms

With three oxygen atoms:

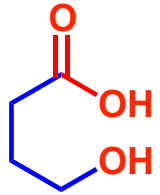
2. Hydroxy acid



α-hydroxy acid

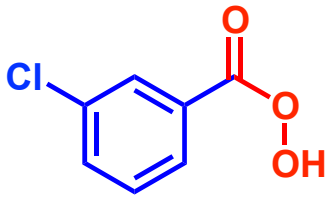


β-hydroxy acid



γ-hydroxy acid

3. Peracid



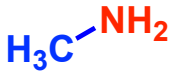
meta-chloro perbenzoic acid

Functional Groups

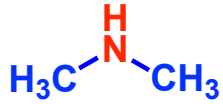
With heteroatoms

With One Nitrogen atom

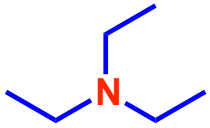
1) Amines



Methyl amine
(primary amine)

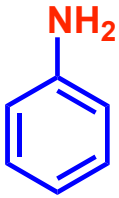


Dimethyl amine
(secondary amine)



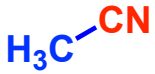
Triethyl amine
(tertiary amine)

2) Aromatic amine



Aniline

3) Nitriles



Acetonitrile

Functional Groups

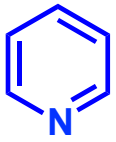
With heteroatoms

With One Nitrogen atom

4) Aziridine

aziridine

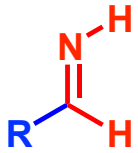
5) Aromatic amines



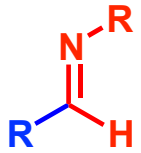
Pyridine

Pyrrole

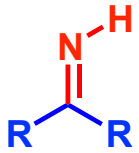
6) Imine



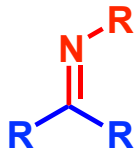
Primary aldimine



Secondary aldimine



Primary Ketimine



Secondary Ketimine

Functional Groups

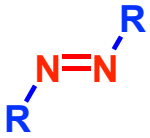
With heteroatoms

With Two Nitrogen atoms

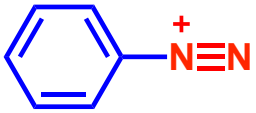
1) Diazo

Diazomethane

2) Azo



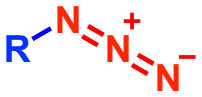
3) Diazonium



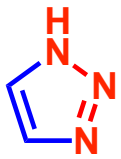
Benzenediazonium cation

With Three Nitrogen atoms

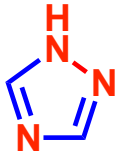
1) Azides



2) Triazole



1,2,3-triazole



1,2,4-triazole

With Four Nitrogen atoms

1) Tetrazole

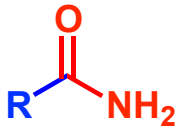
1-triatrazole

Functional Group

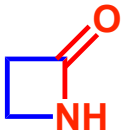
With heteroatoms

With One Nitrogen atom and One oxygen atom

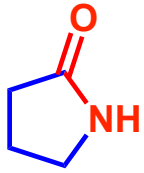
1) Amide



2) Lactams

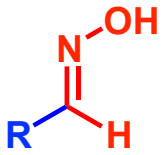


β–lactam

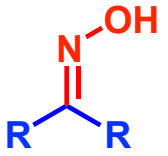


γ–lactam

3) Oximes

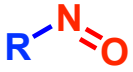


aldoxime



ketoxime

4) Nitroso



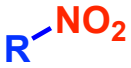
5) Nitrile oxide

Functional Group

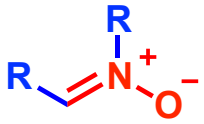
With heteroatoms

With One Nitrogen atom and Two oxygen atoms

1) Nitro

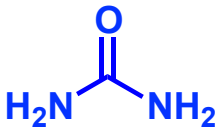


2) Nitrones



With Two Nitrogen atom and One oxygen atom

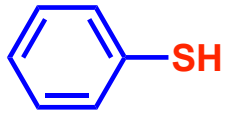
1) Urea



Functional Group

With heteroatoms (Sulfur)

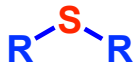
1) Thiols



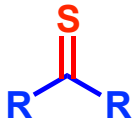
Thiophenol

Ethanethiol

2) Thio ethers

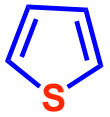


3) Thio carbonyl



4) Thiirane

5) Heterocycles

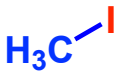


Thiophene

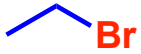
Functional Group

With heteroatoms (Halogen)

1) Halides

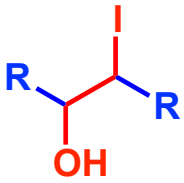


Methyl iodide



Ethyl bromide

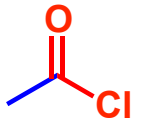
2) Halohydrin



3) Dihalides

1,2-dichloroethane

4) Acid Chloride



Acetyl chloride

5) Halolactones