

**Introduction**, Definition of organic chemistry, classification of hydrocarbons, types of chemical bonds, ionic and covalent; atomic and molecular orbital, sigma and pi bond, hybridization,  $sp^3$ ,  $sp^2$ ,  $sp$ ; inductive effect, polarity and polarization.

( 2 Lectures)

**Alkanes**, structure, hybridization, nomenclature, physical properties, preparation: by hydrogenation of alkenes , hydrolysis of alkyl Grignard reagent , by reaction of lithium dialkyl cuprates with alkyl halides and by Würtz reaction. Reaction of alkanes: halogenations by  $Br_2$ ,  $Cl_2$ . Ring strain in cycloalkanes , reaction of cyclopropane and cyclobutane with halogen,  $H_2$ , conc.  $H_2SO_4$ ,  $HBr$ .

( 3 Lectures)

**Alkenes**, structure, geometrical isomerism, nomenclature, physical properties, preparation: from dehydration of alcohols (Zaitsevrule) and dehydrohalogenation. Reaction: electrophilic addition reaction (Markonikow rule, stability of carbocation), addition of  $H_2$ , halogen, hydrohalogen,  $HOX$ , water; oxidation of alkenes with ozone and potassium permanganate.

( 2 Lectures)

**Alkynes**, structure, nomenclature, physical properties and acidity of terminal alkyne, preparation: from dehydrohalogenation and reaction of sodium acetylide with primary alkyl halide. Reaction: of alkynes, hydrogenation, halohydrogenation, hydration.

( 2 Lectures)

**Aromatic compounds**, aromaticity and Huekel rule, nomenclature, electrophilic aromatic substitution reactions (alkylation, acylation, halogenations, nitration and sulfonation). Effects of substituents on electrophilic aromatic substitution reaction. Side-chain reactions of Benzene-derivatives.

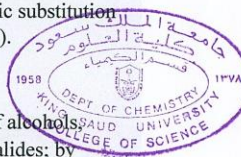
( 3 Lectures)

• **1<sup>st</sup> Midterm Exam**

**Organic halogen compounds**, classes, nomenclature, physical properties, preparation: by halogenations of alkanes, alkenes, alkynes and aromatic rings; hydrohalogenation of alkenes and alkynes and by conversion of alcohols by  $HCl/ZnCl_2$ ,  $SOCl_2$ ,  $PX_3$ ,  $PX_5$ . Reaction of organic halides: nucleophilic substitution reaction , elimination reaction, reaction with  $Mg$  (Grignard compounds).

( 2 Lectures)

**Alcohols and phenols**, classification and nomenclature of alcohols; physical properties, preparation: of alcohols from alkenes and alkyl halides; by



reduction of aldehydes, ketones and acids; by addition of Grignard compounds to aldehydes and ketones. Reaction of alcohols with breaking of oxygen-hydrogen bond (salt formation and ester formation); reaction with cleavage the hydroxyl group (elimination and substitution); oxidation of alcohols, nomenclature and acidity of phenols, preparation of phenols: from diazonium salt and benzene sulfonic acids, electrophilic substitution reaction of phenols.

**( 3 Lectures)**

**Ethers**, Structure and nomenclature, physical properties, preparation of ethers: by dehydrogenation of symmetric alcohols and by Williamson synthesis. Reaction of ethers: with hot concentrated HI, HCl, HBr, preparation of epoxide: by peracids. Reaction of epoxide: with  $H_3O^+$ , alcohol, hydrohalic acid (HI, HCl, HBr), Grignard compound and organolithium compound,

**( 2 Lectures)**

**Aldehydes and Ketones**, nomenclature, physical properties, preparation: by oxidation of alcohols, ozonolysis, hydration of alkynes and Friedel-Crafts acylation. Reaction of aldehydes and ketones: reduction and oxidation; addition of Grignard compounds, hydrogen cyanide, alcohol, ammonia and ammonia derivatives.

**( 2 Lectures)**

- **2<sup>nd</sup> Midterm Exam.**

**Carboxylic acids**, nomenclature and physical properties, acid strength and structure. Preparation: by oxidation of primary alcohols and aldehydes; hydrolysis of nitrile; oxidation of alkyl benzenes ; carbonation of Grignard reagents. Reaction of carboxylic acids: formation of salt, ester, amide and acid chloride. Carboxylic acid derivatives, nomenclature, preparation: from acid and acid chloride, hydrolysis of acid derivatives.

**( 3 Lectures)**

**Amines**, classification and nomenclature, physical properties and basicity. Preparation: by alkylation of ammonia; reduction of nitrogroup, nitrile and amide. Reaction of amines: formation of salt, amide, imine and diazonium salt.

**( 1 Lectures)**

- **Final Exam.**



**1) Organic chemistry: A short course by I Harold Hart, David J. Hart and Leslie E. Craine, Houghton Mifflin Company, USA.**