



UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

SYLLABUS DEL CORSO

Chimica Organica I

1920-1-E2702Q085

Aims

The course aims to provide the fundamental knowledge of organic chemistry, with a rational approach that will allow the student to predict and interpret the structure and reactivity of organic molecules.

Contents

Classification of organic chemistry, structure of organic molecules, concepts of reactivity, study of the different classes of organic compounds, general informations on the main classes of natural compounds.

Detailed program

General aspects of Organic Chemistry.

Atoms involved in Organic molecules and their electrons. Hybridation of carbon atoms. Molecular orbitals, and hybrid orbitals. Representation of a structure of organic compound. Molecular orbital delocalization, properties of aromatic compounds. Polarised bonds and dipolar interactions. Intermolecular bounds.

Fundaments of chemical reactivity.

Symbols and definitions. Thermodynamic and kinetic of a reaction. Reaction coordinates, activation energy, transition state, reaction intermediates. Reaction mechanisms, electrophiles, nucleophiles, radicals.

Alkanes and cycloalkanes.

Definition, structure, isomeric forms, nomenclature. Conformations of alkanes and cycloalkanes. Reactivity of alkanes, oxidation, halogenation. Radical reactions.

Stereoisomery.

Bases of stereoisomery. Stereogenic center. Enantiomers. Diastereoisomers. R and S configurations. Mesoforms. Stereogenic axis. Stereoisomers cis and trans, E and Z.

Alkenes.

Structure, nomenclature, physical properties. Addition of electrophiles. Carbocations, order of stability, addition of nucleophiles, transposition, elimination. Radical additions. Concerted additions, epoxidation, catalytic hydrogenation.

Alkynes.

Structure, nomenclature, physical properties. Acidity of terminal alkynes. Electrophile addition. Hydration and tautomerism. Hydrogenation.

Alkyl halides.

Structure, nomenclature, physical properties. Nucleophilic substitution and elimination reactions. Mono and bimolecular mechanisms.

Alcohols and thiols.

Structure, nomenclature, physical properties. Acidity. Nucleophilic substitution and elimination reactions. Esters and ethers formation. Oxidation. Thiols and thioethers. Phenols.

Ethers.

Structure, nomenclature, physical properties and reactivity.

Epoxides.

Structure, nomenclature, physical properties and reactivity.

Amines.

Structure, nomenclature, physical properties. Basicity and nucleophilic character. Synthesis of amines. Hofmann elimination. Diazonium salts.

Aldehydes and Ketones.

Structure, nomenclature, physical properties. Nucleophilic addition reactions with strong nucleophiles or acid catalysed. Addition of carbon nucleophiles: cyanide, organometallic compounds. Acid catalysed addition of water, alcohols, thiols, ammonia, amines and ammonia derivatives. Tautomerism. Aldol reaction. Reductions. Oxidation of aldehydes.

Carboxylic acids and derivatives.

Structure, nomenclature, physical properties. Acidity. Influence of the structure on the pKa. Reactivity of carboxylic acids, acyl chlorides, anhydrides, esters, amines, nitriles. Differences in their reactivity, including reduction and reaction with organometallic reagents.

α -halogenation. Claisen condensation. Acetacetic and malonic synthesis.

Conjugate systems.

Reactivity of conjugated dienes and α,β -unsaturated carbonyl compounds.

Polyfunctional compounds.

Intramolecular reactions, concepts of protection and activation.

Biomolecules.

Carbohydrates: structure of monosaccharides, D e L, cyclic forms, a and anomers, glycosidic bond, disaccharides, polysaccharides.

Amino acids: structure, behaviour at different pH. Peptidic bond. Peptide synthesis.

Nucleic acids: structure and bases complementarity.

Lipids: fatty acids, triglycerides, glycolipids, phospholipids, terpenes, steroids

Prerequisites

Knowledge of the atomic structure, the main principles of kinetic and thermodynamic, of the weak interactions

Teaching form

classroom lessons and tutoring

Textbook and teaching resource

Any good textbook of organic chemistry

textbook of exercises of organic chemistry

Semester

second semester

Assessment method

The examination will assess the level of understanding of the logics that allow us to interpret the structure and reactivity of organic molecules, and the knowledge of the main classes of organic compounds.

Written examination with open questions, 2 hs duration, based on exercises.

Those who pass the written test will support an oral exam aimed at verifying the understanding of the concepts and the logic of organic chemistry, and the knowledge of the classes of organic compounds, structure, nomenclature, reactivity.

Office hours

Thursday at h. 12.30
