UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Basic Chemistry For Materials Science

2122-1-F5302Q034

Aims

The course aims to provide the knowledge of general, inorganic and organic chemistry necessary for students who have not acquired them in their first level courses.

Contents

Basic course of general, inorganic and organic chemistry.

The general and inorganic chemistry deals with the fundamental aspects of chemistry, with the aim to relate the physical properties of the materials with their chemical composition. The main chemical phenomena (reactions, equilibria, ph), as well as some basis of stoichiometry, will be also addressed.

In organic chemistry the structural aspects, the weak bonds responsible for molecular interactions and the covalent bonds that give rise to polymeric structures of interest for materials sciences will be addressed.

Detailed program

The atomic theory. Formulas and nomenclatures of binary and ternary compounds. Fundamental notions of stoichiometry. Stoichiometry in solutions: concentration and molarity. Chemical reactions and balance. Electronic configuration of atoms and ions. Periodical properties in chemistry. Ionic, covalent and metallic bonds. The shape of the molecules and the VSEPR theory. Molecular orbital theory. Chemical properties of condensed matter. Properties of solutions. Thermodynamics and kinetics of chemical reactions. Chemical equilibria: acid-base, precipitations and redox.

General aspects of organic chemistry: Atoms in organic chemistry and their electronic equipment. Hybridizations of carbon atoms. Molecular orbitals, hybrid orbitals. Structure representation.Delocalization of molecular orbitals, resonance, aromaticity. Polarized bond and dipolar moments. Intermolecular forces. Nomenclature, functional groups, isomerism. Stereoisomery. Enantiomers. Diastereoisomers. Configurations and descriptors (R and S). Mesoforms. The stereogenic axis. Cis and trans stereoisomers, E and Z. The conformations of alkanes and cycloalkanes. Fundamentals of chemical reactivity applied to the formation of materials. The classes of organic compounds, functional groups and their role in materials. Alkyl halides. Alcohols and thiols. Ethers. Epoxides. Amines. Aldehydes and Ketones. Carboxylic acids and their derivatives. Carbohydrates: structure of monosaccharides, steric series D and L, cyclic forms, ?and ? anomers, glycosidic bond, disaccharides, polysaccharides, their importance as biomaterials. Amino acids: structure, properties, peptides and proteins, their relevance as materials. Nucleosides, oligonucleotides and nucleic acids, self-assembling capacities, aptamers. Lipids, structure and properties and application in materials (liposomes)

Prerequisites

none

Teaching form

Classroom lectures.

Textbook and teaching resource

Any textbook of general and inorganic chemistry

Any textbook of basic organic chemistry

Semester

firts semester

Assessment method

Oral exam. For each part of the course (inorganic chemistry and organic chemistry) an exam is carried out. The final mark is the weighted average of the marks obtained on each part.

Office hours

Inorganic Chemistry, Wednesday 9.00 (upon previous arrangement by email)

Organic Chemistry, Thursday 12,30 (upon previous arrangement by email)