CHEMISTRY AND BIOCHEMISTRY PROPAEDEUTIC

I Year	Scientific Field	DISCIPLINE	TUTOR
Chemistry and Biochemistry Propaedeutics	BIO/10	*Chemistry and Biochemistry Propaedeutics*	**Marini Stefano**
ECM 7			
Coordinator			
Marini Stefano			

Specific aims	Comprehension and knowledge of chemico-physical and molecular mechanisms which are at the base of vital processes. Knowledge of chemical compounds involved in biological processes and comprehension of some chemical reactions active during vital processes.

PROGRAM of Propaedeutics of Biochemistry

Introduction remarks. Periodic table of elements and inorganic nomenclature. Atom: atom models, atomic particles: proton, neutron, electron. Isotopes. Electrons and atom electronic configuration. The quantum-mechanical model of the atom. Quantum numbers and orbitals. Auf-bau. Chemical bonds.
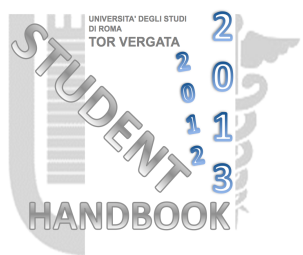
Matter states. Gas: ideal gas law. Absolute temperature and its relation with mean molecular speed. Mixture of gases; Dalton law. Liquids: vapor pressure of a liquid. Solids: structural characteristics of covalent, ionic, molecular and metallic solids.

Thermodynamics. Thermodynamic potentials; enthalpy, Hess law, entropy. Free energy: relationship with enthalpy and entropy.

Solutions. Concentrations of solutions: dilution and mixing of solutions. Vapor pressure of a solution (Raoult law). Solubility of gases in liquids: Henry law.

Chemical equilibrium. Equilibrium in gaseous phase. Expression of equilibrium constant. K_p and K_c relationship. Equilibrium influencing factors. Homogeneus and hetherogeneus equilibrium.

Solutions of electrolytes. Strong and weak electrolytes: dissociation grade. Colligative properties of electrolyte solutions. Van't Hoff binomial. Acid and bases following Arrhenius, Bronsted and Lowry definitions. Strong and weak acid and bases. Dilution law of Ostwald. pH in strong and weak acid and base solutions. Buffers. Dissociation of polyprotic acids and bases. Acid-base titrations.

Heterogeneous systems. Equilibria of slightly soluble ionic compounds. The solubility-product constant. The effect of a common ion.

Kinetic. Kinetic introduction, activated complex theory, activation energy. Kinetic equations and reaction order. Relationship between kinetic constant and activation energy (Arrhenius energy). Relationship between kinetic constants and equilibrium constants.

Electrochemistry. Redox reactions and chemical potentials. Oxidation number. Redox reactions and their balance. Redox standard potentials. Nernst equation. Electromotive force potential of a cell. Half-cell. Chemical and concentration cells.

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PROGRAM of Propaedeutics of Biochemistry	**Carbon atom hybridization**. Sp3, sp2, sp hybridization and their geometry. **Hydrocarbons.** Saturated hydrocarbons (arenes): alkanes, cicloalkanes. Nomenclature. Conformational isomerism and geometric isomerism (cis-trans). Alkanes reactions: halogenation ant its mechanism. Unsaturated hydrocarbons: alkenes and alkynes. Nomenclature. Addiction reactions to alkenes. Markovnikov rule. Alkynes addiction. **Aromatic compounds.** Benzene structure: resonance model. Aromatic compounds nomenclature. Electrophilic aromatic substitution and its mechanism. Activating/deactivating groups in electrophilic aromatic substitution. Ortho-para and meta directing group. Polycyclic aromatic hydrocarbons. **Alcohols, phenols, thiols.** Nomenclature. Acidity and alkalinity of alcohols and phenols. Alcohols' reactions. Alcohol with more than an unique alcoholic group. Alcohols and phenols in comparison. Aromatic substitution in phenols. Thiols. **Aldehydes and ketones.** Nomenclature. Aldehydes and ketones preparation. Carbonylic group. Nucleophilic addition at carbonylic groups. Acetals and hemiacetals formation. Oxidation of carbonylic compounds. Keto-enol tautomerism. Alfa hydrogen acidity. Aldol condensation. **Carboxylic acids and their derivatives.** Nomenclature. Carboxylate ion resonance. Effects of acid structure: inductive effect. Acids preparation. Carboxylic acid derivatives: esters, anhydrides, amides. **Difunctional acids. Dicarboxylic acids.** Unsaturated acids. Ketoacids. Esterification mechanisms. Glycerol triesters. **Ammines and other nitrogen compounds.** Classification and nomenclature of ammines. Ammines preparation. Ammine alkalinity. comparation between ammines and amides. Ammines reactions: heterocycles, pyrrole, pyridine, imidazole, pyrimidine, purines. **Stereoisomerism.** Chirality. Enantiomers. Polarized light. Diastereoisomers. Meso compounds. Racemic mixtures. **Carbohydrates.** Definition, classification and nomenclature. Monosaccharides. Monosaccharides chirality. Fisher projections. Cyclic structure of monosaccharides. Mutarotation. Pyranosidic and furanosidic structures. **Amino acid and proteins.** Amino acid properties and their reactions. Peptide bond.
TEST Books	Chemistry by M.S. Silderberg, McGraw-Hill International Edition. Introduction to General, Organic and Biochemistry by F.A. Bettelheim, W.H. Brown, M.K. Campbell, S.O. Farrell, Brooks/Cole.
METHOD of TEST	Chemistry and propedeutical biochemistry course provides two final different proofs: a written and an oral proof. Written proof will deal with the whole program as reported above and will consist in 5 stoichiometry exercises which must be sorted out; each exercises will be valued from 0 to 5 points as a function of the exercise' progresses and solution' quality. Moreover, a further exercise of organic nomenclature (valued from 0 to 5 points) must be also sorted out. To be admitted to the oral proof the written proof must be passed with a whole mark higher than 15. Oral proof, which is usually held one week after the written proof, consists of an oral examination over the whole program with a commission made by prof. Coletta, prof. Marini and a researcher. It is important to underlay that oral examination admission is valid only for the same examination session.

UNIVERSITA' DEGLI STUDI DI ROMA TOR VERGATA

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