

UNIVERSITY OF BARI  
FACULTY OF MEDICINE AND SURGERY  
DEGREE IN MEDICINE AND SURGERY  
(BARI ENGLISH MEDICAL CURRICULUM)

PROGRAM OF  
CHEMISTRY AND INTRODUCTORY BIOCHEMISTRY  
(2014-15)

**GENERAL CHEMISTRY**

1. Definition of chemical changes. States of matter. Dimensional analysis. Metric and International System Units. Significativity of physical measurements. Accuracy and precision.
2. The structure of atoms. The periodic table of elements. Nuclear chemistry: radionuclides, type of radiations emitted by unstable isotopes. Time of decay.
3. Chemical bonding. The octet rule, Lewis structures and the VSEPR model. Ionic and covalent bonds. Standard nomenclature of inorganic compounds. Chemical bonding: resonance structures, polarity of molecules. Atomic orbital hybridization. Molecular orbitals:  $\sigma$  and  $\pi$  bonds.
4. Electronic configuration of molecular orbitals. Bond strength and length. Diamagnetic and paramagnetic compounds. General rules for nomenclature of inorganic compounds.
5. Molecular weight. Mole and molar mass. Chemical reactions. Balancing a chemical reaction. Stoichiometric calculations. Type of reactions: insoluble salt formation, gas formation, acid-base and redox reactions. The oxidation number. Redox reaction balance. The states of the matter and the kinetic molecular theory.
6. Boyle, Charles and Gay-Lussac laws of gases. The ideal gas law. Weak attractive forces between molecules: van der Waals forces and H bonding. The phase diagram.
7. Exercises on reaction balancing. Solutions: concentration measurement units. Colligative properties of solutions. Osmotic pressure.

8. Thermochemistry: Internal energy of a system. Enthalpy and heat of reaction. Standard enthalpy of formation and Hess's law. The second law of thermodynamics and entropy. The Gibbs free energy.
9. Chemical kinetics: the rate of reaction. Order of the reaction. Activation energy and the transition state of a chemical reaction. The Arrhenius plot. Reaction mechanisms: elementary steps and intermediate products. Rate-limiting step of a reaction.
10. Chemical equilibrium: the equilibrium constant of a reaction. Definition of acid and base according to Arrhenius, Bronsted and Lewis. Ionic product of water. pH, pKa and pKb. Buffer solutions. Titration. Henderson-Hasselbach equation.
11. Electron motive force of an electrochemical cell. Standard electrode potential and spontaneity of redox reactions. Free energy change of a redox reaction.

### ORGANIC CHEMISTRY

1. Organic chemistry. Introduction to functional groups. Alkanes. Constitutional isomers. Reactions of alkanes. Alkenes and alkynes. Conjugated double bonds. Reactivity of alkenes.
2. Aromatic compounds. Heterocycles. Phenols. Alcohols, ethers and thiols.
3. Optical stereoisomerism: enantiomers and diastereomers. R/S system nomenclature of stereoisomers. Specific rotation.
4. Aliphatic and aromatic amines. Amines as bases. Aldehydes and ketones. Carboxylic acids. Fatty acids and reactivity of carboxylic acids. Esters, anhydrides and amides.
5. Carbohydrates. Mono-, oligo- and polysaccharides. Fisher and Howarth projections. Anomerism. Carbohydrate reactivity.
6. Lipids. Triglycerides. Phospho- and glycolipids. Steroids. Sex and adrenocorticoid hormones. Prostaglandin, thromboxanes and leukotrienes.
7. Amino acids: classifications and reactivity. Peptides, oligo peptides and proteins. Orders of proteins structure. Co-operativity and allostery.