



Dipartimento di Scienze e Tecnologie

ACADEMIC YEAR 2017/2018

DEGREE in Biotechnology
COURSE of General and Inorganic Chemistry

TEACHER: Prof. Giuseppe Graziano

Introduction: Atoms, molecules, ions and isotopes. Atomic masses and atomic mass units. Molecular weight. Chemical and physical properties. Composition, structure and state of aggregation. Phases.

Atomic structure: Rutherford experiment. Atomic number and mass number. Orbital: forms and energies. Quantum numbers and electronic Spin. Pauli's principle and Hund's rule. Orbital filling order. Electronic configuration. Periodic system: classification of elements. Ionization energy and electron affinity.

Chemical bond: Lewis formulas and the rule of the cutter. Ionic bond in crystalline structures. Covalent bond. MO-LCAO theory. Treatment of homonuclear and heteronuclear diatomic molecules. Sigma and P-Greek bonds. Hybrid orbitals for the treatment of larger molecules. Molecular geometry: VSEPR theory. Electronegativity. Molecular dipole moment. Metallic bond.

Chemical reactions - Stechiometry: nomenclature of chemical compounds. Oxidation number. The law of mass conservation. The atomic theory and the law of the defined proportions. Avogadro's number. Concept of mole and the molar mass. Chemical equations. Balancing chemical reactions.

The gas state: ideal and real gases. Gas laws: transformations at constant temperature, constant volume, constant pressure. The principle of Avogadro. The molar volume of a gas. Ideal gas equation of state. Kinetic gas theory. Maxwell's molecular speed distribution curve. Van der Waals equation for real gases.

Liquid state and solid state: Gas liquefaction: intermolecular interactions. Hydrogen bond. Vapour pressure and critical phenomena. State diagram of a pure substance: water and carbon dioxide. Surface tension. Evaporation and boiling. Ionic, molecular and covalent solid. Crystalline structures. Fusion and sublimation.

Solutions: Ways to express the concentration of a solution. Solubility and saturated solutions. Raoult's law. Colligative properties. Lowering the vapor pressure. Increasing the boiling temperature rise and lowering the freezing temperature. Osmosis and osmotic pressure.

Chemical reactions and energy: state functions. I law of thermodynamics. II law of thermodynamics. Entropy and its molecular interpretation. Gibbs free energy and spontaneity of a process.

Chemical Balance: the law of mass action. Le Chatelier's principle and factors that affect the chemical equilibrium. Gas phase equilibria and heterogeneous equilibria. Solubility product.

Acids and Bases: Theories of Arrhenius, Bronsted-Lowry and Lewis. Water self-ionization. Acid-base equilibria. Definition of pH of an aqueous solution. Acid and base dissociation constants. Buffer solutions. Titrations. Salt solubility and solubility product.

Electrochemistry: principles of a voltaic cell. Standard electrode reduction potentials. Nernst's law. Voltaic cells of common use. Concentration cells and pH meter. Electrolysis and some industrial electrolytic processes. Issues related to energy production.



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Textbooks:

Chemistry - Kotz, Treichel, Townsend - Edises

Chemistry, a molecular approach - Tro - Edises

Chemistry Fundamentals - Brown, Lemay, Bursten - Edises

Stoichiometry - Giannoccaro, Doronzo - Edises