



UNIVERSITÀ
degli STUDI
di CATANIA

DEPARTMENT OF BIOLOGICAL, GEOLOGICAL AND
ENVIRONMENTAL SCIENCES
Bachelor's Degree in Biology
Academic Year 2016/2017 - 1° Year

GENERAL AND INORGANIC CHEMISTRY - channel 1

CHIM/03 - 9 CFU - 1° Semester

Teaching Staff

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LEARNING OBJECTIVES

The course aims to provide the basics of General and Inorganic Chemistry as a cultural basis essential for the understanding of the courses later encountered by the students, sequentially, organic chemistry, biochemistry and molecular biology.

The course of General Chemistry will also give the student an idea of the role of chemistry in society and in everyday life. In particular, the student, through the study of chemistry will not only be aware of the fundamental role carried out by this discipline in different scientific and technological fields, particularly in the chemistry of bio-systems, but will also learn the fundamental principles behind the scientific method.

The student must acquire, through the study of the fundamental laws that govern them, basic knowledge on the various states of aggregation structure with particular reference to the study of the electronic configuration of atoms and molecules and the chemical dynamics (chemical reactions especially in their stoichiometric, thermodynamic and kinetic aspects). The student will be able to correlate the structure to the chemical reactivity and to perform stoichiometric calculations at the base of chemical measurements.

DETAILED COURSE CONTENT

1 - STRUCTURE OF - Subatomic particles: Electron, proton, neutron - atomic number, mass number - isotopes - atomic mass unit - Atomic model of Bohr / Rutherford - Quantum Mechanical Description of the atom - Atomic orbitals - Quantum Numbers - the Pauli exclusion principle - Principle of maximum multiplicity

2 - PERIODIC SYSTEM OF ELEMENTS - electronic configuration and periodic classification of the elements - Periodic properties: atomic and ionic radii, ionization energy, electron affinity, electronegativity.

3 - CHEMICAL BOND - Ionic bond - covalent bond - valence bond theory - Electronegativity of atoms and polarity of bonds - Oxidation number - Dative bond - VSEPR Theory: molecular geometry hybrid -Orbitals - Resonance - Chemical bonding and structural formulas of the most common inorganic compounds.

4 - INTERMOLECULAR FORCES - Van der Waals and London Forces - hydrogen bond.

5 - GASEOUS STATE - General characteristics of gaseous state - ideal or perfect Gas - ideal gas laws - Gas Equation - Gas Diffusion - Real Gas. Numerical applications.

6 - STOICHIOMETRY - The concept of mole - stoichiometry law- Determination of the formula of a compound - The chemical equation and its equilibrium- Identification of redox reactions - Balancing of redox reactions - Stoichiometry: Quantitative relationships in chemical reactions - limiting reagent, numerical applications

7 - CONDENSED PHASES AND STATE CHANGES - Outline of solid state properties as a function of the chemical bond - the liquid state Features - State changes - Vapor Pressure - State diagram of the water and carbon dioxide- Le Chatelier's principle -.

8 - WATER SOLUTIONS - Types of solutions - Concentration units - Solubility (with particular reference to the solubility of ionic compounds) - Henry's Law - colligative properties of solutions: Lowering of vapor pressure and Raoult's Law - Cryoscopy and ebullioscopy - Osmosis and osmotic pressure - electrolyte solutions. Colligative properties of electrolytes - Dissociation Grade, Numerical applications

9 - KINETICS - Factors affecting the rate of reaction - kinetic equation and reaction order - Graphical Treatment of 1st order reaction - elementary reactions: the reaction rate-limiting step - Activation energy - Catalysts

10 - CHEMICAL BALANCE - The balance in homogeneous systems - chemical equilibrium Law - Factors affecting the balance - Ionic equilibria in aqueous solution - Dissociation of water and pH -Theory of acids and bases: Acids and Bases according to Arrhenius, Bronsted and Lewis - ampholytes - pH of salt solutions (hydrolysis) - Buffer solutions - Calculation of pH in solution of acids, bases, salts and buffers - pH indicators. Numerical applications.

11 - ELECTROCHEMISTRY - Galvanic cells - Nernst equation - Series of potential standards and its importance - - Electrolysis - Faraday law.

12 - ELEMENTS OF THERMODYNAMICS - Enthalpy - Hess's Law (to be treated prior to chemical bonding) - Entropy (to be treated before the aqueous solutions) - Free Energy - Temperature Role in the spontaneity of chemical reactions (to be treated before electrochemistry)

13 - INORGANIC CHEMISTRY - metals and non-metals: general information on the chemical and physical properties, natural and biological relevance. General characteristics of each group of the periodic Table. Main oxidation states and compounds of hydrogen, alkali metals and alkaline earth metals, Carbon, Nitrogen, Phosphorus, Oxygen, Sulfur and Chlorine. Transition elements: general information. Coordination compounds of biological relevance.

The underlined parts, and everything else that is necessary to pass the test for the programmed number (see the site of Biological Sciences), are discussed in depth at the basic courses to be held in the

afternoons of the first two weeks of the course.

TEXTBOOK INFORMATION

1. PRINCIPI DI CHIMICA. Authors: **Atkins, Jones**. Publisher: Zanichelli.

2. STECHIOMETRIA. Guida alla soluzione di problemi di chimica. Authors: **Lausarot, Vaglio**. Publisher: PICCIN

3. CHIMICA. Authors: **Kotz, Treichel, Townsend**. Publisher: EdiSES. VI Edizione

4. Fondamenti di Chimica. M. Schiavello, L. Palmisano. Publisher: EdiSES. V Edizione

Lecture notes
