UNIVERSITÀ DEGLI STUDI DI BARI ALDO MORO

dipartimento di farmacia-scienze del farmaco

General information	
Academic subject	General and Inorganic Chemistry
Degree course	Pharmacy
Year of study	1°
European Credit Transfer and Accumulation System (ECTS)	10
Language	ITALIAN
Academic Year	2022/23
Academic calendar (starting and ending date)	November 7,2022 -May 26, 2023
Attendance	Mandatory attendance

Professor/ Lecturer Course A-E	
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Tutoring (time and day)	By appointment

Syllabus	
Learning Objectives	The primary goal of the course is to provide a solid foundation in the basic concepts and facts of general and inorganic chemistry, particularly those needed for a successful understanding of biologic- chemistry and pharmaceutic-chemistry for other courses for which chemistry is a prerequisite. The course aims to give the student an appreciation of the importance of chemistry to society in general and to daily life in particular.
Course prerequisites	Basic knowledge of Mathematics (I and II grade equations, conversion between measurements units and operations with logarithms) and geometry
Contents	**Introductory notions** Units of measurement and conversion factors. SI system. Fundamental definitions of physics. Basic mathematical concepts (scientific notation; logarithms; exponential function; resolution of first- and second-degree equations; functions and graphs). Fundamentals of the atomic nature of matter. States of aggregation

	and changes of state. Phases. Homogeneous and heterogeneous systems. Mixtures. Solutions. Separation of the components of a system. Substances, compounds, elements. Lavoisier's Law of Conservation of Mass. Dalton's atomic theory. The Law of Definite Composition or Proportions (Proust), Law of combining volumes (Gay-Lussac) Avogadro's hypothesis. Atoms, molecules, atomic symbols and chemical formulas. Atomic structure: protons, neutrons, electrons. Atomic number. Mass number. Definition of mole. Avogadro number. Molar mass. Mass Percentage composition and empirical formula. Chemical equations and their balancing. The periodic table. Metals and non-metals. Valence. Electrons distribution in atoms. Chemical bonds. **Atomic structure and properties** Rutherford's atomic model. Fundamental experiences on the constitution of the matter. Light and electromagnetic waves. Interference and diffraction. Atomic spectra. Hydrogen atom spectrum. Bohr's atomic model for hydrogen. The undulatory properties of particles. Heisenberg's Uncertainty principle. Basic principles of quantum mechanics. Quantum numbers. Hydrogen atomic orbitals. Polyelectronic atoms. Aufbau principle. Pauli exclusion principle. Hund's rule. Aufbau and periodic table. Periodic properties, atomic and ionic radii. Ionization energy. Electron affinity. **Chemical bonding** Bonding energy. Ionic bond. Reticular energy. Covalent bond. Covalent molecules. Octet rule. Valence and electronic configurations. Single and multiple bonds. Lewis structures. Molecules and polyatomic ions. Dimensions of atoms and ions. Geometry of molecules. V.S.E.P.R. Theory of Molecular Orbital Theory (L.C.A.O.). σ and π bonds. Homonuclear and heteronuclear diatomic molecules. Electronegativity. Localized molecular orbitals. Hybrid orbitals. Resonance structures. Resonance energies. Bonding order. Bonding distance. Bonding energy. Dipoles and dipole moments. Bond Polarity. Polar molecules. Van der Waals forces and intermolecular chemical bonds. Van der Waals radius. Hydrogen bonding and experimental evidences. Metallic bond. Conductors and insulators. **Gaseous state:** Pressure and volume: Boyle's law. Temperature and volume: I law of Gay-lussac and Charles. Temperature and pressure, Gay-lussac's law. Normal conditions. Notions on the kinetic-molecular theory of gases. The Ideal gas Equation. Avogadro's law. Gas mixtures and Dalton's law of partial pressures. Diffusion and effusion. Molecular velocities. Graham's law. Van der Waals equation. Composition of air. **Introduction to chemical reactions** Chemical Nomenclature. Electronegativity. Polar bonds. Ionic bonds. Reduction-Oxidation reactions. Electrolytes in aqueous solution. Acids and bases. Strength of acids and bases. Acid-base reactions. Conjugated acid-base pairs. **Solid state.** Crystalline and amorphous solids. Elementary grids and cells. Relationship between structure and properties. Allotropes. **Thermochemistry and Thermodynamics** The heat involved in chemical reactions: exothermic and endothermic reactions. Enthalpy changes. Hess's Law. The laws of thermodynamic. Entropy. Free energy. **Chemical kinetics** Reaction rate, kinetic equations and reaction order. Influence of concentration and temperature on reaction rate. Activation energy. Homogeneous and heterogeneous catalysis. Typical examples of industrial catalysis. **Liquid state and solutions**

	Liquid-vapour equilibrium. Dependence of vapour pressure on temperature. Solid-vapour and liquid-solid equilibria. Single component phase diagrams: water, carbon dioxide. Properties of aqueous solutions. Units of measurement of concentrations. Solubility and temperature. Law of distribution. Henry's law. Ideal solutions. Colligative properties. Vapor pressure of solutions. Raoult's Law. Liquid-vapour equilibrium in two-component systems. Fractional distillation. Real mixtures (azeotropic). Cryoscopy and ebullioscopy. Osmotic pressure. Two-components Phase diagrams. Electrolytic solutions. **Chemical equilibrium** Equilibrium constants in homogeneous and heterogeneous systems. Expression of equilibrium constants. Degree of advancement and yield of chemical reactions. Influence of intensive variables on chemical equilibrium. Relationship between equilibrium constant and Gibbs's free energy. Le Chatelier's Principle. **Acid-base equilibria** Strong and weak electrolytes. Acid and base definitions (Arrhenius, Bronsted and Lowry, Lewis). Ionic water product, pH, pOH, pKw. Acids and bases in diluted aqueous solution. Dissociation constant and strength of acids and bases. Polyprotic acids. Ampholites. Relationship between acid character, structure and periodic table. Titrations. pH indicators. Buffer solutions. Heterogeneous equilibria. Solubility product. **Electrochemistry** Oxidation-reduction (redox) reactions and electrode reactions. Galvanic cells. Measurement of the electromotive force of a battery. Nernst equation. Redox potentials. Strength of oxidant and reducing agents. Normal hydrogen electrode. Glass electrode and electrochemical measurement of pH. Dry cells and accumulators. Electrolysis. Decomposition and polarization potential. Overvoltage. Faraday laws and electrode processes in electrolysis. **Inorganic Chemistry** Chemical Properties and Periodic Table. Typical elements and transition elements. Coordination compounds. Polydentate ligands and complexes. Preparation of the main industrial inorganic products (Hydrogen, soda, chlorine, ammonia, sulphuric acid, aluminum). Water hardness and softening methods. Carsism. Carbon-14 Dating.
Books and bibliography	Fondamenti di Chimica L. Palmisano M.Schiavello Casa Editrice: EdiSES La Chimica di base (terza edizione) Nobile, Mastrorilli Casa Editrice Ambrosiana STECHIOMETRIA I.Bertini, C. Luchinat, F. Mani Casa Editrice Ambrosiana Stechiometria dal testo di M. Freni e A. Sacco Caselli, Rizzato, Tessore Casa Editrice EdiSES
Additional materials	

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
100	80	20	150
ECTS			

10	8	2	

Teaching strategy	
	The course is based on lectures, with the support of PowerPoint, held in class and on exercises on stoichiometric-related topics.
Expected learning outcomes	
Knowledge and understanding on:	The students will gain an understanding and a knowledge of the fundamental concepts of General and Inorganic Chemistry for the study the active principles used for health and cosmetic purposes, by knowing their structural chemistry features.
Applying knowledge and understanding on:	The students will gain an understanding and a knowledge of the fundamental concepts of stoichiometry, via numerical exercises. They will acquire the skills necessary for be able to correlate the experimental data with chemical reactivity.
Soft skills	• *Making informed judgments and choices* The student will be able to critically assess modes of interaction/transformation of inorganic molecules, even biologically interesting • *Communicating knowledge and understanding* The student will acquire communication abilities using a specific language by employing proper chemical terms and expositive clearness. ○ *Capacities to continue learning* The student will master independently the issues related to the Inorganic Chemistry.

Assessment and feedback	
Methods of assessment	The examination consists of a written test followed by an oral test. The written exam aims to assess the knowledge of inorganic and organic general chemistry acquired by the student during the course and the student's ability to solve stoichiometric calculations. Calculator is allowed in written test. No PC, Tablet, Mobile phones, Smartwatch are allowed in any test. Access to oral exam is possible after passing the written test. The result of written test is communicated via by IT platform Esse3. The final written test can be replaced by two tests taken during the course (one at about half of the program and the other at the end of the program). The weighted average score of the two tests provides the final written mark.
Evaluation criteria	*Knowledge and understanding* ○ Students should show their acquired fundamental concepts of chemistry in order to achieve the necessary competences for studying the active principles used for health and cosmetic purposes, by knowing their structural chemistry features. *Applying knowledge and understanding* ○ Students should be capable of applying their basic knowledge of chemistry to the solution of exercises provided, also as a necessary step forward to the problems related to analysing, recognising and purifying natural products. *Autonomy of judgment* ○ Students should master the acquired basic chemistry principles. *Communication skills* ○ Students should be capable of express themselves clearly and unambiguously both in the verbal and in the oral form.

	Capacities to continue learning ○ Students should be capable of extract main concepts from both the advised books and the lectures. ○
Criteria for assessment and attribution of the final mark	The maximum score achievable is 30. If the writer score achieved at the test is less than 15, it is not possible attend the oral examination. The final vote will take into account of the mark at written test and oral examination. If the final grade is equal to or greater than 18/30 the examination is positive.
Additional information	