



CHIMICA GENERALE ED INORGANICA I E LABORATORIO A - L

12 CFU - 1° Semester

Teaching Staff

ANTONINO GULINO

Email: agulino@unict.it

Office: Dipartimento di Scienze Chimiche /Viale Andrea Doria 6, 95125 Catania

Phone: 0957385067

Office Hours: Lunedì, Mercoledì e Venerdì ore 9-11, ed alla fine di ogni lezione

LEARNING OBJECTIVES

▪ **General and Inorganic Chemistry: Theory**

Acquisition of important concepts of general chemistry, inorganic, stoichiometry and organic elements. The course is organized so as to provide a good understanding of the basic chemistry (inorganic and stoichiometry) and is divided into a theoretical part and a part that consists of exercises aimed at the solution of chemical problems. The aim of the course is to acquire reasoning skills to deal with the study of chemical phenomena with analytical and numerical methods.

▪ **General and Inorganic Chemistry: Experiments and exercises.**

Module 2 of the course provides students with the basic notions of safety in the laboratory and will allow them to perform chemical reactions related to the General and Inorganic Chemistry course I. In the light of the information obtained in the first module of this course, students will be able to rationalize the chemical processes in gas phase or in aqueous solution experimentally carried out.

COURSE STRUCTURE

▪ **General and Inorganic Chemistry: Theory**

Lectures and exercises in the classroom.

▪ **General and Inorganic Chemistry: Experiments and exercises.**

Lectures, exercises in the classroom and experiments on chemical reactions in the laboratory.

DETAILED COURSE CONTENT

▪ **General and Inorganic Chemistry: Theory**

Starting course on the nomenclature.

1 - STRUCTURE OF THE ATOM

Subatomic particles: Electron, proton, neutron - atomic number, mass number - isotopes - atomic mass unit - Bohr / Rutherford atomic model. Wave Mechanical atom model. - Atomic orbitals - quantum numbers - Principle of exclusion of Pauli - principle of maximum multiplicity - the principle of aufbau.

2 - PERIODIC SYSTEM OF ELEMENTS

Periodical classification and electronic configuration of the elements - Periodic properties: atomic and ionic radii, ionization energy, electron affinity, and electronegativity.

3 - CHEMICAL BOND

Ionic bond, covalent bond, valence bond theory. Electronegativity of atoms and polarity of bonds - Oxidation number. Dative bond. V.S.E.P.R. theory. Hybrid orbitals and molecular geometry. Resonance. Chemical bonding and structural formulas of the most common inorganic compounds. Molecular orbital theory. Metal bond and elements of the band theory.

4 - INTERMOLECULAR FORCES

Van der Waals and London forces. Hydrogen bond.

5 - ELEMENTS OF THERMODYNAMICS.

6 - GAS LAWS.

General characteristics of the gaseous state. Ideal gas. Ideal gas laws. State law of the ideal gas. Law of partial pressures and volumes. Gas diffusion. Real gases. Numerical applications.

7 - STOICHIOMETRY

The concept of mole - Stoichiometry laws. Formula determination of compounds - The chemical equation and its balance. Redox reactions. Stoichiometry: quantitative relationships in chemical reactions. Numerical applications.

8 - CONDENSED STATES AND CHANGES

Solid state characteristics depending on the chemical bond. Characteristics of liquids. State changes. State diagram of water and of carbon dioxide. Mobile equilibrium principle.

9 - AQUEOUS SOLUTIONS

Concentration units. Solubility. Henry's Law. Colligative properties of solutions: Vapour pressure and Raoult's Law;- Cryoscopy and ebullioscopy; Osmosis and osmotic pressure. Electrolyte solutions. Colligative properties of electrolytes. Degree and dissociation factor. Numerical applications.

10 - THE CHEMICAL EQUILIBRIUM

The equilibrium in homogeneous systems. Mass Action Law and equilibrium constant. Factors affecting the equilibrium. Ionic equilibria in aqueous solutions. Dissociation of water and pH. Theory of acids and bases: Arrhenius's acids and bases, Bronsted and Lewis acids and bases. Ampholytes. Hydrolysis. Buffer solutions. Calculation of pH in acidic, basic, salts and buffer solutions. Acid-base

reactions and stoichiometry of solutions. Heterogeneous equilibria. Solubility product. Numerical applications.

11 - ELECTROCHEMISTRY

Galvanic cells. Nernst equation. Series of standard potentials and its importance. Concentration cells. Electrolysis. Faraday's laws.

12 - ELEMENTS OF KINETIC

13 - INORGANIC CHEMISTRY

Metals and non-metals: general information on the chemical and physical properties. General characteristics of each group of the periodic system. Alkaline and alkaline earth metals. Main oxidation states and compounds of Hydrogen, Oxygen, Carbon, Nitrogen, Phosphorus, Sulfur and Chlorine. Transition elements: general information. Coordination compounds. Ligands. Coordination number and geometry. Nomenclature. Outline of theories of chemical bonding in coordination compounds.

▪ **General and Inorganic Chemistry: Experiments and exercises.**

Laboratory experiences on the following topics:

Spectroscopy and flame tests

Preparation of the copper oxide

Preparation of the cuprous oxide

ACID-BASIC TITRATION

Construction of a stack and water electrolysis

Measurement of the volume of 1 mole of gaseous hydrogen

TEXTBOOK INFORMATION

▪ **General and Inorganic Chemistry: Theory**

Texts 1-4 are equivalent and the student is free to choose others not listed.

Texts of exercises 5-7 are equivalent and the student is free to choose others not listed.

1. KOTZ, TREICHEL, TOWNSEND Chimica V edizione - EdiSES
2. ATKINS, JONES, Principi di Chimica - Zanichelli
3. PETRUCCI, HERRING, MADURA, BISSONNETTE, Chimica Generale - Piccin
4. EBBING, Chimica Generale - Editoriale Grasso
5. NOBILE, MASTRORILLI, Vol.1 e 2, Esercizi di Chimica - Ambrosiana
6. GIOMINI, BALESTRIERI, GIUSTINI, Fondamenti di Stechiometria - EdiSES
7. P.MICHELIN LAUSAROT, G.A. VAGLIO, Fondamenti di Stechiometria - Piccin

▪ **General and Inorganic Chemistry: Experiments and exercises.**

-NOBILE, MASTRORILLI, Vol.1 e 2, Esercizi di Chimica - Ambrosiana

-GIOMINI, BALESTRIERI, GIUSTINI, Fondamenti di Stechiometria - EdiSES

-P.MICHELIN LAUSAROT, G.A. VAGLIO, Fondamenti di Stechiometria - Piccin

- Teaching material of the lessons
