DIPARTIMENTO DI SCIENZE

COURSE: **GENERAL AND INORGANIC CHEMISTRY I**	
ACADEMIC YEAR: **2017-2018**	
TYPE OF EDUCATIONAL ACTIVITY: **Basic**	
TEACHER: **Angela Maria Rosa**	
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Language: **ITALIANO**	

ECTS: **8** (**5** Theory + **2** Numerical Applications + **1** Laboratory Activity)	n. of hours: **76** (**40** T + **24** NA + **12** LA)	Campus: **Potenza** Dept./School: **Dipartimento di Scienze** Program: **Chemistry (L27)**	Semester: **I** from 01.10.2018 to 20.12 2018/20.01 2019

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

Skills

- reading/writing formulas for the most common inorganic compounds according to the IUPAC rules;
- stoichiometry elements;
- electronic structure of the atoms according to the Quantum Mechanics (Schrödinger equation);
- periodic properties of the elements;
- salient aspects of the two main bonding models and of the intermolecular interactions;
- phisical and chemical properties of gas, liquid and solid phases of the matter, including solutions;
- mcroscopic and microscopic properties of the phase equilibria.
- elementary laboratory techniques: mass and volume measurements, preparation and dilution of solutions.

Learning outcomes

- ability to solve stoichiometry problems;
- ability to correlate the physico-chemical properties of the elements with their electronic configurations;
- ability to predict the geometry and the bond parameters of simple inorganic compounds;
- ability to correlate the macroscopic properties of the compounds with the nature of the chemical bond;
- ability to correlate the main physical properties of the condensed phases with the nature of the intermolecular interactions;
- ability to report accurately and concisely the data of the laboratory experiments.

PRE-REQUIREMENTS

High school Algebra, Geometry and Physics.

SYLLABUS

Stoichiometry and the Fundamentals of Atomic Theory. (8h T + 6h NA)

Definition of substance, element, and compound. Dalton's atomic theory. Fundamental units in the International Sistem. Derived units and conversion between units. Significant figures. The mole concept, atomic masses and molecular masses. Chemical formulas and their determination. IUPAC rules for reading and writing the chemical formulas of the most important families of inorganic compounds. Chemical reactions and chemical equations (balancing chemical reaction). Reaction stoichiometry.

Electronic structure and periodic properties of the Elements. (8h T + 4h AN)

Atomic models. Quantum Mechanics principles and the Schrödinger equation. Quantum numbers, wave function, and atomic orbitals. Electronic configuration of the elements and Periodic Table. Periodicity of the atomic properties: ionization potentials, atomic radii, electron affinity, electronegativity.

The chemical bond. (8h T + 6h NA)

Bond parameters (bond energy, bond length, bond angles), bond models. The Ionic bond in the ionic solids. Lattice energy and Born-Haber cycle. Covalent bond: the molecular orbital concept; molecular orbital as linear combination of atomic orbitals (LCAO-MO). Electronic configuration of omonuclear and eteronuclear diatomic molecules using the MO approach. Empirical methods to determine the number of bonds in polyatomic molecules: Lewis structures and evaluation of the relative stabilities of resonance structures using the formal charge concept.

Molecular geometry: the Valence Shell Electron Pair Repulsion (VSEPR) model. Polarity of a chemical bond. Dipole moment of diatomic and polyatomic molecules. Hybrid orbitals and molecular geometry. Weak bonds: London's forces, dipole-dipole and ion-dipole interactions, hydrogen bonds.

Gases. (4h T + 4h NA)

State parameters and state equation. Ideal gas and ideal gas laws (Boyle, Charles, Gay-Lussac, and Avogadro's laws). The state equation of the ideal gas. Mixture of ideal gases and Dalton's law. Kinetic theory of gases. Distribution of the molecular rates: the Maxwell-Boltzmann distribution function. Real gases and van der Waals state equation.

Condensed phases of the matter. (2h T)

Liquid phase: macroscopic properties and Maxwell-Boltzmann distribution of the molecular rates. Solid phase: macroscopic properties of crystalline solids; ionic, molecular, covalent, and metallic solids. Space Lattices.

Phase changes and phase equilibria. (4h T)

Energetics of the phase changes. Definition of state function and of the main thermodynamic state functions (enthalpy, entropy, free energy). Enthalpy changes in physical process and chemical reactions (Hess law). Phase equilibria. Vapor pressure of pure liquids and solids and its dependence on the temperature. The phase rule. Phase diagrams for one-component systems (H_2O, CO_2, S).

Solutions. (6h T + 4h NA)

Definition of solution; solution types; solution concentration units; conversion of concentration units. Preparation of liquid solutions. Ideal solutions and Raoult's Law. Electrolytic solutions. Nominal and actual concentration of electrolytic solutions. Colligative properties of ideal solutions. Ideal solutions containing two volatile components. Distillation principle. Positive and negative deviation from ideality. Solubility: definition of solubility and solubility prevision of solid and liquid solutes in liquid solvents using thermodynamic concepts.

Laboratory Applications . (12h)

Lab introduction: (1) absolute and relative error definition; random and systematic errors in the experimental measurements; instrument sensibility; accuracy and precision of a measure; (2) lab tour, lab safety; description of the main instruments for volume and weight measurements (analytical balances, cylinders, becker, pipettes, burettes).

Lab experiences: **1.** Masss and volume measurements and determination of the density of some liquids and solids.
2. Density and concentration of some aqueous solutions. Construction of a calibration curve.

TEACHING METHODS

The lectures will be comprised of PowerPoint slides provided by the teacher and supplemented with chalkboard presentations. Numerical application will be comprised of chalkboard problem solving and discussions. Laboratory activities will be introduced by PowerPoint and chalckboard presentations. The students will also be provided with supplementary worksheets.

EVALUATION METHODS

The final exam will comprise a written examination consisting of six numerical problems and an oral examination. A score of at least 18/30 in the written examination is mandatory to access the oral examination. The evaluation of the laboratory written reports will contribute to the final score of the exam.

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

The students will be provided with PowerPoint slides of the lectures.

Required textbooks:

- P. Atkins e L. Jones , Principi di Chimica, Casa Editrice Zanichell, Terza edizione italiana condotta sulla quinta edizione americana
- Mahan B. H. e Myers R. J., Chimica, Casa Editrice Ambrosiana
- Bertini I. e Mani F., Stechiometria: un avvio allo studio della Chimica, Casa Editrice Ambrosiana

INTERACTION WITH STUDENTS

Office Hours: 9:00–11:0 Monday and Wednesday and by e-mail appointment.

EXAMINATION SESSIONS (FORECAST)[1]

22/02/2019; 22/03/2019; 07/06/2019; 26/07/2019; 25/09/2019; 25/10/2019; 6/12/2019

SEMINARS BY EXTERNAL EXPERTS YES □ NO **X**

[1]Subject to possible changes: check the web site of the Teacher or the Department/School for updates.

FURTHER INFORMATION