SCUOLA DI SCIENZE AGRARIE, FORESTALI, ALIMENTARI ED AMBIENTALI

COURSE: General and Inorganic Chemistry			
ACADEMIC YEAR: 2017-2018			
TYPE OF EDUCATIONAL ACTIVITY: Basic			
LECTURER: Prof. Giampaolo Ricciardi			
e-mail: giampaolo.ricciardi@unibas.it		web:	
phone: 0971/205933		mobile (optional):	
Language: Italian			

ECTS: 6 (5 L + 1 E)	n. of hours: 56 (40 L + 16 E))	Campus: Potenza Dept./School: School of Agriculture, Forest, Food and Environmental Sciences Program: MSc in Food Technology	Semester: 2

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

This is a basic course in General and Inorganic Chemistry. The main objective of the Course is to provide the Students with the basic knowledge of the principal General and Inorganic Chemistry topics. In particular, at the end of the Course, the Students should be able to handle the basic General and Inorganic Chemistry concepts in solving simple stoichiometric problems and in discussing the electronic structure of atoms, small molecules, and solid aggregates as well.

- **knowledge and understanding:** knowledge and understanding of the general principles governing, both at a qualitative and quantitative level, the macroscopic behaviour of the matter and the reactivity of the inorganic compounds, the behaviour of pure phases, the physical and chemical equilibria, the electronic structure of mono- and poly-electronic atoms, the periodic properties of the elements, the chemical bond, and the intermolecular forces. Knowledge and understanding of the IUPAC rules.
- **applying knowledge and understanding**: ability to read and write the formulas of the most common inorganic compounds according to the IUPAC rules; ability to apply the basic stoichiometric principles in solving elementary stoichiometry problems; ability to identify the salient physical and chemical properties of gaseous, liquid and solid phases of the matter, including solutions; ability to identify and to handle, both at a qualitative and quantitative level, the general properties of ionic equilibria (acid-base, redox, solubility) in aqueous solution; ability to recognize the principal models of the atomic electronic structure, including the quantum-mechanical model, and to identify the periodic properties of the elements; ability to handle the ionic model and the covalent model of the chemical bond to interpret the relationships between the macroscopic properties and chemical bond in ionic solids and in molecular systems; ability to identify the weak intermolecular (inter-particle) interactions and to assess their role in determining the solubility of a given substnce in the common solvents, and other physical propreties of the matter, such as the boiling and melting point; ability to recognize and describe the essential factors governing the kinetics of a chemical reaction.
- **making judgements**: ability to select and apply the best procedure in solving simple stoichiometric problems; ability to make relationships between the salient macroscopic and microscopic properties of the matter; ability to discriminate the different macroscopic properties of the matter and to apply the correct microscopic interpretation.
- **communication skills**: ability to organize in a logical way and to communicate, using an appropriate and correct language and mathematical and graphical tools as well, the acquired knowledge.
- **learning skills**: ability to collect and organize in a functional way the information coming from class lectures, suggested books, and literature data.

PRE-REQUIREMENTS

High-school Algebra, Geometry, and Physics. Specifically, the following skills are considered essential: the use of the exponential notation; use/treatment of identities and simple equations; use of the Cartesian system; treatment of the basic properties of vectors; handling the basic elements of symmetry; handling the basic properties of the most common geometrical figures; knowledge of the basic concepts of electrostatics: electric charge, electric field, Coulomb’s law.

SYLLABUS (**Units in Bold**)

Stoichiometry and Fundaments of the Atomic Theory. (5h L + 5h E)

Introduction to the Stoichiometry: basic definitions, use of balanced chemical equations to predict the degree of conversion of reactants into products; IUPAC rules for the nomenclature of the most common inorganic compounds.

Electronic Structure of Atoms. (5h L + 1h E)

Models of the atomic electronic structure, including the essential aspects of the quantum-mechanical model. Periodical properties of the elements: definitions and relevant trends.

Chemical Bond. (5h L + 3h E)

Relevant geometric and energetic parameters of the chemical bond. The ionic bond model. Lattice and Lattice energy. The covalent bond model. The Lewis approach to determine the connectivity of the central atom in molecular systems. Resonance. Predicting the molecular geometry through the VSEPR approach. Polarity of the chemical bond and molecular geometry. Hybridization of atomic orbitals and molecular geometry.

Weak Chemical Bonds. (2h L)

Intermolecular interactions: hydrogen bond, dipole-ion interaction, dipole-dipole interaction, London's interactions. Role of the weak chemical interactions in determining the relevant physico-chemical properties of the matter in condensed phase, including the solubility and mixing capability of the chemical substances.

Phases and Phase Equilibria. (4h L)

Ideal gas model and related empirical laws. State law of the ideas gas. Mixtures of ideal gases. Maxwell-Boltzmann rate distribution law. Relationships between the phenomenological and microscopic properties of solids. General properties of liquids. Phase transition and energetics of phase transition. Phase equilibria. Water phase diagram.

Solutions. (4h L + 1h E)

Basic definitions. Ideal solutions and the Raoult law. Electrolytic and non-electrolytic solutions and the van't Hoff factor. Colligative properties of ideal solutions.

Ionic Equlibria in Aqueous Solution. (2h L + 1h E)

Principal physico-chemical characteristics and properties of the ionic equlibria in aqueous solution. Expression and meaning of the equilibrium constant. The Principle of Le Chatelier.

Acid-base Equlibria. (6h L + 3h E)

Acid-base definitions according to Arrhenius, Lowry-Brønsted, and Lewis. Water self-ionization constant. The pH scale. Solutions containing pure monoprotic acids and bases and mixtures of. Buffer solutions.

Solubility Equilibria. (2h L + 1h E)

Basic definitions. Role of the cation and of the anion in determining the degree of solubility of a salt. Solubility product constant and related applications. Effect of the shared ion on the solubility of a salt.

Redox Equilibria. (3h L + 1h E)

Basic definitions. Quantitative treatment of the redox chemical equations. Elements of the electrochemical cells.

Kinetics. (2h L)

Basic definitions. Elements of the reaction mechanisms. Transition-state theory and reaction energy profile.

TEACHING METHODS

Theoretical lessons, Classroom tutorials.

Lecture format: lectures will be comprised of PowerPoint slides prepared by the Teacher supplemented with chalkboard presentations.

EVALUATION METHODS

Written examination (25-30 questions and 3-4 numerical problems concerning, in all, 6 of the topics treated during the term).

TEXTBOOKS AND ON-LINE EDUCATIONAL MATERIAL

Reference textbook:

- P. Atkins e L. Jones, Principi di Chimica; Publisher: Zanichelli, Bologna, Italy.
- In addition the students will be provided with PowerPoint slides prepared by the Teacher.

INTERACTION WITH STUDENTS

Office hours: 9.30-11.30 am M., 11:30-1:30 pm Th., and by appointment .

EXAMINATION SESSIONS (FORECAST)[1]

19/1/2018, 16/02/2018, 16/3/2018, 4/5/2018, 8/6/2018, 6/7/2018, 5/10/2018, 7/12/2018, 18/1/2019, 15/2/2019/, 15/3/2019.

EVALUATION COMMITTEE

Prof. Giampaolo Ricciardi (member, president), Prof. Angela Maria Rosa (member), Prof. Mario Amati (additional member), Prof. Maurizio D'Auria (additional member).

SEMINARS BY EXTERNAL EXPERTS YES □ NO □X

FURTHER INFORMATION

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