SCUOLA DI SCIENZE AGRARIE, FORESTALI, ALIMENTARI ED AMBIENTALI

COURSE: General and Inorganic Chemistry (Module of the Course "General and Inorganic Chemistry and Organic Chemistry")			
ACADEMIC YEAR: 2016-2017			
TYPE OF EDUCATIONAL ACTIVITY: Basic			
TEACHER: Prof. Giampaolo Ricciardi			
e-mail: giampaolo.ricciardi@unibas.it		website:	
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 Agricoltural Technologies	Term: 2

EDUCATIONAL GOALS AND EXPECTED LEARNING OUTCOMES

Skills

– reading/writing the formulas of the most common inorganic compounds according to the IUPAC rules;
– elements of Stoichiometry;
– models of the atomic electronic structure, including the quantum-mechanical model;
– periodic properties of the elements;
– the ionic model and the covalent model of the chemical bond;
– empirical methods to predict the molecular geometry of small molecules
– weak intermolecular (inter-particle) interactions;
– Physical and chemical properties of gas, liquid and solid phases of the matter, including solutions;
– general properties of ionic equilibria in aqueous solution (qualitative and quantitative aspects);
– elements of kinetics;

Learning outcomes

– solve elementary stoichiometry problems;
– make relationships between the macroscopic properties of the elements and their electronic structure;
– make relationships between the macroscopic properties and chemical bond in ionic solids and in molecular systems;
– handle the qualitative and quantitative aspects of acid-base equilibria in aqueous solution;
– evaluate the solubility of low-solubility salts and predict the role of intrinsic and extrinsic effects on the solubility of low-solubility salts (even quantitative aspects);
– identify and handle, both qualitatively and quantitatively, the redox reactions;
– recognize and describe the main factors governing the kinetics of a chemical reaction.

PRE-REQUIREMENTS

High-school Algebra, Geometry, and Physics.

SYLLABUS

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 of the lectures 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]

20/1/2017, 24/02/2017, 24/3/2017, 12/5/2017, 16/6/2017, 14/7/2017, 6/10/2017, 15/12/2017

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.

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