UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze della Terra e del Mare		
ACADEMIC YEAR	2017/2018		
BACHELOR'S DEGREE (BSC)	GEOLOGY		
INTEGRATED COURSE	GENERAL AND INORGANIC CHEMISTRY WITH ELEMENTS OF ENVIRONMENTAL CHEMISTRY - INTEGRATED COURSE		
CODE	16461		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	CHIM/03, CHIM/12		
HEAD PROFESSOR(S)	CASELLA GIROLAMO	Ricercatore	Univ. di PALERMO
OTHER PROFESSOR(S)	MACCOTTA ANTONELLA	Ricercatore	Univ. di PALERMO
	CASELLA GIROLAMO	Ricercatore	Univ. di PALERMO
CREDITS	11		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	1		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Not mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	**CASELLA GIROLAMO** Tuesday 14:00 17:00 Via Archirafi,20 - II° piano Wednesday 14:00 17:00 Via Archirafi,20 - II° piano **MACCOTTA ANTONELLA** Tuesday 13:30 15:30 Via Archirafi, 20 - V piano		

DOCENTE: Prof. GIROLAMO CASELLA

PREREQUISITES	The student must posses the Maths, Physics and Chemistry basics from the former grade school.
LEARNING OUTCOMES	Knowledge and understanding: The course aims to allow the student: to recognize chemical compounds according to their chemical formula; to recognize the bond occurring in a molecule according to the elements properties; to know the principles and laws of the thermodynamics; to know the properties of the state of the matter; to know the properties of compounds; to explain and interpret the chemical reactions; to recognize the main organic functional groups; to know the main chemical processes occurring in the environment and the main pollutant reactions affecting the environment. The student must explain the behaviour of the molecules accounting for the chemical bond which occurs. He must predict the behavior of a reaction according to the thermodynamics laws. Moreover, the student can apply the electrochemistry laws to recognize and develop redox reactions. Finally, the student can define the properties of an ecosystem based on the composition and reactivity of the system itself. Applying knwoledge and understanding: After the course, students should be able to: apply the main Chemistry laws to solve exercises concerning ponderal calculations for chemical reactions in solid and gaseous states and solution phase; to correlate macroscopic properties of the matter with the microscopic atomic and molecular models; to manage the concepts of the chemical equilibrium and to solve problems concerning pH calculation; to use the electrochemistry laws to predict and explain the reactivity of the elements; to elaborate experimental data. Making judgements: Ability to use and to understand chemical concepts from the text or other scientific sources as pictures, draws, charts, ecc. Communications skills: Ability to fluently communicate chemical concepts according to the conventional chemical language. Learning skills: Abilty to classify, schematise and recast the new concepts learned.
ASSESSMENT METHODS	The final evaluation consists of a written and a oral examinations with mark expressed as n/30. The written exam consists of at least 9 excercices which must be solved in 2.5 hrs, to verify the student's skills in solving chemical problems and its theoretical background. Students obtaining at least 15/30 are admitted to the oral test, where it will be tested, besides his chemical knowledge, its public speaking ability concerning chemical issues. In case of successful evaluation, the final vote will start from 18/30 up to 30/30, also cum laude when the student showed to reached an excellent knowledge of the argoments in the Syllabus, accordingly to the following explanation. Written and oral examination are equally pondered for the final vote. When the student reached an elementary chemical background, he/she showed to know the basics of the course's topics and can do elementary links among them. In addition, he/she can also evaluate a chemical problem and he/she can explain it within a regular communication skills framework. To get an evaluation of 30/30 cum laude, the student must demonstrate an excellent knowledge of the studied topics, he/she can apply these knowledge also to solve new and advanced chemical problems, beyond the knowledge owned by the student.
TEACHING METHODS	Lessons and exercises in the classroom.

MODULE
GENERAL AND INORGANIC CHEMISTRY

Prof. GIROLAMO CASELLA

SUGGESTED BIBLIOGRAPHY

Libro di testo/Textbook
1) Peter William Atkins, Loretta Jones - Principi di chimica -Terza edizione italiana condotta sulla quinta edizione americana (2012) – Zanichelli

Ulteriori testi di supporto/further backing textbooks
2) Manotti Lanfredi Anna M.; Tiripicchio Antonio - Fondamenti di chimica. Seconda Edizione – Casa Editrice Ambrosiana (2006)
3) William L. Masterton, Cecile N. Hurley – Chimica. Principi e reazioni. Sesta edizione - Piccin (available at the library).

AMBIT	50187-Discipline chimiche
INDIVIDUAL STUDY (Hrs)	134
COURSE ACTIVITY (Hrs)	66

EDUCATIONAL OBJECTIVES OF THE MODULE

The lesson plan aims to provide students with suitable tools to understand chemical transformations which occurs in the environment. Students, must already know the basics concerning: atomic structure of the matter, chemical bond, laws ruling chemical equilibria and chemical reactions, according to the properties of the Periodic Table main elements.

SYLLABUS

Hrs	Frontal teaching
4	Introduction to the course - Atomic structure - Quantum numbers and atomic orbitals - Electronic configuration - The Periodic Table - Ionization energy and electron affinity - Electronegativity - Oxidation Number - Periodic properties of the elements.
9	The covalent bond: two-electrons bond, Lewis formalism. Molecular Geometry: VSEPR and Hybridization - The ionic bond - Inter-molecular Interactions.
1	Molecular orbitals (overview)
4	States of the matter - Gas: the ideal gas law, the laws of the real gases - Liquid State - Solutions and their colligative properties - Solid state: lattice structures and amorphous solids - Phase transitions - Clayperon equation.
3	Atomic and molecular mass - Mole - percentage composition - Chemical formulas (minimum molecular weight and empirical formula) - Chemical reactions and limiting reactant.
2	Overview of nomenclature. Binary compounds of hydrogen and oxygen - hydroxides and oxxoacids - Salts.
8	Chemical Thermodynamics - Energy, Enthalpy, Entropy, Gibb's free Energy. Predicting the spontaneity and the direction of a reaction.
1	Chemical kinetics - Rate of the reaction - Factors affecting the rate of a reaction - Catalysts (overview).
7	Chemical equilibrium - Equilibrium reactions and equilibrium constant - Law of mass action - Le Chatelier Principle: how concentrations, pression, volume, temperature affect the chemical equilibirum.
8	Theories of acids and bases - Strenght of acids and bases - Ionic equilibria in solution phase: the ionic product of water - pH - Hydrolysis - Buffer solutions.
5	Heterogeneus equilibria in water solution -Kps - The common ion effect - Solubilization of precipitates.
4	Red-Ox reactions - Balancing of redox reactions using the half-reaction and oxidation number methods - Balancing of redox reactions in acidic and basic solution.

Hrs	Practice
2	Calculation of: minimum weight formula, molecular formula, percent composition - Ponderal calculations
2	Molecular structure of a molecule by using Lewis, VSEPR and hybridizations models.
4	Chemical equilibrium
2	pH and solubility.

MODULE
ELEMENTS OF ENVIRONMENTAL CHEMISTRY

Prof.ssa ANTONELLA MACCOTTA

SUGGESTED BIBLIOGRAPHY	
Peter W. Atkins - Chimica Fisica - Zanichelli (disponibile presso la Biblioteca di Scienze della Terra e del Mare).	
AMBIT	10707-Attività formative affini o integrative
INDIVIDUAL STUDY (Hrs)	49
COURSE ACTIVITY (Hrs)	26
EDUCATIONAL OBJECTIVES OF THE MODULE	
The module aims to increase the knowledge of important chemical processes related to the different environmental compartments that are the object of study of the Geological Sciences.	

SYLLABUS

Hrs	Frontal teaching
1	Introduction to the module of Environmental Chemistry Elements.
1	Thermodynamics and chemical equilibrium - The temperature dependence of the equilibrium constant: Van't Hoff equation.
5	From ideal gas law to phase diagram for a single component - Gibbs phase rule - Ideal and real systems - Phase diagrams for binary mixtures - Solid solutions - Interpretation of binary phase diagrams - Ternary phase diagrams (outlines).
3	Organic Chemistry - Classification of organic compounds - Functional groups - Environmental organic chemistry.
3	Outlines of spectroscopy - Interaction of electromagnetic radiation with matter - Absorption and emission spectra in atoms and molecules - Atomic absorption spectroscopy - UV-vis spectrophotometry - IR spectroscopy.
3	Electrochemistry - Electrochemical cells - Standard potentials - Nernst equation - Electrolytic cells (outlines).

Hrs	Practice
10	Environmental analysis techniques - Preparation of solution by dilution method - Titrations - Calibration line - pH measurement - Conductivity measurement - Redox reactions and electrochemical cells.