UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Scienze della Terra e del Mare
ACADEMIC YEAR	2019/2020
BACHELOR'S DEGREE (BSC)	NATURAL AND ENVIRONMENTAL SCIENCE
SUBJECT	PRINCIPLES OF CHEMISTRY FOR NATURE AND ENVIRONMENT
TYPE OF EDUCATIONAL ACTIVITY	B
AMBIT	50172-Discipline agrarie, chimiche, fisiche, giuridiche, economiche e di contesto
CODE	19286
SCIENTIFIC SECTOR(S)	CHIM/12
HEAD PROFESSOR(S)	MACCOTTA ANTONELLA Ricercatore Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	6
INDIVIDUAL STUDY (Hrs)	102
COURSE ACTIVITY (Hrs)	48
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	2° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**MACCOTTA ANTONELLA** Tuesday 13:30 15:30 Via Archirafi, 20 - V piano

DOCENTE: Prof.ssa ANTONELLA MACCOTTA

PREREQUISITES	Entering student is expected to have a working knowledge of high school maths, in particular,algebra, logarithms, and scientific notation.
LEARNING OUTCOMES	Knowledge and understanding: The successful student in this course will demonstrate mastery of basic chemical concepts: atomic structure of matter, electronic structure and periodic table, chemical bond, molecular shapes, intermolecular forces, states of matter, phase diagrams, chemical reactions and stoichiometry, kinetics and chemical equilibrium, laws of thermodynamics, acid/base and precipitation equilibria, electrochemistry. Applying knowledge and understanding: The successful student will be able to: interpret and illustrate the chemical behavior of the molecules based on the nature of the present chemical bond and the molecular shape, predict the course of a reaction and the conditions that make it more favorable according to the principles of thermodynamics, solve problems relative to chemical reactions (acid-base, solubility, redox), analyze unary and binary phase diagrams, recognize the principal chemical reactions in environmental field. Making judgments: The student will be able to interpret and use data from text or other scientific sources, also presented through drawings, patterns, diagrams, tabulates. It will also be able to read and critically evaluate journal papers in the chemical field. Communication skills: The student should be able to communicate and express basic chemistry issues both in oral and written form demonstrating mastery of language, accessible to an unknowable public. Learning skills: The student will acquire the ability to schematize and rework the obtained knowledge. This will enable him/her to apply these concepts autonomously and critically to the natural and environmental sciences.
ASSESSMENT METHODS	A midterm test, consisting of some exercises, takes place for an evaluation of student's learning. The final exam consists of a written and an oral test. The written test lasts up to two and half hours and consists of six exercises to verify the ability to solve chemistry problems. Consulting textbooks or notes is not permitted. Each answer will be marked with a grade between 0 (missing or wrong) and 5 (correct). To pass the written test with a grade of 15/30 at least is a prerequisite for the admission to the oral test that aims for a further verification of the knowledge gained and for the evaluation of the student's exhibiting and processing skills. The exam is passed with a final grade of 18/30. The final test will be considered passed if the student shows at least a general knowledge of the subject and minimal applicative expertise; the student has also to prove argumentative and expressive skills making him capable of transmitting his knowledge to the examiner. The final grade will be increased if the student will show a comprehensive knowledge of the subject and the ability to actively interact with the examiner during the oral interview.
EDUCATIONAL OBJECTIVES	The course aims to provide the student with the tools to understand the chemical transformations occurring in nature and in the different environmental compartments. He must know the basic principles relative to: atomic structure of matter, chemical bond, chemical reactions, kinetics and chemical balance, intermolecular forces.
TEACHING METHODS	Lecturers and numerical exercises.
SUGGESTED BIBLIOGRAPHY	Chimica generale Autori: Julia Burdge, Jason Overby Edra, seconda edizione, 2017 ISBN-10: 8821446999 ISBN-13: 978-8821446993 oppure Fondamenti di chimica generale Autori: Peter Atkins, Loretta Jones Zanichelli, 2014 ISBN: 9788808636140 oppure Chimica: materia, tecnologia, ambiente Autori: Ivano Bertini, Claudio Luchinat, Fabrizio Mani Casa Editrice Ambrosiana, prima edizione, 2016 ISBN-10: 8808182738, ISBN-13: 978-8808182739 oppure Chimica. Principi e reazioni Autori: William L. Masterton, Cecile N. Hurley Piccin, sesta edizione, 2010 ISBN: 978-8829920419

SYLLABUS

Hrs	Frontal teaching
4	Introduction to the course – The components of matter: elements, compounds, mixtures - Natural and artificial elements - Formulas - Nomenclature - The atom: atomic number, mass number, isotopes - Mole and molar mass.
4	Electronic model of the atom - The wave-particle duality - Electromagnetic radiation - Quantization of energy and spectrum of atomic hydrogen – Electronic model of hydrogen atom, atomic numbers and atomic orbitals - Electronic configuration of polyelectronic atoms - Periodic table and periodic properties: ionization energy, electronic affinity, electronegativity, atomic sizes - Metals and non-metals.
5	The chemical bond: covalent bond, structural formulas, diatomic molecules, polyatomic molecules and molecular geometries, hybrid orbitals, resonance. Ionic bond, geometry of ionic compounds - Metallic bond: band model.
1	Intermolecular forces - van der Waals forces - Hydrogen bonding – Aggregation states.
4	Solid, gas, liquid state.
2	Thermodynamics - Transitions and phase diagrams for one-component systems.
4	Multicomponent systems - Solutions: gas solubility, colligative properties, electrical properties - Phase diagrams for binary systems - Solid solutions.
4	Chemical reactions and stoichiometry: meaning of formulas, oxidation number, balance of chemical reactions (acid-base, precipitation and redox).
2	Equilibrium and thermodynamics of gas-phase reactions.
2	Kinetic properties of reactions: reaction rate, kinetic laws for First-Order, Second-Order, and Zero-order reactions, reaction mechanism and elemental processes, collision theory, catalysis, photochemical reactions.
6	Acid-base equilibria: Brønsted-Lowry model, application of acid-base equilibria, Lewis acid-base - Solubility equilibria: solubility product, factors affecting solubility.
4	Electrochemistry: redox reactions, voltaic cells, electrode potential, chemical equilibrium in electrochemical systems, concentration cells, electrochemical reactions relative to metals, prediction of the products of a reaction from potential standards, electrolysis, conductivity.
3	- Chemistry in the environment: molecules and reactions
3	Outlines of spectroscopy and applications.