UNIVERSITÀ DI PAVIA

Anno Accademico 2019/2020

CHEMISTRY	
Enrollment year	2017/2018
Academic year	2019/2020
Regulations	DM270
Academic discipline	CHIM/07 (FOUNDATIONS OF CHEMISTRY FOR TECHNOLOGIES)
Department	DEPARTMENT OF ELECTRICAL,COMPUTER AND BIOMEDICAL ENGINEERING
Course	BIOENGINEERING
Curriculum	PERCORSO COMUNE
Year of study	3°
Period	2nd semester (02/03/2020 - 12/06/2020)
ECTS	6
Lesson hours	45 lesson hours
Language	Italian
Activity type	WRITTEN AND ORAL TEST
Teacher	DONDI DANIELE (titolare) - 6 ECTS
Prerequisites	Basic knowledge in mathematics, in particular differential and integral calculations.
Learning outcomes	The course aim to provide the fundamentals of chemistry and chemical-physics useful for the comprehension of materials structure-activity relationship. In particular, students will be able to predict the products of inorganic reactions starting from reagents. Moreover, thermodynamic will be used to predict the heat of reaction and the spontaneity. In this way the student should be able to predict if the reaction occurs or not.
Course contents	Basics of chemical formulas and chemical reactions Qualitative and quantitative aspects of chemical formulas and reactions, stoichiometry, principal reaction types

Radiochemistry
Nuclear stability, radioactive decays, kinetic of radioactive decay, natural radioactive families. Chemical and biological effects of radiations. The environmental radioactivity. Radon.

Basics of chemical bond theory
The hydrogen atom. Electronic configuration of elements and periodic properties. Ionic, covalent, polarized-covalent, coordination and metallic bonds. Molecular geometries. Dipolar moments of molecules. Intermolecular interactions: hydrogen-bond, van der Waals forces and dispersion forces. Ionic and covalent valences of elements of s, p block and first transition row. Oxides, hydrides, anions and cations, salts. Basics of organic chemistry.

States of matter
Gaseous state: ideal gases and real gases. The ideal gas equation. Gaseous mixtures, Dalton's law, PVT calculations. Solid state: crystalline systems, Bravais' lattices, compact structures, reference structures for ionic salts. Covalent (diamond, graphite, silicon, quartz), metallic and molecular crystals. Liquid crystals. Liquid state: surface tension, adhesion and cohesion forces, wettability, vapor tension.

Thermodynamics, kinetics and chemical equilibrium
Thermodynamic state functions. Enthalpy of formation of compounds, heats of reaction, thermodynamic cycles (Hess law), reaction isotherm. The equilibrium in gaseous phase, the equilibrium constant, reaction quotient, the effect of physical variables. Basics of chemical kinetics.

Solutions
The measuring units of concentration: molarity, molality, w/w and w/v percent. Liquid-vapor equilibrium, the Raoult's law. Freezing-point depression, boiling-point elevation, osmotic pressure. Solubility equilibrium (solubility product). Acid-base equilibrium, definition of pH, pH of strong and weak acids and basis. Hydrolysis of anions and cations. Buffer solutions.

Phase equilibria
Phase state diagram of water. Thermal analysis of alloys. Eutectic diagrams and diagrams with total and partial solubility in the solid phase.

Electrochemistry
Electrode potentials and basics of batteries. Standard electrochemical potentials, Nernst equation. Corrosion phenomena of metals, passivation, corrosion protection. Batteries and accumulators in everyday use. Electrolysis.

Materials
Polymeric materials and structure/property relationship. Metals and ferrous alloys: steel, cast iron, the Fe/C diagram. Thermal treatments. Ceramic materials.

Teaching methods

Lectures (hours/year in lecture theatre): 45

	During the course slides were projected and additional exercises/explanations are drawn on blackboard. All slides are available for download. E-learning website where students can exercise online with immediate evaluation of results. It's possible also to make challenges between students.
Reccomended or required readings	Didactic material fiven by the lecturer. Book: D. Dondi e L. Vasta. Chimica: principi e applicazioni . Universitas Studiorum. website for self evaluation: http://www-5.unipv.it/dondi/ . website with exercises done: https://sites.google.com/site/dondidaniele/ .
Assessment methods	Written exam consisting of theory (30 quizzes, 1h) and numerical exercises (2h). Oral exam optional.
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Sustainable development goals - Agenda 2030	$lbl_legenda_sviluppo_sostenibile