



### CHEMISTRY

<b>Enrollment year</b>	2014/2015
<b>Academic year</b>	2016/2017
<b>Regulations</b>	DM270
<b>Academic discipline</b>	CHIM/07 (FOUNDATIONS OF CHEMISTRY FOR TECHNOLOGIES)
<b>Department</b>	DEPARTMENT OF CIVIL ENGINEERING AND ARCHITECTURE
<b>Course</b>	
<b>Curriculum</b>	PERCORSO COMUNE
<b>Year of study</b>	3°
<b>Period</b>	1st semester (05/09/2016 - 20/01/2017)
<b>ECTS</b>	6
<b>Lesson hours</b>	80 lesson hours
<b>Language</b>	ITALIAN
<b>Activity type</b>	WRITTEN AND ORAL TEST
<b>Teacher</b>	QUARTARONE ELIANA (titolare) - 3 ECTS CAPSONI DORETTA - 3 ECTS
<b>Prerequisites</b>	Basic knowledge of Mathematics, differential calculus, integral calculus.
<b>Learning outcomes</b>	The course aims to provide the fundamentals of chemistry and chemical-physics useful for the comprehension of materials structure-activity relationship. It also discusses on the materials of specific interest to the Master of Science in Civil Engineering and Architecture.
<b>Course contents</b>	Basics of chemical formulas and chemical reactions Qualitative and quantitative aspects of chemical formulas and reactions, stoichiometry, principal reaction types.  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 (diamonds, 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 temperature. 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. Building materials: lime, hydraulic lime, plaster, cements. Wood and derivatives.

#### Teaching methods

Lectures (hours/year in lecture theatre): 80  
Practical class (hours/year in lecture theatre): 0  
Practicals / Workshops (hours/year in lecture theatre): 0

#### Reccomended or required readings

R. Chang, K. Goldsby, Fondamenti di chimica generale, Seconda Edizione, Mc Graw Hill - Education

#### Assessment methods

Written exam.

**Further information**

Written exam.

