Corso di Laurea in
SCIENZA E TECNOLOGIA DEI MATERIALI

Triennale – L30

General information		
Academic subject	**GENERAL AND INORGANIC CHEMISTRY**	
Degree course	MATERIAL SCIENZE	
Academic Year	2021-2022	
European Credit Transfer and Accumulation System (ECTS)		6
Language	ITALIAN	
Academic calendar (starting and ending date)	1st semester	
Attendance	Suggested	

Professor/ Lecturer	
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Virtual headquarters	
Tutoring (time and day)	Every day by appointment

Syllabus	
Learning Objectives	To acquire basic knowledge of chemistry that allows the student to perform the most common stoichiometric calculations and to be able to follow without difficulty other courses in chemistry and materials science
Course prerequisites	Basic knowledge of physics and mathematics at high school level
Contents	PRELIMINARY CONCEPTS Elements, compounds, molecules, allotropic states, chemical formulas, Lavoisier's law, Dalton's law, Einstein's law, atomic number, mass number, isotopes, isotopic abundance, homogeneous systems, heterogeneous systems, phase. MOLE Absolute and relative atomic mass, geonormal average atomic masses, Avogadro's number, concept of mole, calculation of the minimum formula. Exercises. ELECTRONIC STRUCTURE OF ATOMS Light, emission and absorption spectra, atomic theories of Rutherford and Bohr, particle-wave dualism, De Broglie's postulate, Heisenberg uncertainty principle, principles of quantum mechanical atomic theory, wave function and Schrödinger equation, quantum numbers and orbitals, point probability and radial probability, polyelectronic atoms, Pauli's principle and Hund's rule, AUFBAU, periodic table, ionization potential, electron affinity, periodic properties, metals, non-metals and semi-metals. CHEMICAL BOND Ionic bond, covalent bond, Lewis theory, VSER, quantum mechanical theory of chemical bond, VB, hybridization, resonance, Molecular Orbital (X2, HX), electronegativity, metallic bond (hints), secondary bonds. Exercises.

	NOMENCLATURE AND REACTIONS Oxidation number, traditional nomenclature, IUPAC nomenclature, acid-base reactions - balancing, redox reactions - balancing, most common oxidants and reducing agents and their reactions, stoichiometric calculations, limiting reagent, reaction yield. Exercises. AERIFORM STATE Ideal and real gases, Boyle, Charles and Gay Lussac's laws, Avogadro's hypothesis, ideal gases equation of state, gas density, Dalton and Amagat's law, reactions between substances in the gaseous state, gas evolution in chemical reactions, combustion. Exercises. CONDENSED STATES Covalent, molecular, ionic, metallic solids, liquid state, vapor pressure of solids and liquids, Raoult's law, colligative properties NOTES OF CHEMICAL THERMODYNAMICS. State functions, heat, work, temperature, first law of thermodynamics, internal energy, enthalpy, reversible and irreversible transformations, second law of thermodynamics, entropy, free energy, criteria of spontaneity, variation of free energy with temperature, third principle of thermodynamics SOLUTIONS Concentrations, equivalent and normality. Exercises. NOTE of CHEMICAL EQUILIBRIUM Equilibrium constant, mass action law, heterogeneous equilibria, strong and weak electrolytes, Ostwald's law of dilution, solubility equilibrium. CHANGES OF STATE Clausius and Clapeyron's law, melting, evaporation, sublimation, condensation, solidification, frost, positive and negative deviations from Raoult's law, phase rule, distillation diagram (ideal and real cases), azeotrope, state diagram of water and carbon dioxide, eutectic diagrams. ACID BASIC THEORIES Acid base theory, strong and weak acids and bases, amphoteric, leveling effect of water, pH and pOH, degree of dissociation, calculation of the pH of strong acids and bases, weak acids and bases, calculation of the pH of mixtures of acids and bases strong, mixtures of weak acids or bases, strong-weak acid mixtures, Hydrolysis, buffer solutions. Exercises. NOTES OF ELECTROCHEMISTRY Galvanic cells, electrolytic cells, faraday's laws, standard hydrogen electrode, first kind, gas and insoluble salt electrodes, electromotive force and ddp, standard red-ox potentials, redox reaction predictions, Nernst equation, metal dissolution, pH measurement, metal corrosion and methods of protection, electrolysis and discharge order.
Books and bibliography	A.M Manotti Lanfranchi A. Tiripicchio, FONDAMENTI DI CHIMICA, Ambrosiana Ed.

Additional materials	Only a few chapters and/or sections. Integration with lecture notes is suggested to make easier the text understanding

Work schedule			
Total	Lectures	Hands on (Laboratory, working groups, seminars, field trips)	Out-of-class study hours/ Self-study hours
Hours			
150	40	15	95
ECTS			
6	5	1	

Teaching strategy	Lectures and numerical exercises in the classroom
Expected learning outcomes	
Knowledge and understanding on:	○ knowledge of the basic aspects of chemistry
Applying knowledge and understanding on:	○ ability to perform elementary stoichiometric calculations
Soft skills	• Making informed judgments and choices ○ evaluate the reactivity of compounds and elements • Communicating knowledge and understanding ○ skills in communication in the Italian language; ○ skills in exposing chemical problems • Capacities to continue learning ○ It depends on the student's abilities and its application to study.

Assessment and feedback	
Methods of assessment	written exam (51%), oral exam (49%)
Evaluation criteria	• Ability to solve stoichiometry problems; • Knowledge of chemical nomenclature; • Knowledge of the atomic structure; • Ability in the description of molecules; • Prediction of the reactivity of elements and compounds • Knowledge of the main thermodynamic and electrochemical theories
Criteria for assessment and attribution of the final mark	right answer the teacher's questions on the topics of the program with the degree of detail used in class
Additional information	