UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Ingegneria
ACADEMIC YEAR	2023/2024
BACHELOR'S DEGREE (BSC)	MECHANICAL ENGINEERING
SUBJECT	CHEMISTRY
TYPE OF EDUCATIONAL ACTIVITY	A
AMBIT	50293-Fisica e chimica
CODE	01788
SCIENTIFIC SECTOR(S)	CHIM/07
HEAD PROFESSOR(S)	ALESSI SABINA Professore Associato Univ. di PALERMO
OTHER PROFESSOR(S)	
CREDITS	9
INDIVIDUAL STUDY (Hrs)	144
COURSE ACTIVITY (Hrs)	81
PROPAEDEUTICAL SUBJECTS	
MUTUALIZATION	
YEAR	1
TERM (SEMESTER)	1° semester
ATTENDANCE	Not mandatory
EVALUATION	Out of 30
TEACHER OFFICE HOURS	**ALESSI SABINA** Monday 15:00 16:30 su TEAMS:https://teams.microsoft.com/l/team/19%3AvmYkmcJYPgz-eZxOD12AgTTKk3UKu2ay6wUcWe9lm1c1%40thread.tacv2/conversations?groupId=dbae24b6-02c7-4914-a311-b3f1db3907f7&tenantId=bf17c3fc-3ccd-4f1e-8546-88fa851ba Thursday 12:15 13:30 Ed. 6 Ing. Chimica piano III stanza 3010

DOCENTE: Prof.ssa SABINA ALESSI

PREREQUISITES	Basic knowledge of mathematics, geometry and physics
LEARNING OUTCOMES	Knowledge and understanding: knowledge of the fundamental of the electronic material structure and of physical/chemical transformation. Applying knowledge and understanding: ability to use the fundamentals of material structure for qualitative structure/properties relationships. Moreover, on the base of simple thermodynamic considerations, ability to choose the best reaction processing conditions. Making judgments: The student will be able to evaluate: - The validity and the approximation of the models relative to the material physical and chemical behaviour; - The use of the fundamental principles of the thermodynamics and of the kinetics in order to carry out the chemical reactions Communication skills: ability to discuss the chemical topics presented during the course with particular reference to both atomic and molecular structure and also to both chemical reactions thermodynamics and kinetics fundamentals, using an appropriate scientific terminology. Learning ability: At the end of the course the student will know the fundamental principles of the material structure and of the thermodynamic and kinetic aspects of chemical reactions. He will understand the difference between a phenomenological approach and a microscopic/ modellistic approach in the study of the material properties, and of its transformation. All these skills will contribute to the formation of the scientific student background in view of the further engineering studies.
ASSESSMENT METHODS	The assessment of the acquired knowledge and expertise is evaluated through a written test with a number of exercises variable between 6 and 10, some of them mainly numerical and some others mainly theoretical, followed by an oral interview . The written test has a minimum duration time of 90 min. The numerical questions concern the application and conversion of concentration measuring units and mass balance in chemical reactions; the applications of chemical equilibrium; applications of electrochemistry ; structure of matter. The theoretical questions may cover other aspects of the discipline and aim to assess the ability to establish connections among the different topics. The evaluation of the written test corresponds to: A (30-28), B (27-25), C (24-22), D (21-18). The evaluation A is referred to an optimum written test where the exercises are both almost complete and fully correct, with only few imperfections; the evaluation B is referred to a very good written test where some exercises are both almost complete and fully correct and others are mainly incomplete with eventual imperfections; the evaluation C is referred to a good written test where some exercises are almost complete and almost fully correct and others are partially correct or they are not carried out; the evaluation D is referred to a sufficient written test where some exercises are both mainly incomplete and/or not fully correct and others are not carried out. The admission to the oral exam is subject to the achievement of minimum D in the written test. The final evaluation is the medium between the written test and the oral test. The oral test consists in questions mainly to deepen or to clarify key elements of the written test. The oral questions proposed to the student aim to verify the level of: a) knowledge and understanding of the course contents; b) ability to analyze and solve simple problems; c) communication skills with reference to the course topics that the student has reached. In particular, the ability to identify connections among different topics and apply the correct tools to solve problems will be evaluated. The evaluation is expressed in thirtieths. The final evaluation will be: Excellent (30-30 and praise). Very good knowledge of the topics with analytical ability, excellent properties of language, the student has an excellent ability to apply knowledge to solve problems proposed Very Good (26-29). Good command of the topics, full of language, the student is able to apply knowledge to solve problems proposed. Good (24-25). Basic understanding of the main topics, discrete properties of language, with limited ability to independently apply the knowledge to the solution of the proposed problems. Satisfactory (21-23).The student has not fully mastered the main teaching subjects but it has the knowledge, satisfactory property language, poor ability to independently apply the knowledge acquired. Sufficient (18-20). Minimum basic understanding of the major teaching and technical language issues, very little or no ability to independently apply the knowledge acquired. Insufficient, the student does not have an acceptable knowledge of the contents of the topics covered in the teaching.
EDUCATIONAL OBJECTIVES	The knowledge of the fundamentals aspects of the material structure and its transformations, with particular reference of the thermodynamic and kinetic behavior of ideal systems.
TEACHING METHODS	Teaching takes place in the first half of the first year and consists of lectures and of numerical exercises.
SUGGESTED BIBLIOGRAPHY	- R.Bertani, M.Dettin, M.Mozzon, P.Sgarbossa "Fondamenti di Chimica per le Tecnologie" - ed. Edises

	- A. Del Zotto - Esercizi di Chimica Generale- Edises

SYLLABUS

Hrs	Frontal teaching
3	Chemical elements, compounds and mixtures. Atoms, molecules, ions, Mole, Chemical reactions and stoichiometric calculations
1	Thermodynamic system, state functions and equations. Homogeneous and heterogeneous systems, phase
1	Homogeneous systems concentrations units: molarity, molality, molar fraction, weight and volume percentage
3	Gaseous systems. Ideal gas: state equation. Kinetic theory of ideal gases; molecular velocities distribution. Real gases: Van der Waals equation
5	First law of thermodynamics and thermochemistry: internal energy and enthalpy. Exothermic and endothermic transformations
6	Second law of thermodynamics and chemical equilibrium. Entropy, free enthalpy, free energy. Standard conditions. Equilibrium constant for homogeneous reactions. Le Chatelier-Braun principle. Equilibrium constant for etherogeneous reactions
5	Liquid-vapor equilibrium: vapor pressure of a liquid. Liquid boiling point. Solid-liquid and solid-vapor equilibria. State diagrams
7	Bohr atomic model for hydrogen atom. Schrodinger equation. Atomic orbitals for hydrogen atom and for polyelectronic atoms. Electronic configuration of the elements and periodic table of the elements Periodic properties: ionization energy and electronic affinity
9	Chemical bond. Ionic bond. Covalent bond: valence bond theory. and bonds. Polar covalent bonds: electronegativity. Dative bond. Molecular geometry and hybrid orbitals. Van der Waals forces. Hydrogen bond. Metallic bond.
1	The solid state. Amorphous and crystalline solids. Ionic, molecular, metallic and macromolecular crystalline solids.
10	Solution equilibria. Solubility and saturated solutions. Solubility of gases in liquids: Henry's law. Acid-base equilibrium. Molecular structure/acid base properties relationships. Solubility equilibrium. Colligative properties of the solutions
6	Redox reactions and electrochemistry. Oxidation number. Conjugated redox pair. Piles and galvanic semielements: redox standard potentials. Nernst equation. Electrolysis. Faraday's laws
3	Chemical kinetics. Homogeneous reactions. Reactions rate: reaction order, reaction mechanism and rate determining step. Influence of the temperature on the reaction rate: Arrhenius equation. Catalysts
2	The periodic table of the elements. Hydrides. Basic, acid and amphoteric oxides. The most common inorganic acids. Salts

Hrs	Practice
3	Chemical elements, compounds and mixtures. Atoms, molecules, ions, Mole, Chemical reactions and stoichiometric calculations
2	Homogeneous systems concentrations units: molarity, molality, molar fraction, weight and volume percentage
2	Gaseous systems. Ideal gas: state equation. Kinetic theory of ideal gases; molecular velocities distribution. Real gases: van der Waals equation
2	First law of thermodynamics and thermochemistry: internal energy and enthalpy. Exothermic and endothermic transformations
2	Second law of thermodynamics and chemical equilibrium. Entropy, free enthalpy, free energy. Standard conditions. Equilibrium constant for homogeneous reactions. Le Chatelier-Braun principle. Equililbrium constant for etherogeneous reactions
5	Solution equilibria. Solubility and saturated solutions. Solubility of gases in liquids: Henry's law. Acid-base equilibrium. Molecular structure/acid base properties relationships. Solubility equilibrium. Colligative properties of the solutions
3	Redox reactions and electrochemistry. Oxidation number. Conjugated redox pair. Piles and galvanic semielements: redox standard potentials. Nernst equation. Electrolysis. Faraday's laws