



UNIVERSITÀ DEGLI STUDI DI PALERMO

DEPARTMENT	Biomedicina, Neuroscienze e Diagnostica avanzata		
ACADEMIC YEAR	2023/2024		
MASTER'S DEGREE (MSC)	MEDICINE AND SURGERY		
INTEGRATED COURSE	GENERAL AND INORGANIC CHEMISTRY - INTEGRATED COURSE		
CODE	21794		
MODULES	Yes		
NUMBER OF MODULES	2		
SCIENTIFIC SECTOR(S)	CHIM/07, BIO/10		
HEAD PROFESSOR(S)	DI GAUDIO FRANCESCA Ricercatore	Univ. di PALERMO	
OTHER PROFESSOR(S)	DI GAUDIO FRANCESCA Ricercatore	Univ. di PALERMO	
	BELLARDITA MARIANNA Professore Associato	Univ. di PALERMO	
CREDITS	6		
PROPAEDEUTICAL SUBJECTS			
MUTUALIZATION			
YEAR	1		
TERM (SEMESTER)	1° semester		
ATTENDANCE	Mandatory		
EVALUATION	Out of 30		
TEACHER OFFICE HOURS	BELLARDITA MARIANNA Monday 10:00 12:00 Tutti i giorni, previo appuntamento da concordare via mail: marianna.belardita@unipa.itPer il momento i ricevimenti si svolgeranno on-line DI GAUDIO FRANCESCA Friday 13:00 14:00 DIPARTIMENTO PROMOZIONE DELLA SALUTE, MATERNO INFANTILE DI MEDICINA INTERNA E SPECIALISTICA DI ECCELLENZA - PROMISE - "GIUSEPPE D'ALESSANDRO" - CQRC Via del Vespro n. 133, primo piano		

PREREQUISITES	In order to be admitted to this Bachelor course, students must pass a compulsory examination based on a general culture test that includes mathematics, chemistry and basic biochemistry. To understand the issues of the Integrated Course of Chemistry and Biochemistry, such elements are sufficient.
LEARNING OUTCOMES	<p>Knowledge and Capacity of understanding: The students should know and understand: i) the basic atomic, molecular, and physicochemical properties of matter, ii) the characteristics of the elements and molecules and the principles which underlie their chemical and physical behavior; iii) the structures and properties of the main organic compounds and biological macromolecules. The students should also know the biochemical and molecular bases of cellular activities and understand the mechanisms that regulate the metabolic processes. In particular, they should know: i) the main biological molecules and the metabolic processes in which they are involved; ii) the mode of action of enzymes, and the principles of enzyme catalysis and regulation; iii) the bases of bioenergetics and iv) the general mechanisms of extracellular signal transduction.</p> <p>Capacity to apply knowledge and understanding: The students should be able to apply their knowledge for interpreting the behavior of biological molecules and understanding the molecular mechanisms which underlie the metabolic processes and life.</p> <p>Making judgments: The students should acquire autonomy in the learning process in order to become able to evaluate possible interactions among the different metabolic processes and xenobiotics.</p> <p>Communication skills: The students should be able to express the basics of acquired knowledge by both written and oral essays, with scientific-technical language appropriate to the topics discussed.</p> <p>Learning ability: The students should develop a scientific learning methodology which allows them to interpret and further investigate the biochemical problems arising in the continuation of their studies and career; they should acquire the ability to integrate all the acquired knowledge by also showing a critical approach to biological problems and an attitude towards the scientific research. Finally, they should be able to propose solutions for analytical problems, and to search autonomously for updated scientific information.</p>
ASSESSMENT METHODS	<p>The evaluation involves two intermediate trials (one for chemistry and one for biochemistry) and one final oral exam, consisting of the final integrated assessment of the Integrated Course with interview, optional for the student, aimed at further deepening both knowledge and full understanding of the topics dealt with in the course, both the eligibility and presentation skills of the candidate. The Intermediate Chemistry Test will consist of a written test of biological buffer, basic acid equilibria, osmotic, equilibria of solubility, oxide reduction reactions and an oral test on all the topics of the Module. The intermediate biochemistry test consists of 31 multiple choice questions that may include a part in which you are asked to briefly explain the reasons for your choice. The two intermediate tests take place on different days and before the final integrated exam. Overcoming intermediate tests is binding for access to the final oral test. As stated, during the final exam, the student can directly accept the vote resulting from the average of the votes in the two tests or undergo a further oral interview, aimed at improving the overall rating. The rating is thirtyfive. To pass the exam, the exam must get a final final score between 18 and 30</p> <p>and Lode. The threshold of sufficiency will be achieved when the student shows the knowledge and understanding of the arguments of both modules at least in the general guidelines and has sufficient application skills; should also possess exhibit capacities to allow the supposed knowledge transmission to the examiner. Below this threshold, the examination is insufficient. The more the examination will be able to interact with the examiner, and the more his knowledge and skills will be in the details of the discipline being tested, the more the evaluation will be positive. The evaluation is expressed using a 30-point scale. ECTS grades: A – A+ Excellent (30-30 cum laude) - Grade descriptors : Excellent knowledge of teaching contents for Integrated Course and laboratory activities; students should show high analytical and synthetic capabilities and should be able to apply their knowledge to solve highly complex problems. ECTS grade : B Very good (27-29) - Grade descriptors: Good knowledge of the teaching contents and excellent language control; students should show analytical and synthetic skills and be able to apply their knowledge to solve problems of medium and, in some cases, even higher complexity. ECTS grade: C Good (24-26)- Grade descriptors: Good knowledge of teaching contents and good language control; the students should be able to apply their knowledge to solve problems of medium complexity ECTS grade: D Satisfactory (21-23)- Grade descriptors: Average knowledge of the teaching contents, in some cases limited to the main topic; acceptable ability to use the specific discipline language and independently apply the acquired knowledge. ECTS grade: E Sufficient (18-20) - Grade descriptors: Minimum teaching content knowledge, often limited to the main topic; modest ability to use the subject specific</p>

	language and independently apply the acquired knowledge. ECTS grade: F Fail (1-17) - Grade descriptors: Lack of an acceptable knowledge of the main teaching content knowledge; very little or no ability to use the specific subject language and apply independently the acquired knowledge. Exam failed.
TEACHING METHODS	Frontal lectures, written tutorials, visit the center of Mass Spectrometry - Center for Quality Control and Chemical Risk (CQRC).

MODULE ORGANIC CHEMISTRY

Prof.ssa FRANCESCA DI GAUDIO

SUGGESTED BIBLIOGRAPHY

TESTI CONSIGLIATI RECOMMENDED BOOKS

CHIMICA E PROPEDEUTICA BIOCHIMICA con inclusi il kit di modellistica molecolare.
F. A. Bettelheim, W. H. Brown, M. K. Campbell, S. Farrell
I edizione 2011 – EDISES

TESTI ALTERNATIVI ALTERNATIVE BOOKS

CHIMICA ORGANICA
H. HART CHIMICA ORGANICA - ZANICHELLI

AMBIT	50423-Struttura, funzione e metabolismo delle molecole d'interesse biologico
INDIVIDUAL STUDY (Hrs)	45
COURSE ACTIVITY (Hrs)	30

EDUCATIONAL OBJECTIVES OF THE MODULE

TRAINING OBJECTIVES OF THE MODULE

The student at the end of the course will be able to face and solve application problems related to the various topics covered, will have acquired the ability to correlate between the various topics and will learn to critically analyze the results obtained by learning to recognize their validity. In addition, it will be able to understand how the atomic and molecular properties of matter are the basis of their chemical-physical behavior and their biological role. However, in general, the main objective that will be tried with the course, is to give students the awareness of the essential role that the discipline has in providing: tools of knowledge and regulation of the functioning of the human organism and its interactions with the outside world; ability to interpret the results of laboratory diagnostics; ability to evaluate bioengineering materials.

SYLLABUS

Hrs	Frontal teaching
3	HYDROCARBONS SATURATED: Carbon Hybridization; Alkanes, formulas, nomenclature, structures, conformations, isomers and stereoisomers, Cycloalkanes, sources and reactions, combustion and halogenation of alkanes, alkyl halides, Molecules of biological and technological interest.
3	HYDROCARBONS UNSATURATED: Property, Alkenes and Nomenclature, Alkynes and Nomenclature, geometric isomers, Reactions of Alkenes and Alkynes, conjugated dienes, allyl systems, Electrophilic addition to alkenes and alkynes, catalytic hydrogenation, polymerization, Molecules of biological and technological interest
2	POLARITY AND CHEMICAL REACTIVITY: Nucleophilic Substitution and Elimination reactions, Grignard reagents, reactions of biological and technological interest.
2	AROMATIC COMPOUNDS: aromatic and heteroaromatic compound, Benzene and derivatives, electrophilic aromatic substitution, electronic effects of the substituents, phenols and quinones, aryl halides, amines: structure and reactivity, heterocyclic compounds: pyrrole, Imidazole, pyridine, Pyrimidine, Purine, tautomerism structures heterocyclic, Molecules of biological and technological interest.
1	ALCOHOL: alcohols, diols, glycerol, synthetic routes and reactions, Molecules of biological and technological interest.
3	CARBONYL COMPOUNDS: aldehydes and ketones, nucleophilic Addition, hemiacetals, acetals, cyanohydrin, Imines, Enamines. Oxidation and reduction, acidity 'of the hydrogens in keto-enol tautomerism, carbanions, aldol condensations, Molecules of biological and technological interest.
3	CARBOXYLIC ACIDS AND DERIVATIVES: carboxylic acids and their derivatives, nucleophilic substitution acyl chlorides of acids, amines and Starches, anhydrides, esters, Thioesters, Claisen condensation, esterification and hydrolysis of esters, oxo, keto acids, dicarboxylic acids, esters and anhydrides biological importance, Molecules of biological and technological interest.
2	STEREOCHEMISTRY: Optical activity, Diastereoisomers and Racemi, Stereochemistry of organic reactions, Molecules of biological and technological interest.
4	CARBOHYDRATES: monosaccharides, steric Series, cyclic structures, Mutarotation, glycoside bond, glycosides, oxidation, reduction, Reducing sugars, ribose, Deoxyribose, glucose, galactose, mannose, fructose, disaccharides (maltose, cellobiose, lactose, sucrose), polysaccharides (Amylose, Amylopectin, cellulose, glycogen), amino sugars, Molecules of biological and technological interest.
3	LIPIDS: Saturated and unsaturated fatty acids omega 3 and omega 6, simple and complex lipids, terpenes and steroids, phospholipids, biological role of lipids, detergents and soaps, lipids related to food, Molecules of biological and technological interest.

2	PROTEINS: Amino acids: structure and configuration, acid-base equilibria of amino acids and peptides, isoelectric point and isoionic, Bond peptide - peptide structures, synthesis of polypeptides, enzymes, Molecules of biological and technological interest.
2	LABORATORY DIAGNOSTICS: Clinical chemistry and quality control of analytical data

MODULE GENERAL CHEMISTRY

Prof.ssa MARIANNA BELLARDITA

SUGGESTED BIBLIOGRAPHY

L. Palmisano, G. Marci, A. Costantini, G. Luciani, M. Schiavello "Elementi di Chimica" II Ed., ISBN: 9788836230235, Edises.
In alternativa al primo: F. A. Bettelheim, W. H. Brown, M. K. Campbell, S. O. Farrell, O. J. Torres, "Chimica e Propedeutica Biochimica" ISBN: 9788879598415, Edises.
G. Marci, L. Palmisano, F. Ruffo, Stechiometria, ISBN: 978883623105D, Edises.

AMBIT

20949-Attività formative affini o integrative

INDIVIDUAL STUDY (Hrs)

45

COURSE ACTIVITY (Hrs)

30

EDUCATIONAL OBJECTIVES OF THE MODULE

EDUCATIONAL OBJECTIVES

At the end of the course, the student will be able to face and solve application problems related to the various topics covered, will have acquired the ability to correlate the various topics and will learn to critically analyze the results obtained by learning to recognize their validity. Furthermore, he will be able to understand how the atomic and molecular properties of matter are the basis of their chemical-physical behavior and essential for the understanding of the biochemical and molecular basis of cellular activities. Basic chemistry knowledge is in this case absolutely necessary. However, in general, the main objective that we will try to achieve with the course of Chemistry, is to give students the awareness of the essential role that the discipline has in the interpretation of biological processes and in the properties of the materials used in the field of bioengineering.

LEARNING OUTCOMES

Knowledge and understanding

At the end of the course, the student will have acquired the basic knowledge concerning the structure of matter, the principles that regulate its chemical-physical transformations and the energy variations that accompany them. He must know and understand the atomic, molecular and physico-chemical bases of matter, the characteristics of the elements and molecules and the principles underlying their chemical-physical behavior, the structure and properties of compounds. This knowledge is essential for understanding the biochemical and molecular basis of cellular activities and for understanding the mechanisms that regulate metabolic processes..

Applying knowledge and understanding

- The student must demonstrate logical reasoning skills and aptitude to tackle problems in a scientifically rigorous way.
- The student must know how to make calculations to determine the species and concentrations in chemical and chemical-physical balances and must know how to correlate the structure of matter with its properties.
- Above all, he must be able to apply the knowledge acquired to interpret the behavior of molecules in the biological field and have the ability to understand the molecular mechanisms underlying metabolic processes and life.

Making judgements

- The student will have acquired autonomy in the application of the fundamental concepts of chemistry and in the resolution of problems concerning oxide-reductions, solutions, molecular, ionic and acid-base balances.

Communication skills

- The student must be able to present the topics addressed in an appropriate language. He must be able to communicate with competence and properties of language the problems related to the understanding of the structure of matter and its transformations.

Learning skills

- The student will be able to deal independently the study of problems concerning all aspects presented during the course.

Assessment methods

Learning of the contents proposed during the course will be assessed through two tests: one written and one oral.

The written exam, which tends to verify the skills and knowledge relating to the disciplinary field of the course, will consist of clear and uniquely interpretable, numerical and theoretical questions, with open answers that respect constraints such as to make them comparable with criteria of predetermined correction. The logic followed by the student in solving the question, the correctness of the procedure identified for the solution of the question, the accuracy of the final result, the adequacy of the numerical result found, the ability to critically understand the results obtained, the use of adequate language will be taken into consideration. The written test will cover the following topics: stoichiometry, colligative properties of the solutions, ionic equilibria (pH of aqueous solutions, solubility), balancing of redox reactions. The theoretical questions will focus on less applicative topics such as atomic theories (at a qualitative level), chemical bonds, dependence of the properties of materials on the types of bond, acid-base theories, the fundamental laws of chemistry. The total score of the written tests will be out of thirty and will result from the sum of the scores given to each question depending on its complete resolution, partial or no resolution.. The expected duration of the written test is two hours.

The oral examination will consist of an interview aimed at ascertaining the possession of the disciplinary skills and knowledge required by the course, the elaborative and expository skills and the application to concrete cases. The candidate must answer at least three questions orally, on all parts of the program, with reference to the recommended texts.

The final evaluation will be expressed in thirty and will be the average of both the written and oral tests. The sufficiency threshold will be reached when the student will show knowledge and understanding of the topics at least in general lines and will demonstrate that they have minimum applicative skills in order to solve concrete cases; the student must also possess expository and argumentative skills such as to allow the transmission of your knowledge to the examiner. Below this threshold, the examination will be insufficient. The more, however, the examining with his argumentative and expository skills

will be able to interact with the examiner, and the more his knowledge and application skills will go into the detail of the discipline being tested, the more the evaluation will be positive.

Description of evaluation methods

EvaluationVoteOutcome

Excellent30 - 30 laudeExcellent knowledge of the topics, excellent language properties, good analytical ability, the student is able to apply the acquired knowledge to expose the topics and predict, understand and solve the proposed molecular processes.

Very Good26-29Good mastery of the topics, full language properties, the student is able to apply the acquired knowledge to expose the topics and predict, understand and solve the proposed molecular processes.

Good24-25Basic knowledge of the main topics, discrete language properties with limited ability to independently apply the acquired knowledge to expose the topics and predict, understand and solve the proposed problems.

Satisfying21-23The student does not have full mastery of the main topics of teaching but possesses the knowledge, satisfactory language properties, poor ability to apply the acquired knowledge independently.

Sufficient

18-20Minimal basic knowledge of the main topics of teaching and technical language, very little or no ability to apply the acquired knowledge independently. His language is enough to communicate with examiners.

Insufficient

The student does not have an acceptable knowledge of the contents of the topics covered in the course.

Description of evaluation methods

EvaluationVoteOutcome

Excellent30 - 30 laudeExcellent knowledge of the topics, excellent language properties, good analytical ability, the student is able to apply the acquired knowledge to expose the topics and predict, understand and solve the proposed molecular processes.

Very Good26-29Good mastery of the topics, full language properties, the student is able to apply the acquired knowledge to expose the topics and predict, understand and solve the proposed molecular processes.

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Sufficient

18-20Minimal basic knowledge of the main topics of teaching and technical language, very little or no ability to apply the acquired knowledge independently. His language is enough to communicate with examiners.

Insufficient

The student does not have an acceptable knowledge of the contents of the topics covered in the course.

SYLLABUS

Hrs	Frontal teaching
1	Introduction to the Course. Scientific Method, Matter, fundamental laws of chemistry, atoms and molecules, stoichiometry.
2	Atomic structure, electronic configurations, orbitals, isomers.
2	Periodic system of elements. Periodic properties.
3	The chemical bond: ionic bond, covalent bond, molecule polarity, hydrogen bond. Hybridization of orbitals. Electronegativity. Geometry of the molecules.
2	States of matter: liquid, solid and gaseous state.
1	Oxidation number. Combustion reactions, redox reactions.
2	Inorganic nomenclature.
2	Multi-component systems: the solutions. Ways of expressing concentration. Aqueous solutions, vapor pressure. Colligative properties, osmosis, dialysis. Electrolytes and non-electrolytes.
2	Elements of thermodynamics and kinetics. Thermodynamic quantities and thermodynamic laws of chemical interest. Reaction rate. Catalysis.
1	Chemical equilibrium. Le Chatelier's principle.
2	Acid-base theories. Acids, bases and their properties, strength of acids and bases. pH and pOH.
2	Salts and their hydrolysis. Acid-base titration. Buffer solution.
1	Solubility equilibrium. Henry's law: solubility of gases in liquids.

Hrs	Practice
1	Weight and molar ratios. Excess reagent and limiting reagent.
1	Structural formulas and inorganic nomenclature.
1	Balancing redox reactions.
1	Solutions and colligative properties.
1	Chemical equilibria.
2	Ionic equilibria: pH, buffer solutions, solubility.