UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Inorganic Chemistry I and Laboratory

2425-2-E2702Q092

Aims

Aim of the course is to give a deep knowledge of the chemistry of the elements and the inorganic compounds, focusing on the relationships betwwen structure, properties and reactivity. At the end of the course the student will possess the basic knowledge of inorganic chemistry and will learn some main experimental methodologies for the synthesis of inorganic compounds.

Knowledge and understanding
The students will study the general topics of inorganic chemistry: athomic teory and periodicity of the elements; models of the chemical bond; molecolar symmetry; ionic and metallic solids; acid-base and donor-acceptor; oxidation and reduction; as well as the knowledge of the properties of the elements of the main groups and the transition metals and of their compounds. Experimental methods of synthesis and characterization of inorganic compounds will be learnt by the laboratory experiences.

Applying knowledge and understanding
The students will be able to use the IUPAC nomenclature to identify inorganic compounds; to describe the chemical behaviour of the element groups of the periodic table; to correctly understand the relationships between structure, properties and reactivity of the inorganic compounds by using the knowledge of the base and periodic properties of the elements and of their compounds. Besides they will have skills to synthesize inorganic compounds and safely handle the chemical reactants, included their correct disposal to prevent risks in laboratory.

Making judgements
The students will be able to identify the fundamental and periodic properties able to explain and predict the reactivity of the elements and their compounds; to draft a report on the experimental activity of the laboratory, briefly describing the experience, reporting information from the acquisition of the experimental data, critically evaluating their results.

Learning skills
The student will understand the fundementals of the inorganic chemistry and of the periodic properties of the elements, correctly applying them to the problems to solve also in contexts different from those provided;

examining in depth the topics with diffeerent tools than those provided; understanding which information can be obtained by observations or data.

Communication skills
The students will describe orally, clearly and concisely and with correct use of language the fundamentals of inorganic chemistry; the properties, structures and reactivity of inorganic compounds; as well as objectives and procedures of the laboratory experiences.
The students will carry out the laboratory experimental work in small group sharing the work organization and the communication of information and results; besides the will ba able to communicate the scientific results with written laboratory reports.

Contents

The course of Inorganic Chemistry is organized in two parts: a) the fundamental topics of inorganic chemistry (atomic structure, molecular structure and chemical bond, structure of the solids, acid and base, oxidation and reduction, coordination compounds, periodic properties of the elements); b) the chemistry of the elements of the main groups and of transition metals.
The Laboratory of Inorganic Chemistry provides a theoretical part to recall and examine in depth the basic knowledge of inorganic chemistry necessary for lab experiments and a practical part of experiments of synthesis and reactivity of inorganic compounds, performed individually or in couple, also devoted to the learning of the main experimental lab techniques.

Detailed program

Inorganic Chemistry.

Atomic structure – Introduction to the chemical bond. The bonding and the properties of covalent and ionic compounds – The structure of the solids - Chemistry of acid/base and donor/acceptor.- Reactions of oxidation and reduction – Main properties and periodicity of s and p groups and of transition metals. - Hydrogen – Groups 1 and 2 – Group of boron – Group of carbon – Group of nitrogen – Group of oxygen – Halogens- The chemistry of transition metals. Coordination compounds. Coordination number and symmetry. Classification of ligands. The constant of stability. The chemical bond in the coordination compounds. Reaction of complexes: substitution, redox, isomerization. Metallorganic compounds.

Laboratory of Inorganic Chemistry .

Experiences of synthesis and reactivity of the main group element and of transition metals: Synthesis and thermal analysis of oxalates hydrate of Group II; Synthesis of polysiloxanes; The acid properties of boron: synthesis and reactivity of tetrafluoroborate; The oxidation states of tin: synthesis of Sn(II) and Sn(IV) iodides; Synthesis of transition-metal acetylacetonates; Synthesis and properties of ZnO.

Prerequisites

Basic knowledge concerning the General Chemistry and the Laboratory of General Chemistry.

Positive evaluation of General and Inorganic Chemistry and Laboratory Exam of the first year of the Degree

Course)

Teaching form

The course of Inorganic Chemistry and Laboratory (10 CFU) include 8 CFU of lectures corresponding to 64 hours and 2 CFU of activities of laboratory corresponding to 24 hours:

- 32 lectures of two hours are delivered as in-presence delivered lessons;
- 6 activities of laboratory of four hours are delivered as in-presence interactive activities.

The lessons are recorded and put at students disposal on the e-learning platform.
Introductive lessons for the laboratory activities, preliminary recorded and integrated with tutorial videos of the experimental operations of the laboratory experiences, are put at students disposal on the e-learning platform.
The lessons of Inorganic Chemistry are delivered in Italian language by the teacher which presents the topics of the course by slide presentation or on the blackboard. The slides of the lessons will be supplied to the students on the e-learning platform. The regular attendance of the lessons is recommended for an easier learning, although it is not more compulsory.
The activities of the Laboratory provides individual or in couple laboratory experiences preceded by the recorded introductive lessons available for the suudents on e-learning platform and by short lectures also with the help of slide presentation before the beginning of every experience. The attendance of the Laboratory is compulsory

Textbook and teaching resource

Slides of the lessons of Inorganic Chemistry (e-learning)
Learning exercises of the main topics of Inorganic Chemistry (e-learning)

Lecture Notes of the Laboratory experiences (e-learning)
Recording of the Introductive lessons for the laboratory activities (e-learning)
Slides of the Introductive lessons for the laboratory activities (e-learning)

Textbook of Inorganic Chemistry suggested by the lecturer:
M.Weller, T.Overton, J.Rourke, F.Armstrong, La Chimica Inorganica di Atkins, Zanichelli

Semester

Second semester of the second year of the Degree Course.

Assessment method

The student acquires the CFU of the course passing a written and an oral examination. No *in-itinere* tests are provided.
The written examination consists in six reports of laboratory, papers reporting for every laboratory experience a brief description of the operating methods of the experimental tests, the obtained results and critical observations

on the own experimental activity. The evaluation of the reports concerns the knowledge by the student of the inorganic chemistry principles at the basis of the laboratory experiences, and the precisions and accuracy in reporting the results, the graphics and the experimental observations (mark from 0 to 5 for every experience, total 30/30 for the laboratory modulus). The positive evaluation of the laboratory reports (minimum 18/30 corresponding to an average score of 3) and the attendance to the Lab (at least 5 on 6 experiments) allow the admission to the oral exam.
The oral examinations (grade from 18/30 to 30/30) consist in open questions on the topics of the Inorganic Chemistry course and the Laboratory activity treated at the lesson and on the textbooks.
The final grade corresponds to a weighted sum of the results of the two parts of the course with the following graduation.
18-21: preparation on a limited part of the topics of the program, with scarce capacity of dissertation and independent analysis which, during oral test, have to be very often helped and demanded by the questions of the teacher; uncertain explanation capacity; lexicon often unclear and not accurate, sometimes not correct; with very low capacity of critical evaluation.
22-24: preparation on a good number of the topics of the program, even if not homogeneous, with sufficient capacity of dissertation and independent analysis, sometimes helped and demanded by the questions of the teacher; sufficiently clear explanation capacity; generally correct lexicon , even if sometimes not accurate; limited capacity of critical evaluation.
25-27: preparation on many topics of the program, good capacity of dissertation and critical analysis with good autonomy, capacity to apply the knowledge to real cases, correct lexicon, clear explanation capacity and
good and correct use of the language.
28 – 30/30L: complete and exhaustive preparation on all topics of the program, independent capacity of dissertation and critical analysis, capacity to connect the topics to real cases, different contexts and branches of knowledge, full competence of the discipline lexicon; excellent, clear and precise explanation capacity and capacity of argumentation.

Office hours

From Monday to Friday by appointment.

Sustainable Development Goals

AFFORDABLE AND CLEAN ENERGY