UNIVERSITÀ
DEGLI STUDI DI MILANO-BICOCCA

COURSE SYLLABUS

Inorganic Chemistry I and Laboratory

2021-2-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 between structure, properties and reactivity.

Knowledge and understanding.

Students, by the end of the course, will learn the basic principles of the inorganic chemistry and of the elements and main groups, in particular regarding preparation, reactivity and applications. The students will be able to relate the properties of the elements and of the groups with the position of the elements in the periodic table. Moreover, in the laboratory the students will learn some main experimental methodologies for the synthesis of inorganic compounds.

Applying knowledge and understanding.

By the end of the course, students will be able to describe adequately characteristics and properties of the main groups; to evaluate the stability/reactivity of the main inorganic compounds; to use the learnt experimental methodologies in laboratories for the synthesis of inorganic compounds.

Making judgments.

By the end of the course, students will become able to predict the stability/reactivity of the main inorganic compounds **and to** individuate the proper compounds to carry out a specific application/reaction based on the knowledge of their chemical properties.

Communication skills.

By the end of the course, students will be able to describe the topics of the course with clarity, coherence, and command of language.

Learning skills.

By the end of the course, students will have developed the ability to solve and face with more complex exercises, arguments and experiments.

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, molecular symmetry, 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 learning 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.

Laboratory of Inorganic Chemistry .

Experiences of synthesis and reactivity of the main group element and of transition metals: 1)Synthesis and thermal analysis of oxalates hydrate of Group II; 2) Synthesis of polysiloxanes; 3) The acid properties of boron: synthesis and reactivity of tetrafluoroborate; 4) The oxidation states of tin: synthesis of Sn(II) and Sn(IV) iodides; 5) Synthesis of transition-metal acetylacetonates; 6) Emulsion 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 is organized in lectures, where syllabus topics are exposed with the help of slide presentation (power point) or blackboard explanation. The lessons presentation will be supplied to the students on the e-learning platform.

The Laboratory of Inorganic Chemistry provides individual or in couple laboratory experiences preceded by brief explanatory lectures with the help of slide presentation (power point) or blackboard explanation. The attendance of the Laboratory is compulsory

Textbook and teaching resource

Slides of the lectures of Inorganic Chemistry, Learning exercises of the main topics of Inorganic Chemistry and lecture notes of the Laboratory experiences are supplied by the lecturer in e-learning platform

Textbook of Inorganic Chemistry suggested by the lecturer (P. Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong, Inorganic Chemistry, Oxford University Press)

Semester

Second semester of the second year of the Degree Course.

Assessment method

Laboratory

The assessment of the Lab activity, is composed by : the attendance to the Lab (at least 5 on 6 experiments) and the evaluation of the final report including clarity of the presentation; precision and accuracy in reporting calculations, graphics, and numerical results; and correctness of the synthetic comments for each laboratory experiments (in printed format, marks in the 0-5 range). The positive evaluation of the laboratory reports (average score of 3 respect to at least 5 experiences) allows the admission to the oral exam. The student acquires the CFU of the Laboratory course passing a final oral examination performed in conjunction to that of Inorganic Chemistry.

Inorganic Chemistry

Oral exam on the main topics of the course. The oral exam will be graded according the following criteria: answer/question congruence; knowledge of the general properties of elements or groups of elements and related detailed concepts; knowledge of the relations between the characteristics of the different elements/groups and their position in the periodic table; appropriate use of the chemical terminology and capability of writing balanced chemical equations.

The final grade corresponds to a weighted sum of the results of the two parts of the course.

Office hours

From Monday to Friday by appointment.