UNIVERSITY OF GOTHENBURG

DEPARTMENT OF CHEMISTRY AND MOLECULAR BIOLOGY

KEM050 Inorganic Chemistry, 15 credits

Oorganisk kemi, 15 högskolepoäng

First Cycle

Confirmation

This course syllabus was confirmed by Department of Chemistry and Molecular Biology on 2015-03-24 and was last revised on 2018-12-20 to be valid from 2018-12-20, spring semester of 2019.

Field of education: Science 100%
Department: Department of Chemistry and Molecular Biology

Position in the educational system

The course is classified at the level 30-60 credits for Degree of Bachelor. Alternatively, it can be read as a freestanding course. The course replaces course KEN050 and the two courses may not be counted in together for a degree.

The course can be part of the following programmes: 1) Bachelor of Science Programme in Medicinal Chemistry (N1LMK) and 2) Bachelor of Science Programme in Chemistry (N1KEM)

Main field of studies	*Specialization*
Chemistry	G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

Entry requirements

For admission to the course, approved result on course KEM011 Basic chemistry 1 (15 credits) and KEM021 Basic chemistry 2 (15 credits), or equivalent knowledge, are required.

Learning outcomes

After passed course the student should be able to:

Knowledge and understanding

- **explain** the basic concepts and theories in inorganic chemistry such as acid/base, redox reaction, chemical bonding,
- **explain** coordination compounds and their specific reactions,
- **explain** the use of organometallic subjects in catalysis and medicine,
- **explain** important spectroscopic methods such as X-ray and infrared spectroscopy,
- **describe** the different groups of the periodic table, **explain** specific properties of elements in a certain group and trends in groups,
- **describe** important nanomaterials and their properties and potential applications.

Competence and skills

- qualitatively **identify** common inorganic subjects based on their chemical reactions,
- **determine** structure and bond properties in common inorganic compounds, **classify** their symmetry and **use** the symmetry to determine their properties,
- **discuss** the properties of inorganic compounds based on their structure and bondings and symmetry,
- **synthesise** inorganic compounds with microscale techniques and **identify** and **characterise** them by means of IR, UV and X-ray methods,
- **discuss** specific chemical problems in the use of of coordination compounds and **find solutions** to them,
- **utilise** these properties in the laboratory synthesis and analytical work,
- orally and in writing **account for and discuss** information from synthesis experiments in dialogue with students and teachers in the course.

Judgement and approach

- **explain** the industrial importance of inorganic compounds and how their production and use must be adapted to a sustainable society,
- **present and take into account** safety aspects in connection with all activities extensive inorganic compounds,
- **explain** historical and industrial aspects of the inorganic chemistry,
- **discuss** possibilities and risks with use of nanomaterial and other new materials.

Course content

Inorganic Chemistry is the chemistry of elements- particularly their coordination chemistry. Fields of subjects interfacing to physics and material science, organic chemistry and catalysis, as well as biochemistry and biological function, constitute the field of current research. The industrial production of inorganic materials is large and includes modern materials such as catalysts, semiconductors, optical instruments, superconductors and advanced ceramic materials (for example for ball bearings). The course comprises a review of theory as well as exercises and laboratory sessions. The

student should obtain a comprehensive understanding for the importance of inorganic chemistry for research and industrial production in the perspective of a future sustainable society.

The content in the lectures of the course are divided into three main areas: fundamental principles, elements and their compounds, and current research.

The section *fundamental principles* includes:

- Atomic structure, molecular structure and chemical bonding,
- solid state and its prototype structures,
- acids and bases as well as oxidation-reduction seen from the industrial point of view,
- physical and analytical methods in inorganic chemistry as well as molecular symmetry,
- introduction to the inorganic coordination chemistry,
- metal complexes, electronic structures as well as reaction mechanisms,
- catalysis, in particular use of organometallic complexes.

The section about elements and their compounds includes a systematic review of all groups from hydrogen via alkali metals to halogens. Special emphasis is put on their occurrence and industrial use as well as reactions with other elements for formation of interesting chemical compounds. Furthermore, safety aspects on compounds with dangerous properties are discussed.

The section research area addresses the following:

- The solid state with materials chemistry for example nanomaterial and nanotechnology,
- bio-inorganic chemistry, structure-function relationships,
- organometallic compounds in medicine.

Laboratory sessions

In the course, two separate laboratory courses are given. The first course is a training in qualitative analysis of unknown elements and ions in solid phase as well as in solution (so-called ion hunting). Training is individual and follow a systematic timetable that are used during course.

The other laboratory course includes synthesis methods in microscale for the production of interesting inorganic compounds as well as analyses of reaction products by means of UV, IR and powder X-ray methods. The course is concluded with result presentations in

the form of individual written reports as well as an individual oral presentation.

Sub-courses

1. **Theory part** *(Teoridelen),* 9 credits
   Grading scale: Pass with Distinction (VG), Pass (G) and Fail (U)
   The sub-course includes fundamental principles, elements and their compounds as well as current research.

2. **Practical part** *(Praktiska delen),* 6 credits
   Grading scale: Pass (G) and Fail (U)
   The module includes laboratory sessions and result presentations.

Form of teaching

Part 1: Teaching comprises lectures and calculation exercises.

Part 2: Teaching comprises laboratory experiments and independent project work.

Language of instruction: English and Swedish
The course is given as a principal rule in Swedish but can be given completely or partly in English if the circumstances require it.

Course literature in English can be involved.

Assessment

Part 1: Examination is performed through written examination and oral presentations as well as optional take-home examinations.

Part 2: Examination takes place through laboratory reports and oral presentations.

A student who fails at regular examination is offered additional examination sessions.

If a student who has failed twice on the same part of the examination wants to change examiner before the next examination session the request should be submitted in writing to the department and be approved if there are not special causes against this (HF chapter 6 section 22).

In case a course has ceased or undergone major changes the student should normally be guaranteed access to at least three examinations (including regular examination) during a time of at least a year based on the earlier planning of course.

Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U).
Part 1: For grade Pass (G) the following is required:

- at least 50% of the maximum total of points in examination,
- completed oral presentation.

For grade Pass with distinction (VG) is required

- at least 75% of the maximum total of points in examination,
- completed oral presentation.

Result from take-home examinations can give extra points equivalent up to 3% of the maximum total of points of examination per take-home examination. The oral presentation can give extra points equivalent up to 4% of the maximum total of points of examination.

Part 2: For grade Pass (G) the following is required:

- approved laboratory reports,
- completed oral presentation.

Final grade:

- For grade Pass (G) in the whole course passed results of all modules are required.
- For grade Pass with distinction (VG) in the whole course, apart from passed results of all modules, grade Pass with distinction (VG) on module 1 is required.

Regarding application of the ECTS scale for grade please see decision 28/05/2007, diary nr G 8 1976/07.

Course evaluation

Course evaluation is performed in relation to course's intended learning outcomes and content and is implemented at the end of the course through an individual written questionnaire on University of Gothenburg's virtual learning environment. A student who participates in or has completed a course should be given the opportunity to anonymously express experiences of and views in the course in a course evaluation. A compilation of the course evaluation and course coordinator's reflection should be made available for the students within reasonable time after course end.

Additional information

The course is sustainability related.