Course syllabus

Allmän, oorganisk och organisk kemi
General, Inorganic and Organic Chemistry

KOKA30, 12 credits, G1 (First Cycle)

Valid for: 2023/24
Faculty: Faculty of Engineering, LTH
Decided by: PLED B/K
Date of Decision: 2023-04-18

General Information

Main field: Technology.
Compulsory for: N1
Language of instruction: The course will be given in Swedish

Aim

General chemistry

To provide basic understanding of and knowledge about chemical processes and phenomena. Fundamental understanding of structure and reactivity of inorganic compounds and knowledge about the principles of chemical formulae and important chemical concepts in the Swedish and the English language.

Organic chemistry

The course aims to provide basic knowledge in organic chemistry. Emphasis is placed on parts of the fundamental organic chemistry withat has particular relevance to eduation in nanoscience.

Learning outcomes

Knowledge and understanding
For a passing grade the student must

General chemistry

- Be able to use chemical nomenclature in order to name and give formulas for inorganic substances as well as to use basic chemical concepts and terminology.
- Be familiar with atomic orbitals, electron configurations and the relationship between these and the periodic table.
- Be familiar with the description of basic inorganic structures in the solid state
- Be able to explain and use thermodynamic data and expressions and to use the relationship between them.
- Be able to understand and apply the concept of chemical equilibria
- Be able to derive and interpret reaction mechanisms, formulate rate laws and relate the rate of a chemical process to the temperature

Organic chemistry

- show ability to identify and name the most common classes of organic compounds
- show ability to describe and explain the dynamics of simple hydrocarbons (conformational analysis)
- show ability to describe chemical bonds and intermolecular forces in organic systems
- show ability to describe molecular chirality and stereochemical relationships
- show ability to describe the hybridization of carbon atoms, and simple molecular orbital systems
- show ability to describe conjugation and aromaticity in organic molecules
- show ability to describe basic reactions in organic chemistry by arrow formatlism and front orbital reasoning
- show ability to describe the structural elements and properties of important bio-molecules.

Competences and skills
For a passing grade the student must

General chemistry

- Be able to derive molecular geometry and from this draw conclusions about intermolecular forces and their significance for physical properties in solid and liquid substances.
- Be able to calculate relationships between unit cell parameters, interatomic distances, and density for cubic structures.
- Be able to solve basic thermodynamic problems and interpret the results
- Be able to analyse and solve chemical equilibrium problems
- Be able to describe electrochemical cells and analyse the processes in electrochemical cells as well as calculate cell potentials
- Be able to use basic integrated rate laws and to calculate data related to these.

Organic chemistry

- show ability to give systematic namnes of simple organic compounds
- show ability to apply conformational analysis to predict the reactivity of simple organic compounds
- show ability to predict and explain reactivity and selectivity in organic reactions outgoing from analysis of reactive intermediates
- show ability to apply an understanding of electronegativity and chemical bond to predict the acid-base properteis of simple organic compounds

Judgement and approach
For a passing grade the student must

General chemistry

- Be able to present chemical calculations using correct units and appropriate accuracy in a logical and relevant way.
- Be able to collect, present and evaluate results from practical experiments.

Organic chemistry

- On a basic level, show ability to value risks and opportuniteis associated with the use of organic molecules in society
- On a basic level, show ability to value risks associated with chemical laboratory work

Contents

General chemistry

Fundamental chemical processes related to applications in nano science and technology are described and explained.

The course comprises

- Fundamental chemical concepts
- The structure of atoms and the periodic table
- Chemical formulae, reactions, and stoichiometry
- The states of matter: gases, liquids, solids, and phase transitions
- Solutions
- Chemical bonding
- Geometry of molecules
- Intermolecular forces: dispersion forces, hydrogen bonding, dipole-dipole and ion-dipole interactions.
- Chemical thermodynamics: Enthalpy, entropy, internal energy, and free energy and their interrelations. The first, second and third laws of thermodynamics. Standard etnthalpy of formation and reaction.
- Chemical equilibrium with basic numerical applications
- Electrochemistry: Redox processes. The electrochemical cell.
- Chemical kinetics: The rate constant and the temperature dependence of the rate constant. The initial rate method. Activation energy. Chain reactions

The student works actively with problem solving during the course in order to reach the learning outcomes described above. Skills and abilities in the professional use of scientific and chemical therminology are promoted by the use of standard English literature.

Organic chemistry

The course covers the structure, reactivity, properties, and use of organic compounds on a basic level. Fundamental concepts like nomenclature, chirality and molecular isomerism are covered. The emphasis of the course lies on fundamental understanding of reactivity and the chemical bond. Reactons covered in the course includes addition, substitution, and elimination reactions, electrophilic aromatic substitution, enolate chemistry, and addition to, and substitution on, the carbonyl carbon. The structure and properties of important bio-molecules like sugars proteins and RNA/DNA are covered as well as simple experimental methods and safety evaltuations associated with laboratory work.

Examination details

Grading scale: TH - (U,3,4,5) - (Fail, Three, Four, Five)
Assessment: Written exams, laboratory experiments, and written reports are mandatory. The final grade is based on a merger of the results on written exams.

The examiner, in consultation with Disability Support Services, may deviate from the regular form of examination in order to provide a permanently disabled student with a form of examination equivalent to that of a student without a disability.

Parts
Code: 0116. **Name:** General and Inorganic Chemistry.
Credits: 6. **Grading scale:** TH. **Assessment:** Written examination.
Code: 0216. **Name:** Laboratory Exercises.
Credits: 0. **Grading scale:** UG. **Assessment:** Participation is mandatory, passed written report.
Code: 0316. **Name:** Organic Chemistry.
Credits: 6. **Grading scale:** TH. **Assessment:** Written examination.

Admission

The number of participants is limited to: No
The course overlaps following course/s: TEK285, KOKA01, KOKA05

Reading list

- Burrows, A., Holman, J., Parsons, A., Pilling, G., Price, G.: Chemistry3 - Introducing Inorganic, Organic and Physical Chemistry, Third edition. Oxford University Press, 2017, ISBN: 9780198733805.

Contact and other information

Course coordinator: Martin Ek Rosén, martin.ek_rosen@chem.lu.se
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Further information: Course responsible in general chemistry (KOKA30a): Martin Ek Rosén; Course responsible in organic chemistry (KOKA30b): Peter Somfai