



## DEPARTMENT OF CHEMISTRY AND MOLECULAR BIOLOGY

### **KEM011 Basic Chemistry 1, 15 credits**

Grundläggande kemi 1, 15 högskolepoäng

*First Cycle*

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#### **Confirmation**

This course syllabus was confirmed by Department of Chemistry on 2014-03-24 and was last revised on 2019-05-23 by Department of Chemistry and Molecular Biology to be valid from 2019-05-23, autumn 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 0-30 credits for Degree of Bachelor. Alternatively, it can be read as a free-standing course.

The course can be part of the following programmes: 1) Programme in Pharmacy (F2APP), 2) Programme in Pharmacy (F2APO), 3) Bachelor of Science in Environmental Science (N1MVN), 4) Bachelor's Programme in Biology (N1BIO), 5) Bachelor's Programme in Molecular Biology (N1MB1), 6) Bachelor of Science Programme in Medicinal Chemistry (N1LMK), 7) Bachelor of Science Programme in Chemistry (N1KEM) and 8) Biology, Master's Programme (N2BIO)

*Main field of studies*

Chemistry

*Specialization*

G1N, First cycle, has only upper-secondary level entry requirements

#### **Entry requirements**

General entrance requirements for university studies and the Swedish upper secondary courses Physics B, Chemistry B, Mathematics D or Physics 2, Chemistry 2, Mathematics 4 or equivalent.

## Learning outcomes

The course intends to provide the students with relevant knowledge and skills in basic chemistry and give them a good basis for continued studies. On successful completion of the course the student will be able to:

### *Knowledge and understanding*

- **account for** basic concepts theories and working methods in the area of chemistry,
- **account for** the basic thermodynamic units work, heat, energy, enthalpy, entropy and free energy and their mutual relationships,
- **account for** and **explain** basic relationships between chemical bonding, chemical reactions and the structure and function of simple chemical compounds,
- **explain**, in elementary terms, the concept of spontaneity in a chemical process as well as those molecular properties and driving forces that determine the direction and rate of the reaction as well as its final equilibrium state,
- **describe**, at a general level, basic thermodynamic properties and their molecular implications,
- **explain** everyday phenomena on the basis of chemical concepts.

### *Competence and skills*

- **perform** elementary reasonings and calculations for simple chemical reactions and other processes,
- **interpret** simple reaction mechanisms, **formulate** and **apply** simple rules for reaction rates and **calculate** related properties,
- **present** chemical calculations with correct units,
- **carry out** simple experiments after a provided description as well as **present** theory and results of laboratory session in a final report.

### *Judgement and approach*

- **plan** work in a chemical laboratory and **evaluate** chemical health risks,
- **discuss** possibilities and challenges for chemists connected to a social, economic, and environmentally sustainable society/sustainable development.

## Course content

The course is divided into three modules A, B and C that are described below.

**Module A:** Stoichiometry, chemical equilibria and chemical thermodynamics, 4.5 credits (Stoichiometry, Equilibrium and Chemical Thermodynamics, 4.5 hec)

## Stoichiometry

### Basic chemical concepts including

- Reaction yield
- Elemental composition
- Balancing of reactions
- amount of substance

### Chemical equilibria

#### Calculations of simple equilibria for:

- The strength of acids
- Buffer capacity
- The solubility of salts
- Connected equilibrium reactions
- Natural buffer systems in sea and soil
- The chemistry of water
- Gas equilibria
- The redox system in galvanic elements
- Carbon dioxide in air and water

### Elementary chemical thermodynamics

- The laws of thermodynamics
- Exothermic and endothermic processes, calorimetry, enthalpy, free energy
- Calculation of equilibrium constants from thermodynamic data
- Phase diagrams, the vapor pressure of solutions, freezing-point depression, boiling-point elevation, osmosis

**Module B:** ? Atoms, bindings, chemical kinetics and general inorganic chemistry?, 4.5 credits (Atom, Bonds, Chemical Kinetics and General Inorganic Chemistry, 4.5 hec)

### Models for atoms and bindings

- The structure of atoms, orbital, Aufbau principle
- Trends in the periodic system: Ionization energy, electronegativity, atomic and ionic radii
- Chemical binding, bond polarity
- Localized-electron bond model, Lewis structures, the structure of molecules
- Molecular orbital model

#### Interaction between light and matter

- Electromagnetic radiation
- Absorption and emission of radiation

#### Chemical kinetics

- How fast do place chemical reactions proceed?
- Rate constants, reaction order, half-life, radioactivity
- Activation energy and temperature dependent reactions

#### General inorganic chemistry

- Structure and properties for atomic molecular and ionic solid subjects
- Inorganic compounds' structure as well as trends in their properties described by means of the periodic system
- The coordination compounds of transition metals: nomenclature, isomerism, biological complexes and crystal fields

**Module C:** Laboratory sessions and chemical health risks, 6 credits (Laboratory Exercises and Chemical Health Hazards, 6 hec)

#### *Laboratory sessions*

The exercises train basic abilities in chemical laboratory work. The laboratory sessions also illustrate parts of the theoretical content of the course. The module includes:

- A written test to check that the student knows current protections and safety precautions
- Equipment and organisation of a chemical laboratory
- Code of conduct for laboratory including handling of chemicals and laboratory glass
- Report writing

### Chemical health risks

- Incident risks with chemical laboratory work. Strong emphasis is put on environment and health risks.

### Form of teaching

Teaching is conducted by lectures, calculation exercises, assisted problem solving and laboratory exercises.

*Language of instruction:* Swedish and English

The course is given as 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

Assessment whether the aim of the course has been achieved is done by written examinations and laboratory reports. Four written subtests are held during course, and a written examination is held at the end of the course. For students who have not passed the regular examination additional examination sessions are offered. To pass the whole course, approved results on the written examination covering modules A and B as well as approved results on module C comprising laboratory sessions and reports are required. For students who have not passed the regular written examination, additional examination sessions are offered. Failed laboratory exercises may be redone the next time the laboratory part is held.

If a student who has failed the same part of the examination twice wants to change their examiner before the next examination session such request should be submitted in writing to responsible department and be approved if there are not special reasons against it.

### Grades

The grading scale comprises: Pass with Distinction (VG), Pass (G) and Fail (U). On each of the modules A and B, some of the grades Pass with distinction (VG), Pass (G) and Fail (U) is awarded. In the laboratory part (module C), some of the grades Pass (G) and Fail (U) is awarded. The credits from the subtests are included into the score for the respective module.

For grade Pass in the whole course, at least 60% of the maximum score on the examination and grade Pass on Module C are required, as well as that the student:

- give linguistically understandable, clearly structured and coherent replies,
- shows familiarity with the contents of course,
- accounts for and uses the basic concepts that are introduced in the course,
- distinguishes between their own and others' ideas and arguments,
- clearly presents and with objective arguments justify their own opinion.

For grade Pass in the whole course, at least 75% of the maximum score on examination, grade Pass on Module C are required, as well as, in addition to the requirements for grade Pass, the student:

- relates critically and independently to the questions that are treated,
- shows deepened familiarity with the contents of course,
- applies several perspectives on the contents of course, as well as
- demonstrates and problematises the relationship between these different perspectives.

In the grading, a holistic assessment is always made, which builds on an aggregation of the above-mentioned criteria.

Regarding application of ECTS grading scale, see Vice-chancellor decision 28/05/2007, diary nr G 8 1976/07.

### **Course evaluation**

The course evaluation is done in relation to the intended learning outcomes and content of the course. It is performed at the end of the course by an individual written questionnaire on the virtual learning environment at University of Gothenburg.

Students who participate in or have completed a course should be given the possibility to anonymously express experiences of and views on 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 the end of the course. The

written course evaluation is archived.

**Additional information**

The course is related to sustainable development.