



**LUND**  
UNIVERSITY

Faculty of Science

## **KEMB09, Chemistry: Physical Chemistry - Basic Course, 15 credits**

*Kemi: Fysikalisk kemi - grundkurs, 15 högskolepoäng*  
**First Cycle / Grundnivå**

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### **Details of approval**

The syllabus was approved by Study programmes board, Faculty of Science on 2009-11-26 and was last revised on 2009-11-26. The revised syllabus applies from 2010-07-01, autumn semester 2010.

### **General Information**

The course is a compulsory first-cycle course for a degree of Bachelor of Science, main field of study Chemistry.

*Language of instruction:* Swedish

*Main field of studies*

Chemistry

*Depth of study relative to the degree requirements*

G1F, First cycle, has less than 60 credits in first-cycle course/s as entry requirements

### **Learning outcomes**

The aim of the course is to provide students with basic knowledge of physical chemistry in the areas of thermodynamics and quantum mechanics, and of their applications in science. The laboratory module of the course aims to provide the skills required for both experimental and theoretical studies in these areas.

The objective is that the students, on completion of the course, shall have acquired the following knowledge and skills.

### **Knowledge and understanding**

On completion of the course, the students shall be able to

- describe the nature of ideal and non-ideal gases
- apply the first and second laws of thermodynamics

- quantitatively manage physical phase transformations in pure substances
- use thermodynamics for mixtures (ideal and non-ideal)
- quantitatively manage phase diagrams for two-component systems
- calculate the equilibrium for chemical reactions
- describe the fundamentals of quantum mechanics
- apply the concepts of translation, rotation, vibration and spin in quantum mechanics
- describe the structure of atoms and their electrons
- describe the term 'chemical bond' using valence bond theory and molecular orbital theory
- determine the symmetry properties of molecules and their application

## Course content

The course consists of two parts:

*Part one* provides the fundamentals of classical thermodynamics, including the following: gases, pressure-volume work, the first law of thermodynamics, state functions, the concept of entropy, the second law of thermodynamics, heating equipment, Helmholtz's and Gibb's free energy, chemical potential, activities, ideal solutions, colligative properties, the phase rule and phase diagrams, the pressure and temperature dependency of the equilibrium constant, ion activities, and the Debye-Hückel Limiting Law.

*Part two* provides the fundamentals of quantum mechanics (the Schrödinger equation, wave functions, Born's interpretation, operators, expected values and the uncertainty principle) and their application. The electron structure of the atom and the structure of the periodic system are discussed, as well as molecules and chemical bonds. The term 'symmetry' is introduced, and the application of symmetry in quantum mechanics and spectroscopy is illustrated.

The course includes both experimental and computer-based *laboratory exercises*.

## Course design

The teaching consists of lectures, tutorials and calculation exercises, as well as laboratory exercises. All laboratory exercises are compulsory.

## Assessment

The assessment is based on a written exam.

A re-sit examination is offered soon after the examination to students who do not pass.

*Subcourses that are part of this course can be found in an appendix at the end of this document.*

## Grades

Marking scale: Fail, Pass, Pass with distinction.

For a grade of Pass on the whole course, the student must have passed the exam and the laboratory exercises.

The grades awarded for the exam are Fail, Pass, and Pass with Distinction. The grades awarded for the lab exercises and associated compulsory components are Fail and Pass.

The final grade is determined by the grade of the exam.

## **Entry requirements**

To be admitted to the course, students must have basic eligibility, Physics B and have passed courses equivalent to:

- KEMA00 General and Analytical Chemistry, 7.5 credits, KEMA01 Organic Chemistry – Basic Course, 7.5 credits, KEMA02 Inorganic Chemistry – Basic Course, 7.5 credits and KEMA03 Biochemistry – Basic Course, 7.5 credits and
- one of the courses MATA01 Mathematics for Scientists 1, 15 credits, or MATA11 Mathematics 1 Alpha, 15 credits.

Students who have obtained the equivalent knowledge by other means, may also be admitted to the course.

## **Further information**

The course may not be included in a degree together with KEM103 General Chemistry 3, 15 credits.

## Subcourses in KEMB09, Chemistry: Physical Chemistry - Basic Course

Applies from H13

- 0711 Physical Chemistry - Basic Course, 10,0 hp  
Grading scale: Fail, Pass, Pass with distinction
- 0712 Physical Chemistry - Basic Course, Laboratory Work, 5,0 hp  
Grading scale: Fail, Pass

Applies from H07

- 0701 Physical Chemistry - Basic Course, 15,0 hp  
Grading scale: Fail, Pass, Pass with distinction
- 0702 Physical Chemistry - Basic Course, Laboratory Work, 0,0 hp  
Grading scale: Fail, Pass