Reg No: KEGBF4/20261

Faculty of Health, Science and Technology
Chemistry

Syllabus

Chemical Thermodynamics and Kinetics

Course Code:	KEGBF4
Course Title:	Chemical Thermodynamics and Kinetics *Kemisk termodynamik och kinetik*
Credits:	7.5
Degree Level:	Undergraduate level
Progressive Specialisation:	First cycle, has less than 60 credits in first-cycle course/s as entry requirements (G1F)

Major Field of Study:
KEA (Chemistry)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2025-09-03, and is valid from the Spring semester 2026 at Karlstad University.

Prerequisites
Registered for 30 ECTS credits in Chemistry with 12 ECTS credits completed, or for students in the Master programme in Chemical Engineering at Karlstad University, registered for 22.5 ECTS credits in Chemistry with 11 ECTS credits completed, or equivalent.

Learning Outcomes
The aim of the course is for students to acquire fundamental knowledge and skills to understand the chemistry of macroscopic systems, particularly within chemical thermodynamics and kinetics.

Upon completion of the course, students should be able to:
1. perform calculations regarding the energy transformations of chemical systems based on fundamental chemical thermodynamics,
2. give an account of key concepts in chemical thermodynamics,

3 calculate equilibrium reactions using principles of chemical thermodynamics,
4. give an account of the difference between ideal and non-ideal chemical systems,
5. describe selected molecular interactions and their physico-chemical consequences,
6. carry out basic calculations regarding reaction rates based on fundamental reaction kinetic models,
7. plan, conduct, and report laboratory work related to the theoretical content of the course within given timeframes,
8. give an oral account of a chosen topic within the scope of the course to a group, and
9. describe the connection between the models presented in the course and experimental results.

Content
Instruction is in the form of lectures, exercises, laboratory sessions, and seminars. Certain sections are expected to be studied independently by the students, which makes it important that they can understand course literature in English. Some teaching may be provided as recorded material.

The course consists of two parts, which are examined separately: the theory component and the laboratory component. The course objectives can only be achieved when both have been completed.

The theory component, corresponding to 5 ECTS cr, presents the fundamentals of chemical thermodynamics, equilibrium theory from a thermodynamic perspective, covering both phase equilibria and electrochemical processes, as well as molecular interactions, particularly van der Waals forces. Basic reaction kinetic models and their connection to chemical reactions are also addressed. The theory course provides the conceptual and computational foundation necessary for students to achieve the course objectives.

The laboratory component, corresponding to 2.5 ECTS cr, consists of practical laboratory components and is integrated with the theory course. Attendance and active participation in all laboratory components are mandatory. To participate in a laboratory session, students must pass a safety test and prepare for the session by reading and processing the instructions and relevant parts of the course literature. Oral checks of preparation may occur. To receive credit during the current term, all reports and protocols must be submitted and approved within three weeks after the course ends. Reports and protocols submitted later will be graded as time permits, but no later than the following term.

The laboratory component also includes mandatory seminars. These seminars cover report writing, risk assessment, processing and analysis of data from laboratory experiments, review of the laboratory components, and an exercise in oral presentation of a chosen topic related to the course content. Attendance and active participation in all components of the laboratory course are mandatory.

Reading List
See separate document.

Examination
Assessment of the theory component is both continuous and based on individual hand-in assignments, and based on an individual written exam. The continuous assessment and the written exam are combined to determine the final grade.

Assessment of the laboratory component is continuous and based on laboratory reports and active participation in mandatory seminars.

If students have a decision from Karlstad University entitling them to Targeted Study Support due to a documented disability, the examiner has the right to give such students an adapted examination or to examine them in a different manner.

Grades
One of the grades Distinction (VG), Pass (G), or Fail (U) is awarded in the examination of the course. For students in Engineering, one of the grades 5 (Pass with Distinction), 4 (Pass with Some Distinction), 3 (Pass), or U (Fail) is awarded in the examination of the course.

Quality Assurance
Follow-up relating to learning conditions and goal-fulfilment takes place both during and upon completion of the course in order to ensure continuous improvement. Course evaluation is partly based on student views and experiences obtained in accordance with current regulations and partly on other data and documentation. Students will be informed of the result of the evaluation and of any measures to be taken.

Course Certificate
A course certificate will be provided upon request.

Additional information
The local regulations for studies at the Bachelor and Master levels at Karlstad University stipulate the obligations and rights of students and staff.

The course KEGBF4 cannot be included in the same degree programme as the courses KEGBF3, KEGBF2, KEGBF1, KEGBF0, KEGBFT, KFK240, or KFK241.

The course includes up to five days of mandatory attendance at Karlstad University.