



Faculty of Health, Science and Technology
Chemistry

Syllabus

Chemical Calculations

Course Code:	KEGA31
Course Title:	Chemical Calculations <i>Kemiska beräkningar</i>
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 2021-08-27, and is valid from the Spring semester 2022 at Karlstad University.

Prerequisites

General admission requirements plus Chemistry 2 and Mathematics 4, or equivalent

Learning Outcomes

The aim of the course is for students to acquire the basic knowledge and skills required for chemistry-oriented activities and for further science and technology studies.

Upon completion of the course, students should be able to:

1. use correct units and the correct number of significant figures in chemical calculations,
2. apply the ideal gas equation,
3. determine empirical and molecular formulas,
4. balance a chemical equation, define different ways of reporting it and calculate reaction yield,
5. define and use the concepts activity and equilibrium,

6. define pH and calculate the pH of a solution,
7. use titration as an analysis technique,
8. perform calculations and explain the concept of kinetics, and
9. prepare, conduct, and report the result of laboratory experiments within a given time limit.

Content

The course comprises a theoretical module and a laboratory module. Learning outcome 9 only relates to the laboratory module while the other components can be treated in either module.

Learning outcome 1: numerical values, significant figures, converting units, unit analysis

Learning outcome 2: the ideal gas equation, pressure, volume, temperature, amount of substance, the gas constant

Learning outcome 3: empirical formula, molecular formula

Learning outcome 4: chemical reactions in general, redox reactions in particular, molecular reaction equation, ionic reaction equation, net ionic reaction equation, limiting reagents, yield in chemical reactions, simple electrolysis problems, concentration, amount of substance, mass, molar mass

Learning outcome 5: dynamic equilibrium, activity, activities at equilibrium, concentrations at equilibrium, the acid constant (K_a), the base constant (K_b), conjugated acid-base pair, solubility product (K_{sp}), solubility, complex constant, equilibrium constant (concentration, K_c and pressure, K_p), reaction quotient, Le Châtelier's principle, common reactant, the autoionisation of water, pK_a , pK_b , pK_w

Learning outcome 6: pH, pOH, pH indicators, pH calculations, buffer solutions, buffer equation (Henderson-Hasselbalch), preparation of buffer solutions

Learning outcome 7: concentration, amount of substance, mass, molar mass, calculate the dilution of solutions, redox titration, acid-base titration

Learning outcome 8: kinetics, the rate of a reaction, rate constant, half-life, the Arrhenius equation, activation energy

Learning outcome 9: practical laboratory work based on theory treated in the course, laboratory safety, and results from the laboratory work reported according to instructions within a given time limit.

Reading List

See separate document.

Examination

Assessment of the theoretical module is based on optional hand-in assignments and an individual written exam. The laboratory module is assessed on the basis of mandatory attendance and active participation in laboratory work, a safety test, and a lab report according to instructions and within a given time limit.

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 Engineering students, 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 may include as many as 5 days of mandatory attendance at Karlstad University.