Reg No: EMGA14/20212

Faculty of Health, Science and Technology
Environmental and Energy Systems

Syllabus

Environmental Chemistry

Course Code:	EMGA14
Course Title:	Environmental Chemistry *Miljökemi*
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:
MEI (Environmental and Energy Systems)

Course Approval
The syllabus was approved by the Faculty of Health, Science and Technology 2020-10-19, and is valid from the Autumn semester 2021 at Karlstad University.

Prerequisites
General admission requirements and upper secondary level Mathematics 3c, Physics 2, and Chemistry 1 (field-specific eligibility A8) plus a basic course (7.5 ECTS credits) in environmental studies, or equivalent

Learning Outcomes
Upon completion of the course, students should be able to:
- explain important concepts of basic chemistry, such as chemical bonding and chemical equilibrium,
- describe stoichiometry and mass balance in chemical reactions and perform basic chemical calculations,
- give an account of the chemical processes of climate change, acidification, ozone conversion, and eutrophication,

- give examples of molecular structures typical of environmental pollutants,
- give examples of the environmental and health-related effects of a few common toxic substances,
- predict likely pathways of environmental pollutants in nature,
- calculate the effects of emissions on various natural systems such as lakes, soils, and the atmosphere,
- give examples of ethical aspects of the development and use of substances that are or may be environmentally harmful,
- describe experimental protocols of the type full and fractional two-level and three-level factorial experiments,
- use basic statistics to analyse the reliability of measurement results,
- handle chemicals and equipment safely in the laboratory, and
- demonstrate skills in some common measurement methods in environmental analysis.

Content
The course is based on lectures with follow-up teaching sessions and calculation tutorials. Sampling methodology, laboratory safety, and measurement methods in environmental analysis are exercised practically through one or several field trips and laboratory sessions.

Course content:
- Environmental chemistry as a practical tool. Correlations between different environmental problems. Using reaction rates and equilibrium constants in calculations in order to assess the significance of different reaction pathways and to calculate substance concentrations. Equilibrium between gases and liquids (Henry's law).
- Stratospheric ozone - formation and degradation, natural and created catalysts, how ozone holes are formed.
- Tropospheric ozone - photochemical smog, the interaction of nitrogen oxides, ozone, hydrocarbons, and light, primary and secondary pollutants.
- Acidification - how nitrogen oxides and sulphur oxides react into acidifying substances, alkalinity, buffer systems.
- Climate change - greenhouse gases; absorption of heat radiation, the carbonate system, aerosols, GWP (weighting of greenhouse gases).
- Eutrophication - phosphate chemistry, microbiological processes regarding phosphorous and nitrogen, BOD, COD.
- Environmental pollutants - organic environmental pollutants and toxic equivalence, heavy metals, spread and effects.
- Design of experiments - planning experiments so that they yield useful information.
- Handling measured values - error propagation, confidence interval, measurement data analysis, uncertainty assessment.

Reading List
See separate document.

Examination
Assessment is based on an individual written exam.
Attendance is required for laboratory assignments and field trips.
Students must pass a laboratory safety test before they are allowed to participate in laboratory sessions.

If students have a decision from Karlstad University entitling them to special pedagogical 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 Fail (U), Pass (3), Some Distinction (4), or Distinction (5) is awarded in the examination of the course.
One of the grades Fail (U), Pass (3), Some Distinction (4), or Distinction (5) is awarded in the examination of the written exam.
One of the grades Pass (G) and Fail (U) is awarded in the examination of the laboratory component.

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.

Students are required to meet the cost of field trips.