MJ1530 Physics, Chemistry, Energy and the Environment 15.0 credits

Fysik, Kemi, Energi och Miljö

This is a translation of the Swedish, legally binding, course syllabus.

If the course is discontinued, students may request to be examined during the following two academic years

Establishment

Course syllabus for MJ1530 valid from Autumn 2011

Grading scale

A, B, C, D, E, FX, F

Education cycle

First cycle

Main field of study

Technology

Specific prerequisites

Basic requirements for engineering programmes
Compulsory for year 1 in the Master of Science in Engineering and of Education (CL), no other students are admitted

Language of instruction

The language of instruction is specified in the course offering information in the course catalogue.

Intended learning outcomes

The course provides an introduction to university studies in Chemistry, Physics, and Engineering, with focus towards energy and sustainable development. The aim is to provide a broad background in natural science and technology for further studies and future working careers. After the course the student should be able to

- solve technical problems, which are related to applied electro physics
- follow, and on a higher mark level in detail explain, physical arguments and problems related to the course contents
- estimate size and reasonableness in physical problems
- use and understand restrictions in physical measurements and instruments
- evaluate and present physical measurements in text and in diagrams
- explain physical problems, conditions and restrictions for persons without technical / physical education.

“Physical” in the text above, means that part of physics that is included in the syllabus (se below).

- name and identify chemical compounds based on systematic, inorganic nomenclature and represent chemical compounds with different techniques.
- classify inorganic reactions and predict what products that form from some key reactants, and decide what works as an acid / base, oxidant / reductant, ligand / central atom. Students should also be able to describe coordination complexes, and the concepts of ligand, chelate, and multi-core complexes.
- make relevant observations of chemical reactions and convey them orally and in writing, and write correctly balanced reaction formulas.
- make stoichiometric and thermochemical calculations.
- describe models of atoms, electronic structure and the periodic table.
- describe and apply models for chemical bonding.
- give an overview of the theoretical foundations of chemistry, chemical reactivity, chemical kinetics and chemical equilibrium.
- describe and discuss a designated area in the chemistry around us / in everyday life or modern materials / chemistry of today, development or instrumental analysis of modern chemistry.
- perform simple chemical laboratory work with regard to safety.
- with own words describe the main outlines of the Swedish energy system
- with own words describe the main outlines of and motivations for the Swedish Environmental Objectives, mirroring important environmental problems

- with own wordsdescribe the processes behind the greenhouse effect, based on natural science, and critically analyze how this greenhouse effect is influenced by anthropogenic factors
- with own words describe the definition of Sustainable Development as well as discuss difficulties related to the goal of Sustainable Development
- analyze current and historical developments in the area of energy and environment in relation to Sustainable Development
- work in groups and with nuance discuss and suggest solutions to upcoming problems within the group
- independently and in group seek scientific information, summarize information and present it in a scientific way in an oral presentation and in a written report.

Course contents

The course is divided into three parts

Fundamentals of electric and magnetic fields, Models of atoms, Band model for solids, Radiation especially heat radiation, Light sources, Laser, Laser metrology, Spectroscopy

The second part deals with: Chemical reactions and reaction formulas. Representation of chemical compounds with names, formulas and models. Atomic structure, periodic table, electron configuration, orbitals, models of chemical bonding, Lewis structures and VSEPR model. Chemical reactivity, kinetics, and equilibrium. Stoichiometry. Thermo- chemistry. Application examples. Laboratory safety and chemical hazards. Communicating chemistry.

The third part concerns: the environment and energy, energy systems and sustainable development. Global warming is an important example that will also serve as an introduction for methods on how to approach an environmental problem as well as the engineer's role to handle and find solutions to an environmental problem.

The course includes an academic introduction that includes group dynamics, how to search for scientific information and how to write a scientific report.

Course literature

Will be suggested at the course start

Examination

- INL1 - Assignment Chemistry, 1.0 credits, grading scale: P, F
- LAB1 - Laboratory work Chemistry, 1.0 credits, grading scale: P, F
- PRO1 - Project work Energy and Environment, 2.0 credits, grading scale: P, F
- TEN1 - Examination Physics, 5.0 credits, grading scale: A, B, C, D, E, FX, F
- TEN2 - Examination Chemistry, 3.0 credits, grading scale: A, B, C, D, E, FX, F

- TEN3 - Examination Energy and Environment, 3.0 credits, grading scale: A, B, C, D, E, FX, F

Based on recommendation from KTH's coordinator for disabilities, the examiner will decide how to adapt an examination for students with documented disability.

The examiner may apply another examination format when re-examining individual students.

Ethical approach

- All members of a group are responsible for the group's work.
- In any assessment, every student shall honestly disclose any help received and sources used.
- In an oral assessment, every student shall be able to present and answer questions about the entire assignment and solution.