

Subject module in chemistry

(English version of the legal Danish subject module curriculum)

DATO/REFERENCE

June 20, 2013

JOURNALNUMMER

2012-1220

The regulations of these subject module descriptions are issued pursuant to the Curricula for the Bachelor Study Programmes in Natural Sciences, Hum-Tek, Humanities, and Social Science. The regulations of the Curriculum for the Bachelor Study Programme to which the student has been admitted are applicable unless otherwise clearly stated in the regulations of the subject module descriptions.

Purpose

§ 1. The purpose of the subject module in chemistry is to give students a basic knowledge of and elementary skills in facts and phenomena, methods and theory and their applications in order to enable students, independently and in cooperation with others, to engage in elementary academic activities of research, development, administration, teaching, and other types of dissemination on a chemical foundation.

A further objective of the subject module in chemistry is to qualify students to enter a Master Programme in Chemistry or other related subjects.

(2) The subject module in chemistry is one of two subject modules that form part of the bachelor studies at Roskilde University. The subject module corresponds to 35 ECTS points.

Description of competency

§ 2. The purpose of subject module in chemistry is to give students the following knowledge, skills, and qualifications.

Knowledge:

- Knowledge of fundamental chemical concepts and theories.
- Knowledge of instrument dependent and classic experimental methods.
- Knowledge of safety aspects of laboratory work.
- Knowledge of the properties of selected classes of compounds.
- Knowledge of how to apply chemistry for the solution of a problem.

Skills:

- Skills to identify and apply relevant chemical concepts, theories and methods to a problem.
- Skills to apply relevant experimental and other empirical methods in chemistry.
- Skills to generate and analyse chemical data.
- Skills to include physical quantities in chemical models by using mathematical formalism.
- Skills to apply formal presentations and methods, including algorithms.
- Skills to critically and systematically search chemical literature.
- Skills to read and apply the chemistry literature.
- Skills to make a correct written or oral dissemination using fundamental chemical terms.

Qualifications:

- Qualifications to identify, recognise, describe, define, and analyse, independently and in cooperation with others, problems by means of chemical theories and methods.
- Qualifications to apply an interdisciplinary analysis of problems and to suggest solutions – not only on the basis of chemistry but also on the basis of relevant theories, methods, and perspectives of the other bachelor subject.
- Qualifications to plan and carry out relevant chemical experiments that are in accord with safety regulations.
- Qualifications to use formalized chemical models in problem solving.
- Qualifications to reflect on how chemical knowledge contributes and is challenged by the development of society.
- Qualifications to be able to distinguish and point out relations between basic and applied chemistry.
- Qualifications to consider the innovative potentials of a chemical approach to specific technical and societal problems.
- Qualifications to critically evaluate the application of chemistry in the solutions of practical problems.
- Qualifications to study independently and to be able to cooperate in sharing knowledge and reflections.

Content and structure

§ 3. The subject module corresponds to 35 ECTS points and consists of the following elements:

- Subject module project in chemistry (15 ECTS points).
- Subject module course 1: Chemical thermodynamics and kinetics (5 ECTS points).
- Subject module course 2: Quantum chemistry and spectroscopy (5 ECTS points).
- Subject module course 3: Analytical chemistry of ions (5 ECTS points).
- Subject module course 4: Mixtures and separation (5 ECTS points).

Recommended academic requirements

§ 4. The academic requirements for admission to the subject module are for students to possess knowledge, skills, and qualifications equivalent to the courses “The chemical reaction” and “Organic chemistry” both pertaining to the basic part of the Bachelor Programme in Natural Sciences.

The subject module in chemistry builds on the qualifications acquired during the basic part of the Bachelor Programme in Natural Sciences. Students who do not possess these or equivalent qualifications must expect to study harder in order to avoid prolonged studies.

Description of the elements of the subject module

§ 5.

Title	Subject module project in chemistry.
Type	Project.
Status	Compulsory.
ETCS	15 ECTS points.
Purpose (assessment criteria)	<p>The purpose of the project is for students to acquire:</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Knowledge of chemical concepts, theories, and methods relevant for the chosen problem. - Knowledge of selected chemical subject areas relevant for the chosen problem. - Knowledge of methods and approaches relevant for the chosen problem. - Knowledge of possible perspectives of the problem in relation to society, the theory of science, or the didactics of chemistry. <p>Skills:</p> <ul style="list-style-type: none"> - Skills in applying relevant experimental or other empirical methods. - Skills to use models for analysing data. - Skills to apply relevant mathematical and formal and abstract representations and methods. - Skills to apply relevant IT tools efficiently in the project work. - Skills to carry out a systematic search for scientific literature and skills to use original, scientific literature relevant for the chosen problem. - Skills to disseminate a scientific problem in accordance with academic requirements and standards, orally and in a project report. - Skills to plan and direct a project efficiently.

	<p>Qualifications:</p> <ul style="list-style-type: none"> - Qualifications to, independently and in cooperation with others, recognize, describe, define, and analyse problems by using natural science theories and methods. - Qualifications to identify and combine elements of theories, models, simulations, observations and experiments in relation to the chosen problem. - Qualifications to design and carry out relevant experiments, simulations, or other ways of obtaining empirical data. - Qualifications to work out and critically analyse mathematical or other scientific models. - Qualifications to critically analyse the strength and weaknesses of the applied theories and methods. - Qualifications to reflect on and discuss characteristics of the project and its relation to chemistry and other science subjects. - Qualifications to reflect on and communicate about one's own academic and personal qualifications.
Overall content	<p>The purpose of the project work is to illustrate how to describe and solve/analyse a problem/set of problems by using chemistry and chemical methods.</p> <p>The project work is concluded by the writing of a project report.</p>
Language	Danish or English as agreed with the students attending the project module.
Reading skills	Reading skills in English are required.
Academic requirements	<p>It is recommended that students have passed at least one of the subject module courses before commencing the project module.</p> <p>Students must pass at least one of the other subject module courses, at the latest during the same period of time as the project work.</p>
Examination	<p>The project is made in groups of 2 to 8 students cf. Curriculum for the relevant Bachelor Study Programme. The project is assessed at an oral examination. The examination is 30 minutes, as a maximum, per student including the assessment discussion.</p> <p>The examination is a group examination. The examination is based on the project report and it is a conversation between the students and the examiners. The examinations of the students is based on the entire project report and performed in a way which allows individual assessment.</p> <p>The project report as the basis of the examination means that questions from the examiners can be asked not only to the entire project report but also to the subject area of the entire project module.</p> <p>Each student is assessed individually, and the assessment is a joint assessment of the project report and the oral presentation.</p>
Marking	7 point scale.
Assessment	External.

Subject module course 1	
Title	Chemical thermodynamics and kinetics.
Type	Course.
Status	Compulsory.
ETCS	5 ECTS points
Purpose (assessment criteria)	<p>The purpose of the course is for students to acquire:</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Knowledge of concepts and fundamental regularities of the chemical thermodynamics. - Knowledge of concepts and models in chemical kinetics. - Knowledge of selected physico-chemical properties of pure substances and mixtures - Knowledge of selected physico-chemical methods of determining the properties of pure substances and mixtures. <p>Skills:</p> <ul style="list-style-type: none"> - Skills to apply relevant formal and abstract methods and models of pure substances and mixtures. - Skills to use fundamental regularities in chemical thermodynamics to work out models of properties of pure substances and mixtures/compounds. - Skills to work out relevant rate expressions as models for analysis of kinetic experiments. - Skills to analyse and interpret data from kinetic experiments. <p>Qualifications:</p> <ul style="list-style-type: none"> - Qualifications to analyse a chemical experiment from a thermodynamic perspective. - Qualifications to analyse data from physico-chemical measurements of pure substances and mixtures. - Qualifications to analyse chemical reactions from a kinetic perspective. - Qualifications to analyse, within a limited period of time, an academic problem, to make decisions, and to apply an academic view.
Overall content	Fundamental chemical thermodynamics and kinetics.
Language	Danish or English as agreed with the students attending the course.
Reading skills	Reading skills in English are required.
Academic requirements	None apart from the recommended academic qualifications, cf. §4.
Examination	<p>A 3 hour written individual examination at the university.</p> <p>Support: Notes, textbooks, and calculator.</p>
Marking	7 point scale.
Assessment	External.

Subject module course 2	
Title	Quantum chemistry and spectroscopy.
Type	Course.
Status	Compulsory.
ETCS	5 ECTS points.
Purpose (assessment criteria)	<p>The purpose of the course is for students to acquire:</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Knowledge of fundamental concepts and rules of quantum chemistry. - Knowledge of fundamental quantum chemical models of particular properties and chemical bonds. - Knowledge of the description of molecules on the basis of quantum chemical models. - Knowledge of simple quantum chemical models of molecular spectroscopy. <p>Skills:</p> <ul style="list-style-type: none"> - Skills to use/apply relevant formal and abstract methods and models for the description of chemical compounds at the molecular level. - Skills to apply fundamental rules of quantum chemistry to set up models of properties of chemical compounds at the molecular level. - Skills to apply simple considerations of symmetry in connection with spectroscopic measurements. - Skills to analyse data from spectroscopic measurements of pure substances. <p>Qualifications:</p> <ul style="list-style-type: none"> - Qualifications to apply simple theoretical models for the description of chemical reactivity. - Qualifications to analyse a chemical experiment from a molecular perspective. - Qualifications to analyse, within a limited period of time, an academic problem, to make decisions, and to apply an academic view.
Overall content	Fundamental quantum chemistry and spectroscopy.
Language	Danish or English as agreed with the students attending the course.
Reading skills	Reading skills in English are required.
Academic requirements	None apart from the recommended academic qualifications, cf. §4.
Examination	<p>A 3 hour individual written examination at the university.</p> <p>Support: Notes, text books, calculator.</p>
Marking	7 point scale.
Assessment	External.

Subject module course 3	
Title	The analytical chemistry of ions
Type	Course.
Status	Compulsory.
ETCS	5 ECTS points.
Purpose (assessment criteria)	<p>The purpose of the course is for students to acquire</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Knowledge of the classes of substance characterized by ions. - Knowledge of typical chemical characteristics of ions and salts. - Knowledge of qualitative methods for the detection of specific ions. - Knowledge of quantitative analyses of ions. - Knowledge of security aspects of handling commonly used chemicals, and simple and instrument dependent laboratory methods. <p>Skills:</p> <ul style="list-style-type: none"> - Skills to correctly follow an instruction for a simple chemical experiment. - Skills to observe the results of simple experiments. - Skills to interpret the observed results of simple experiments. - Skills to apply simple laboratory equipment in a way which is correct and according to safety regulations. - Skills to apply certain instrument dependent methods of analysis. - Skills to obtain reproducible results of chemical experiments and procedures in chemical analysis. - Skills to analyse and interpret obtained data in their context. <p>Qualifications</p> <ul style="list-style-type: none"> - Qualifications to choose and carry through relevant procedures for the identification of ions. - Qualifications to choose and carry through relevant classic and instrument dependent quantitative analyses. - Qualifications to deal with common chemicals.
Overall content	Properties and analytical chemistry of ions and salts.
Language	Danish or English as agreed with the students attending the course.
Language skills	Reading skills in English are required.
Academic requirements	None apart from the recommended academic requirements, cf. §4.
Examination	<p>A 3 hour individual written examination at the university.</p> <p>Support: Notes, text books, and calculator.</p> <p>In order to register for the examination students must have attended the course, and the group reports of the experimental/practical parts of the course, including analysis and interpretation of data, must have been approved.</p>
Marking	Passed/Failed.
Assessment	Internal.

Subject module course 4	
Title	Mixtures and separation.
Type	Course.
Status	Compulsory.
ECTS	5 ECTS points.
Purpose (assessment criteria)	<p>The purpose of the course is for students to acquire</p> <p>Knowledge:</p> <ul style="list-style-type: none"> - Knowledge of concepts and models for the description of pure phases and mixtures. - Knowledge of selected physico-chemical properties of pure phases and mixtures. - Knowledge of methods of determining the properties of selected physico-chemical properties of pure phases and mixtures. - Knowledge of chromatographic methods. - Knowledge of isolation methods. <p>Skills:</p> <ul style="list-style-type: none"> - Skills to correctly follow an instruction for a method of measurement for the determination of selected physico-chemical properties of pure phases and mixtures. - Skills to observe data obtained by applying chromatographic methods. - Skill to obtain reproducible results. - Skills to interpret observed data obtained by applying chromatographic methods. - Skills to apply laboratory equipment in a way which is correct and in accord with safety regulations. - Skills to analyse and interpret observed data for colligative properties of mixtures. <p>Qualifications:</p> <ul style="list-style-type: none"> - Qualifications to apply pure phases and mixtures from a thermodynamic perspective. - Qualifications to choose and carry through relevant instrument dependent, quantitative methods of analysis. - Qualifications to analyse and interpret observed data obtained by applying chromatographic methods.
Overall content	Mixtures, separation and isolation.
Language	Danish or English as agreed with the students attending the course.
Reading skills	Reading skills in English are required.
Academic requirements	Students must have acquired knowledge, skills and qualifications equivalent to subject model course 1 (Chemical thermodynamics and kinetics).
Examination	A 30 minutes oral, individual examination (including assessment discussion) which includes the reports prepared during the course.

	In order to register for the examination students must have attended the course, and the group reports of the experimental/practical parts of the course, including analysis and interpretation of data, must have been approved.
Marking	7 point scale.
Assessment	Internal.

Coming into force and transitional rules

§ 6. The description of the subject modules will come into force on 1st September, 2013.

(2) The description of the subject modules apply to all students admitted to a Bachelor Programme as per 1st September 2012 or later.

Adopted by the Board of Studies for *Chemistry* at a meeting on the 8th October, 2012.

Approved by the Board of Studies for the Bachelor Study Programme in Natural Sciences on the 21st November, 2012.

Approved by the Vice rector on December, 5. 2012