Chemistry

/Kemi/SCB codes: 10499, 10699

1 General description of the research subject

The research subject of Chemistry encompasses the science of chemistry, which is the study of the composition, properties, and transformations of material substances, including the structure, dynamics, and chemical reactions of atoms, molecules and ions, as well as their applications in biology, physics, medicine, life sciences, forensics, nanoscience, materials science, computational science and other fields.

Research in Chemistry aims to apply chemistry models, methods, and approaches across various scientific disciplines, such as analytical chemistry, physical chemistry, materials chemistry, inorganic chemistry, organic chemistry, and biochemistry including areas like protein chemistry and structural biology. Many projects in this field are connected to life sciences and materials sciences. The subject can be interdisciplinary in nature, as understanding and applying chemical systems often require knowledge from several areas of chemistry.

The PhD studies aims to provide strong subject knowledge in chemistry as described above, as well as in the fields of biology, physics, medicine, life sciences, biotechnology, forensic science, nanoscience, materials science, computational science or other areas relevant to the chosen research direction. It also aims to develop strong skills in planning investigations and using modern research equipment and/or computational methods of relevance to the chosen focus of research.

2 Eligibility requirements and selection

The basic eligibility requirements as well as the general principles for selection are specified in the faculty's *Study Handbook for PhD Studies*.

2.1 Specific eligibility requirements

Entitled to be admitted to graduate level education in the research subject of Chemistry is anyone who has completed the course requirements of at least 60 ECTS at master's level related to the subject. These 60 ECTS must include an independent work (degree thesis) with a scope of at least 30 ECTS in an area relevant to the research subject.

3 Degree

PhD studies in Chemistry lead to a Degree of Doctor or a Degree of Licentiate. The latter degree can also serve as a stage in the PhD studies. The Degree of Licentiate comprises 120 ECTS, of which the licentiate thesis corresponds to 90 ECTS, and courses of 30 ECTS of which at least 15 ECTS must be at PhD level. The Degree of Doctor comprises 240 ECTS, of which the doctoral thesis corresponds to 180 ECTS, and courses of 60 ECTS, of which at least 30 ECTS must be at PhD level.

4 Goals and implementation of the PhD studies

The general outcomes and objectives of PhD studies are specified in the introduction to the faculty's *Study Handbook for PhD Studies*, as well as in the Higher Education Ordinance (reprinted in the *Study Handbook*'s appendix A).

Education at PhD level in Chemistry gives the PhD student the prerequisites to fulfill all degree outcomes. The education consists of research and thesis work, courses, participation in seminars, participation in national and international conferences, and where applicable collaboration with industry.

The PhD student must acquire a good ability to critically and independently plan, lead, implement and communicate research and development projects. After the education, the PhD student must be well prepared for efforts in research and development work, both in business and in the academic world.

The education gives the PhD student a broad knowledge and understanding in his/her research area, e.g. by working with the various research projects, by following basic and comprehensive courses, and by participating in one of the multidisciplinary research schools' activities.

The PhD student acquires a deep knowledge and understanding within his/her research subject and in particular in his research focus, among other things, by working with the research projects, by participating in the research group's seminars, presentations and discussions, and by actively participating in in-depth courses in his/her research area.

The PhD student develops familiarity with scientific methodology through his/her own research in the research group and in collaboration with other research groups within and outside Sweden, and by completing a compulsory course in research methodology.

PhD students in the subject of Chemistry acquire skills and abilities by

- independently plan, organize and carry out research work
- participate in the research group's seminars, presentations and discussions, and in doing so regularly report achieved results, present plans for further work and critically discuss the research work

- during the study period conduct a number of seminars, including for the PhD students a half-time seminar where the results achieved so far and plans for the further thesis work are presented
- participate in relevant national and international conferences and there present research results orally and/or as posters and participate in scientific discussions
- initially under the guidance of more experienced researchers and eventually independently lead the work of formulating research results in research reports and scientific articles
- critically analyze and review other produced reports and articles
- participate in activities such as one of the multidisciplinary research schools or other activities

Valuation skills and attitudes are developed within the research subject Chemistry, e.g. by the PhD student

- follows a compulsory course in research ethics
- participates in seminars and conferences within their subject together with their research group and with collaboration partners
- trains in critically and constructively reviewing other people's results, reports and articles, and at the same time trains in absorbing critical and constructive criticism.

The doctoral students in the postgraduate subject Chemistry show intellectual independence by, among other things, write a thesis. Most often this is done as a summary thesis. It is also possible to write a monograph thesis.

The education provides the PhD student with an in-depth insight into the possibility of science to contribute to sustainable social development. This is achieved by the faculty common course requirements, as well as through participation in ongoing discussions, such as research seminars, and reflecting on the sustainability aspects of their own research work.

4.1 Thesis

The overall rules regarding the format, submission and grading of a thesis can be found in the faculty's *Study Handbook for PhD Studies*.

The topic for the thesis is chosen in consultation with the supervisor. For the licentiate degree, the student writes a scientific thesis which is defended at a public seminar. For the doctoral degree, the student writes a scientific thesis, which is defended at a public defence. The thesis should have been fully or partially subjected to international assessment.

A doctoral thesis can be a monograph or a summary thesis. A synthesis thesis for a doctoral degree usually consists of 4-6 articles and a summary, where at least two articles have been accepted for publication in established scientific journals or books and also the remaining included articles are deemed to meet reasonable requirements to be accepted for publication. A monograph must maintain a correspondingly high scientific level.

A licentiate thesis can consist of a monograph or a summary thesis. A summary thesis for a licentiate degree usually consists of 2-3 articles and a summary, where at least one article has been accepted for publication in an established scientific journal or book and the remaining included articles are also deemed to meet reasonable requirements to be accepted for publication. A monograph must maintain a correspondingly high scientific level.

For both types of theses, the research may have been carried out as a team effort, but the student's share of the research work must involve an independent contribution and is particularly reported in the introduction to the thesis.

4.2 Individual study plan

An individual study plan will be formulated for each PhD student. The detailed planning of courses and other components will be conducted in consultation with the supervisor and documented in the individual study plan (see *Study Handbook for PhD Studies*, section 5.3). The study plan should be established within one month after admission to PhD studies, and it should be revised at least once a year.

4.3 Supervision

The general regulations for supervision can be found in the *Study Handbook for PhD Studies*, section 4, and in the faculty's policy for supervision of PhD studies.

4.4 Courses

4.4.1 Faculty course requirements

Scientific theory, methodology, ethics, gender equality and sustainability
All PhD students admitted should complete mandatory courses as decided by the faculty in scientific theory, methodology, ethics, gender equality and sustainability, or be deemed to have equivalent competencies, in order to receive a degree.

Pedagogic studies
All PhD students who teach should complete a basic course in pedagogy. At least 3 ECTS from this course should be included in the PhD studies, and any remaining credits should be counted as departmental duties (see *Study Handbook for PhD Studies*, section 5.5).

4.4.2 Subject related courses

Subject-related courses
For all PhD students, the course Perspectives on interdisciplinary chemistry, 6 ECTS, is compulsory. A half-time seminar is mandatory for PhD students, as is an introductory seminar where the PhD student presents early research plans.

Courses within the research subject
The PhD courses are adapted to the student's background and research subject. Courses in the area must comprise at least 38 ECTS for a PhD degree and 15 ECTS for a licentiate degree. The research subject courses are determined individually for each PhD student in the individual study plan. It is also possible for the PhD student to follow courses that broaden the subject.

Courses outside the subject area
In addition to subject-oriented courses, non-subject courses may also be included, for example courses in presentation technology, leadership, intellectual property law, project management, entrepreneurship, gender equality, sustainability, media training and scientific publishing.

4.4.3 Accreditation

Accreditation of course credits is regulated by the *Study Handbook for PhD studies*, section 5.6.

4.4.4 Other courses

Also courses, including research subject courses, at other higher education institutions, as well as summer schools, can be included, as well as self-studies in special areas. Also special activities such as for example active participation in symposia, seminars and other research can be planned in the PhD education.

5 Other information

5.1 Transitional provisions

Changes to the general study syllabus do not apply to those who have already been admitted to PhD studies in the research area. A change to the new general study syllabus may however be approved if both the main supervisor and the PhD student agree. In such a case, this should be documented in the individual study plan.

6 Commencement

1. The General Study Syllabus comes into force on 1st of July 2023.