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UMEÅ UNIVERSITET

General syllabus for doctoral studies in Chemistry

with doctoral degree as goal

Scope: 240 higher education credits (ECTS)
Degree: Doctoral degree
Study level: Third-cycle
Established by: General syllabus established by the Faculty of Science and Technology Board on 2025-09-25
Enters into force: 2025-10-01
Responsible body: Faculty of Science and Technology
Specializations: Analytical Chemistry, Biophysical Chemistry, Biogeochemistry, Biochemistry, Chemometrics, Environmental Chemistry, Inorganic Chemistry, Organic Chemistry, Technical Chemistry, and Pharmaceutical Chemistry

This document has been translated from Swedish into English. If the English version differs from the original, the Swedish version takes precedence.

1. Subject description and delimitation

Chemistry is defined here as the scientific field that investigates the properties, composition, and structure of chemical compounds, elements, and mixtures, and how these determine, among other things, function, reactions, transformations, and energy changes in such processes. A central theme in chemistry is the study of phenomena at the molecular level (including atoms, molecules, and macromolecules). The specific focus within chemistry is guided by the specialization subject of the studies, and depending on the types of systems and processes examined, a broad spectrum of experimental, measurement, modeling, and computational methods is used. Chemistry is a fundamental science with interfaces to several other disciplines. It often addresses cross-disciplinary questions from a holistic perspective, focusing on molecular and atomic phenomena.

A Doctor of Philosophy in Chemistry is expected to have acquired a broad understanding of the subject and deep knowledge within their area of specialization, including the ability to conduct research that makes significant contributions to the field.

2. Objectives of the education

2.1 Description of education at the current level

The education is at third-cycle level. The goals for third-cycle education can be found in Chapter 1 of the Higher Education Ordinance 9 a §.

2.2 National goals for the degree

The national goals for the degree can be found in the Higher Education Ordinance, Appendix 2, and can also be found at the end of this document.

The objectives for the doctoral degree in chemistry are defined in the Higher Education Ordinance, Chapter 6, Sections 4–5, where the terms *research area* and *limited area of this research field* refer to chemistry (as defined above) and the doctoral student's specialization, respectively. These

national objectives are complemented with perspectives on gender equality and equal opportunities, integrated into the program's content and design to provide insight into how traditional structures maintaining inequality can be counteracted.
A sustainability perspective is also integrated, focusing on the potential and limitations of science in contributing to sustainable societal development; particularly concerning global goals such as quality education, health and well-being, and resource and environmental issues.

3. Entry requirements and prerequisites

To be admitted to doctoral education, the applicant must meet both general and specific entry requirements and be deemed to have the overall ability required to benefit from the education (Higher Education Ordinance, Chapter 7, Section 35).

General entry requirements

To fulfil the general entry requirements, the applicant must have qualifications equivalent to either a completed degree at advanced level (second-cycle), or completed course requirements of at least 240 ECTS, including at least 60 ECTS at advanced level, or has otherwise acquired essentially equivalent knowledge within or outside Sweden. The faculty board may, in the case of a specific applicant, consent to an exemption from the general entry requirements if there are special reasons to do so. (Higher Education Ordinance, Chapter 7, Section 39)

Specific entry requirements

To meet the specific entry requirements for doctoral education in chemistry, the applicant must have completed higher education studies comprising at least 90 credits in chemistry or other subjects deemed directly relevant to the intended specialization. Of these, at least 15 credits at the advanced level must be within the specialization or equivalent.

The requirements for prior knowledge as described above are also considered to be met by those who have otherwise acquired essentially equivalent knowledge.

4. Selection

Selection among applicants who meet the entry requirements will be made with consideration of their ability to benefit from doctoral education, and is based on the following assessment criteria:

- personal suitability
- previous study results and
- other merits

However, applicants must not be given preference over other applicants in the selection process solely based on the assessment that the applicant can receive accreditation for previous education or professional activities. (Higher Education Ordinance, Chapter 7, Section 41)

Decisions regarding admissions to studies at doctoral level concluding in a doctoral degree are made in accordance with Umeå University's delegation of authority.

5. Content and structure

5.1 General

An individual study plan is to be established for each doctoral student, which shall give details of financing, supervision, courses, thesis-related work, etc. For a doctoral degree, the studies shall entail 240 higher education credits (ECTS). A doctoral student can, if desired, pursue a licentiate degree as an intermediate goal.

Doctoral education leading to a doctoral degree corresponds to four years of full-time study and consists of a course component of 40-90 credits and an academic thesis of 150-200 credits.

5.2 Content

The programme consists of coursework and thesis work. The annual review of the doctoral student's individual study plan ensures an appropriate selection of courses and other activities to achieve the national goals for doctoral education.

The character of the education is highly international. Doctoral students participate in international collaborations and are expected to present their research results in international contexts.

5.2.1 Courses

Doctoral education in chemistry includes 40–90 credits of coursework. It includes mandatory courses common to all doctoral students in chemistry and individually selected courses based on each student's needs. The mandatory courses develop generic skills, provide insight into the subject and its scientific methodology at large, and address gender-equality and equal-opportunity issues as an integrated component. Depending on the specialization and the doctoral student's prior knowledge, the admission decision shall specify additional compulsory course requirements if this is deemed necessary to ensure that the doctoral student attains a good general understanding of the subject as well as deep knowledge in their area of specialization. The following courses are mandatory for all doctoral students with a doctoral degree as the final goal:

Mandatory courses developing general competence:

- Introduction to Doctoral Studies at the Faculty of Science and Technology, 1 credit
- Writing Science, 5 credits
- Oral Presentation, 1 credit
- Science, Ethics, and Society, 4 credits
- Seminar series in chemistry, 8 credits
- Introductory teaching course for doctoral students, 1 credit

Courses providing general competence in chemistry and its research methodology:

In doctoral education in chemistry, at least 20 credits of courses within the subject chemistry must be included, of which at least 10 credits must be within the specialization.

Additional mandatory course requirements for the individual doctoral student may be added if necessary and are specified in the admission decision.

Elective courses:
The remaining part of the course requirement is fulfilled by taking elective broadening and specialization courses within the subject, as well as courses that provide additional generic skills. Courses are selected by the doctoral student in consultation with the supervisor and should be highly tailored to the student's area of study.

5.2.2 Doctoral thesis

The doctoral thesis shall comprise at least 150 credits and either take the form of a coherent, unified scientific work (monograph thesis) or a compilation of scientific papers with an introduction, summary, and discussion of these papers (compilation thesis), which must also include a description of the author's contribution to each individual paper. The thesis must also contain a popular science summary intended for readers outside academia.
The doctoral thesis shall be defended orally at a public disputation and is assessed with one of the grades Pass or Fail. In grading, consideration is given to both the content of the thesis and the oral defense.

6. Examination

A doctoral degree is awarded upon completion of doctoral studies equivalent to 240 higher education credits, provided that the applicant has received the grade *Pass* in all mandatory parts. In particular, this includes the public defense of the doctoral thesis and its approval by the grading committee. Degree certificates are issued following application to Student Services/Examina.

7. Other instructions

The provisions that apply in respect of doctoral studies can be found in:

- The Higher Education Ordinance (HEO): Chapter 5 (employment as a doctoral student), Chapter 6 (the education), and Chapter 7 (admission to education), Appendix 2 (Degree Ordinance).
- Admission regulations for doctoral education at Umeå University.
- Local degree ordinance at Umeå University.
- Rules for doctoral education at Umeå University.
- Handbook for doctoral studies at the Faculty of Science and Technology at Umeå University.

National Goals for the Doctoral Degree

(Higher Education Ordinance, Chapter 6, Sections 4 and 5)

Knowledge and understanding

For the doctoral degree, the doctoral student shall

- demonstrate broad knowledge and systematic understanding of the research field as well as advanced and up-to-date specialized knowledge in a limited area of this field, and
- demonstrate familiarity with research methodology in general and the methods of the specific field of research in particular.

Competence and skills

For the doctoral degree, the doctoral student shall

- demonstrate the capacity for scholarly analysis and synthesis as well to review and assess new and complex phenomena, issues, and situations autonomously and critically
- demonstrate the ability to identify and formulate issues with scholarly precision, critically, autonomously, and creatively, and to plan and use appropriate methods to undertake research and other qualified tasks within predetermined time frames, and to review and evaluate such work
- demonstrate through a dissertation the ability to make significant contribution to the formation of knowledge through his or her own research
- demonstrate the ability in both national and international contexts to present and discuss research and research findings authoritatively in speech and writing and in dialogue with the academic community and in society in general
- demonstrate the ability to identify the need for further knowledge and
- demonstrate the capacity to contribute to social development and support the learning of others, both through research and education, and in some other qualified professional capacity.

Judgement and approach

For the doctoral degree, the doctoral student shall

- demonstrate intellectual autonomy and disciplinary rectitude as well as the ability to make assessments of research ethics, and
- demonstrate specialized insight into the possibilities and limitations of research, its role in society, and the responsibility of the individual for how this is used.