

Master degree programme Chemistry

Appendices to the Teaching and Examination Regulations

Appendix I Teaching outcomes of the degree programme (art. 1.3)

The objectives of the master's degree programme Chemistry are:

- to prepare students for an independent professional career; in this context this means being able to carry out fundamental or applied scientific research, as well as applying state of the art scientific knowledge in a wide variety of new practical situations,
- to make students develop skills, knowledge and insight in a specialization area of the field of study, with a focus on insight in and approach to scientific problems,
- to make students develop the ability to clearly and concisely communicate the acquired knowledge to others.

The objectives of the programme result in the following learning outcomes

G. General academic skills for the master's degree programme Chemistry

The graduate

1. is able to keep up with and make use of professional literature in relevant subfields,
2. is able to make himself/herself familiar with a subfield of the own discipline within a reasonable time span,
3. is able to formulate a research plan based on a global problem description in a subfield of the own discipline,
4. is able to analyze, interpret using state of the art information, and draw conclusions from research results,
5. is able to operate effectively in a position in which knowledge and research skills within the field of the own discipline are required,
6. is able to perform in a multidisciplinary team, transfer knowledge to others, give oral presentations, write a report or internationally accessible scientific article, and take part in a scientific discussion,
7. is able to design, conduct and evaluate experiments and the necessary checks and balances independently,
8. is able to relate his/her own results and conclusions to results already available in the literature,
9. has sufficient understanding of the role of the own discipline in society to come to a well-considered choice and practice of profession,
10. has an understanding of the role of the own discipline in a sustainable society.

CH. Specific academic knowledge and skills for the master's degree programme Chemistry.

The graduate

1. has advanced knowledge of aspects of one of the following fields of knowledge:
 - Advanced Materials: synthesis, characterization and properties of materials; the relation between chemical and physical properties of materials on the one hand and the nature of the chemical bonding, and molecular and crystal symmetry on the other hand.
 - Catalysis and Green Chemistry: reactions and interactions of molecules and the application of this insight in synthetic chemistry and catalysis as well as knowledge about sustainable chemistry.
 - Chemical Biology: behavior and design of biochemical systems and their functional properties. Synthetic biology as well as protein engineering.
2. is able to judge whether the properties of created products and possible side or waste products can result in undesired side effects in the short or long term,
3. is able to work at academic level on a research problem in an area of chemistry, which is not his/her own main field of study,
4. (M-variant) is prepared for a professional career in management and policy.

Appendix II Specializations of degree programme (art. 2.2)

The degree programme has the following tracks:

- Advanced Materials
- Catalysis and Green Chemistry
- Chemical Biology
- Honours traject Chemical Biology
- Science, Business and Policy
- Within the degree programme qualified students can follow the Erasmus Mundus programme Theoretical Chemistry and Computational Modelling (TCCM). For this programme the Erasmus Mundus TCCM regulations, as laid down in the consortium agreement of the programme, the student agreement and the SGA agreement with the EACEA, apply.

Appendix III Content of degree programme (art. 2.3)

The programme comprises 120 ECTS; of which it comprises 60 ECTS in courses, a research project of 45 ECTS and a second research project or internship of 15 ECTS.

Advanced Materials track

Module	ECTS	Assessment	Practical
Reaction Mechanisms	5	Written exam	
Structure Determination with Spectroscopic Methods	5	Written exam	
Colloquium	5	Report, presentation	x
Final Exam	5	Oral exam	
Cross-disciplinary Materials Science	5	Report, presentation	
Structure at Macro, Micro and Nano Scale	5	Written exam, report/assignment	
Functional Properties	5	Written exam	
Characterisation of Materials	5	Written exam, practical assignment	x
Optional courses in Chemistry	20	See appendix IV	See app. D
Research Project	45	Assessment of performance, report, presentation	x
Second research project or traineeship	15	Assessment of performance, report, presentation	x

Catalysis and Green Chemistry track

Module	ECTS	Assessment	Practical
Reaction Mechanisms	5	Written exam	
Structure Determination with Spectroscopic Methods	5	Written exam	
Colloquium	5	report, presentation	x
Final Exam	5	Oral exam	
Green Chemistry and Biocatalysis	5	Written exam, presentations, report	x
Chemical Catalysis	5	Written exam	
Sustainability for Engineers	5	Assignments, report, presentation	x
Organic Synthesis: Methods and Strategy 1	5	Written exam	
Optional courses in Chemistry	20	See appendix IV	See app. D
Research Project	45	Assessment of performance, report, presentation	x
Second research project or traineeship	15	Assessment of performance, report, presentation	x

Chemical Biology track

Module	ECTS	Assessment	Practical
Reaction Mechanisms	5	Written exam	
Structure Determination with Spectroscopic Methods	5	Written exam	
Colloquium	5	report, presentation	x
Final Exam	5	Oral exam	
Advances in Chemical Biology	5	Written exam, presentation	
Synthetic Biology & Systems Chemistry	5	Oral exam, presentation	
Advanced Protein Crystallography	5	Written exam	
Protein and Enzyme Engineering	5	Presentation	x

Optional courses in Chemistry	20	See appendix IV	See app. D
Research Project	45	Assessment of performance, report, presentation	x
Second research project or traineeship	15	Assessment of performance, report, presentation	x

Honours traject Chemical Biology

Module	ECTS	Assessment	Practical
Reaction Mechanisms	5	Written exam	
Structure Determination with Spectroscopic Methods	5	Written exam	
Colloquium	5	report, presentation	x
Final Exam	5	Oral exam	
Advances in Chemical Biology	5	Written exam, presentation	
Protein and Enzyme Engineering	5	Presentation, practical, computer practical, report, discussion	x
Honours traject modules, offered by the University of Groningen, University of Leiden, the Technical University of Eindhoven and the Radboud University (each one module of 3 ECTS).	12	Depending on the module offered and assessed by the other universities.	
Optional courses in Chemistry	20	See appendix IV	See app. D
Research Project	45	Assessment of performance, report, presentation	x
Second research project or traineeship	15	Assessment of performance, report, presentation	x

Science, Business and Policy track

Module	ECTS	Assessment	Practical
Reaction Mechanisms	5	Written exam	
Structure Determination with Spectroscopic Methods	5	Written exam	x
Colloquium	5	Report, presentation	x
Final Exam	5	oral exam	
Modules in Chemistry to be determined on individual basis	10	As indicated for the corresponding module	As indicated for the corresponding module
Research Project in Chemistry	30	Assessment of performance, report, presentation	x
Course Science, Business and Policy	20	Assignment, exam, attendance	x
Internship Science, Business and Policy	40	Assessment of performance, reports, attendance	x

Erasmus Mundus programme Theoretical Chemistry and Computational Modelling (TCCM)

The first year of the programme is arranged locally at the home university of the student, and must comply with the Erasmus Mundus TCCM regulations. In the first year the student must attend courses and pass related exams for 60 ECTS credits. The first year for those students whose home university is the University of Groningen is as follows:

Module	ECTS	Assessment	Practical
Reaction Mechanisms	5	Written exam	
Structure Determination with Spectroscopic Methods	5	Written exam	
Colloquium	5	Report, presentation	x
Final Exam	5	oral exam	
Molecular Quantum Mechanics 1	5	Written exam	
Molecular Quantum Mechanics 2	5	Written exam	
Selected topics in Theoretical Chemistry	5	Written exam	
Molecular Dynamics	5	Practical assignments, reports, presentation, written exam	x
Electives or levelling courses	20	See appendix IV	See appendix IV

The second year of the programme is divided into two modules:

International Intensive Course (24 ECTS): a 4-week international intensive course and 10 weeks of tutorial-related home work.

Master Thesis (36 ECTS): devoted to research activity associated with a co-tutored work thesis, part of which (a minimum of 18 ECTS) is to be developed abroad, in a laboratory of a partner University.

Appendix IV Optional modules (art. 2.4)

The elective courses are specializing and can be selected from the entire master degree program in Chemistry. In order to provide a guideline for the student that wants to specialize in a particular field, package choices have been defined (vide infra). The student can request the board of examiners to be allowed to select a particular course outside the master in Chemistry programme. Students are allowed to add 5 EC from the electives to their internship.

Optional modules in Physical and Theoretical Chemistry

Module	ECTS	Assessment	Practical
Computational Quantum Chemistry	5	Written exam, report	x
Molecular Dynamics	5	Practical assignments, reports, presentation, written exam	x
Physical Methods for Chemical Analysis	5	Written exam	
Selected topics in Theoretical Chemistry	5	Written exam	
Molecular Quantum Mechanics 1	5	Written exam	
Molecular Quantum Mechanics 2	5	Written exam	

Optional modules in Molecular Chemistry, Synthetic Organic Chemistry

Module	ECTS	Assessment	Practical
Organic Synthesis: Methods and Strategy 2	5	Written exam	
Organometallic Chemistry	5	Written exam, report	
Stereochemistry	5	Report	x

Optional modules in Molecular Chemistry, Physical Organic Chemistry

Module	ECTS	Assessment	Practical
Computational Quantum Chemistry	5	Written exam, report	x
Physical Methods for Chemical Analysis	5	Written exam	
Supramolecular Chemistry and Functional Systems	5	Written exam	

Optional modules in Polymer Science

Module	ECTS	Assessment	Practical
Polymer Science Lab 3	5	Report, oral exam, practical assignment	x
Polymer Physics	5	Written exam, report, presentation	x
Nanochemistry	5	Written exam	

Optional modules in Erasmus Mundus programme Theoretical Chemistry and Computational Modelling (TCCM)

In the first year of the programme, 10 ects out of the total of 60 ECTS credits may be required to levelling courses for those students who, on the advice of their local tutor and after approval of the Board of Examiners, need to upgrade their level in at most two of the following fields Mathematics, Physics or Chemistry.

Elective courses complete the total number of ects of the first year of the programme to 60 ects. Students whose home university is the University of Groningen can take these courses in the field of nanoscience, solid state science, astro- or atmospheric chemistry, bio-/organic/inorganic/polymer chemistry, reactivity, programming and numerical methods or applied mathematics.

Appendix V Entry requirements (art. 3.2)

For students admitted to the programme there are no entry requirements for the individual modules.

Appendix VI Admission to the degree programme and different specializations (art. 4.1.1 and 4.2)

Holders of the following Bachelor's degrees from the University of Groningen are considered to have sufficient knowledge and skills and will be admitted to the Master's degree programme in Chemistry on that basis:

- BSc Scheikunde
- BSc Biologie/Life Science & Technology – major Moleculaire Levenswetenschappen provided that the elective Practicum Chemie voor Moleculaire Levenswetenschappen is part of the student's bachelor programme