Master degree programme Chemistry
Appendix I

Learning outcomes of the master's degree programme Chemistry (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

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

The graduate

A1. is able to keep up with and make use of professional literature in relevant subfields,
A2. is able to make himself/herself familiar with a subfield of the own discipline within a reasonable time span,
A3. is able to formulate a research plan based on a problem description in a subfield of the own discipline,
A4. is able to analyze, interpret using state of the art information, and draw conclusions from research results,
A5. is able to operate effectively in a position in which knowledge and research skills within the field of the own discipline are required,
A6. 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,
A7. is able to design, conduct and evaluate experiments and the necessary checks and balances independently,
A8. is able to relate his/her own results and conclusions to results already available in the literature,
A9. has sufficient understanding of the role of the own discipline in society to come to a well-considered choice and practice of profession,
A10. has an understanding of the role of the own discipline in a sustainable society.

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

The graduate 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.

The graduate:

B1. 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,

B2. 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,

B3. (Science, business and policy-specialization) 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 (compulsory courses, track courses and electives) , a research project of 45 ECTS and a second research project of 15 or 20 ECTS.

Compulsory course units for Master Chemistry:

Practicals are defined as labpracticals

Course unit	ECTS	Practical	Entry requirements
Reaction Mechanisms	5		
Structure Determination with Spectroscopic Methods	5		
Colloquium	5		
Final Exam	5		
Research Project	45	x	
Second research project	15 or 20	x	

The second research project is 15 ECTS and could be extended before the start of the project to 20 ECTS after approval of the Board of Examiners. The second research project should be performed in a different research group in comparison to the master research project.

Advanced Materials track

Course unit	ECTS	Practical	Entry requirements
Cross-disciplinary Materials Science	5		
Structure at Macro, Micro and Nano Scale	5		
Functional Properties	5		
Characterisation of Materials	5		

Electives in Chemistry	20	See course units	

Catalysis and Green Chemistry track

Course unit	ECTS	Practical	Entry requirements
Green Chemistry and Biocatalysis	5		
Chemical Catalysis	5		
Sustainability for Engineers	5		
Organic Synthesis: Methods and Strategy 1	5		
Electives in Chemistry	20	See course units	

Chemical Biology track

Course unit	ECTS	Practical	Entry requirements
Advances in Chemical Biology	5		
Synthetic Biology & Systems Chemistry	5		
Advanced Protein Crystallography	5		
Protein and Enzyme Engineering	5	x	
Electives in Chemistry	20	See course units	

Honours traject Chemical Biology

Course unit	ECTS	Practical	Entry requirements
Advances in Chemical Biology	5		
Protein and Enzyme Engineering	5	x	
Honours traject courses, to follow at University of Groningen, University of Leiden, the Technical University of Eindhoven and the Radboud University (each one module of 3 ECTS).	12		
Electives in Chemistry	20	See course units	

The track 'Science business and policy' and the TCCM programme have their own specific compulsory programme:

Science, Business and Policy track

Course unit	ECTS	Practical	Entry requirements
Reaction Mechanisms	5		
Structure Determination with Spectroscopic Methods	5	-	
Colloquium	5		
Final Exam	5		
Electives in Chemistry	10	See course unit	
Research Project in Chemistry	30	x	
Course Science and Policy	10		
Course Science and Business	10		
Internship Business and Policy	40	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. The first year for those students whose home university is the University of Groningen is as follows:

Course unit	ECTS	Practical	Entry requirements
Reaction Mechanisms	5		
Structure Determination with Spectroscopic Methods	5		
Colloquium	5		
Final Exam	5		
Molecular Quantum Mechanics 1	5		
Molecular Quantum Mechanics 2	5		Molecular Quantum Mechanics 1
Selected topics in Theoretical Chemistry	5		
Molecular Dynamics	5	x	
Electives or levelling courses	20	See course units	

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 Electives (art. 2.4)

The elective courses are specializing and can be selected from the entire master degree programme 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 ECTS from the electives to their second research project.

Course unit	ECTS	Practical	Entry requirements
Computational Quantum Chemistry	5	x	
Molecular Dynamics	5	x	
Physical Methods for Chemical Analysis	5	x	
Selected topics in Theoretical Chemistry	5		
Molecular Quantum Mechanics 1	5		
Molecular Quantum Mechanics 2	5		Molecular Quantum Mechanics 1
Organic Synthesis: Methods and Strategy 2	5		
Organometallic Chemistry	5		
Stereochemistry	5	x	
Computational Quantum Chemistry	5	x	
Biomaterials 2	5		
Supramolecular Chemistry	5		
Polymer Science Lab 3	5	x	
Polymer Physics	5	x	

Design of industrial catalysts	5	x	
Nanochemistry	5		
Science communication skills	5		
Science in the media	5		
Popular science writing	5		

A student is allowed to follow one of the last three Education-Communication electives above in the master.

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 and compulsory order of examinations (art. 3.4)

See table.

Appendix VI Admission to the degree programme and different specializations (art. 5.1.1 + art. 5.2)

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.

Appendix VII

Application deadlines for admission (art. 5.6.1)

Deadline of Application	**Non-EU students**	**EU students**
Nanoscience	February 1st 2016	May 1 st 2016
Behavioural and Cognitive Neurosciences	May 1st 2016	May 1st 2016
Biomolecular Sciences (topprogramme)	May 1st 2016	May 1st 2016
Evolutionary Biology (topprogramme)	May 1st 2016	May 1st 2016
Remaining FMNS Masters	May 1st 2016	May 1st 2016

Decision deadlines
(art. 5.6.3)

Deadline of Decision	**Non-EU students**	**EU students**
Nanoscience	June 1st 2016	June 1st 2016
Behavioural and Cognitive Neurosciences	June 1st 2016	June 1st 2016
Biomolecular Sciences (topprogramme)	June 1st 2016	June 1st 2016
Evolutionary Biology (topprogramme)	June 1st 2016	June 1st 2016
Remaining FMNS Masters	November 1st 2016	November 1st 2016