

Appendix Master degree programme Chemistry

Appendix I Learning outcomes of the degree programme (art. 3.1)

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 become familiar with a subfield of their own discipline within a reasonable time span,
- A3. is able to formulate a research plan based on a problem description in a subfield of their own discipline,
- A4. is able to analyze, interpret using state of the art information, and draw conclusions from research data,
- 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 work 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 controls independently,
- A8. is able to relate their own results and conclusions to data already available in the literature,
- A9. has sufficient understanding of the role of their own discipline in society to come to a well-considered choice and practice of their profession,
- A10. has an understanding of the role of their 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 pertinent fields of knowledge through a coherent* program for example:

- Synthesis, characterization and properties of materials; the relation between chemical and physical properties of materials and the nature of the chemical bonding, and molecular structure.
- Reactions and interactions of molecules and the application of this insight in synthetic chemistry and catalysis as well as knowledge of sustainable chemistry.
- Behavior and design of biochemical systems and their functional properties. Synthesis in biology as well as protein engineering.

The graduate:

- B1. is able to judge whether the properties of products prepared and possible side or waste products can result in undesired side effects in the short or long term,
- B2. is able to work at an academic level on a research problem in an area of chemistry, which is not their own main field of study,
- B3. (Science, business and policy-specialization) is prepared for a professional career in management and policy.

*a coherent program is defined as one which leads to specialisation in a pertinent field of chemistry in the opinion of the program director.

Appendix II Tracks/Specializations of the degree programme (art. 3.6)

The degree programme is comprised of the following tracks:

- Research. Recommended specialisations are described in Appendix III in addition to the open program.
- 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. 3.8)

Tracks

The program has 3 tracks:

- Erasmus Mundus programme TCCM track
- Science, Business and Policy track
- Research track

Erasmus Mundus programme Theoretical Chemistry and Computational Modelling track (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 consists the following course units:

Course unit	Code	ECTS	Prac.*	Entry requirements
Reaction Mechanisms	WMCH006-05	5		
Structure Determination with Spectroscopic Methods	WMCH008-05	5		
Intensive Course TCCM	WMCH026-30	30		
Molecular Dynamics	WMBS003-05	5		
Molecular Quantum Mechanics 1	WMCH010-05	5		
Molecular Quantum Mechanics 2	WMCH016-05	5		Molecular Quantum Mechanics 1
Topics in chemistry with Python	WMCH028-05	5		
Scientific Integrity	WMCH007-00	0		
Colloquium	WMCH001-05	5		Research Project TCCM
Final Exam	WMCH002-05	5		Research Project TCCM
Research Project TCCM	WMCH902-30	30	x	Reaction Mechanisms, Structure Determination with Spectroscopic Methods, Scientific Integrity
Electives		20		

* Practicals are defined as laboratory practicals

Science, Business and Policy track

Course unit	Code	ECTS	Prac.	Entry requirements
Reaction Mechanisms	WMCH006-05	5		
Structure Determination with Spectroscopic Methods		5		
Scientific Integrity	WMCH007-00	0		
Colloquium	WMCH001-05	5		Research Project Chemistry
Final Exam	WMCH002-05	5		Research Project Chemistry
Research Project in Chemistry	WMCH904-30	30	x	Scientific Integrity
Introduction Science and Business	WMSE001-10	10		
Introduction Science and Policy	WMSE002-10	10		
Work Placement Business and Policy	WMSE902-40	40	x	Intr. to Science and Business, Intr. to Science and Policy
Electives in Chemistry		10		

Research track

Course unit	Code	ECTS	Prac.	Entry requirements
Reaction Mechanisms	WMCH006-05	5		
Structure Determination with Spectroscopic Methods	WMCH008-05	5		
Scientific Integrity	WMCH007-00	0		
Colloquium	WMCH001-05	5		Master Research Project Chemistry
Final Exam	WMCH002-05	5		Master Research Project Chemistry
Master Research Project	WMCH901-40	40	x	Reaction Mechanisms, Structure Determination with Spectroscopic Methods, Scientific Integrity
Second research project*	WMCH903-20	20/25	x	Master Research Project Chemistry
Specialization courses		20		
Electives		20**		

*The second research project is 20 ECTS and could be extended, before the start of the project, to 25 ECTS (at the expense of an elective course) after approval of the Board of Examiners. The second research project should be performed in a different research group and topic in comparison to the master research project. For the research and education specialization The second research project is replaced by Vakdidactiek 1 (TEM0505) and Masterstage 2 (TEM0315).

** The research and education specialization has 30 EC specialization courses in addition to a second specialisation of 20 EC 10 EC of Electives.

Students of the Research track are recommended to follow one of the specializations listed below.

Students who wish to follow an open program must submit their program for approval including confirmation of the program's coherence and sufficient coverage of the *Eindtermen* of the Masters Chemistry program.

Students who wish to follow an open program must contact the Programme Director within the first 6 months of their MSc registration, to prepare an application for their program which has to be submitted for approval to the Board of Examiners.

The Board of Examiners will grant the request for an open degree programme where the proposed program:

- covers the Learning Outcomes of the Masters Chemistry program sufficiently
- shows a clear overall coherence.

Recommended specializations

<p>Catalysis in Chemistry Chemical Catalysis Advanced Biocatalysis Organic Chemistry: Methods and Strategy 1 Organometallic Chemistry</p>	<p>Advanced Synthesis Stereochemistry Organic Chemistry: Methods and Strategy 1 Organic Chemistry: Methods and Strategy 2 Chemical Catalysis</p>
<p>Synthesis & Chemical Biology Advances in Chemical Biology Synthetic Biology and System Chemistry Organic Chemistry: Methods and Strategy 1 Organic Chemistry: Methods and Strategy 2</p>	<p>Supramolecular Chemistry Supramolecular Chemistry Bioinspired Designer Materials Stereochemistry Organic Chemistry: Methods and Strategy 1</p>
<p>Polymer Chemistry Bioinspired Designer Materials Polymer Physics Polymer Products Physical Chemistry of Polymers: theory and practice</p>	<p>Organometallic Chemistry Organometallic Chemistry Physical Methods in Chemical Analysis Chemical Catalysis Computational modelling in research or MQM 1</p>
<p>Theoretical Chemistry and Modelling Molecular Quantum chemistry 1 Molecular Quantum chemistry 2 Computational modelling in research Topics in Chemistry with Python</p>	<p>Solid State materials and Sustainable energy Structure at Macro, Meso and Nanoscale Functional Properties Physical Methods for Chemical Analysis Sustainable Electric Energy Storage</p>
<p>Chemical Biology Advanced Biocatalysis Synthetic Biology & Systems Chemistry Advances in Chemical Biology Organic Chemistry: Methods and Strategy 1</p>	<p>Protein Biochemistry Molecular Modeling and Analysis in Structural Biology WMBS021-05 Advanced Biocatalysis WMCH027-05 Synthetic Biology and Systems Chemistry WMCH021-05 And one of the following 3 courses: Molecular Dynamics WMBS003-05 Advanced Genetic Engineering WMBS006-05 Next-generation Sequencing Methods and Data Analysis WMBS014-05</p>
<p>Research and Education* Basiscursus (TEM0105) – 5 EC Masterstage 1 (TEM0205) – 5 EC Vakdidactiek 1 (TEM0505) – 5 EC* Masterstage 2 (TEM0315) – 15 EC* * The courses TEM0505 and TEM0315 will substitute the core program course WMCH903-20 Second Research Project</p> <p>Entry requirements for the specialization: - introduction-meeting with Leraarenopleiding - approval by BoE LO in GMW</p> <p>Courses are followed in this order: Basiscursus, Masterstage 1, Vakdidactiek 1, Masterstage 2</p> <p>On completion of the courses in the specialization Research and Education, the student can apply for exemption for those courses by submitting their program to the BoE for the Educative masters (GMW) and after completion of an additional 30 ECTS of courses can complete said masters. The submission of the grades for the final course of both masters programs should be done simultaneously.</p>	

*The Research and Education specialization must be combined with a second MSc chemistry specialization to ensure coherence of the MSc Chemistry (research) program.

Appendix IV Electives

(art. 3.9.1)

Students can request the board of examiners to be allowed to select a particular course outside the master in Chemistry programme.

Course unit	Code	EC	Prac.	Entry requirements
Bio-based Products	WMCE001-05	5		
Biomaterials 2	WMBE001-05	5		
Interfacial Engineering	WMCE003-05	5		
Molecular Dynamics	WMBS003-05	5		
Photochem. and Photoredox catalysis	WMCH032-05	5		
Protein and Enzyme Engineering	WMBS004-05	5	x	
Skills in Science Communication	WMEC006-05	5		
Molecular Modeling and Analysis in Structural Biology (MMB)		5		
Advanced Biocatalysis	WMCH033-05	5		
Bioinspired Designer Materials	WMCH009-05	5	x	
Functional Properties	WMPH051-05	5		
Molecular Quantum Mechanics 1	WMCH010-05	5		
Photovoltaics science and energy	WMCH011-05	5		not open to students who already passed the Solar Cells (CHPHV-08) course
Physical Methods for Chemical Analysis	WMCH012-05	5	x	
Polymer Products	WMCE005-05	5		
Stereochemistry	WMCH013-05	5		
Structure at Macro, Meso, Nano Scale	WMPH020-05	5		
Advances in Chemical Biology	WMCH014-05	5		
Characterisation of Materials	WMPH021-05	5	x	Cannot be taken in combination with Structure at the macro, micro and nanoscale
Chemical Catalysis	WMCH015-05	5		
Design of Industrial Catalysts	WMCE009-05	5		
Molecular Quantum Mechanics 2	WMCH016-05	5		
Organic Synthesis: Methods and Strategy 1	WMCH017-05	5		
Organometallic Chemistry	WMCH018-05	5		
Product Focussed Process Design	WMCE011-05	5		
Topics in Chemistry with Python	WMCH028-05	5		
Supramolecular Chemistry	WMCH020-05	5		
Sustainable Electric Energy Storage	WMCH029-05	5	x	
Synthetic Biology & Systems chemistry	WMCH021-05	5		
Astrochemistry	WMAS018-05	5		
Biophysical Imaging & Manipulation Techn.	WMPH047-05	5	x	
Computational modelling in research	WMCH035-05	5		
Organic Synthesis: Methods and Strategy 2	WMCH024-05	5		
Polymer Physics	WMCH025-05	5	x	
Physical Chemistry of Polymers: theory and practice	WMCH034-05	5	x	

Appendix V Entry requirements and compulsory order of examinations (art. 4.4)

Entry requirements are mentioned in tables appendices III and IV.

Appendix VI Admission to the degree programme (art. 2.1A.1 + art. 2.1B.1)

1. Application Procedure for selective master degree programmes

All candidates have to register in Studielink and upload the following documents before 1 May (start 1 September):

- Copy of ID card or passport
- Proof of English language proficiency
- Curriculum Vitae
- Official transcript of records
- Diploma of relevant Bachelor's degree programme (if not possible, provide reason)
- List of subjects/courses yet to be followed including course descriptions
- For non-UG students: clear description of content/learning objectives of all required courses
- List of extracurricular activities
- Complete Checklist

After candidates have completed their registration in Studielink, applications will be processed in the following way:

For holders of a Dutch BSc diploma:

- School of Science and Engineering compiles the individual selection file
- School of Science and Engineering submits the individual selection file to the Admissions Board of the individual programme

For holders of a non-Dutch BSc diploma:

1. Admissions Office compiles the individual selection file
2. Admissions Office validates individual Bachelor's degree diploma
3. Admissions Office submits the individual selection file to the SSE
4. SSE submits the individual selection file to Admissions Board of the individual programme

2. Selection procedure

In order to select the appropriately suited and motivated students, the Admission Board requires a complete selection file from all candidates. The Admission Board of the individual programmes will review all individual applicants based on their selection file. All candidates that have an appropriate background will be considered admissible and further considered for the selection procedure described below.

At least two members of the Admissions Board score the selection criteria. If the scores on the academic performance, extracurricular activities and/or the motivation deviate 1 point or more, all members of the admissions board will review the application, after which they score a second time. This outcome constitutes the final score. Candidates with a total score of 5 or greater will be admitted to the program.

2.1. Admissibility

The appropriateness of the background level will be assessed by the Board of Admissions and must be of sufficient basis for participation in the MSc Chemistry program. The Board of Admissions considers.

- **Relevance and affiliation/fit** of the bachelor programme followed to the master programme (list of subjects/courses followed and grades obtained; brief description of the content of key subjects/courses demonstrating the knowledge and skill(s) acquired by the student¹).

¹ Key subjects/courses, the nature of the knowledge and relevant skill(s) are defined by the Program director in consultation with the programme committee, and are approved by the Program Board.

- **Dutch BSc Chemistry degree**
Applicants are automatically considered 'admissible' if they hold a BSc Chemistry degree from the University of Groningen, if they have followed successfully the UG chemistry pre-Master program, if they hold a BSc degree in chemistry from the University of Leiden, University of Utrecht, University of Amsterdam, the Free University Amsterdam (VU), or the Radboud University - Nijmegen.
- **University of Groningen BSc LST degree**
Applicants with a BSc LST degree from the University of Groningen are admissible to the MSc Chemistry, when they have completed the below mentioned courses (all required):
 - Electrochemical Technology (WBCE021 -05)
 - Synthesis 2 lab course (WBCH008-05)
 - Physical Chemistry 2 (WBCH015-05)
 - Soft Molecular Materials (WBCH017 -05)
 - Track practical OMIC (WBCH032-05)
 - (Bio)Catalysis (WBCH019-05)
 - Physical Organic and photochemistry (WBCH027 -05)
 - Bachelor Research Project Chemistry (WBCH901 -15)
- **Students with a BSc degree not in the first two categories will be considered on a case by case basis** including a verification of transcript and course content description, with a minimum requirement for a core program (with learning outcomes equivalent to the following courses in the BSc Chemistry program of the UG (6 out of the following 7 courses are required)
 - [Organic Chemistry 1](#)
 - [Organic Chemistry 2](#)
 - [Physical Chemistry 1](#)
 - [Physical Chemistry 2](#)
 - [Spectroscopy](#)
 - [Inorganic Chemistry](#)
 - [Biochemistry and biotechnology](#)

Regular pre-master program

Applicants with a HBO degree from Hanze University of Applied Sciences or equivalent are expected to have followed successfully the following pre-master program:

- Organic Chemistry 2 (5 ECTS, block 1A)
- Calculus (5 ECTS, block 1A)
- Physical Chemistry 2 (5 ECTS, block 1B)
- Solar Cells (5 ECTS, block 1B)
- Biochemistry (5 ECTS, block 2A)
- Physical Organic and Photochemistry (5 ECTS, block 2A)
- Macromolecular Chemistry (5 ECTS, block 2A)
- Spectroscopy (5 ECTS, block 2B)
- Inorganic Chemistry (5 ECTS, block 2B)

Deviations from regular pre-master program

When the applicant has demonstrable knowledge (*e.g.* extracurricular courses at BSc level) of one of the core pre-master courses, an exemption can be granted. This is done in consultation with the program director.

Practical implementation of the admissibility check

The check for MSc Chemistry admissibility is performed by two BoA members per submission round. In case of doubt, the BoA chair reviews the file, and makes a decision, for which advice from the Program Director may be obtained.

The premaster applications are assessed by two BoA members per submission. In case of doubt, the file will be assessed by the BoA chair.

2.2. Selection

1. Weighted average of grades ≥ 7

Dutch degrees: When the weighted average of grades amount to 7 or higher, a fixed amount of 4 points is awarded.

Non-Dutch degrees: Students have to provide their weighted average grade and information about the grading system at their host institution. The Board of Admissions reserves the right to assess this information on a case-by-base basis, and reach a conclusion about the value of the weighted grade, and will award 4 points if the provided information proves a similar grade level. The Board of Admissions may seek advice from international colleagues.

2. Motivation

The applicant is awarded 2 points for each excellent answer, 1 point for each satisfying answer, or 0 points if the answer is not sufficient.

In case a specific motivation is not covered in the predefined list, the BoA members will together discuss the scoring of this answer, and note it in the scoring sheet.

3. Extracurricular activities

Points can be awarded for activities that showcase exceptional involvement, to a maximum of 5 points.

In case a specific activity is not covered in the predefined list, the BoA members will together discuss the scoring of this answer, and note it in the scoring sheet.

Practical implementation of the selection process

1. Two BoA members check the average weighted grades ≥ 7 of the updated grades list, and note this in the Mastersheet.

2. Two BoA members together score all three questions for each applicant. When an answer is not listed, or there is a disagreement on the scoring between the two BoA members, the file is flagged and discussed at the next BoA meeting.

3. Two BoA members assess the extracurricular activities with an exhaustive list of pre-defined activities. When an activity is not on the list, or there is a disagreement on the scoring between the two BoA members, the file is flagged and discussed at the next BoA meeting. The total scores are noted in the Master sheet,

3. Timeline for the application and selection procedure

The application procedure for the start on 1 September 2023 will open on 1 October 2022 and will close on 1 May 2023. In October 2022, the details of the entire application procedure will be published on the *Admission and Application* website for the individual Master's degree programme.

After registration in Studielink, all candidates will receive an email with an overview of the application procedure, the deadlines and instructions on how to proceed.

After candidates have successfully submitted all necessary documents the School of Science and Engineering (for holders of a Dutch BSc diploma,) or the Admissions Office (for holders of a non-Dutch BSc diploma) will send the candidate a confirmation of receipt.

The Board of Admissions will assess and score the applications out of a total of 15 points over the three selection criteria: (i) average weighted grade, (ii) motivation, and (iii) extracurricular activities.

- (i) An average weighted grade for bachelor courses of 7 or greater will earn 4 pts
- (ii) The motivation table is comprised of 3 questions each of which can earn 2 pts
- (iii) Extracurricular activities, contingent on sufficient evidence provided, attract either 0.5 or 1 pt each to a maximum of 5 pts

A minimal score of 5 points is needed for direct admission to the MSc Chemistry.

Admission is always conditional on obtaining a BSc degree or completing the pre-master program before the MSc Chemistry start date.

The motivation table comprises of three questions:

Question	Consider including the following aspects
1. What specific aspects of the Master's programme in Chemistry at the University of Groningen motivated you to apply?	Specific courses and specialisations, research activities/groups, your experience during your BSc degree
2. How has your previous education prepared you for our research-focused Master's degree in Chemistry? Be sure to include how research projects or other relevant experiences contribute to your motivation.	Practical courses, research projects, educational activities tailored towards your preferred track
3. Why do you want to obtain a Master's degree in Chemistry? For example, list any concrete plans you have for after graduation.	Concrete ideas about next position (industry, academia, field), or efforts to arrive at a concrete plan

The Board of Admissions will offer places to candidates who score a total of 5 points or more. Candidates who are not selected can lodge a written appeal against this decision within six weeks of the date of sending, with the Board of Appeal for Examinations, P.O. Box 72, 9700 AB Groningen, the Netherlands.

The admission to the program is only valid for the academic year following the application date.

Students who are offered a place for an academic year have to accept or decline the place before August 31 preceding that academic year. Students who accept the offer need to be enrolled before September 1 of that academic year.

Appendix VII Transitional provisions (art. 7.1)

For cohort 2022-2023 and earlier

Course	May be replaced with	Info
Advanced Protein Crystallography (WMBS008-05)	Any other elective	
Computational Chemistry (WMCH022-05)	Computational modelling in research (WMCH035-05)	Name change
Practical Physical Chemistry of Polymers (WMCH030-05)	Physical Chemistry of Polymers: theory and practice (WMCH034-05)	Name change
Biocatalysis & Green Chemistry (WMCH027-05)	Advanced Biocatalysis (WMCH033-05)	Name change

Appendix VIII Additional Requirements Open degree Programme (art. 3.10)

N/A for chemistry