



**Programme-specific Section of the
Curriculum for the MSc Programme in
Chemistry
at the Faculty of Science, University of Copenhagen
2013 (Rev 2017)**

Contents

1 Title, affiliation and language	2
1.1 Title	2
1.2 Affiliation	2
1.3 Corps of external examiners	2
1.4 Language	2
2 Academic profile	2
2.1 Purpose	2
2.2 General programme profile	3
2.3 General structure of the programme	3
2.4 Career opportunities	3
3 Description of competence profiles	3
3.1 Analytical Chemistry	3
3.2 Inorganic Chemistry	4
3.3 Organic Synthesis	4
3.4 Physical Chemistry	5
4 Admission requirements	5
4.1 Applicants with a Bachelor's degree in Chemistry	5
4.2 Applicants with a Bachelor's degree in Nanoscience	6
4.3 Applicants with a Bachelor's degree in Biochemistry	6
4.4 Other applicants	6
4.5 Language requirements	6
5 Prioritisation of applicants	6
6 Structure of the programme	7
6.1 Analytical Chemistry	7
6.2 Inorganic Chemistry	8
6.3 Organic Synthesis	9
6.4 Physical Chemistry	9
7 Exemptions	10
8 Commencement etc.	10
8.1 Validity	10
8.2 Transfer	10
8.3 Amendment	11
Appendix 1 Tables	12
Appendix 2 Interim arrangements	14
Appendix 3 Description of objectives for the thesis	20

1 Title, affiliation and language

A shared section that applies to all BSc and MSc Programmes at the Faculty of Science is linked to this programme-specific curriculum.

1.1 Title

The MSc Programme in Chemistry with a specialisation in Analytical Chemistry leads to a Master of Science (MSc) in Chemistry with a specialisation in Analytical Chemistry with the Danish title: *Cand.scient. (candidatus/candidata scientiarum) i kemi med en specialisering i analytisk kemi.*

The MSc Programme in Chemistry with a specialisation in Inorganic Chemistry leads to a Master of Science (MSc) in Chemistry with a specialisation in Inorganic Chemistry with the Danish title: *Cand.scient. (candidatus/candidata scientiarum) i kemi med en specialisering i uorganisk kemi.*

The MSc Programme in Chemistry with a specialisation in Organic Synthesis leads to a Master of Science (MSc) in Chemistry with a specialisation in Organic Synthesis with the Danish title: *Cand.scient. (candidatus/candidata scientiarum) i kemi med en specialisering i organisk syntese.*

The MSc Programme in Chemistry with a specialisation in Physical Chemistry leads to a Master of Science (MSc) in Chemistry with a specialisation in Physical Chemistry with the Danish title: *Cand.scient. (candidatus/candidata scientiarum) i kemi med en specialisering i fysisk kemi.*

1.2 Affiliation

The programme is affiliated with the Study Board of Physics, Chemistry and Nanoscience, and the students can both elect, and be elected, to this study board.

1.3 Corps of external examiners

The following corps of external examiners is used for the central parts of the MSc Programme:

- Corps of External Examiners for Chemistry (*kemi*).

1.4 Language

The language of this MSc Programme is English.

2 Academic profile

2.1 Purpose

The objective of the programme is to provide the graduates with an in-depth knowledge within the methods and scientific basis of chemical research. The education is based on the competences the students have acquired during the MSc programme. On completion of the programme, students will be able to perform research at advanced levels; analyse and solve problems within the broad field of chemistry. A master's degree in chemistry equips the graduates with the necessary skills for participating in research groups or for the independent leadership and management of complex work and development situations within the field. The MSc Programme in Chemistry combines formal coursework with independent research guided by an experienced researcher.

2.2 General programme profile

The MSc Programme in Chemistry is a research-based education. The master's programme in chemistry has four specializations: Inorganic Chemistry, Organic Synthesis, Physical Chemistry and Analytical Chemistry. In each of the specializations there are 30 ECTS obligatory courses which will give the graduate in-depth knowledge within the methods and scientific basis of chemical research in the given specialisation. The thesis work is experimental in nature, e.g. it must include experimental work or production of scientific work in terms of the generation of original data and/or original material.

Chemistry is the key subject area of the programme.

2.3 General structure of the programme

The MSc Programme is set at 120 ECTS.

The MSc Programme in Chemistry consists of the following elements:

- Specialisation, 120 ECTS, including the thesis.

The student must choose one of the following specialisations:

- Analytical Chemistry.
- Inorganic Chemistry.
- Organic Synthesis.
- Physical Chemistry.

2.4 Career opportunities

The MSc Programme in Chemistry qualifies students to become professionals within business functions and/or areas such as:

- A PhD programme
- The private sector such as the pharmaceutical companies.
- High-tech companies.
- Consulting companies.
- The public sector.
- Universities.
- Sector Research Institute.
- Prerequisites for further studies, including a PhD program.

3 Description of competence profiles

Students following the MSc Programme acquire the knowledge, skills and competences listed below. Students will also acquire other qualifications through elective subject elements and other study activities.

3.1 Analytical Chemistry

On completion of the programme, an MSc in Chemistry with a specialisation in Analytical Chemistry has acquired the following:

Knowledge about:

- A solid theoretical understanding of sampling theory and sample preparation methods, chromatography and mass spectrometry, spectroscopic methods.
- Practical use of advanced analytical techniques for analysis of gas, liquid and solid samples.
- Quantitative and qualitative chemical analyses.
- Method development, validation and quality control of chemical analyses.

Skills in/to:

- Plan sampling experiments and analyse the results.
- Plan, perform and optimize sample preparation for organic compounds and elements in simple and complex matrices.
- Develop and apply methods for separating chemical compounds in mixtures using chromatography and related methods.
- Perform quantitative and qualitative chemical analysis of organic compounds and elements in gas, liquid and solid matrices.
- Apply solid data processing and evaluation of analytical data.
- Critically assess reported analytical chemistry research including chromatographic, mass spectrometry, and spectroscopy research.
- Select a suitable analytical platform for the separation, detection and quantification of analytes from complex matrices on the basis of chemical properties of the analyte and knowledge of the matrix.

Competences in/to:

- Be able to critically read papers in current international advanced analytical and physical chemistry journals.
- Enable the student to plan and perform: sampling, sample preparation of complex matrices, chemical analysis of simple and complex mixtures of chemicals and elements using modern analytical chromatography, mass spectrometry spectroscopy methods, data analysis for qualitative (identification) and quantitative (concentration measurements) analysis
- Be able to develop, validate and quality assure new analytical methods.

3.2 Inorganic Chemistry

On completion of the programme, an MSc in Chemistry with a specialisation in Inorganic Chemistry has acquired the following:

Knowledge about:

- Inorganic and coordination chemistry.
- Ligand field theory.
- Modern experimental techniques in modern inorganic chemistry.

Skills in/to:

- Describe the most important experimental techniques applied in the characterisation of inorganic compounds.
- Describe and rationalise the most important periodic variation in the chemical and physical properties of the elements and their compounds.

Competences in/to:

- Discuss descriptive inorganic chemistry and important models applied to inorganic chemistry.
- Analyse reactions on the basis of inorganic chemistry.
- Analyse scientific papers with inorganic synthetic problems.

3.3 Organic Synthesis

On completion of the programme, an MSc in Chemistry with a specialisation in Organic Synthesis has acquired the following:

Knowledge about:

- Physical organic chemistry.
- Reaction and synthesis in medicinal chemistry.

- Modern techniques for synthesis of advanced organic and inorganic small-molecules.

Skills in/to:

- Elucidate the reaction mechanisms of the desired and undesired organic reactions.
- Work independently with specialised equipment and advanced synthesis methods
- Work with synthetic chemistry under inert atmosphere, anhydrous condition and extreme condition (temperature, pressure, etc.).
- Work with various type of chromatographic purification methods.

Competences in/to:

- Analyse reactions on the basis of physical organic chemistry.
- Analyse scientific papers and patents dealing with synthetic problems.
- Analyse a complex synthetic problem and plan a feasible synthesis.
- Make educated choice regarding the use the advanced techniques and advanced equipment.
- Make educated choice regarding the execution of the chemical reactions and purification methods.

3.4 Physical Chemistry

On completion of the programme, an MSc in Chemistry with a specialisation in Physical Chemistry has acquired the following:

Knowledge about:

- Computational chemistry.
- Experimental and theoretical advanced physical chemical methods.
- Experimental techniques used in gas, liquid and solid phase spectroscopy.

Skills in/to:

- Establish, evaluate and complete a theoretical investigation of a chemical problem using modern scientific computing software within chemistry.
- Use of basic spectroscopic instruments and to describe different techniques and the theory behind them.

Competences in/to:

- Be able to critically read papers in current international computational and physical chemistry journals.
- Discuss a concrete computation chemistry problem and utilise the most efficient and suitable calculation method to solve the problem.
- Assess the usefulness of different spectroscopic techniques to solve different research questions.

4 Admission requirements

With a Bachelor's degree in Chemistry from the University of Copenhagen the student is granted reserved access and guaranteed a place on the MSc Programme in Chemistry if the student applies before the application deadline during the first application period after the completion of the Bachelor's degree.

4.1 Applicants with a Bachelor's degree in Chemistry

Applicants with a Bachelor's degree in Chemistry from one of the following:

- Danish universities: University of Copenhagen, Aarhus University, University of Southern Denmark.

- Nordic universities: Lund University, Norwegian University of Science and Technology, Stockholm University, University of Iceland, University of Oslo.

are directly academically qualified for admission to the MSc Programme in Chemistry.

4.2 Applicants with a Bachelor's degree in Nanoscience

Applicants with a Bachelor's degree in Nanoscience from the University of Copenhagen are directly academically qualified for admission to the MSc Programme in Chemistry.

4.3 Applicants with a Bachelor's degree in Biochemistry

Applicants with a Bachelor's degree in Biochemistry from the University of Copenhagen may also be admitted if their programme includes the following:

- General and inorganic chemistry.
- Organic chemistry.
- Analytical chemistry.
- Chemical synthesis.
- Physical chemistry.
- Laboratory teaching, including laboratory safety.

The elements must account for a total of min. 60 ECTS.

4.4 Other applicants

The Faculty may also admit applicants who, after an individual academic assessment, are deemed to possess educational qualifications equivalent to those required in Subclauses 4.1-3.

4.5 Language requirements

4.5.1 Applicants from Nordic universities

Applicants with a Bachelor's degree from Nordic universities must as a minimum document English language qualifications comparable to a Danish upper secondary school English B level.

4.5.2 Non-Nordic applicants

Applicants with a non-Nordic Bachelor's degree must be able to document English proficiency corresponding to an IELTS test score of minimum 6.5 or a TOEFL test score of minimum 83 (Internet-based).

5 Prioritisation of applicants

If the number of qualified applicants to the programme exceeds the number of places available, applicants will be prioritised as follows:

- 1) Applicants with a Bachelor's degree in Chemistry from the University of Copenhagen seeking admission by way of direct extension of their completed BSc programme.
- 2) Applicants with a Bachelor's degree in Chemistry from the University of Copenhagen.
- 3) Applicants with a Bachelor's degree in Chemistry.
- 4) Applicants with a Bachelor's degree in Nanoscience from the University of Copenhagen.
- 5) Applicants with a Bachelor's degree in Biochemistry from the University of Copenhagen.
- 6) Other applicants.

If the number of qualified applicants within a category exceeds the number of places available, applicants will be prioritised according to the following criteria (listed below in prioritised order):

- Applicants are then prioritised according to their total number of ECTS within the relevant academic fields and the grades obtained.

6 Structure of the programme

The compulsory subject elements, restricted elective subject elements and the thesis constitute the central parts of the programme (Section 21 of the Ministerial Order on Bachelor and Master's Programmes (Candidatus) at Universities).

Before the beginning of the MSc Programme the student must choose a specialisation.

6.1 Analytical Chemistry

The specialisation is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 30 ECTS.
- Elective subject elements, 30 ECTS.
- Thesis, 60 ECTS.

6.1.1 Compulsory subject elements

All of the following subject elements are to be covered (30 ECTS):

• NPLK13003U	Advanced Analytic Chemistry – Sampling and Sample Preparation	Block 1	7.5 ECTS
• NPLK13004U	Advanced Analytic Chemistry – Chromatography and Mass Spectrometry	Block 2	7.5 ECTS
• NKEK10004U	Advanced Physical Chemistry	Block 3+4	15 ECTS

6.1.2 Elective subject elements

30 ECTS are to be covered as elective subject elements.

All subject elements at MSc level may be included as elective subject elements in the MSc Programme.

BSc subject elements corresponding to 15 ECTS may be included in the MSc Programme.

Projects outside the course scope may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 5 to the shared section of the curriculum.

Projects in practice may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 4 to the shared section of the curriculum.

6.1.3 Thesis

The MSc Programme in Chemistry with a specialisation in Analytical Chemistry includes a thesis corresponding to 60 ECTS, as described in Appendix 2 to the shared curriculum.

The thesis must be written within the academic scope of the programme.

6.1.4 Academic mobility

The curriculum makes it possible to follow subject elements outside the Faculty of Science.

For students admitted in September the academic mobility in the MSc Programme in Chemistry with a specialisation in Analytical Chemistry is placed in block 3+4 of the 1st year.

For students admitted in February the academic mobility in the MSc Programme in Chemistry with a specialisation in Analytical Chemistry is placed in block 3+4 of the 1st year.

Academic mobility requires that the student follows the rules and regulations regarding pre-approval and credit transfer.

In addition the student has the possibility to arrange similar academic mobility in other parts of the programme.

6.2 Inorganic Chemistry

The specialisation is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 30 ECTS.
- Elective subject elements, 30 ECTS.
- Thesis, 60 ECTS.

6.2.1 Compulsory subject elements

All of the following subject elements are to be covered (30 ECTS):

• NKEK15003U	Methods and Modelling in Inorganic Chemistry	Block 1+2	15 ECTS
• NKEK15004U	Descriptive Inorganic Chemistry	Block 3+4	15 ECTS

6.2.2 Elective subject elements

30 ECTS are to be covered as elective subject elements.

All subject elements at MSc level may be included as elective subject elements in the MSc Programme.

BSc subject elements corresponding to 15 ECTS may be included in the MSc Programme.

Projects outside the course scope may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 5 to the shared section of the curriculum.

Projects in practice may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 4 to the shared section of the curriculum.

6.2.3 Thesis

The MSc Programme in Chemistry with a specialisation in Inorganic Chemistry includes a thesis corresponding to 60 ECTS, as described in Appendix 2 to the shared curriculum. The thesis must be written within the academic scope of the programme.

6.2.4 Academic mobility

The curriculum makes it possible to follow subject elements outside the Faculty of Science.

For students admitted in September the academic mobility in the MSc Programme in Chemistry with a specialisation in Inorganic Chemistry is placed in block 1+2 of the 1st year.

For students admitted in February the academic mobility in the MSc Programme in Chemistry with a specialisation in Inorganic Chemistry is placed in block 3-4 of the 1st year.

Academic mobility requires that the student follows the rules and regulations regarding pre-approval and credit transfer.

In addition the student has the possibility to arrange similar academic mobility in other parts of the programme.

6.3 Organic Synthesis

The specialisation is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 30 ECTS.
- Elective courses, 30 ECTS.
- Thesis, 60 ECTS.

6.3.1 Compulsory subject elements

All of the following subject elements are to be covered (30 ECTS):

• NKEK13007U	Reaction and synthesis in Medicinal Chemistry (KemiMed)	Block 1+2	15 ECTS
• NKEK13006U	Organic Chemistry	Block 3+4	15 ECTS

6.3.2 Elective subject elements

30 ECTS are to be covered as elective subject elements.

All subject elements at MSc level may be included as elective subject elements in the MSc Programme.

BSc subject elements corresponding to 15 ECTS may be included in the MSc Programme.

Projects outside the course scope may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 5 to the shared section of the curriculum.

Projects in practice may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 4 to the shared section of the curriculum.

6.3.3 Thesis

The MSc Programme in Chemistry with a specialisation in Organic Chemistry includes a thesis corresponding to 60 ECTS, as described in Appendix 2 to the shared curriculum. The thesis must be written within the academic scope of the programme.

6.3.5 Academic mobility

The curriculum makes it possible to follow subject elements outside the Faculty of Science.

For students admitted in September the academic mobility in the MSc Programme in Chemistry with a specialisation in Organic Chemistry is placed in block 1+2 of the 1st year.

For students admitted in February the academic mobility in the MSc Programme in Chemistry with a specialisation in Organic Chemistry is placed in block 3-4 of the 1st year.

Academic mobility requires that the student follows the rules and regulations regarding pre-approval and credit transfer.

In addition the student has the possibility to arrange similar academic mobility in other parts of the programme.

6.4 Physical Chemistry

The specialisation is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 30 ECTS.
- Elective subject elements, 30 ECTS.
- Thesis, 60 ECTS.

6.4.1 Compulsory subject elements

All of the following subject elements are to be covered (30 ECTS):

• NKEA07016U	Computational Chemistry	Block 1+2	15 ECTS
• NKEK10004U	Advanced Physical Chemistry	Block 3+4	15 ECTS

6.4.2 Elective subject elements

30 ECTS are to be covered as elective subject elements.

All subject elements at MSc level may be included as elective subject elements in the MSc Programme.

BSc subject elements corresponding to 15 ECTS may be included in the MSc Programme.

Projects outside the course scope may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 5 to the shared section of the curriculum.

Projects in practice may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 4 to the shared section of the curriculum.

6.4.4 Thesis

The MSc Programme in Chemistry with a specialisation in Physical Chemistry includes a thesis corresponding to 60 ECTS, as described in Appendix 2 to the shared curriculum. The thesis must be written within the academic scope of the programme.

6.4.5 Academic mobility

The curriculum makes it possible to follow subject elements outside the Faculty of Science.

For students admitted in September the academic mobility for the MSc Programme in Chemistry with a specialisation in Physical Chemistry is placed in block 1+2 of the 1st year.

For students admitted in February the academic mobility for the MSc Programme in Chemistry with a specialisation in Physical Chemistry is placed in block 3+4 of the 1st year.

Academic mobility requires that the student follows the rules and regulations regarding pre-approval and credit transfer.

In addition the student has the possibility to arrange similar academic mobility in other parts of the programme.

7 Exemptions

In exceptional circumstances, the study board may grant exemptions from the rules in the curriculum specified solely by the Faculty of Science.

8 Commencement etc.

8.1 Validity

This subject specific section of the curriculum applies to all students enrolled in the programme – see however Appendix 2.

8.2 Transfer

Students enrolled on previous curricula may be transferred to the new one as per the applicable transfer regulations or according to an individual credit transfer by the study board.

8.3 Amendment

The curriculum may be amended once a year so that any changes come into effect at the beginning of the academic year. Amendments must be proposed by the study board and approved by the Dean.

Notification about amendments that tighten the admission requirements for the programme will be published online at www.science.ku.dk one year before they come into effect.

If amendments are made to this curriculum, an interim arrangement may be added if necessary to allow students to complete their MSc Programme according to the amended curriculum.

Appendix 1 Tables

Tables for students admitted to the programme in September (summer):

Table – Analytical Chemistry

	Block 1	Block 2	Block 3	Block 4
1st year	Elective	Elective	Elective	Elective
	Advanced Analytic Chemistry – Sampling and Sample Preparation	Advanced Analytic Chemistry – Chromatography and Mass Spectrometry	Advanced Physical Chemistry	
2nd year	Thesis			




 Compulsory	 Restricted elective	The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.
 Elective		

Table – Inorganic Chemistry

	Block 1	Block 2	Block 3	Block 4
1st year	Methods and Modelling in Inorganic Chemistry		Descriptive Inorganic Chemistry	
	Elective	Elective	Thesis	
2nd year	Elective	Elective	Thesis	




 Compulsory	 Restricted elective	The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.
 Elective		

Table – Organic Synthesis

	Block 1	Block 2	Block 3	Block 4
1st year	Elective	Elective	Elective	Elective
	Reaction and Synthesis in Medicinal Chemistry		Organic Chemistry	
2nd year	Thesis			







 Compulsory	 Restricted elective	The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.
 Elective		

Table – Physical Chemistry

	Block 1	Block 2	Block 3	Block 4
1st year	Elective	Elective	Elective	Elective
	Computational Chemistry		Advanced Physical Chemistry	
2nd year	Thesis			

 Compulsory	 Restricted elective	The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.
 Elective		

Tables for students admitted to the programme in February (winter):

Table – Analytical Chemistry*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Elective	Elective
	Advanced Physical Chemistry		Advanced Analytic Chemistry – Sampling and Sample Preparation	Advanced Analytic Chemistry-Chromatography and Mass Spectrometry
2nd year	Thesis			

Compulsory
 Restricted elective
 Elective

The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

* This table is only relevant for students who begin the MSc Programme in February (block 3)

Table – Inorganic Chemistry*

	Block 3	Block 4	Block 1	Block 2
1st year	Descriptive Inorganic Chemistry		Methods and Modelling in Inorganic Chemistry	
	Elective	Elective	Thesis	
2nd year	Elective	Elective	Thesis	
	Thesis			

Compulsory
 Restricted elective
 Elective

The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

* This table is only relevant for students who begin the MSc Programme in February (block 3)

Table – Organic Synthesis*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Elective	Elective
	Organic Chemistry		Reaction and Synthesis in Medicinal Chemistry	
2nd year	Thesis			

Compulsory
 Restricted elective
 Elective

The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

* This table is only relevant for students who begin the MSc Programme in February (block 3)

Table – Physical Chemistry*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Elective	Elective
	Advanced Physical Chemistry		Computational Chemistry	
2nd year	Thesis			

Compulsory
 Restricted elective
 Elective

The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

* This table is only relevant for students who begin the MSc Programme in February (block 3)

Appendix 2 Interim arrangements

The Shared Section of the BSc and MSc Curricula for Study Programmes applies to all students.

The interim arrangements below only consist of parts where the current curriculum differs from the rules and regulations that were previously valid. Therefore, if information about relevant rules and regulations are missing, it can be found in the curriculum above.

1 General changes for students admitted in the academic year 2015/16 or 2016/2017

Students admitted to the MSc Programme in the academic year 2015/16 or 2016/17 must finish the programme as listed in the curriculum above with the following exceptions.

1.1 Specialisations

Students admitted in the academic year 2015/16 or 2016/17 are allowed to finish their programme with one of the three specialisations that were outlined in the curriculum.

1.1.1 Green and Sustainable Chemistry

The specialisation is discontinued. It was offered for the last time in the academic year 2016/17.

Structure of the programme

The specialisation is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 30 ECTS.
- Restricted elective subject elements, 15 ECTS.
- Elective subject elements, 15 ECTS.
- Thesis, 60 ECTS.

Table – Green and Sustainable Chemistry

	Block 1	Block 2	Block 3	Block 4
1st year	Elective	Elective	Elective	Elective
	Advanced Photochemistry	Atmospheric Environmental chemistry	Sustainable Chemistry	
2nd year	Thesis			

Compulsory
 Restricted elective
 Elective
 The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

Table – Green and Sustainable Chemistry*

	Block 3	Block 4	Block 1	Block 2
1st year	Elective	Elective	Elective	Elective
	Sustainable Chemistry		Advanced Photochemistry	Atmospheric Environmental Chemistry
2nd year	Thesis			

Compulsory
 Restricted elective
 Elective
 The table illustrates the recommended academic progression. The student is allowed to plan an alternative progression within the applicable rules.

*This table is only relevant for students who begin the MSc Programme in February (block 3)

Compulsory subject elements

All of the following subject elements are to be covered (30 ECTS):

• NKEK13018U	Advanced Photochemistry	Block 1	7.5 ECTS
• NKEK11002U	Atmospheric Environmental Chemistry	Block 2	7.5 ECTS
• NKEK13021U	Sustainable Chemistry	Discontinued*	15 ECTS

* See course specific changes below.

Restricted elective subject elements

15 ECTS are to be covered as subject elements from the following list:

• NKEA09010U	Scientific writing, planning and presentation	Block 1	7.5 ECTS
• NKEK15003U	Methods and Modelling in Inorganic Chemistry	Block 1+2	15 ECTS
• NPLK13004U	Advanced Analytic Chemistry – Chromatography and Mass Spectrometry	Block 2	7.5 ECTS
• NKEA09012U	Air Pollution and Health	Block 2	7.5 ECTS
• NKEK10004U	Advanced Physical Chemistry	Block 3+4	15 ECTS
• NKEA60002U	Kemiske Undervisningsforsøg	Block 3	7.5 ECTS
• NKEK13006U	Organic Chemistry	Block 3+4	15 ECTS
• NKEK13009U	Protein Structure and Function	Block 4	7.5 ECTS
• NKEK14015U	The Chemistry of Metal Ions in Biological Systems	Discontinued*	7.5 ECTS

* See course specific changes below.

Elective subject elements

15 ECTS are to be covered as elective subject elements.

All subject elements at MSc level may be included as elective subject elements in the MSc Programme.

BSc subject elements corresponding to 15 ECTS may be included in the MSc Programme.

Projects outside the course scope may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 5 to the shared section of the curriculum.

Projects in practice may be included in the elective section of the programme with up to 15 ECTS. The regulations are described in Appendix 4 to the shared section of the curriculum.

Thesis

The MSc Programme in Chemistry with a specialisation in Green and Sustainable Chemistry includes a thesis corresponding to 60 ECTS, as described in Appendix 2 to the shared curriculum. The thesis must be written within the academic scope of the programme.

Competence profile

On completion of the programme, an MSc in Chemistry with a specialisation in Green and Sustainable Chemistry has acquired the following:

Knowledge about:

- Green and sustainable chemistry.
- Heterogeneous and homogenous catalysis.
- Environmental atmospheric chemistry.
- Photochemistry.

Skills in/to:

- Describe and optimise the sustainability of a chemical process.

- Describe the kinetics and mechanism of the degradation of emitted chemical in to the atmosphere.
- Calculate photo-physical properties of molecular systems.

Competences in/to:

- Discuss green and sustainability chemistry in the broadest sense of the subject.
- Discuss climate change including the mechanisms and causes of anthropogenic climate forcing.

Title

The MSc Programme in Chemistry with a specialisation in Green and Sustainable Chemistry leads to a Master of Science (MSc) in Chemistry with a specialisation in Green and Sustainable Chemistry with the Danish title: *Cand.scient. (candidatus/candidata scientiarum) i kemi med en specialisering i grøn og bæredygtig kemi.*

2.2. General changes for students admitted in the academic year 2014/15 or earlier

Students admitted to the MSc Programme in the academic year 2014/15 or earlier must finish the programme as listed in the curriculum above with the following exceptions.

2.1 Specialisations

Students admitted in the academic year 2014/15 or earlier are allowed to finish their programme with one of the three specialisations that were outlined in the curriculum.

All students must follow one of the following three specialisations.

2.1.1 General profile in Chemistry

The specialisation is discontinued. It was offered for the last time in the academic year 2014/15.

Structure of the programme

The specialisation is set at 120 ECTS and consists of the following:

- Restricted elective subject elements, 30, 45 or 60 ECTS
- Elective subject elements, 30 ECTS
- Thesis, 30, 45 or 60 ECTS

Restricted elective subject elements

At least 15 ECTS are to be covered by subject elements from the following list:

• NKEA07016U	Computational Chemistry	Block 1+2	15 ECTS
• NKEK10004U	Advanced Physical Chemistry	Block 3+4	15 ECTS
• NKEK13006U	Organic Chemistry	Block 3+4	15 ECTS
• NKEK15004U	Descriptive Inorganic Chemistry	Block 3+4	15 ECTS

The remaining ECTS (up to 15, 30 or 45 ECTS) are to be covered by subject elements from the following list:

• NKEK13007U	Reactions and Synthesis in Medicinal Chemistry	Block 1+2	15 ECTS
• NKEA07016U	Computational Chemistry	Block 1+2	15 ECTS
• NKEK13018U	Advanced Photochemistry	Block 1	7.5 ECTS
• NKEA09010U	Scientific writing planning and presentation	Block 1	7.5 ECTS
• NPLK13003U	Advanced Analytical Chemistry - Sampling and Sample Preparation	Block 1	7.5 ECTS
• NPLK13004U	Advanced Analytical Chemistry - Chromatography and Mass Spectrometry	Block 2	7.5 ECTS
• NKEK11002U	Atmospheric Environmental Chemistry	Block 2	7.5 ECTS
• NKEA06015U	Crystallography	Block 2	7.5 ECTS

• NKEA09012U	Air Pollution and Health	Block 2	7.5 ECTS
• NKEA08006U	Heterocyclic Chemistry	Block 3	7.5 ECTS
• NKEK10004U	Advanced Physical Chemistry	Block 3+4	15 ECTS
• NKEA06002U	Kemiske undervisningsforsøg	Block 3	7.5 ECTS
• NKEK12006U	Surface Physical Chemistry	Block 3	7.5 ECTS
• NKEK13020U	Quantum Chemistry of Molecular Electromagnetic Properties	Block 3	7.5 ECTS
• NKEK13006U	Organic Chemistry	Block 3+4	15 ECTS
• NKEK15004U	Descriptive Inorganic Chemistry	Block 3+4	15 ECTS
• NKEA06002U	Kemiske undervisningsforsøg	Block 4	7.5 ECTS
• NKEK13009U	Protein Structure and Function	Block 4	7.5 ECTS
• NKEK13019U	Molecular Electronics Theory	Block 4	7.5 ECTS
• NKEK11003U	Advanced Synthetic Techniques	Block 5	7.5 ECTS
• NKEK13021U	Sustainable Chemistry	Discontinued*	15 ECTS
• NKEA07017U	Group Theory and its Application in Chemistry	Discontinued*	7.5 ECTS

* See course specific changes below.

Thesis

Students can freely choose the size of the thesis corresponding to 30, 45 or 60 ECTS

2.1.2 Green and Sustainable Chemistry

The specialisation in Green and Sustainable Chemistry is continued in the current curriculum but has been changed in its composition of the compulsory and restricted elective subject elements.

Structure of the programme

The specialisation is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 15 ECTS.
- Restricted elective subject elements, 30, 45 or 60 ECTS.
- Elective subject elements, 15 ECTS.
- Thesis, 30, 45 or 60 ECTS.

Compulsory subject elements

All of the following subject elements are to be covered (15 ECTS):

• NKEK13021U	Sustainable Chemistry	Discontinued*	15 ECTS
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* See course specific changes below.

Restricted elective subject elements

30, 45 or 60 ECTS (depending on the size of the thesis) are to be covered by subject elements from the following lists:

1) 15 ECTS are to be covered as subject elements from the following list:

• NKEA07016U	Computational Chemistry	Block 1+2	15 ECTS
• NKEK10004U	Advanced Physical Chemistry	Block 3+4	15 ECTS
• NKEK13006U	Organic Chemistry	Block 3+4	15 ECTS
• NKEK15004U	Descriptive Inorganic Chemistry	Block 3+4	15 ECTS

2) 7.5 ECTS are to be covered as subject elements from the following list:

• NKEK13018U	Advanced Photochemistry	Block 1	7.5 ECTS
• NKEA09012U	Air Pollution and Health	Block 2	7.5 ECTS
• NKEK11002U	Atmospheric Environmental Chemistry	Block 2	7.5 ECTS
• NKEK13009U	Protein Structure and Function	Block 4	7.5 ECTS

3) 7.5, 22.5 or 37.5 ECTS (depending on the size of the thesis) are to be covered by subject elements from the following list:

• NKEK13018U	Advanced Photochemistry	Block 1	7.5 ECTS
• NKEA09010U	Scientific writing planning and presentation	Block 1	7.5 ECTS
• NKEA07016U	Computational Chemistry	Block 1+2	15 ECTS
• NKEK13007U	Reactions and Synthesis in Medicinal Chemistry	Block 1+2	7.5 ECTS
• NKEA09012U	Air Pollution and Health	Block 2	7.5 ECTS
• NKEK11002U	Atmospheric Environmental Chemistry	Block 2	7.5 ECTS
• NKEA06015U	Crystallography	Block 2	7.5 ECTS
• NKEK10004U	Advanced Physical Chemistry	Block 3+4	15 ECTS
• NKEA60002U	Kemiske undervisningsforsøg	Block 3+4	7.5 ECTS
• NKEK13006U	Organic Chemistry	Block 3+4	15 ECTS
• NKEK15004U	Descriptive Inorganic Chemistry	Block 3+4	7.5 ECTS

Thesis

Students can freely choose the size of the thesis corresponding to 30, 45 or 60 ECTS

2.1.3 Organic Synthesis

The specialisation in Organic Synthesis is continued in the current curriculum but has been changed in its composition of the compulsory and restricted elective subject elements.

Structure of the programme

The specialisation is set at 120 ECTS and consists of the following:

- Compulsory subject elements, 37.5 ECTS.
- Restricted elective subject elements, 7.5, 22.5 or 37.5 ECTS.
- Elective subject elements, 15 ECTS.
- Thesis, 30, 45 or 60 ECTS.

Compulsory subject elements

All of the following subject elements are to be covered (37.5 ECTS):

• NKEK11003U	Advanced Synthetic Techniques	Blok 5	7.5 ECTS
• NKEK13007U	Reactions and Synthesis in Medicinal Chemistry	Blok 1+2	15 ECTS
• NKEK13006U	Organic Chemistry	Blok 3+4	15 ECTS

Restricted elective subject elements

7.5, 22.5 or 37.5 ECTS (depending on the size of the thesis) are to be covered by subject elements from the following list:

• NKEA09012U	Air Pollution and Health	Block 2	7.5 ECTS
• NKEK11002U	Atmospheric Environmental Chemistry	Blok 2	7.5 ECTS
• NKEA06015U	Crystallography	Blok 2	7.5 ECTS
• NKEA08006U	Heterocyclic Chemistry	Blok 3	7.5 ECTS
• NKEA06002U	Kemiske undervisningsforsøg	Blok 3	7.5 ECTS
• NKEK10004U	Advanced Physical Chemistry	Blok 3+4	15 ECTS
• NKEK13009U	Protein Structure and Function	Blok 4	7.5 ECTS
• NKEK11003U	Advanced Synthetic Techniques	Blok 5	7.5 ECTS
• NKEK15004U	Descriptive Inorganic Chemistry	Blok 3+4	15 ECTS
• NKEK14015U	The Chemistry of Metal Ions in Biological Systems	Discontinued*	7.5 ECTS

* See course specific changes below.

Thesis

Students can freely choose the size of the thesis corresponding to 30, 45 or 60 ECTS

3 Course specific changes

Course specific changes	
Exploratory Data Analysis / Chemometrics (NFOK14020U), 7,5 ECTS	<p>The course was a restricted elective course on the General Profile and on the specialisations in Specialisation Analytical Chemistry in the academic year 2015/16.</p> <p>The course was offered for the last time in the academic year 2016/17.</p>
Inorganic Chemistry (NKEK13010U), 15 ECTS	<p>The course was a restricted elective course on the General Profile and on the specialisations in Green and Sustainable Chemistry and Organic Synthesis in the academic year 2014/15.</p> <p>The course was offered for the last time in the academic year 2014/15</p> <p>The course has changed title and is equivalent to Descriptive Inorganic Chemistry (NKEK15004U), 15 ECTS</p>
Group Theory and its Application in Quantum Chemistry (NKEA07017U), 7,5 ECTS	<p>The course was a restricted elective course on the specialisations in Inorganic Chemistry and Physical Chemistry</p> <p>The course was offered for the last time in the academic year 2015/16 and a third exam is offered in the academic year 2016/17.</p>
Sustainable Chemistry (NKEK13021U), 7.5 ECTS	<p>The course was compulsory on the specialisation in “Green and Sustainable Chemist” in the year 2014/15 to 2016/17, restricted elective in the specialisation in “General profile in Chemistry” in 2014/15 and earlier and in the specialisations “Physical Chemistry” and “Inorganic Chemistry” in 2015/16.</p> <p>The course will be offered for the last time in the academic year 2016/17 and a third exam is offered in the academic year 2017/18.</p> <p>Kurset er ækvivalent med Advanced Physical Chemistry (NKEK10004U), 7.5 ECTS.</p>
The Chemistry of Metal Ions in Biological Systems (NKEK14015U), 7.5 ECTS	<p>The course was restricted elective on the specialisation in “Organic Synthesis” in the year 2014/15 or earlier, “Organic Chemistry”, “Inorganic Chemistry” and “Physical Chemistry” in year 2016/17 or 2015/2016 and in “Green and Sustainable Chemist” in the year 2015/16-2016/17.</p> <p>The course will be offered for the last time in the academic year 2016/17 and a third exam is offered in the academic year 2017/18.</p>

Appendix 3 Description of objectives for the thesis

After completing the thesis, the student should have:

Knowledge about:

- Acquired knowledge and learned appropriate methods within selected areas in chemistry of active research.
- Acquired in-depth knowledge of selected areas in chemistry at an international level by conducting independent research and working under supervision.

Skills in/to:

- Read and understand original academic literature in the field of chemistry.
- Explain chemistry work, both orally and in writing.
- Identify, define and formulate the scientific issue/impact of a research project.
- Define and develop testable hypotheses.
- Process and analyse data.

Competences in/to:

- Formulate, structure and manage a research project involving the development and use of chemical methods.
- Manage complex work and development situations.
- Seek out and summarise the available knowledge in selected areas of chemistry.
- Assess chemical methods, and their application and limitations.
- Discuss chemical methods, theory and results, both in general and on a scientific level.
- Discuss the application of chemical results in an industrial, social and ethical context in an academic manner.
- Take independent responsibility for own academic development and specialisation.