

*This is a nonofficial translation from the German original. Only the German original "Wegleitung für das Bachelor- und Masterstudium in Chemie an der Philosophisch-Naturwissenschaftlichen Fakultät der Universität Basel" (25 May 2021) is legally valid.*

## **Guidelines for the Bachelor's and Master's Degree Program in Chemistry at the Faculty of Science of the University of Basel**

German original approved by the Faculty of Science of the University of Basel on 25<sup>th</sup> May 2021

Issued by the chemistry teaching committee based on the study program "Bachelor of Sciences in Chemistry" (Studienplan für den Bachelorstudiengang Chemie (Chemistry)) and the study program "Master of Sciences in Chemistry" (Studienplan für den Masterstudiengang Chemie (Chemistry)) of the Faculty of Science of the University of Basel (from 15<sup>th</sup> September 2021).

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## **1 Study Objectives**

### **1.1 Bachelor's Degree Program**

After the first four semesters, students know and understand the fundamentals of general, inorganic, organic, physical, and analytical chemistry. They also have solid basic knowledge in related fields necessary for understanding modern chemistry, such as mathematics, physics and computer science.

After two further semesters, students have in-depth knowledge from the fields of spectroscopy, photochemistry, reaction kinetics, natural product chemistry, organic synthesis, bioorganics, bioinorganics, supramolecular chemistry, colloid chemistry inorganic and organic analysis, coordination chemistry, biochemistry, theoretical and computational chemistry, which is needed to understand more complex processes. Since university chemistry studies are in most cases complemented with a master's degree and often continue to a doctoral program, a high level of theoretical understanding is required.

The students can apply this scientific knowledge to given problems and are familiar with the required ways of thinking. They are able to handle chemicals and equipment in the chemical laboratory responsibly and use the computer for solving chemical problems.

Through studies in a non-subject elective area, students deepen their knowledge of related scientific fields (for example, biology) and know about the interconnections of these subjects to chemistry.

### **1.2 Master's Degree Program**

In the Master's degree program, students acquire special knowledge from the above-mentioned areas, which enables them to define chemical problems within a specified framework and to propose and conduct corresponding theoretical and experimental solutions. They can choose appropriate courses from the lecture program and acquire special experimental skills in two elective internships in different research groups of the Department of Chemistry.

With the Master's thesis, the students acquire an in-depth insight into a defined research field. This knowledge enables them to work on a research project themselves under supervision and to interpret the results obtained. They are able to correctly document their own scientific work and to reproduce experimental results as well as theoretical conclusions and hypotheses in a comprehensible manner. The students are able to read scientific texts (also in English) and to critically analyze research results and hypotheses. In the final written master's thesis, students demonstrate their ability to write a scientific text independently.

The language of instruction in the master's degree program is English.

### **1.3 Doctorate**

The students carry out an independent research activity within the framework of a doctoral thesis. This enables them to further deepen the skills mentioned above and to independently formulate and experimentally test original and innovative ideas and hypotheses. They are able to present their own research work in the field of chemistry within the framework of lectures and poster presentations, to reduce results to their core statements and to derive theses or theoretical models from them. They are able to collaborate with peers and in transdisciplinary teams and to responsibly question their own scientific activities.

## **2 Career Opportunities**

Professional training at the bachelor's level qualifies students for more practical chemical occupations, such as further development of methods and products, and the pursuit of an additional interdisciplinary study. The master's degree, usually in combination with a doctorate, is usually required at universities (teaching and research) or in industry for a scientific career and the management of a research group.

Both the bachelor's and the master's degree allow graduates to work in the field of basic and applied research or in consulting and include career opportunities in chemical and pharmaceutical companies (chemical synthesis, organic and inorganic analysis, formulation, production, quality control, documentation), in the public sector (school service, quality control, environmental analysis, medical analysis, public relations), in companies with scientific sub-aspects (food chemistry, documentation/journalism) or at universities. Due to the specific training in analytical thinking and the use of computers, chemistry graduates are also in demand in non-chemical industries (banking, information technology).

## **3 Program Structure**

The program is designed as a full-time study program. If studied part-time, the duration of study is extended accordingly. The program is divided into a bachelor's degree program of 180 credit points (CP), which can be entered in the fall semester, followed by a master's degree program of 90 CP, which can be started in the fall or spring semester.

The bachelor's degree program is designed to take 6 semesters. In the first year, basic knowledge in mathematics, physics and chemistry is taught and supplemented with two internships in general chemistry. In the second year, basic theoretical and methodological knowledge in inorganic, organic, physical and analytical chemistry is taught and complemented with internships in organic and inorganic chemistry. In the third year, students acquire in-depth knowledge in the above-mentioned subjects and expand their application and practical skills through internships in physical and interdisciplinary chemistry. In addition, basic knowledge is acquired in computer science, biochemistry and a non-subject elective. Due to the increasing interdisciplinarity between biology and chemistry, it is recommended to take courses in biology/biochemistry.

In the Master's degree program, specialization is achieved by choosing specific courses. It is possible to focus on the subfields of inorganic chemistry, organic chemistry or physical chemistry. The restrictions to this freedom of choice are regulated in the section "Structure of studies" of the curriculum for the Master's program in Chemistry (Appendix 3 of the

Regulations of the Faculty of Humanities and Natural Sciences of the University of Basel for the Master's program of September 15, 2020).

### 3.1 Credit Points

For the students, 1 credit point (CP) corresponds to a work load of 30 hours.

The Bachelor's degree program comprises a total of 180 CP (on average 60 CP per academic year), the Master's degree program a total of 90 CP.

### 3.2 Bachelor's Degree Program

The following tables summarize the courses of the Bachelor's degree program and the credit points corresponding to them. Lectures marked with \* are main lectures which are assessed through «Examen» according to § 11 of the “Regulation of the Faculty of Science of the University of Basel for the Bachelor's Degree Program” of September 15, 2020 (Ordnung der Philosophisch-Naturwissenschaftlichen Fakultät der Universität Basel für das Bachelorstudium, in short: Regulation Frame Bachelor's Degree Program).

#### Study Program Introductory Level (1<sup>st</sup> Year)

Introductory level studies of the first year comprise the following mandatory courses in modules chemistry, physics, mathematics, and internship in general chemistry.

Sem.	Lectures/Internships	Semester Hours	Credit Points
1.	Einführung in die Chemie*	6	6
	Einführung in die Physik I: Mechanik und Thermodynamik*	6	6
	Mathematik I für Naturwissenschaften*	6	6
	or Mathematische Methoden I*		
	Praktikum in allgemeiner Chemie	12	12
2.	Grundlagen der organischen Chemie*	6	6
	Physikalische Chemie I: Thermodynamik und Kinetik*	4	4
	Einführung in die Physik II: Elektrodynamik und Optik*	6	6
	Mathematik II für Naturwissenschaften*	6	6
	or Mathematische Methoden II*		
	Praktikum in allgemeiner Chemie	8	8
<b>Total acquirable Credit Ppoints</b>			<b>60</b>

Note: The main lectures “Mathematische Methoden I/II” are mathematically more demanding than the main lectures “Mathematik I/II für Naturwissenschaften”; they can serve as a basis for the advanced courses “Funktionentheorie und Vektoranalysis” and “Differentialgleichungen”. The attendance of the main lectures “Mathematische Methoden I/II” is recommended for students interested in mathematics and physical chemistry.

### Study Program Advanced Level (2<sup>nd</sup> Year)

Advanced level studies comprise the following courses of modules analytical chemistry, inorganic chemistry, organic chemistry, physical chemistry, computer science and biochemistry and electives.

Sem.	Lectures/Internships	Semester Hours	Credit points
3.	Anorganische Chemie I: Chemie der Hauptgruppenelemente und Gruppentheorie*	3	3
	Organische Chemie I: Einführung in die organische Chemie*	4	4
	Physikalische Chemie II: Kondensierte Materie und Quantentheorie*	3	3
	Analytische Chemie I: Grundlagen der Strukturaufklärung*	2	2
	Praktikum in organischer Chemie	15	15
4.	Anorganische Chemie II: Koordinationschemie*	3	3
	Organische Chemie II: Organische Synthese*	3	3
	Physikalische Chemie III: Molekulare Quantenmechanik und Spektroskopie *	3	3
	Analytische Chemie II: Grundlagen der quantitativen Analytik und Spektroskopie*	2	2
	Praktikum in anorganischer Chemie	15	15
	Einführung in die Programmierung	4	4
	Electives** (except chemistry)	3	3
<b>Total acquirable Credit Points</b>			<b>60</b>

**Study Program Advanced Level (3<sup>rd</sup> Year)**

Sem.	Lectures/Internships	Semester Hours	Credit Points
5.	Anorganische Chemie III: Chemie und Spektroskopie der d- und f-Metalle*	2	2
	Organische Chemie III: Bioorganische Chemie*	2	2
	Physikalische Chemie IV: Molekulare Dynamik und elektronische Struktur*	3	3
	Analytische Chemie III: Elektroanalytik und Trennmethoden*	2	2
	Biochemistry - Molecular Principles of Life	2	2
	Praktikum in physikalischer Chemie	15	15
	6.	Anorganische Chemie IV: Organometallchemie der Übergangsmetalle *	3
Organische Chemie IV: Struktur und Reaktivität*		2	2
Physikalische Chemie V: Statistische Mechanik*		2	2
Analytische Chemie IV: Strukturaufklärung mittels mehrdimensionaler NMR Spektroskopie*		2	2
Biochemie für Chemiker		1	1
Fortgeschrittenes Praktikum in Chemie		15	15
Electives** (Except chemistry)		9	9
<b>Total acquirable Credit Points</b>			<b>60</b>

**\*\* Note to electives in the Bachelor's degree program:**

Elective courses can be chosen from the entire academic program of the University of Basel. However, it is recommended to attend courses in the field of biology/biochemistry because of the increasing interconnection of chemistry and biology.

A maximum of 3 CP can be acquired throughout the Bachelor's degree program for participation in university self-governance. Before performing such work, a learning contract must be signed by the student, the responsible faculty member and the head of the teaching committee. Such an extracurricular assessment is based on a learning contract according to § 14 of the der Regulation Frame Bachelor's Degree Program.

### 3.3 Master's Degree Program

The Master's degree program comprises the following credit points:

Courses	Credit Points
Lectures (when indicated with exercises) of at least two modules a) Inorganic Chemistry, b) Organic Chemistry, c) Physical Chemistry	12
Additional lectures (when indicated with exercises) of modules a) Inorganic Chemistry, b) Organic Chemistry, c) Physical Chemistry, d) Mixed Topics	18
2 Elective Internships	30
Master's Thesis	26
Oral Master's Exam	4

Depending on the semester, different courses of modules a) to d) are offered. The courses must be chosen from the online course directory and be marked with the module «Master Chemie». In module d) Mixed Topics a maximum of 3 CP can be acquired by attending extra-curricular courses (outside the curriculum of the Department of Chemistry).

Elective internships (Wahlpraktika) take six weeks full-time (or 12 weeks half-time). Elective internships that are carried out outside of the Department of Chemistry last a minimum of three months.

As part of the Master's degree program a master's thesis has to be carried out. Its topic and research field can be chosen in agreement with the supervising member of faculty. The students are free to choose the research group. Extension of the Master's thesis' submission deadline is only possible upon justified request to the teaching committee prior to four weeks before the submission deadline ends. The Master's thesis must contain the declaration of scientific integrity (<https://philnat.unibas.ch/de/studium/>).

One of the three practical components (2 elective internships, master's thesis) may be carried out at an external institution. For all external components (i.e. not at the Department of Chemistry of the University of Basel), a member of faculty of the Department of Chemistry is responsible. An external work has to be approved by the teaching committee based on a written application including a project description which has to be submitted for assessment together with the learning contract at least four weeks prior to the start of the work. Approval is given by signature on the learning contract.

During elective internships or master's theses carried out at non-university institutions, after half the time a meeting of the student, the responsible person in industry or the non-university institution, and the responsible member of faculty should take place. The student has to write a summary of the results of this meeting and submit it to the responsible member of the faculty (for elective internships) or the teaching committee (Master's thesis) for approval. The final report must comply with the requirements that are usual in the Department of Chemistry of the University of Basel.

For both elective internships a learning contract must be signed. For the master's thesis a learning contract has to be signed (form as download from <https://philnat.unibas.ch/de/studium/>) prior to the start of the work by the head of the teaching committee, the responsible member of faculty and the student. The learning contracts with the

assessment for both elective internships and the master's thesis must be sent to the Office of the Dean of Studies of the Faculty of Science.

In the Master's degree program a maximum of 1 CP can be acquired for participation in university self-governance. Before performing such work, a learning contract must be signed by the student, the responsible faculty member and the head of the teaching committee. Such an extracurricular assessment is based on a learning contract according to § 13 of the "Regulation of the Faculty of Science of the University of Basel for the Master's Program" (Ordnung der Philosophisch-Naturwissenschaftlichen Fakultät der Universität Basel für das Masterstudium, in short: Regulation Frame Master's Degree Program).

#### **4 Assessment**

Assessment takes place at various levels and through various assessment formats. During the semester, exercises are offered for some lectures, which must be successfully completed. As part of the practical internships, written reports on the individual experiments or the project tasks are assessed.

The assessment of main lectures of the modules chemistry, physics, and mathematics in the introductory level program and of main lectures of the modules analytical chemistry, inorganic chemistry, organic chemistry, and physical chemistry of the advanced level program is evaluated according to § 11 of the Regulations Frame Bachelor's Degree Programs through written exams (Examen). The duration of written exams is based on the number of credit points that can be acquired and is usually one hour for lectures with up to 2 CP and two hours for lectures with more than 2 CP.

Important information on exams (Examen) can be found on the website of the Faculty of Sciences (<https://philnat.unibas.ch/de/examen/>).

The assessment of courses of the Master's program is according to § 11 of the Regulations Frame for the Master's Programs.

#### **5 Admission to the Degree Program, Recognition of Course and Examination Credits**

Admission to the study program is done centrally via Student Administration Office of the University of Basel. The requirements and the procedure of admission to the study program are regulated in §§ 13-18 of the Student Regulations of the University of Basel (Studierenden-Ordnung der Universität Basel).

A bachelor's degree in computational sciences with a major in computational chemistry from the University of Basel entitles the student to transfer to the master's degree program in chemistry, if applicable with requirements.

Upon application of the chemistry teaching committee, the examination committee of the Faculty of Sciences decides on the crediting of comparable study and examination achievements which have been or will be achieved in another study program at the University of Basel or another university, as well as on the crediting of credit points which have been or will be acquired in another study program or another university.

Procedure: A written application with a detailed list of the course achievements to be credited is submitted to the Office of the Dean of Studies of the Faculty of Sciences. Copies of all certificates of academic achievements are enclosed with the application together with a short



summary of the contents of the courses to be credited. The applicant will be informed in writing about the crediting of study and examination achievements as well as of credit points. The crediting letter is issued by the Office of the Dean of Studies of the Faculty of Sciences.

## **6 Participation in Chemistry Internships**

For safety reasons, it is necessary for students participating in chemistry internships to fluently speak German or English. If problematic deficiencies in language skills are identified by the teaching assistants during takeover of the lab place at the beginning of the internship, a review by the practical head or safety officer will be arranged at short notice, which may lead to exclusion from the internship.

The Department of Chemistry follows the Disability Statement of the President's Board of October 15, 2011. Students studying with a disadvantage compensation must contact the practical head at least two weeks before the start of the internship in order to allow for an appropriate organization of the internship. Students with a temporary restriction must contact the practical head prior to the start of the internship or when the restriction occurs. Temporary limitations such as the use of crutches due to an accident that has occurred may result in exclusion from the internship for safety reasons as long as the limitation persists. Participation in the internship for expectant and nursing mothers is not possible.

## **7 Student Information and Supervision (see also section 13)**

The member of the Department of Chemistry in charge of student advising provides information on topics such as the structure of the program, major fields of study, subject combinations, mobility, questions about study and examination regulations, or career prospects. Furthermore, lecturers provide subject-specific information by appointment. In addition, the Basel chemistry student association (Verband Basler Chemiestudierender, VBC) also offers students various forms of support.

Academic advice is offered by the academic advising centers of cantons Basel-Stadt (Steinengraben 5, 4051 Basel) and Basel-Landschaft (Wuhrmattstr. 23, 4103 Bottmingen).

The Department of Chemistry website ([www.chemie.unibas.ch](http://www.chemie.unibas.ch)) provides information on the department, the chemistry curriculum, the chemistry programs, guidelines on the chemistry degree programs and on research and teaching.

## **8 Quality Control**

The course quality is regularly evaluated according to the guidelines for course evaluation of the Faculty of Sciences of the University of Basel.

In case of problems or questions the head of the teaching committee can be contacted at any time (see section 13).

## **9 Doctorate**

The requirements for admission to doctoral studies are defined in the Doctoral Studies Regulations of the Faculty of Sciences of the University of Basel.

## **10 General**

The admission requirements and descriptions of the degree programs at the University of Basel are set out in regulations and guideline documents and are available online ([www.unibas.ch](http://www.unibas.ch), > Documents, > Legal Regulations).

The Student Regulations of the University of Basel (Studierenden-Ordnung der Universität Basel) regulate, among other things: the degree programs and the European Credit Transfer System (ECTS), general rights and obligations of students, admission and registration as well as matriculation and enrollment. Detailed information concerning the procedure for admission to studies can be found online ([www.unibas.ch](http://www.unibas.ch), > Studies).

The Regulations Frame of the Bachelor's and Master's degree program define the Bachelor's and Master's degree programs in general ([www.unibas.ch](http://www.unibas.ch), > dokumentse, > Legal Regulations, > Faculty of Science or [www.philnat.unibas.ch](http://www.philnat.unibas.ch)).

The Study Program for the Bachelor's Degree Program in Chemistry at the Faculty of Sciences of the University of Basel of September 15, 2020 defines the Bachelor's degree program in chemistry; the Study Program for the Master's Degree Program in Chemistry at the Faculty of Sciences of the University of Basel of September 15, 2020 defines the Master's degree program in chemistry ([www.unibas.ch](http://www.unibas.ch), > Documents, > Legal Regulations, > Faculty of Sciences or [www.philnat.unibas.ch](http://www.philnat.unibas.ch)). Both study programs are supplemented and explained by the present guidelines.

The body responsible for the study of chemistry is the teaching committee of the Department of Chemistry, whose composition and duties are regulated in the Regulations of the Department of Chemistry.

## **11 Curricular Questions**

Curricular questions and modification of guidelines or study programs are discussed upon request or on own initiative by the teaching committee. The study programs and the curriculum must be approved by the Faculty of Science, the President's Board, and the University Council. The guidelines have to be approved by the Faculty of Science.

## **12 Validity**

The present guidelines replace the guidelines of February 19, 2019 and are valid as of now for all students in the Bachelor's and Master's degree program in chemistry at the University of Basel.

**13 Institutions relevant to study / Student Advice Center (see also section 7)**

Head of the Teaching Committee Chemistry:

Prof. Dr. Michael Nash, email: michael.nash@unibas.ch

Academic Advice Department of Chemistry:

Prof. Dr. Jonathan De Roo, email: jonathan.deroo@unibas.ch

Study Program Coordination:

Dr. Ina Emme-Papastavrou, email: studium-chemie@unibas.ch

Advice for Student Teachers:

Prof. Dr. Jonathan De Roo, email: jonathan.deroo@unibas.ch

Dean's Office of the Faculty of Science:

(Dean of Studies, Office of the Dean of Studies, Examination Committee):

email: studiendekanat-philnat@unibas.ch

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Appendix:

### **A. Courses for Students enrolled in other Programs**

The Department of Chemistry offers the following courses for students of other programs:

Internships in general, analytic, inorganic, organic, and physical chemistry for students of degree programs in biology, computational sciences, earth sciences, nano sciences, and pharmaceutical sciences.

The assessment of all internships through course-related exams is based on § 12 of the Regulation Frame Bachelor's Degree Program. More detailed information will be given in the course directory in due time.

## **B. Chemistry as Subject in the Bachelor's and Master's Degree Program at the Faculty of Humanities and Social Sciences of the University of Basel**

This appendix defines the details of the Bachelor's and Master's Degree Program at the Faculty of Humanities and Social Sciences at the University of Basel with chemistry as extra-faculty subject.

In case of any contradictions between the study regulations/study programs and/or guidelines of the Faculty of Humanities and Social Sciences and the Faculty of Sciences, the study regulations/study programs and/or the guidelines for the extra-faculty subject Chemistry in the Bachelor's and Master's programs of the Faculty of Humanities and Social Sciences apply.

### **Bachelor's Degree Program Chemistry**

#### **a. Module Chemistry (16 CP)**

course 10380-01 (fall semester) "Einführung in die Chemie"

course 10382-01 (spring semester) "Grundlagen der organischen Chemie"

course 10383-01 (spring semester) Übung: "Grundlagen der organischen Chemie"

course 29930-01 (spring semester) "Physikalische Chemie I: Thermodynamik und Kinetik"

#### **b. Module Physics (12 CP)**

course 10839-01 (fall semester) "Einführung in die Physik I: Mechanik und Thermodynamik"

course 10955-01 (spring semester) "Einführung in die Physik II: Elektrodynamik und Optik"

#### **c. Modul Mathematics (12 CP)**

course 10548-01 (fall semester) "Mathematik I der Naturwissenschaften"

course 11041-01 (spring semester) "Mathematik II der Naturwissenschaften"

#### **d. Modul Internship (20 CP)**

course 10701-01 (fall semester) "Allgemeine Chemie"

course 19773-01 (spring semester) "Allgemeine Chemie"

#### **e. Module Advanced Level Chemistry (15 KP). Only courses from modules inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry of the Bachelor's degree program in chemistry, ie. courses of the advanced level program for chemistry students.**

**Master's Degree Program Chemistry**

- a. Module Advanced Level Chemistry (5 CP). Only courses from modules inorganic chemistry, organic chemistry, physical chemistry, analytical chemistry of the Bachelor's study program in chemistry, ie. courses of the advanced level program for chemistry students.
  
- b. Module Internship in Organic Chemistry (15 CP)  
course 10855-01 (fall semester) "Organische Chemie"
  
- c. Modul Internship in Inorganic Chemistry (15 CP)  
course 11047-01 (spring semester) "Anorganische Chemie"

The course descriptions and information on the exams can be found in the online course directory.