Subdivided Module Catalogue
for the Subject

Chemistry
as a Bachelor’s with 1 major
with the degree "Bachelor of Science"
(180 ECTS credits)

Examination regulations version: 2009
Responsible: Faculty of Chemistry and Pharmacy
Course of Studies - Contents and Objectives

The chemistry program in Würzburg offers a research-oriented curriculum. Graduates of the Bachelor-program in chemistry are acquainted with the fundamentals of chemistry, possess the relevant experimental skills and are familiar with the general methods of scientific research. In lectures and tutorials the basic knowledge of the various areas of chemistry is imparted as well as the foundations of mathematics and physics. A further hallmark is the comparably large number of student lab courses. In these labs the laboratory skills and techniques used in experimental scientific work are taught. During their Bachelor thesis the students finally work for a limited time on a specific chemical problem. They demonstrate their scientific abilities in work which is performed under guidance, but to a large extent independently. The students obtain the necessary knowledge to attend a research-oriented Masters program. In addition they possess the basic qualifications necessary for further professional training in industry and business. In supplementary modules they acquire science-related soft skills in specific areas of chemistry and general soft skills that match their personal interests and serve as an additional qualification for various professional areas.
Abbreviations used

Course types: \( E \) = field trip, \( K \) = colloquium, \( O \) = conversatorium, \( P \) = placement/lab course, \( R \) = project, \( S \) = seminar, \( T \) = tutorial, \( Ü \) = exercise, \( V \) = lecture

Term: \( SS \) = summer semester, \( WS \) = winter semester

Methods of grading: \( \text{NUM} \) = numerical grade, \( \text{B/NB} \) = (not) successfully completed

Regulations: (L)ASPO = general academic and examination regulations (for teaching-degree programmes), FSB = subject-specific provisions, SFB = list of modules

Other: \( A \) = thesis, \( LV \) = course(s), \( PL \) = assessment(s), \( TN \) = participants, \( VL \) = prerequisite(s)

Conventions

Unless otherwise stated, courses and assessments will be held in German, assessments will be offered every semester and modules are not creditable for bonus.

Notes

Should there be the option to choose between several methods of assessment, the lecturer will agree with the module coordinator on the method of assessment to be used in the current semester by two weeks after the start of the course at the latest and will communicate this in the customary manner.

Should the module comprise more than one graded assessment, all assessments will be equally weighted, unless otherwise stated below.

Should the assessment comprise several individual assessments, successful completion of the module will require successful completion of all individual assessments.

In accordance with

the general regulations governing the degree subject described in this module catalogue:

ASPO2007

associated official publications (FSB (subject-specific provisions)/SFB (list of modules)):

19-Nov-2009 (2009-74)

This module handbook seeks to render, as accurately as possible, the data that is of statutory relevance according to the examination regulations of the degree subject. However, only the FSB (subject-specific provisions) and SFB (list of modules) in their officially published versions shall be legally binding. In the case of doubt, the provisions on, in particular, module assessments specified in the FSB/SFB shall prevail.
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**Module title**
Analytical Chemistry 1

**Abbreviation**
08-AN1-092-m01

**Module coordinator**
Lecturer of lecture "Analytische Chemie" (Analytical Chemistry)

**Module offered by**
Institute of Inorganic Chemistry

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**Contents**
This module equips students with an advanced knowledge of the periodic table and selected elements. It focuses on bonding conditions, trends in the periodic table and the description and structure of elements. In addition, it introduces students to elementary organic chemistry, coordination chemistry and complex chemistry. The module gives students the opportunity to apply in practice the knowledge they have gained through the related lecture(s). After a safety briefing, the students autonomously conduct experiments in the laboratory. These experiments focus on different methods for the analysis of unknown substances.

**Intended learning outcomes**
Students are able to characterise main group elements and transition metal elements in terms of their structure, reactivity and fabrication. They are able to identify the coordination of the atoms. In addition, they have learned how to use the periodic table, an essential tool for chemists. Students are able to use different methods to analyse unknown substances. In addition, they are able to separate and analyse mixtures.

**Courses** (type, number of weekly contact hours, language — if other than German)
This module comprises 2 module components. Information on courses will be listed separately for each module component.
- 08-AN1-2-092: P (no information on SWS (weekly contact hours) and course language available)
- 08-AN1-1-092: Ü + V (no information on SWS (weekly contact hours) and course language available)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

**Assessment in module component 08-AN1-2-092:** Analytical Chemistry (lab)
- 6 ECTS, Method of grading: (not) successfully completed
- Vortestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nachtestate (post-experiment exams, approx. 15 minutes each)
- Assessment offered: once a year, summer semester

**Assessment in module component 08-AN1-1-092:** Principles of Analytical Chemistry Principles of Analytical Chemistry
- 5 ECTS, Method of grading: numerical grade
- a) 1 to 3 written examinations (1 written examination: 90 minutes; 2 written examinations: 60 or 90 minutes each; 3 written examinations: 60 minutes each) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)

**Allocation of places**
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**Additional information**
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**Referred to in LPO I** (examination regulations for teaching-degree programmes)
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Module title: Inorganic Chemistry 1  
Abbreviation: 08-AC1-092-m01

Module coordinator: 
Instructor of lecture "Experimentalchemie" (Experimental Chemistry)  
Module offered by: Institute of Inorganic Chemistry

ECTS: 21  
Method of grading: Only after succ. compl. of module(s)  
Duration: 1 semester  
Module level: undergraduate  
Other prerequisites: --

Contents:
This module provides students with an overview of the fundamental principles of chemistry. It focuses on partic-
les, metals, acid-base reactions, the periodic table, chemical equilibrium and complexometry. In addition, the
module introduces fundamental models of chemistry and principles of inorganic chemistry. It includes practical
exercises based on the lecture on experimental chemistry and its extension. After a safety briefing, the students
autonomously conduct experiments in the laboratory. The course focuses on laboratory safety, simple lab techni-
ques, the synthesis of simple substances and analyses of unknown substances. In addition, students have the
opportunity to advance their laboratory knowledge.

Intended learning outcomes:
Students are able to explain the principles of the periodic table and to extract information from it. They are ab-
le to explain basic models of the structure of matter. They have developed the ability to use the language of che-
mical formulas to describe chemical reactions and to interpret them by identifying the type of reaction. Students
are able to describe the main quantitative and qualitative analytical methods and their application areas. They
are able to identify fundamental problems in chemistry and perform experiments to solve them. They have deve-
loped the ability to perform the necessary stoichiometric calculations and describe the chemical processes in an
appropriate manner, both in written and oral form.

Courses (type, number of weekly contact hours, language — if other than German)
This module has 4 components; information on courses listed separately for each component.
  • 08-AC1-1-092: V + V + Ü (no information on language and number of weekly contact hours available)
  • 08-AC1-2-092: P (no information on language and number of weekly contact hours available)
  • 08-AC1-3-092: V (no information on language and number of weekly contact hours available)
  • 08-AC1-4-092: P (no information on language and number of weekly contact hours available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every seme-
ster, information on whether module can be chosen to earn a bonus)
This module has the following 4 assessment components. Unless stated otherwise, students must pass all of
these assessment components to pass the module as a whole..

Assessment component to module component 08-AC1-1-092: Grundlagen der Allgemeinen und Anorganischen Chemie
  • 10 ECTS credits, method of grading: numerical grade
  • a) 1-3 written exams (1 written examination 90 minutes, 2 written exams je 60 or 90 minutes, 3 written
    exams je 60 minutes) or b) oral examination of on candidate each (approx. 20 minutes) or c) oral exami-
    nation in groups (groups of two, approx. 30 minutes)

Assessment component to module component 08-AC1-2-092: Praktikum Anorganische Chemie 1
  • 6 ECTS credits, method of grading: (not) successfully completed
  • Vortestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nach-
    testate (post-experiment exams, approx. 15 minutes each)
  • examination offered once a year, winter semester

Assessment component to module component 08-AC1-3-092: Erläuterungen zum Praktikum Anorganische Chemie 1
  • 4 ECTS credits, method of grading: numerical grade
  • 3 written examinations (45 minutes each), weighted 1:1:1, dates to be announced

Assessment component to module component 08-AC1-4-092: Sicheres Arbeiten in chemischen Laboratorien
- 1 ECTS credits, method of grading: (not) successfully completed
- practical assessment (safety drill in laboratory, length to be specified at the beginning of the course

### Allocation of places
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### Additional information
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### Referred to in LPO I (examination regulations for teaching-degree programmes)
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### Module title
Inorganic Chemistry 2

### Abbreviation
08-AC2-092-m01

### Module coordinator
Lecturer of lecture "Festkörperchemie" (Solid State Chemistry)

### Module offered by
Institute of Inorganic Chemistry

### ECTS
6

### Method of grading
Numerical grade

### Only after succ. compl. of module(s)
Only after successful completion of the module(s)

### Duration
1 semester

### Module level
Undergraduate

### Other prerequisites
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## Contents
This module equips students with an advanced knowledge of metals, alloys and saline compounds. It focuses on their structures and properties, special material classes, reactivity and technical processes.

## Intended learning outcomes
Students are able to describe the structure and properties of metals, alloys and saline compounds in an appropriate manner. They are able to systemise them and characterise their structure and reactivity. They can list spectroscopic methods that can be used for the structural analysis of solids and can describe them in an appropriate manner.

## Courses
(type, number of weekly contact hours, language — if other than German)

V (no information on SWS (weekly contact hours) and course language available)

## Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) 1 to 3 written examinations (1 written examination: 90 minutes; 2 written examinations: 60 or 90 minutes each; 3 written examinations: 60 minutes each) or b) oral examination in groups (groups of 2, approx. 30 minutes)

## Allocation of places
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## Additional information
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## Referred to in LPO 1 (examination regulations for teaching-degree programmes)
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### Module title

Inorganic Chemistry 3

### Abbreviation

08-AC3-092-m01

### Module coordinator

Lecturer of lecture "Elementorganische Chemie" (Elemental Organic Chemistry)

### Module offered by

Institute of Inorganic Chemistry

### ECTS

9

### Method of grading

Numerical grade

### Only after succ. compl. of module(s)

08-AC1 (module component 08-AC1-2 only) or 08-AN1 (module component 08-AN1-2 only)

### Duration

1 semester

### Module level

Undergraduate

### Other prerequisites

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### Contents

This module equips students with an advanced knowledge of organometallics. It focuses on their structures and properties, special material classes, reactivity and technical processes. The module gives students the opportunity to do some autonomous research and plan and conduct complex syntheses. The course focuses on the handling of organometallic compounds, their synthesis and working with protective atmospheres. Spectroscopy is used for the exact determination of products.

### Intended learning outcomes

Students are able to describe the structure and properties of organometallics in an appropriate manner. They are able to systemise them and characterise their structure and reactivity. In addition, they are able to develop and explain principles for the synthesis of elementary organic compounds. Students are able to conduct autonomous research and perform experiments to solve complex problems. They are able to describe the technical principles in oral and written form using appropriate scientific terminology. They are able to independently plan and carry out the synthesis of a substance using advanced lab techniques.

### Courses (type, number of weekly contact hours, language — if other than German)

This module comprises 2 module components. Information on courses will be listed separately for each module component.

- 08-AC3-1-092: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 08-AC3-2-092: P (no information on SWS (weekly contact hours) and course language available)

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

**Assessment in module component 08-AC3-1-092:** Elemental Organic Chemistry Elemental Organic Chemistry

- 4 ECTS, Method of grading: numerical grade
- a) 1 to 3 written examinations (1 written examination: 90 minutes; 2 written examinations: 60 or 90 minutes each; 3 written examinations: 60 minutes each) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)

**Assessment in module component 08-AC3-2-092:** Inorganic Chemistry 2 (lab)

- 5 ECTS, Method of grading: (not) successfully completed
- Vorstestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nachtestate (post-experiment exams, approx. 15 minutes each)
- Assessment offered: once a year, winter semester

### Allocation of places

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### Additional information

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### Referred to in LPO I (examination regulations for teaching-degree programmes)

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### Module title

**Bachelor Thesis**

### Abbreviation

08-BA-092-m01

### Module coordinator

head of the research group offering the module

### Module offered by

Faculty of Chemistry and Pharmacy

### ECTS

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### Contents

The module enables the processing of a defined problem within a specified period by applying the scientific methods learned in the course of study.

### Intended learning outcomes

The student has the ability to deal with a defined problem/issue using scientific methods and to document the results.

### Courses (type, number of weekly contact hours, language — if other than German)

no courses assigned

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written thesis

Language of assessment: German or English

### Allocation of places

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### Additional information

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### Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module title
Biochemistry

Abbreviation
08-BC-092-m01

Module coordinator
holder of the Chair of Biochemistry

Module offered by
Chair of Biochemistry

ECTS
6

Method of grading
numerical grade

Only after succ. compl. of module(s)
--

Duration
2 semester

Module level
undergraduate

Other prerequisites
Admission prerequisite to assessment: successful completion of exercises in the respective classes as specified at the beginning of the course (usually 70% of exercises to be successfully completed) as well as regular attendance of exercises (usually a maximum of 2 incidents of unexcused absence).

Contents
The module imparts the basic knowledge of biochemistry by lectures and in-depth tutorials.

Intended learning outcomes
Students have become familiar with the fundamental principles of biochemistry. They are able to describe the key biochemical processes in cellular systems.

Courses
V + Ü + V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment
a) 1 to 3 written examinations (1 written examination: approx. 90 minutes; 2 written examinations: approx. 60 or 90 minutes each; 3 written examinations: approx. 60 minutes each) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)

Allocation of places
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
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Module title | Abbreviation
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Biochemistry Lab | 08-BCP-092-m01

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Contents

In this module the basics of scientific biochemical experimentation shall be practiced in practical exercises.

Intended learning outcomes

After participating in the practical exercises the students master basic biochemical methods and are able to purposefully apply them.

Courses (type, number of weekly contact hours, language — if other than German)

P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

pre/post-experiment examination talks (Vortestate and Nachtestate, approx. 15 minutes each), practical work (log, approx. 5 to 10 pages)
Assessment offered: once a year, summer semester

Allocation of places

Number of places: 24. Should the number of applications exceed the number of available places, places will be allocated in a standardised procedure among all applicants irrespective of their subjects according to the following quotas: Quota 1 (80% of places): grade achieved in module 08-BC; among applicants with the same grade, places will be allocated by lot. Quota 2 (20% of places): number of subject semesters of the respective applicant; among applicants with the same number of subject semesters, places will be allocated by lot. A waiting list will be maintained and places re-allocated as they become available.

Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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<tr>
<td>Managing Director of the Institute of Applied Physics</td>
<td>Faculty of Physics and Astronomy</td>
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**Contents**

Mechanics, vibration theory, thermodynamics, optics, science of electricity, Atomic and Nuclear Physics.

**Intended learning outcomes**

The students have knowledge of the principles of Physics.

**Courses** (type, number of weekly contact hours, language — if other than German)

V + V (no information on SWS (weekly contact hours) and course language available)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

written examination (approx. 120 minutes)

**Allocation of places**

Only as part of pool of general key skills (ASQ): 10 places. Places will be allocated by lot.

**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<tr>
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<td>Institute of Inorganic Chemistry</td>
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**Contents**

Literature search for planning experiments in the field of inorganic chemistry.

**Intended learning outcomes**

Students know how to conduct literature searches for planning experiments in the field of inorganic chemistry.

**Courses** (type, number of weekly contact hours, language — if other than German)

Ü (no information on SWS (weekly contact hours) and course language available)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

2 literature searches about given preparations

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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<td>1 semester</td>
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**Contents**

Literature search for planning experiments in the field of organic chemistry.

**Intended learning outcomes**

Students know how to conduct literature searches for planning experiments in the field of organic chemistry.

**Courses** (type, number of weekly contact hours, language — if other than German)

Ü (no information on SWS (weekly contact hours) and course language available)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

1 literature search about given preparations

**Allocation of places**

--

**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
--- | ---
Mathematics for students of Chemistry and Biology (lecture and practice) | 10-M-MCB-092-m01

Module coordinator | Module offered by
Dean of Studies Mathematik (Mathematics) | Institute of Mathematics

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Contents

Functional relations, differentiation and integration of functions in one variable, curve sketching, differentiation of functions in several variables, power series, ordinary differential equations, systems of linear equations, basic notions in statistics.

Intended learning outcomes

The student is able to recognise and phrase simple questions from natural sciences as mathematical problems, apply basic mathematical methods to them and interpret the results.

Courses (type, number of weekly contact hours, language — if other than German)

This module comprises 2 module components. Information on courses will be listed separately for each module component.

- 10-M-MCB-1-092: V (no information on SWS (weekly contact hours) and course language available)
- 10-M-MCB-2-092: Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

**Assessment in module component 10-M-MCB-1-092: Mathematics for students in Chemistry and Biology**
- 3 ECTS, Method of grading: numerical grade
- written examination (120 minutes)

**Assessment in module component 10-M-MCB-2-092: Exercises in Mathematics for students in Chemistry and Biology**
- 2 ECTS, Method of grading: (not) successfully completed
- exercises (to be submitted on a weekly basis, written examination)

Allocation of places

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Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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<td>Admission prerequisite to assessment: successful completion of exercises in the respective classes as specified at the beginning of the course (usually 70% of exercises to be successfully completed) as well as regular attendance of exercises (usually a maximum of 2 incidents of unexcused absence).</td>
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### Contents

This module provides students with an overview of the fundamental principles of organic chemistry. It examines the bonding situation of carbon and introduces students to the nomenclature of simple and moderately complex organic compounds. The module also discusses the fundamental principles of stereochemistry, substitution, addition and elimination reactions as well as synthesis planning.

### Intended learning outcomes

Students know important categories of substances in organic chemistry. They are able to use different systems of nomenclature to determine simple substance names. Students are able to analyse the stereochemistry of molecules. They are able to describe and formulate some of the most important reactions in organic chemistry. For that purpose, they can analyse and categorise the characteristic reaction conditions and can use them for simple syntheses.

### Courses

(type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) 1 to 3 written examinations (1 written examination: approx. 90 minutes; 2 written examinations: 60 or 90 minutes each; 3 written examinations: 60 minutes each) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)

### Allocation of places

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### Additional information

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### Referred to in LPO I (examination regulations for teaching-degree programmes)

§ 62 (1) 2. Chemie "Organische und Bioorganische Chemie"
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<td>holder of the Chair of Physically Organic Chemistry</td>
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**Contents**

This module introduces students to the rules of aromaticity and discusses specific reactions of aromatics. Using the example of carbonyl compounds, it extends the students’ knowledge of substitution, elimination and addition reactions to complex reaction mechanisms. The course also focuses on oxidation and reduction reactions as well as rearrangement. In addition, it introduces students to the spectroscopic methods of infrared spectroscopy, mass spectrometry and NMR spectroscopy.

**Intended learning outcomes**

Students have become familiar with the criteria for aromaticity. They can analyse the varying reactivity of carbonyl compounds. They are able to describe specific reactions of carbonyls and aromatics. For that purpose, they can plan and formulate multi-stage syntheses with complex reaction mechanisms and can transfer them to unknown reactions. Students are able to describe important spectroscopic methods, to evaluate a spectrum and to draw conclusions regarding the molecular structure.

**Courses** (type, number of weekly contact hours, language — if other than German)

V + Ü + V (no information on SWS (weekly contact hours) and course language available)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) 1 to 3 written examinations (1 written examination: 90 minutes; 2 written examinations: 60 or 90 minutes each; 3 written examinations: 60 minutes each) or b) oral examination in groups (groups of 2, approx. 30 minutes)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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Module title | Abbreviation
--- | ---
Organic Chemistry 3 | 08-OC3-092-m01

Module coordinator | Module offered by
--- | ---
holder of the Professorship of Organic Chemistry | Institute of Organic Chemistry

ECTS | Method of grading | Only after succ. compl. of module(s)
--- | --- | ---
15 | numerical grade | 08-AC1 (module component 08-AC1-1 only) or 08-AN1 (module component 08-AN1-1 only) or 08-OC1 or 08-OC1-GHR

Duration | Module level | Other prerequisites
--- | --- | ---
1 semester | undergraduate | By way of exception, additional prerequisites are listed in the section on assessments.

Contents
This module focuses on polar rearrangements, olefination reactions, pericyclic reactions, carbenes, nitriles and radicals. It discusses the fundamental principles of stereoselective synthesis, asymmetric catalysis, organometallic chemistry and retrosynthesis. The module gives students the opportunity to apply in practice the knowledge they have gained through the related lecture(s). After a safety briefing, the students autonomously conduct experiments in the laboratory. In addition to those experiments, students will be expected to take oral tests and write lab reports to demonstrate their knowledge. The course focuses on the safe handling of hazardous substances, simple experimental unit operations of organic chemistry, simple to multi-level syntheses and the analysis of the products.

Intended learning outcomes
Students are able to formulate olefination reactions. They are able to develop stereoselective syntheses and asymmetric catalyses. Students are able to describe organometallic reactions. They are able to conduct retrosynthetic analyses of molecules. Students know how to safely handle hazardous substances. They are able to conduct simple experimental operations of organic chemistry. They are able to analyse the yield and purity of the products and identify possible error sources. They are able to connect the theoretical aspects covered in the lecture with practical experiments in the laboratory.

Courses (type, number of weekly contact hours, language — if other than German)
This module comprises 2 module components. Information on courses will be listed separately for each module component.

- 08-OC3-1-092: V + Ü (no information on SWS (weekly contact hours) and course language available)
- 08-OC3-2-092: P (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

**Assessment in module component 08-OC3-1-092: Organic Chemistry 3 Organic Chemistry 3**
- 6 ECTS, Method of grading: numerical grade
- a) 1 to 3 written examinations (1 written examination: approx. 90 minutes; 2 written examinations: approx. 60 or 90 minutes each; 3 written examinations: approx. 60 minutes each) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)
- Language of assessment: German or English
- Other prerequisites: Admission prerequisite to assessment: successful completion of exercises in the respective classes as specified at the beginning of the course (usually 70% of exercises to be successfully completed) as well as regular attendance of exercises (usually a maximum of 2 incidents of unexcused absence).

**Assessment in module component 08-OC3-2-092: Organic Chemistry - lab 1**
- 9 ECTS, Method of grading: (not) successfully completed
- Vortestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nachtestate (post-experiment exams, approx. 15 minutes each)
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## Module title
Organic Chemistry 4

## Abbreviation
08-OC4-092-m01

## Module coordinator
holder of the Chair of Organic Chemistry II

## Module offered by
Institute of Organic Chemistry

## ECTS

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## Duration
1 semester

## Module level
undergraduate

## Other prerequisites
By way of exception, additional prerequisites are listed in the section on assessments.

## Contents
This module focuses on heterocyclic compounds, dyes, naturally occurring substances, biopolymers and protecting group techniques. Students enhance their experimental skills by working with special hazardous substances, using complicated working and synthesis techniques as well as extensive purification methods and performing elaborate product analyses.

## Intended learning outcomes
Students are able to name important heteroaromatics and to formulate their reactions and syntheses. They are able to characterise and categorise dyes. Students are able to describe the structure and selective synthesis of proteins. In addition, they are able to describe the structure of the DNA, carbohydrates, fats, terpenes and steroids. Students know how to safely and responsibly handle special hazardous substances. They are able to perform complex syntheses, purification methods and product analyses. They are able to use specialist literature to plan experiments.

## Courses
This module comprises 2 module components. Information on courses will be listed separately for each module component.

- **08-OC4-2-092**: P (no information on SWS (weekly contact hours) and course language available)
- **08-OC4-1-092**: V + Ü (no information on SWS (weekly contact hours) and course language available)

## Method of assessment

### Assessment in module component 08-OC4-2-092: Organic Chemistry - advanced laboratory course for students of chemistry
- 5 ECTS, Method of grading: (not) successfully completed
- Vortestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nachtestate (post-experiment exams, approx. 15 minutes each)
- Assessment offered: once a year, winter semester

### Assessment in module component 08-OC4-1-092: Organic Chemistry 4
- 5 ECTS, Method of grading: numerical grade
- a) 1 to 3 written examinations (1 written examination: approx. 90 minutes; 2 written examinations: approx. 60 or 90 minutes each; 3 written examinations: approx. 60 minutes each) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)
- Other prerequisites: Admission prerequisite to assessment: successful completion of exercises in the respective classes as specified at the beginning of the course (usually 70% of exercises to be successfully completed) as well as regular attendance of exercises (usually a maximum of 2 incidents of unexcused absence).

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Subdivided Module Catalogue for the Subject Chemistry
Bachelor's with 1 major, 180 ECTS credits

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</table>

Contents

This module introduces students to the fundamental principles of quantum mechanics. It analyses molecules on the basis of the following models: particle in a box, harmonic oscillator and rigid rotor. As regards spectroscopy, the module focuses on vibrational spectroscopy, angular momentum quantisation, microwave spectroscopy and UV-VIS spectroscopy. In addition, the module discusses linear operators, eigenvalue problems, matrix representation, differential equations, Fourier transform and orthogonal functions as mathematical bases of the topics listed above.

Intended learning outcomes

Students are able to explain key models of quantum mechanics and to apply them to molecules. They are able to describe different spectroscopic methods. In addition, students know how to apply the mathematical bases of quantum mechanics.

Courses (type, number of weekly contact hours, language — if other than German)

V + Ü + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) 1 to 3 written examinations (1 written examination: approx. 90 minutes; 2 written examinations: 60 or 90 minutes each; 3 written examinations: 60 minutes each) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)

Allocation of places

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Additional information

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Referred to in LPO I (examination regulations for teaching-degree programmes)

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Module title: Physical Chemistry 2: Thermodynamics, Kinetics, Electrochemistry

Abbreviation: 08-PC2-092-m01

Module coordinator: Lecturer of lecture "Thermodynamik, Kinetik, Elektrochemie"

Module offered by: Institute of Physical and Theoretical Chemistry

ECTS: 18

Method of grading: Numerical grade

Duration: 1 semester

Module level: Undergraduate

Other prerequisites: By way of exception, additional prerequisites are listed in the section on assessments.

Contents

This module introduces students to the principles of thermodynamics. It focuses on the laws of thermodynamics, chemical equilibria, ideal and real gasses/solutions/mixed phases and electrochemistry. In addition to thermodynamic processes, it discusses the fundamental principles of kinetics. The module gives students the opportunity to apply in practice the knowledge they have gained through the related lecture(s). After a safety briefing, the students autonomously conduct experiments in the laboratory. In addition to those experiments, students will be expected to take oral tests and write lab reports to demonstrate their knowledge.

Intended learning outcomes

Students are able to explain the laws of thermodynamics. They are able to describe thermodynamic aspects of solutions, gases, mixed phases and electrochemical reactions. Students are able to interpret the kinetic aspects of chemical reactions. They are able to connect the theoretical principles of thermodynamics, kinetics, electrochemistry and spectroscopy with practical laboratory experiments. They are able to analyse the resulting measurements.

Courses

This module comprises 2 module components. Information on courses will be listed separately for each module component.

08-PC2-2-092: P (no information on SWS (weekly contact hours) and course language available)

08-PC2-1-092: V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment

Assessment in this module comprises the assessments in the individual module components as specified below. Unless stated otherwise, successful completion of the module will require successful completion of all individual assessments.

Assessment in module component 08-PC2-2-092: Physical Chemistry (lab)

- 9 ECTS, Method of grading: (not) successfully completed
- Vortestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nachtestate (post-experiment exams, approx. 15 minutes each)
- Assessment offered: once a year, winter semester
- Only after successful completion of module components: 08-PC1-1 or 08-PC2-1

Assessment in module component 08-PC2-1-092: Thermodynamics, Kinetics, Electrochemistry

- 9 ECTS, Method of grading: numerical grade
- a) 1 to 3 written examinations (1 written examination: approx. 90 minutes; 2 written examinations: 60 or 90 minutes each; 3 written examinations: 60 minutes each) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)
- Other prerequisites: Admission prerequisite to assessment: successful completion of exercises in the respective classes as specified at the beginning of the course (usually 70% of exercises to be successfully completed) as well as regular attendance of exercises (usually a maximum of 2 incidents of unexcused absence).
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### Physical Chemistry 4: Statistical Thermodynamics

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<td>lecturer of lecture &quot;Statistische Thermodynamik&quot;</td>
<td>Institute of Physical and Theoretical Chemistry</td>
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</table>

**Contents**

This module deals with basics of statistical thermodynamics.

**Intended learning outcomes**

Students have become familiar with the fundamental principles of statistical thermodynamics and are able to apply the knowledge they have developed.

**Courses**

(type, number of weekly contact hours, language — if other than German)

V + Ü (no information on SWS (weekly contact hours) and course language available)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) 1 to 3 written examinations (1 written examination: approx. 90 minutes; 2 written examinations: approx. 60 or 90 minutes each; 3 written examinations: approx. 60 minutes each) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I**

(examination regulations for teaching-degree programmes)

--
Module title: Practical Course Physics for Students of Non-physics-related Minor Subjects
Abbreviation: 11-PFNF-072-m01

Module coordinator: Managing Director of the Institute of Applied Physics
Module offered by: Faculty of Physics and Astronomy

ECTS: 3

Method of grading: Only after successfully completed module(s)

Duration: 1 semester

Module level: Undergraduate

Contents:
Mechanics, vibration theory, thermodynamics, optics, X-rays, nuclear magnetic resonance, Atomic and Nuclear Physics.

Intended learning outcomes:
The students have knowledge of the principles of Physics.

Courses:
(no information on SWS (weekly contact hours) and course language available)
P

Method of assessment:
a) oral test (approx. 15 minutes) during experiment and b) ungraded written examination (approx. 90 minutes)

Allocation of places:
Only as part of pool of general key skills (ASQ): 10 places. Places will be allocated by lot.

Additional information:

Referred to in LPO I (examination regulations for teaching-degree programmes)
<table>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical and Theoretical Chemistry 3: Symmetry and Quantum Chemistry</td>
<td>08-PC3-092-m01</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Module coordinator</th>
<th>Module offered by</th>
</tr>
</thead>
<tbody>
<tr>
<td>lecturer of lecture &quot;Quantenchemie&quot;</td>
<td>Institute of Physical and Theoretical Chemistry</td>
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<table>
<thead>
<tr>
<th>ECTS</th>
<th>Method of grading</th>
<th>Only after succ. compl. of module(s)</th>
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<tbody>
<tr>
<td>6</td>
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<table>
<thead>
<tr>
<th>Duration</th>
<th>Module level</th>
<th>Other prerequisites</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
<td>Admission prerequisite to assessment: successful completion of exercises in the respective classes as specified at the beginning of the course (usually 70% of exercises to be successfully completed) as well as regular attendance of exercises (usually a maximum of 2 incidents of unexcused absence).</td>
</tr>
</tbody>
</table>

**Contents**

This module deals with basics of quantum chemistry and symmetry in chemistry.

**Intended learning outcomes**

Students have become familiar with the fundamental principles of quantum chemistry and symmetry in chemistry and are able to apply the knowledge they have developed.

**Courses** (type, number of weekly contact hours, language — if other than German)

V + Ü + V + Ü (no information on SWS (weekly contact hours) and course language available)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) 1 to 3 written examinations (1 written examination: 90 minutes; 2 written examinations: 60 or 90 minutes each; 3 written examinations: 60 minutes each) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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### Applied Spectroscopy 3

<table>
<thead>
<tr>
<th>Module title</th>
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</thead>
<tbody>
<tr>
<td>Applied Spectroscopy 3</td>
<td>08-PS3-092-m01</td>
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</tbody>
</table>

#### Module coordinator

- **Module coordinator**: Lecturer of lecture "Praktische Spektroskopie 3"
- **Module offered by**: Institute of Physical and Theoretical Chemistry

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<tr>
<th>ECTS</th>
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<tbody>
<tr>
<td>5</td>
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<tr>
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<th>Other prerequisites</th>
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<tbody>
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<td>1 semester</td>
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</table>

#### Contents

This module gives students the opportunity to apply their theoretical knowledge of spectroscopic methods in practice and to interpret readings or graphs. We will record and analyse UV-VIS, fluorescence and vibration spectra and discuss modern mass spectrometry methods.

#### Intended learning outcomes

Students are able to work with different spectrometers and to interpret the resulting spectra. They are able to conduct error discussions.

#### Courses (type, number of weekly contact hours, language — if other than German)

- **V** (no information on SWS (weekly contact hours) and course language available)

#### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

- 1 written examination (approx. 90 minutes) or 2 written examinations (approx. 60 or 90 minutes each) or 3 written examinations (approx. 60 minutes each) or oral examination of one candidate each (approx. 20 minutes) or oral examination in groups (groups of 2, approx. 30 minutes)

#### Allocation of places

- --

#### Additional information

- --

#### Referred to in LPO I (examination regulations for teaching-degree programmes)

- --
Module title: Programming course for Chemistry Majors
Abbreviation: 08-PKC-092-m01

Module coordinator: Lecturer of lecture "Programmierkurs für Chemiker"
Module offered by: Institute of Physical and Theoretical Chemistry

ECTS: 5
Method of grading: Only after successfully completed module(s)
Duration: 1 semester
Module level: Undergraduate
Other prerequisites: --

Contents: The module introduces students to the basics of a programming language and gives applications to problems related to chemistry.

Intended learning outcomes: Students are able to describe the fundamentals of the programming language and to apply them to problems in chemistry.

Courses: V + Ü (no information on SWS (weekly contact hours) and course language available)

Method of assessment: Practical examination: completion of programming exercises and oral description of algorithms used (length/expenditure of time as specified at the beginning of the course)

Allocation of places: --

Additional information: --

Referred to in LPO I (examination regulations for teaching-degree programmes): --
### Module title
**Theoretical Models in Chemistry**

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>08-TC-092-m01</th>
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</table>

### Module coordinator
**lecturer of lecture "Quantenchemie"**

### Module offered by
Institute of Physical and Theoretical Chemistry

### ECTS
3

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
--

### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
Admission prerequisite to assessment: successful completion of exercises in the respective classes as specified at the beginning of the course (usually 70% of exercises to be successfully completed) as well as regular attendance of exercises (usually a maximum of 2 incidents of unexcused absence).

### Contents
This module provides students with deeper insights into advanced topics in quantum chemistry. It focuses on spin, the Pauli principle, Slater determinants, the Hartree-Fock method, correlation energy, configuration interaction and excited states, the Born-Oppenheimer approximation and bonding models of H₂⁺.

### Intended learning outcomes
Students are able to describe excited states of molecules with the help of key concepts and models.

### Courses
V + Ü (no information on SWS (weekly contact hours) and course language available)

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

a) 1 to 3 written examinations (1 written examination: approx. 90 minutes; 2 written examinations: approx. 60 or 90 minutes each; 3 written examinations: approx. 60 minutes each) or b) oral examination of one candidate each (approx. 20 minutes) or c) oral examination in groups (groups of 2, approx. 30 minutes)

### Allocation of places
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### Additional information
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### Referred to in LPO I
(examination regulations for teaching-degree programmes)

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<table>
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<th>Module title</th>
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<tbody>
<tr>
<td>Toxicology and legal studies</td>
<td>03-TR-072-m01</td>
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<tbody>
<tr>
<td>lecturer of lecture &quot;Toxikologie und Rechtskunde&quot;</td>
<td>Faculty of Medicine</td>
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## Contents
Basics of legal regulations for chemists (handling and transportation of hazardous materials), fundamentals of toxicology.

### Intended learning outcomes
The students master the basics of legal regulations for chemists (handling and transport of hazardous substances) as well as the fundamentals of toxicology.

### Courses (type, number of weekly contact hours, language — if other than German)
V + V (no information on SWS (weekly contact hours) and course language available)

### Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)
written examination (approx. 90 minutes)

### Allocation of places
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### Additional information
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<tr>
<td>Advanced chemical practical course</td>
<td>08-VP-092-m01</td>
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<th>Module offered by</th>
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<tbody>
<tr>
<td>head of the research group offering the module</td>
<td>Faculty of Chemistry and Pharmacy</td>
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</table>

**Contents**

This module gives students the opportunity to explore a research topic and apply the methods commonly used in the discipline in question.

**Intended learning outcomes**

The student is able to deeply acquaint himself/herself with a specific research topic, and to process and to present the results in a written report or a talk.

**Courses** (type, number of weekly contact hours, language — if other than German)

P (no information on SWS (weekly contact hours) and course language available)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)

Talk (approx. 15 minutes)

**Allocation of places**

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**Additional information**

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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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