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: 2015
Responsible: Faculty of Chemistry and Pharmacy
Course of Studies - Contents and Objectives

The degree subject Chemistry is offered by the Faculty of Chemistry and Pharmacy of the JMU as a fundamental course of studies with the degree "Bachelor of Science" (B.Sc.) within the framework of a consecutive Bachelor and Master study model.

The Bachelor's degree programme aims to impart the specialised knowledge and skills necessary for the transition to professional practice or a subsequent Master's degree programme. These include the theoretical foundations of inorganic, organic, physical, theoretical and bioorganic chemistry, as well as the accompanying practical laboratory techniques. The course places emphasis on the acquisition of basic knowledge and training in scientific observation and practical laboratory skills, with a progressively increasing focus on independence in a laboratory setting. This intensive training should equip students with the confidence and skills needed for independent work in a range of application-oriented areas of industry, commerce or management, or provide the basis for advanced scientific training as part of a Master's degree.
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: NUM = numerical grade, 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:

ASPO2015

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

22-Jul-2015 (2015-34)

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.
The subject is divided into

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<td>08-ACP1-152-m01</td>
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<td>08-OCP2-152-m01</td>
<td>Organic Chemistry - advanced laboratory course for students of chemistry</td>
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<td>08-OC3+4-152-m01</td>
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<td>08-PC-QMS-152-m01</td>
<td>Principles of quantum mechanics and spectroscopy</td>
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<td>08-PC-TKE-152-m01</td>
<td>Thermodynamics, Kinetics, Electrochemistry</td>
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<td>08-PC-SBL-152-m01</td>
<td>Symmetry, chemical bonding and light</td>
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<td>10-M-MCB-152-m01</td>
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<td>11-EFN-152-m01</td>
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<td><strong>Subject-specific Key Skills (15 ECTS credits)</strong></td>
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<td><strong>Subject-specific Key Skills, Compulsory Electives (10 ECTS credits)</strong></td>
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<td>Biochemistry 2</td>
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<td>Practical course of Biochemistry</td>
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<td>08-AS1-152-m01 Inorganic Chemistry of the Elements</td>
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<tr>
<td>08-ANP-152-m01 Analytical Chemistry (lab)</td>
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<tr>
<td>08-AC-FS-DA-152-m01 Solid State Chemistry, Spectroscopic Methods (DD)</td>
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<tr>
<th>Subfield Organic Chemistry (28 ECTS credits)</th>
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<td>08-OC1-152-m01 Organic Chemistry 1</td>
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<td>08-OCP1-152-m01 Organic Chemistry - lab 1</td>
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<td>08-OC-OC3-DA-152-m01 Organic Chemistry 3 (DD)</td>
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<thead>
<tr>
<th>Subfield Physical and Theoretical Chemistry (37 ECTS credits)</th>
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<tbody>
<tr>
<td>08-PC-QMS-152-m01 Principles of quantum mechanics and spectroscopy</td>
</tr>
<tr>
<td>08-PC-TKE-152-m01 Thermodynamics, Kinetics, Electrochemistry</td>
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<tr>
<td>08-PCP-152-m01 Physical Chemistry (lab)</td>
</tr>
<tr>
<td>08-TC-152-m01 Quantum Chemistry</td>
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<tr>
<td>08-PC-SBL-DA-152-m01 Symmetry, chemical bonding and light (DD)</td>
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<th>Subfield Basics of Natural Sciences (20 ECTS credits)</th>
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<tr>
<td>08-BC1-152-m01 Biochemistry 1</td>
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<tr>
<td>10-M-MCB-152-m01 Mathematics for students in Chemistry and Biology</td>
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<tr>
<td>11-EFNF-152-m01 Introduction to Physics for Students of other Disciplines</td>
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<tr>
<th>Subfield Competences from foreign university (50 ECTS credits)</th>
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<th>Thesis (10 ECTS credits)</th>
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<td>08-BA-152-m01 Bachelor Thesis</td>
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### Module title
Qualifications - Partner University 1

### Abbreviation
08-VPUB1-152-m01

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<th>Module coordinator</th>
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<tbody>
<tr>
<td>programme coordinator of the exchange programme</td>
<td>Faculty of Chemistry and Pharmacy</td>
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<th>Only after succ. compl. of module(s)</th>
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<th>Module level</th>
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<tbody>
<tr>
<td>2 semester</td>
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<td>Please consult with course advisory service in advance.</td>
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</table>

### Contents
The topics covered in this module correspond to the syllabus of the foreign partner university.

### Intended learning outcomes
Students have developed the knowledge and skills taught in the courses attended by them at the partner university.

### Courses
No courses assigned to module

Course(s) as specified by partner university abroad

### Method of assessment
Assessments as specified by partner university abroad

Language of assessment: German and/or language spoken at partner university abroad

### 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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<th>Module coordinator</th>
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<td>programme coordinator of the exchange programme</td>
<td>Faculty of Chemistry and Pharmacy</td>
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<th>Other prerequisites</th>
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<td>2 semester</td>
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<td>Please consult with course advisory service in advance.</td>
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</table>

### Contents

The topics covered in this module correspond to the syllabus of the foreign partner university.

### Intended learning outcomes

Students have developed the knowledge and skills taught in the courses attended by them at the partner university.

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

No courses assigned to module

### 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)

Assessments as specified by partner university abroad
Language of assessment: German and/or language spoken at partner university abroad

### 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>
<thead>
<tr>
<th>Module title</th>
<th>Abbreviation</th>
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<td>Inorganic Chemistry of the Elements</td>
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<tr>
<td>lecturer of lecture &quot;Chemie der Hauptgruppenelemente&quot; (Chemistry of Main-group Elements)</td>
<td>Institute of Inorganic Chemistry</td>
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<tbody>
<tr>
<td>1 semester</td>
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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.

**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.

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

V (2) + V (2)

**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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/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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<td>head of the research group offering the module</td>
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<th>Duration</th>
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<td>1 semester</td>
<td>undergraduate</td>
<td>The supervisor may make the successful completion of certain modules that are relevant for the respective topic a prerequisite for the assignment of the topic.</td>
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</tbody>
</table>

### 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 to module

### 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)

Bachelor's thesis (approx. 40 pages)

Language of assessment: German and/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 1
Abbreviation: 08-BC1-152-m01

Module coordinator: holder of the Chair of Biochemistry
Module offered by: Chair of Biochemistry

ECTS: 5
Method of grading: numerical grade
Only after succ. compl. of module(s): --

Duration: 1 semester
Module level: undergraduate
Other prerequisites: --

Contents:
The module imparts the basic knowledge of biochemistry by lectures and tutorials. Main topics of the module Biochemistry 1 are particularly the biochemistry of proteins (amino acids, peptide bond, primary, secondary, tertiary and quaternary structure), catalytic strategies and enzyme kinetics, carbohydrate metabolism (glycolysis, gluconeogenesis, citric acid cycle, cellular respiration, photosynthesis), fatty acid metabolism (beta-oxidation, fatty acid synthesis), nucleotide metabolism, urea cycle and metabolism of amino acids. Additionally the module conveys basic knowledge about the structure of DNA and the basics of passing and transformation of genetic information (central dogma).

Intended learning outcomes:
The student has basic knowledge in the covered subject areas of biochemistry. He/She is able to describe the basic biochemical processes in cellular systems.

Courses (type, number of weekly contact hours, language — if other than German):
V (2) + Ü (1)

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. 60 to 90 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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§ 62 I Nr. 2
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<td>Chair of Biochemistry</td>
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<th>Other prerequisites</th>
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<tbody>
<tr>
<td>1 semester</td>
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**Contents**

The module imparts the basic knowledge of biochemistry by lectures and in-depth tutorials. Main topics of the module Biochemistry 2 are particularly Replication, DNA repair, transcription, mRNA maturation, translation and regulation of translation, protein targeting, nuclear transport, and protein degradation. Additionally the module conveys basic knowledge about the cellular signal transduction.

**Intended learning outcomes**

The student has basic knowledge in the covered subject areas of biochemistry. He/She is able to describe the basic biochemical processes in cellular systems.

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

V (2) + Ü (1)

**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. 60 to 90 minutes)

**Allocation of places**

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**Additional information**

Pursuant to Section 2 Subsection 2 Sentence 2 Verordnung über die Ausbildung und Prüfung der Staatlich geprüften Lebensmittelchemikerinnen und Lebensmittelchemiker (Regulation on the training and examination of state-certified food chemists, APOLmCh) in conjunction with No. II 2. Letter e) and No. II 1. Letter c) of Annex 1 of APOLmCh and No. 3 of Annex 3 of APOLmCh.

**Referred to in LPO 1** (examination regulations for teaching-degree programmes)

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<td>undergraduate</td>
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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 (6)

**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)

Log (approx. 30 pages)
Assessment offered: Once a year, summer semester

**Allocation of places**

Students of the Bachelor's degree programme Biochemie (Biochemistry, 180 ECTS credits): no restrictions with regard to available places.

Students of the Bachelor's degree programme Chemie (Chemistry, 180 ECTS credits): no more than 6 places; places will be allocated according to the number of subject semesters, 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 by lot as they become available.

**Additional information**

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**Referred to in LPO 1** (examination regulations for teaching-degree programmes)

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<table>
<thead>
<tr>
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<td>Introduction to Physics for Students of other Disciplines</td>
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<tr>
<td>Managing Director of the Institute of Applied Physics</td>
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<td>2 semester</td>
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</table>

**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 (4) + V (3)

**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 (60 to 120 minutes)

**Allocation of places**
--

**Additional information**
--

**Referred to in LPO I (examination regulations for teaching-degree programmes)**
--
Module title | Abbreviation
---|---
Solid State Chemistry, Spectroscopic Methods, Organoelement Chemistry | 08-AC-FSE-152-m01

Module coordinator | Module offered by
lecturers of lecture "Festkörperchemie" (Solid State Chemistry) and "Elementorganische Chemie" (Elemental Organic Chemistry) | Institute of Inorganic Chemistry

ECTS | Method of grading | Only after succ. compl. of module(s)
---|---|---
12 | numerical grade | --

Duration | Module level | Other prerequisites
---|---|---
2 semester | undergraduate | --

Contents
The module imparts deepened knowledge of metals, alloys, salt-like compounds and organometallics. Focuses are structure and characteristics, special substance classes, reactivity and technical processes.

Intended learning outcomes
The student can correctly outline the structure and characteristics of metals, alloys, salt-like compounds and organometallics. He/She is able to systemize them and to characterize them with regard to their structure and reactivity. He/She can develop and describe principles of synthesis for elementorganic compounds. He/She can list and describe appropriate spectroscopical methods for the structural analysis of solid materials.

Courses (type, number of weekly contact hours, language — if other than German)
V (2) + V (2) + V (3) + Ü (1)

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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/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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<tr>
<td>Solid State Chemistry, Spectroscopic Methods (DD)</td>
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**Module coordinator**

lecture of lecture "Festkörperchemie" (Solid State Chemistry)

**Module offered by**

Institute of Inorganic Chemistry

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**ECTS**

5

**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 (2) + V (2)

**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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/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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<td>lecturer of lecture &quot;Experimentalchemie&quot; (Experimental Chemistry)</td>
<td>Institute of Inorganic Chemistry</td>
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**Contents**

The module provides an overview of the fundamental knowledge of chemistry. Emphasis is placed on the material and particle level, metals, acid-base reactions, the periodic table, chemical equilibrium and complexometry. In addition, the module introduces fundamental concepts of chemistry and teaches the basics of inorganic chemistry.

**Intended learning outcomes**

The student understands the principles of the periodic table and can obtain information from it. He/she is proficient in basic models of the structure of matter and can describe them properly. He/she can depict chemical reactions using typical chemical formula language and interpret them by identifying the type of reaction. The students know how the most important quantitative and qualitative analytical methods work and their areas of application.

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

V (4) + V (2)

**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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/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)

§ 42 I Nr. 1 and § 22 II Nr. 1 h)

§ 62 I Nr. 1
### Module title

**Principles of quantum mechanics and spectroscopy**

### Abbreviation

08-PC-QMS-152-m01

### Module coordinator

Lecturer of lecture "Grundlagen der Quantenmechanik and Spektroskopie" (Principles of Quantum Mechanics and Spectroscopy)

### Module offered by

Institute of Physical and Theoretical Chemistry

### ECTS

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### 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 (4) + Ü (2) + V (2)

### 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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/or English creditable for bonus

### 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
Mathematics for students in Chemistry and Biology

### Abbreviation
10-M-MCB-152-m01

### Module coordinator
Dean of Studies Mathematik (Mathematics)

### Module offered by
Institute of Mathematics

### ECTS
5

### Method of grading
numerical grade

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

### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
--

### 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)

V (3) + Ü (2)

### 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 to 120 minutes) and written exercises (approx. 25)

### Allocation of places
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### Additional information
Pursuant to Section 2 Subsection 2 Sentence 2 Verordnung über die Ausbildung und Prüfung der Staatlich geprüften Lebensmittelchemikerinnen und Lebensmittelchemiker (Regulation on the training and examination of state-certified food chemists, APOLmCh) in conjunction with No. I 2. Letter f) of Annex 1 of APOLmCh.

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

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### Module title
Organic Chemistry - lab 1

### Abbreviation
08-OCP1-152-m01

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

### Module offered by
Institute of Organic Chemistry

### ECTS
8

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

### (not) successfully completed
08-OC1 and 08-ACP1

### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
--

### Contents
This 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 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)
P (14)

### 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)

Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical performance (2 to 4 random examinations)

Language of assessment: German and/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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### Contents
The module deepens the experimental skills of the student by handling special hazardous substances, complex work and synthesis techniques, extensive purification methods and laborious product analyses.

### Intended learning outcomes
The student is able to handle special hazardous substances responsibly. He/She can carry out extensive synthesis, purification techniques and product analyses. He/She can use specific literature to plan experiments.

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

P (11)

### 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)

Vorteststate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical performance (2 to 4 random examinations)

Language of assessment: German and/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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<td>Institute of Organic Chemistry</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 (3) + Ü (1)

### 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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/or English

### Allocation of places

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

§ 62 I Nr. 2
Module title | Abbreviation
---|---
Organic Chemistry 2 and analytical methods in organic chemistry | 08-OC2-152-m01

Module coordinator
holder of the Chair of Physically Organic Chemistry

Module offered by
Institute of Organic Chemistry

ECTS | Method of grading | Only after succ. compl. of module(s)
---|---|---
9 | numerical grade | --

Duration | Module level | Other prerequisites
---|---|---
1 semester | undergraduate | --

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 (3) + Ü (1) + V (2)

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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)
Language of assessment: German and/or English

Allocation of places
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Additional information
--

Referred to in LPO 1 (examination regulations for teaching-degree programmes)
--
### Module title
Organic Chemistry 3 (DD)

### Abbreviation
08-OC-OC3-DA-152-m01

### Module coordinator
holder of the Professorship of Organic Chemistry

### Module offered by
Institute of Organic Chemistry

### ECTS
6

### Method of grading
Numerical grade

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

### Duration
1 semester

### Module level
Undergraduate

### Other prerequisites
--

### Contents
The module focuses on polar rearrangements, olefination reactions, pericyclic reactions, carbenes, nitriles and radicals. It imparts basic knowledge of stereoselective synthesis, asymmetric catalysis, organometallic chemistry and retrosynthesis.

### 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.

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

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<th>Type</th>
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<td>V</td>
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<tr>
<td>Ü</td>
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### 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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/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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</table>

**Contents**

The module focuses on polar rearrangements, olefination reactions, pericyclic reactions, carbenes, nitriles and radicals. It imparts basic knowledge of stereoselective synthesis, asymmetric catalysis, organometallic chemistry and retrosynthesis. Further focuses are heterocycles, dyes, natural products, biopolymers and protecting groups.

**Intended learning outcomes**

The student is able to formulate olefination reactions. He/She can develop stereoselective syntheses and asymmetric catalyses. He/She can outline organometallic reactions and analyse a molecule by retrosynthesis. He/She can name important heterocyclics and outline their reactions and synthesis. He/She is able to characterize and categorize dyes and to describe the structure and the selective synthesis of proteins. Furthermore, he/she can outline the structure of DNA, carbohydrates, fats, terpenes and steroids.

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

V (2) + Ü (2) + V (2) + Ü (2) + S (1)

**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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

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

--
### Module title
Advanced chemical practical course

### Abbreviation
08-OP-152-m01

### Module coordinator
head of the research group offering the module

### Module offered by
Faculty of Chemistry and Pharmacy

### ECTS
5

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

### Duration
undergraduate

### Other prerequisites
--

## 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 (10)

### 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) talk (approx. 15 minutes) or b) log (approx. 10 to 20 pages)
Language of assessment: German and/or English

## Allocation of places
--

## Additional information
--

## Referred to in LPO 1 (examination regulations for teaching-degree programmes)
--
## Laboratory Course Physics for Students of other Disciplines

<table>
<thead>
<tr>
<th>Module title</th>
<th>Laboratory Course Physics for Students of other Disciplines</th>
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<tbody>
<tr>
<td>Abbreviation</td>
<td>11-PNFN-152-m01</td>
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### Module coordinator
Managing Director of the Institute of Applied Physics

### Module offered by
Faculty of Physics and Astronomy

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<th>ECTS</th>
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### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
--

### Contents
Simple experiments in the fields of mechanics, vibration theory, thermodynamics, optics, X-rays, nuclear magnetic resonance, Atomic and Nuclear Physics, imaging methods.

### Intended learning outcomes
The students have detected and understood physical contexts on the basis of the implementation of own experiments. They have a basic understanding of physical phenomena and know the basic ideas and ways of functioning of different measuring and imaging methods as well as their applications, especially in the field of Biomedicine.

### Courses (type, number of weekly contact hours, language — if other than German)
P (4)

### 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) practical assignment with oral test (approx. 15 minutes, during experiments) and b) written examination (90 minutes).
Each experiment comprises preparation, performance and evaluation. Test as well as performance of experiments can each be repeated once.

### Allocation of places
Only as part of pool of general transferable skills (ASQ): 10 places (lottery)

### Additional information
--

### Referred to in LPO 1 (examination regulations for teaching-degree programmes)
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<table>
<thead>
<tr>
<th><strong>Module title</strong></th>
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<tr>
<td>Analytical Chemistry (lab)</td>
<td>08-ANP-152-m01</td>
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<th><strong>Module coordinator</strong></th>
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<tbody>
<tr>
<td>holder of the Chair of Anorganic Chemistry</td>
<td>Institute of Inorganic Chemistry</td>
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<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**Contents**
The module provides the opportunity to apply the knowledge of the introductory lectures in a practical course. After a safety introduction the students experiment independently in the laboratory. Focuses are different analysis methods with unknown compounds.

**Intended learning outcomes**
The student is able to analyze unknown compounds using different methods. He/She is able to separate and analyze mixtures.

**Courses** (type, number of weekly contact hours, language — if other than German)
P (12) + S (1)

**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)
Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical performance (2 to 4 random examinations)
Assessment offered: Once a year, summer semester
Language of assessment: German and/or English

**Allocation of places**
--

**Additional information**
--

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

Inorganic Chemistry 1 (lab)

### Abbreviation

08-ACP1-152-m01

### Module coordinator

holder of the Chair of Anorganic Chemistry

### Module offered by

Institute of Inorganic Chemistry

### ECTS

10

### Method of grading

Only after succ. compl. of module(s)

### (not) successfully completed

--

### Duration

1 semester

### Module level

undergraduate

### Other prerequisites

--

### Contents

The module provides the opportunity to apply the knowledge of the introductory lectures in a practical course. After a safety introduction the students experiment independently in the laboratory. Focuses are laboratory safety, basic laboratory techniques, synthesis of basic compounds and analysis of an unknown compound.

### Intended learning outcomes

The student is able to identify basic chemical issues and to solve them experimentally. Therefore he/she can carry out the necessary stoichiometric calculations and correctly outline the chemical processes written and verbal.

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

P (12) + S (2)

### 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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes) and Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical assignments (2 to 4 random examinations)

Assessment offered: Once a year, winter semester

Language of assessment: German and/or English

### Allocation of places

--

### Additional information

--

### Referred to in LPO I

(examination regulations for teaching-degree programmes)

--
Module title | Abbreviation
---|---
Inorganic Chemistry 2 (lab) | 08-ACP2-152-m01

Module coordinator | Module offered by
holder of the Chair of Anorganic Chemistry | Institute of Inorganic Chemistry

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<td>(08-ACP1 or 08-ACP1-BC) and 08-AC1 and 08-AS1</td>
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</table>

Duration | Module level | Other prerequisites
---|---|---
1 semester | undergraduate | --

Contents
The module provides the opportunity to plan and carry out complex syntheses after an individual research. Focuses are the handling of organometallic compounds, their synthesis and the work in inert atmospheres. Spectroscopical methods are used for the precise determination of the products.

Intended learning outcomes
The student is able to experimentally solve complex issues after an individual research. He/She can describe the technical backrounds an explain them written and verbal using technical language. He/She can independently plan and carry out the synthesis of a chemical compound. Therefor he/she can apply advanced laboratory techniques.

Courses (type, number of weekly contact hours, language — if other than German)
P (12)

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)
Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical performance (2 to 4 random examinations)
Language of assessment: German and/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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<table>
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<tr>
<th>Module title</th>
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<tr>
<td>Physical Chemistry (lab)</td>
<td>08-PCP-152-m01</td>
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<th>Module offered by</th>
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<tr>
<td>lecturer of lecture &quot;Thermodynamik, Kinetik, Elektrochemie&quot;</td>
<td>Institute of Physical and Theoretical Chemistry</td>
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<td>1 semester</td>
<td>undergraduate</td>
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### Contents

This 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 connect the theoretical principles of thermodynamics, kinetics, electrochemistry and spectroscopy with practical laboratory experiments. They are able to analyse the resulting measurements.

### Courses

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

P (6)

### 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)

Vortestate/Nachtestate (pre and post-experiment examination talks approx. 15 minutes each, log approx. 5 to 10 pages each) and assessment of practical performance (2 to 4 random examinations)

Language of assessment: German and/or English

### 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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<table>
<thead>
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<th>Module title</th>
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<td>Applied Spectroscopy 3</td>
<td>08-PS3-152-m01</td>
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<th>Module offered by</th>
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<tbody>
<tr>
<td>lecturer of lecture &quot;Praktische Spektroskopie 3&quot;</td>
<td>Institute of Physical and Theoretical Chemistry</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 (3)

**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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)  
Language of assessment: German and/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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<table>
<thead>
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<th>Module title</th>
<th>Abbreviation</th>
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<tr>
<td>Programming and numerical methods</td>
<td>08-PKC-152-m01</td>
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<tr>
<td>lecturer of lecture “Programmierkurs für Chemiker”</td>
<td>Institute of Physical and Theoretical Chemistry</td>
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<td>1 semester</td>
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**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** (type, number of weekly contact hours, language — if other than German)

S (2) + Ü (2)

**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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Assessment offered: Once a year, summer semester

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

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

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

<table>
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<th>Module title</th>
<th>Abbreviation</th>
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<td>Quantum Chemistry</td>
<td>08-TC-152-m01</td>
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<tr>
<td>lecturer of lecture &quot;Quantenchemie&quot;</td>
<td>Institute of Physical and Theoretical Chemistry</td>
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<th>Other prerequisites</th>
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<td>1 semester</td>
<td>undergraduate</td>
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</table>

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

V (2) + Ü (1)

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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/or English creditable for bonus

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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§ 22 II Nr. 2 f)  
§ 22 II Nr. 3 f)
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<thead>
<tr>
<th>Module title</th>
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<tr>
<td>Symmetry, chemical bonding and light</td>
<td>08-PC-SBL-152-m01</td>
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<tbody>
<tr>
<td>lecturer of lecture &quot;Symmetrie, chemische Bindung and Licht&quot;</td>
<td>Institute of Physical and Theoretical Chemistry</td>
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<td>2 semester</td>
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### Contents

The module provides an introduction to the symmetry of molecules. It focuses on group theory, symmetry operations, point groups, character tables, and selection rules. The module deals with the chemical bond based on the qualitative MO theory and gives an introduction into the basics of computational chemistry. The module provides the opportunity to analyze the interactions between symmetry, chemical bonding and light in detail.

### Intended learning outcomes

The student is able to analyze the symmetry of molecules. He/She can imply on the spectroscopic properties of a molecule by its symmetry.

### Courses

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

V (3) + Ü (2) + V (2) + Ü (2)

### 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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/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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<table>
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<tr>
<td>Symmetry, chemical bonding and light (DD)</td>
<td>08-PC-SBL-DA-152-m01</td>
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**Module coordinator**

- lecturer of lecture "Symmetrie, chemische Bindung and Licht"

**Module offered by**

- Institute of Physical and Theoretical Chemistry

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<td>1 semester</td>
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</table>

**Contents**

The module provides an introduction to the symmetry of molecules. It focuses on group theory, symmetry operations, point groups, character tables, and selection rules. The module deals with the chemical bond based on the qualitative MO theory and gives an introduction into the basics of computational chemistry.

**Intended learning outcomes**

The student is able to analyze the symmetry of molecules. He/She can imply on the spectroscopic properties of a molecule by its symmetry.

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

- V (3) + Ü (2)

**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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

--

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

--
Thermodynamics, Kinetics, Electrochemistry

08-PC-TKE-152-m01

Thermodynamics, Kinetics, Electrochemistry

Module coordinator

lecturer of lecture “Thermodynamik, Kinetik, Elektrochemie”

Module offered by

Institute of Physical and Theoretical Chemistry

ECTS

Method of grading

Only after succ. compl. of module(s)

9

numerical grade

--

Duration

Module level

Other prerequisites

1 semester

undergraduate

--

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.

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.

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

V (4) + Ü (2)

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) written examination (approx. 90 to 180 minutes) or b) oral examination of one candidate each (20 to 30 minutes) or c) oral examination in groups of up to 3 candidates (approx. 15 minutes per candidate) or d) log (approx. 20 pages) or e) presentation (approx. 30 minutes)

Language of assessment: German and/or English creditable for bonus

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>
<thead>
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<th>Module title</th>
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<td>Toxicology and legal studies</td>
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<th>Module offered by</th>
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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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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**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 (1) + V (1)

**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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**Referred to in LPO I** (examination regulations for teaching-degree programmes)
§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
§ 22 II Nr. 3 f)
### Module title
Advanced laboratory course

### Abbreviation
08-VP-152-m01

### Module coordinator
head of the research group offering the module

### Module offered by
Faculty of Chemistry and Pharmacy

### ECTS
5

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

### (not) successfully completed
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### Duration
undergraduate

### Other prerequisites
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### 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 (10)

### 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)
Language of assessment: German and/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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