

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: 2008  
Responsible: Faculty of Chemistry and Pharmacy

## Course of Studies - Contents and Objectives

The Bachelor of Chemistry acquaints graduates with the basics of Chemistry, important experimental techniques and methods of scientific work. It is a research-oriented course.

Contents of Chemistry, Mathematics and Physics are thought in lectures and exercises. Typical for this course is a large number of practical courses which provide experimental techniques for scientific laboratory work. Subsequently the Bachelor's thesis demonstrates the graduates knowledge and skills in finding solutions for specific chemical questions.

Students are thus able to participate on a Master degree course. They also have acquired basic theoretical concepts for several tasks as well as professional further development.

## 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:

**ASPO2007**

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

**17-Nov-2009 (2008-34)**

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

Abbreviation	Module title	ECTS credits	Method of grading	page
<b>Compulsory Courses (145 ECTS credits)</b>				
o8-AC2-072-m01	Inorganic Chemistry 2	6	NUM	8
o8-AC3-072-m01	Inorganic Chemistry 3	9	NUM	9
o8-OC1-072-m01	Organic Chemistry 1	5	NUM	18
o8-OC2-072-m01	Organic Chemistry 2	9	NUM	19
o8-OC3-072-m01	Organic Chemistry 3	15	NUM	20
o8-OC4-072-m01	Organic Chemistry 4	10	NUM	22
o8-PC1-072-m01	Principles of quantum mechanics and spectroscopy	8	NUM	24
o8-PC2-072-m01	Physical Chemistry 2	18	NUM	25
o8-PC4-072-m01	Physical Chemistry 4: Statistical Thermodynamics	3	NUM	28
o8-BC-072-m01	Biochemistry	6	NUM	14
10-M-MCB-072-m01	Mathematics for students in Chemistry and Biology	5	NUM	33
11-EFNF-072-m01	Introduction to Physics for Students of Non-physics-related Minor Subjects	7	NUM	34
11-PFNF-072-m01	Practical Course Physics for Students of Non-physics-related Minor Subjects	3	B/NB	36
o8-PC3-082-m01	Physical and Theoretical Chemistry 3: Symmetry and Quantum Chemistry	6	NUM	27
o8-TC-082-m01	Theoretical Models in Chemistry	3	NUM	31
o8-AC1-082-m01	Inorganic Chemistry 1	21	NUM	6
o8-AN1-082-m01	Analytical Chemistry 1	11	NUM	11
<b>Compulsory Electives (5 ECTS credits)</b>				
o8-PS3-072-m01	Applied Spectroscopy 3	5	NUM	30
o8-PKC-072-m01	Programming course for Chemistry Majors	5	B/NB	29
o8-BCP-072-m01	Biochemistry Lab	5	B/NB	15
<b>Thesis (10 ECTS credits)</b>				
o8-BA-072-m01	Bachelor Thesis	10	NUM	13
<b>Subject-specific Key Skills (10 ECTS credits)</b>				
o8-VP-072-m01	Advanced laboratory course	5	B/NB	32
o3-TR-072-m01	Toxicology and legal studies	3	NUM	5
o8-LRAC-072-m01	Literature research methods	1	B/NB	16
o8-LROC-072-m01	Literature research methods	1	B/NB	17

<b>Module title</b>		<b>Abbreviation</b>
Toxicology and legal studies		03-TR-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Toxikologie und Rechtskunde"		Faculty of Medicine
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
3	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Basics of legal regulations for chemists (handling and transportation of hazardous materials), fundamentals of toxicology.		
<b>Intended learning outcomes</b>		
The students master the basics of legal regulations for chemists (handling and transport of hazardous substances) as well as the fundamentals of toxicology.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V + V (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Biochemistry (2011) Bachelor' degree (1 major) Biochemistry (2013) Bachelor' degree (1 major) Biochemistry (2009) Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008) Bachelor' degree (1 major) Chemistry (2010) Bachelor' degree (1 major) Chemistry (2009) Bachelor' degree (1 major) Food Chemistry (2009) Bachelor' degree (1 major) FOKUS Chemistry (2011) Master's degree (1 major) Chemistry (2013) Master's degree (1 major) Chemistry (2010) Master's degree (1 major) Chemistry (2014) First state examination for the teaching degree Grundschule Chemistry (2009) First state examination for the teaching degree Hauptschule Chemistry (2009) First state examination for the teaching degree Realschule Chemistry (2009) First state examination for the teaching degree Gymnasium Chemistry (2009) First state examination for the teaching degree Mittelschule Chemistry (2013)		

<b>Module title</b>		<b>Abbreviation</b>
Inorganic Chemistry 1		o8-AC1-082-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Experimentalchemie" (Experimental Chemistry)		Institute of Inorganic Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
21	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<p>This module provides students with an overview of the fundamental principles of chemistry. It focuses on particles, 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 techniques, the synthesis of simple substances and analyses of unknown substances. In addition, students have the opportunity to advance their laboratory knowledge.</p>		
<b>Intended learning outcomes</b>		
<p>Students are able to explain the principles of the periodic table and to extract information from it. They are able to explain basic models of the structure of matter. They have developed the ability to use the language of chemical 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 developed the ability to perform the necessary stoichiometric calculations and describe the chemical processes in an appropriate manner, both in written and oral form.</p>		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
<p>This module comprises 3 module components. Information on courses will be listed separately for each module component.</p> <ul style="list-style-type: none"> <li>• o8-AC1-1-072: V + V + Ü (no information on SWS (weekly contact hours) and course language available)</li> <li>• o8-AC1-2-072: P (no information on SWS (weekly contact hours) and course language available)</li> <li>• o8-AC1-3-082: V (no information on SWS (weekly contact hours) and course language available)</li> </ul>		
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>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.</p> <p><b>Assessment in module component o8-AC1-1-072:</b> Principles of Inorganic Chemistry Principles of Inorganic Chemistry</p> <ul style="list-style-type: none"> <li>• 10 ECTS, Method of grading: numerical grade</li> <li>• 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)</li> </ul> <p><b>Assessment in module component o8-AC1-2-072:</b> Inorganic Chemistry 1 (lab)</p> <ul style="list-style-type: none"> <li>• 7 ECTS, Method of grading: (not) successfully completed</li> <li>• Vortestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nachtestate (post-experiment exams, approx. 15 minutes each)</li> <li>• Assessment offered: once a year, winter semester</li> </ul> <p><b>Assessment in module component o8-AC1-3-082:</b> Inorganic Chemistry 1 (lab accompanying lecture)</p> <ul style="list-style-type: none"> <li>• 4 ECTS, Method of grading: numerical grade</li> <li>• 3 written examinations (45 minutes each), weighted 1:1:1, dates to be announced</li> </ul>		

<b>Allocation of places</b>
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<b>Additional information</b>
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<b>Workload</b>
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)
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<b>Module appears in</b>
Bachelor' degree (1 major) Chemistry (2008)

<b>Module title</b>		<b>Abbreviation</b>
Inorganic Chemistry 2		08-AC2-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Festkörperchemie" (Solid State Chemistry)		Institute of Inorganic Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
6	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008)		



<b>Module title</b>		<b>Abbreviation</b>
Inorganic Chemistry 3		o8-AC3-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Elementorganische Chemie" (Elemental Organic Chemistry)		Institute of Inorganic Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
9	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<p>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.</p>		
<b>Intended learning outcomes</b>		
<p>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.</p>		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
<p>This module comprises 2 module components. Information on courses will be listed separately for each module component.</p> <ul style="list-style-type: none"> <li>• o8-AC3-1-072: V + Ü (no information on SWS (weekly contact hours) and course language available)</li> <li>• o8-AC3-2-072: P (no information on SWS (weekly contact hours) and course language available)</li> </ul>		
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>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.</p> <p><b>Assessment in module component o8-AC3-1-072:</b> Elemental Organic Chemistry Elemental Organic Chemistry</p> <ul style="list-style-type: none"> <li>• 4 ECTS, Method of grading: numerical grade</li> <li>• 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)</li> </ul> <p><b>Assessment in module component o8-AC3-2-072:</b> Inorganic Chemistry 2 (lab)</p> <ul style="list-style-type: none"> <li>• 5 ECTS, Method of grading: (not) successfully completed</li> <li>• Vortestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nachtestate (post-experiment exams, approx. 15 minutes each)</li> <li>• Assessment offered: once a year, winter semester</li> </ul>		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Module appears in**

Bachelor' degree (1 major) Chemistry (2007)

Bachelor' degree (1 major) Chemistry (2008)

<b>Module title</b>		<b>Abbreviation</b>
Analytical Chemistry 1		o8-AN1-o82-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Analytische Chemie" (Analytical Chemistry)		Institute of Inorganic Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
11	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<p>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.</p>		
<b>Intended learning outcomes</b>		
<p>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.</p>		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
<p>This module comprises 2 module components. Information on courses will be listed separately for each module component.</p> <ul style="list-style-type: none"> <li>• o8-AN1-2-072: P (no information on SWS (weekly contact hours) and course language available)</li> <li>• o8-AN1-1-082: Ü + V (no information on SWS (weekly contact hours) and course language available)</li> </ul>		
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>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.</p> <p><b>Assessment in module component o8-AN1-2-072:</b> Analytical Chemistry (lab)</p> <ul style="list-style-type: none"> <li>• 6 ECTS, Method of grading: (not) successfully completed</li> <li>• Vortestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nachtestate (post-experiment exams, approx. 15 minutes each)</li> <li>• Assessment offered: once a year, summer semester</li> </ul> <p><b>Assessment in module component o8-AN1-1-082:</b> Principles of Analytical Chemistry Principles of Analytical Chemistry</p> <ul style="list-style-type: none"> <li>• 5 ECTS, Method of grading: numerical grade</li> <li>• 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)</li> </ul>		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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**Referred to in LPO I** (examination regulations for teaching-degree programmes)

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**Module appears in**

Bachelor' degree (1 major) Chemistry (2008)

<b>Module title</b>		<b>Abbreviation</b>
Bachelor Thesis		o8-BA-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
head of the research group offering the module		Faculty of Chemistry and Pharmacy
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	Registration for assessment on a continuous basis as agreed upon with supervisor. Topic to be selected in consultation with supervisor. Topic to be assigned by examination committee (Section 21 Subsection 3 ASPO (general academic and examination regulations)).
<b>Contents</b>		
This module gives students the opportunity to research and write on a defined problem within a given time frame and using the scientific methods they have learned during the programme.		
<b>Intended learning outcomes</b>		
Students are able to conduct research on a defined problem/topic, adhering to the principles of good scientific practice, and to present the results of their work in written form.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
no courses assigned		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008)		

<b>Module title</b>		<b>Abbreviation</b>
Biochemistry		08-BC-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Biochemistry		Chair of Biochemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
6	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	Registration for assessment: Yes, as specified.
<b>Contents</b>		
Comprising lectures and exercises, this module acquaints students with the fundamental principles of biochemistry.		
<b>Intended learning outcomes</b>		
Students have become familiar with the fundamental principles of biochemistry. They are able to describe the key biochemical processes in cellular systems.		
<b>Courses</b> (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)		
<b>Method of assessment</b> (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 (90 minutes)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008) Bachelor' degree (1 major) Mathematics (2007)		

<b>Module title</b>		<b>Abbreviation</b>
Biochemistry Lab		o8-BCP-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Biochemistry		Chair of Biochemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Practical exercises give students the opportunity to learn the fundamental principles of conducting biochemical experiments.		
<b>Intended learning outcomes</b>		
Students have become proficient in essential methods in biochemistry.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
P (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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 (pre-experiment exams, approx. 15 minutes each), assessment of practical performance (log approx. 5 to 10 pages), Nachtestate (post-experiment exams, approx. 15 minutes each)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007)		
Bachelor' degree (1 major) Chemistry (2008)		

<b>Module title</b>		<b>Abbreviation</b>
Literature research methods		o8-LRAC-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Elementorganische Chemie" (Elemental Organic Chemistry)		Institute of Inorganic Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
1	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Literature search for planning experiments in the field of inorganic chemistry.		
<b>Intended learning outcomes</b>		
Students know how to conduct literature searches for planning experiments in the field of inorganic chemistry.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
Ü (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007)		
Bachelor' degree (1 major) Chemistry (2008)		



<b>Module title</b>		<b>Abbreviation</b>
Literature research methods		o8-LROC-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Organische Chemie 4"		Institute of Organic Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
1	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Literature search for planning experiments in the field of organic chemistry.		
<b>Intended learning outcomes</b>		
Students know how to conduct literature searches for planning experiments in the field of organic chemistry.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
Ü (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007)		
Bachelor' degree (1 major) Chemistry (2008)		

<b>Module title</b>		<b>Abbreviation</b>
Organic Chemistry 1		o8-OC1-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Professorship of Organic Chemistry		Institute of Organic Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	Registration for assessment: Yes, as specified.
<b>Contents</b>		
<p>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.</p>		
<b>Intended learning outcomes</b>		
<p>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.</p>		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V + Ü (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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 (90 minutes)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008) Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007)		

<b>Module title</b>		<b>Abbreviation</b>
Organic Chemistry 2		o8-OC2-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Physically Organic Chemistry		Institute of Organic Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
9	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<p>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.</p>		
<b>Intended learning outcomes</b>		
<p>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.</p>		
<b>Courses</b> (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)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008) Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007)		

<b>Module title</b>		<b>Abbreviation</b>
Organic Chemistry 3		o8-OC3-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Professorship of Organic Chemistry		Institute of Organic Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
15	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<p>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.</p>		
<b>Intended learning outcomes</b>		
<p>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.</p>		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
<p>This module comprises 2 module components. Information on courses will be listed separately for each module component.</p> <ul style="list-style-type: none"> <li>• o8-OC3-1-072: V + Ü (no information on SWS (weekly contact hours) and course language available)</li> <li>• o8-OC3-2-072: P (no information on SWS (weekly contact hours) and course language available)</li> </ul>		
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>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.</p> <p><b>Assessment in module component o8-OC3-1-072:</b> Organic Chemistry 3 Organic Chemistry 3</p> <ul style="list-style-type: none"> <li>• 6 ECTS, Method of grading: numerical grade</li> <li>• 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)</li> </ul> <p><b>Assessment in module component o8-OC3-2-072:</b> Organic Chemistry - lab 1</p> <ul style="list-style-type: none"> <li>• 9 ECTS, Method of grading: (not) successfully completed</li> <li>• Vortestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nachtestate (post-experiment exams, approx. 15 minutes each)</li> </ul>		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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**Module appears in**

Bachelor' degree (1 major) Chemistry (2007)

Bachelor' degree (1 major) Chemistry (2008)

<b>Module title</b>		<b>Abbreviation</b>
Organic Chemistry 4		o8-OC4-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
holder of the Chair of Organic Chemistry II		Institute of Organic Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
10	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	By way of exception, additional prerequisites are listed in the section on assessments.
<b>Contents</b>		
<p>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.</p>		
<b>Intended learning outcomes</b>		
<p>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.</p>		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
<p>This module comprises 2 module components. Information on courses will be listed separately for each module component.</p> <ul style="list-style-type: none"> <li>o8-OC4-1-072: V + Ü (no information on SWS (weekly contact hours) and course language available)</li> <li>o8-OC4-2-072: P (no information on SWS (weekly contact hours) and course language available)</li> </ul>		
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>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.</p> <p><b>Assessment in module component o8-OC4-1-072:</b> Organic Chemistry 4 Organic Chemistry 4</p> <ul style="list-style-type: none"> <li>5 ECTS, Method of grading: numerical grade</li> <li>written examination (90 minutes)</li> <li>Other prerequisites: Registration for assessment: Yes, as specified.</li> </ul> <p><b>Assessment in module component o8-OC4-2-072:</b> Organic Chemistry - advanced laboratory course for students of chemistry</p> <ul style="list-style-type: none"> <li>5 ECTS, Method of grading: (not) successfully completed</li> <li>Vortestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nachtestate (post-experiment exams, approx. 15 minutes each)</li> <li>Assessment offered: once a year, winter semester</li> </ul>		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)
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<b>Module appears in</b>
Bachelor' degree (1 major) Chemistry (2007)
Bachelor' degree (1 major) Chemistry (2008)

<b>Module title</b>		<b>Abbreviation</b>
Principles of quantum mechanics and spectroscopy		o8-PC1-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Grundlagen der Quantenmechanik and Spektroskopie" (Principles of Quantum Mechanics and Spectroscopy)		Institute of Physical and Theoretical Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
8	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<p>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.</p>		
<b>Intended learning outcomes</b>		
<p>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.</p>		
<b>Courses</b> (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)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008) Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2007)		



<b>Module title</b>		<b>Abbreviation</b>
Physical Chemistry 2		o8-PC2-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Thermodynamik, Kinetik, Elektrochemie"		Institute of Physical and Theoretical Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
18	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	By way of exception, additional prerequisites are listed in the section on assessments.
<b>Contents</b>		
<p>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.</p>		
<b>Intended learning outcomes</b>		
<p>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.</p>		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
<p>This module comprises 2 module components. Information on courses will be listed separately for each module component.</p> <ul style="list-style-type: none"> <li>o8-PC2-1-072: V + Ü (no information on SWS (weekly contact hours) and course language available)</li> <li>o8-PC2-2-072: P (no information on SWS (weekly contact hours) and course language available)</li> </ul>		
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
<p>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.</p> <p><b>Assessment in module component o8-PC2-1-072:</b> Thermodynamics, Kinetics, Electrochemistry Thermodynamics, Kinetics, Electrochemistry</p> <ul style="list-style-type: none"> <li>9 ECTS, Method of grading: numerical grade</li> <li>written examination (90 minutes)</li> <li>Other prerequisites: Registration for assessment: Yes, as specified.</li> </ul> <p><b>Assessment in module component o8-PC2-2-072:</b> Physical Chemistry (lab)</p> <ul style="list-style-type: none"> <li>9 ECTS, Method of grading: (not) successfully completed</li> <li>Vortestate (pre-experiment exams, approx. 15 minutes each), assessment of practical performance, Nachtestate (post-experiment exams, approx. 15 minutes each)</li> <li>Assessment offered: once a year, winter semester</li> </ul>		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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**Module appears in**

Bachelor' degree (1 major) Chemistry (2007)

Bachelor' degree (1 major) Chemistry (2008)

<b>Module title</b>		<b>Abbreviation</b>
Physical and Theoretical Chemistry 3: Symmetry and Quantum Chemistry		o8-PC3-o82-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Quantenchemie"		Institute of Physical and Theoretical Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
6	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	Registration for assessment: Yes, as specified.
<b>Contents</b>		
This module discusses the fundamental principles of quantum chemistry and symmetry in chemistry.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (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)		
<b>Method of assessment</b> (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 (90 minutes)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2008) Bachelor' degree (1 major) Mathematics (2008)		

<b>Module title</b>		<b>Abbreviation</b>
Physical Chemistry 4: Statistical Thermodynamics		08-PC4-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Statistische Thermodynamik"		Institute of Physical and Theoretical Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
3	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
This module discusses the fundamental principles of statistical thermodynamics.		
<b>Intended learning outcomes</b>		
Students have become familiar with the fundamental principles of statistical thermodynamics and are able to apply the knowledge they have developed.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V + Ü (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008)		

<b>Module title</b>		<b>Abbreviation</b>
Programming course for Chemistry Majors		o8-PKC-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Programmierkurs für Chemiker"		Institute of Physical and Theoretical Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	Registration for assessment: Yes, as specified.
<b>Contents</b>		
This module provides an introduction to the fundamentals of a programming language and discusses how they can be applied to problems in chemistry.		
<b>Intended learning outcomes</b>		
Students are able to describe the fundamentals of the programming language and to apply them to problems in chemistry.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V + Ü (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (type, scope, language — if other than German, examination offered — if not every semester, information on whether module can be chosen to earn a bonus)		
practical examination: completion of programming exercises		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008) Bachelor' degree (1 major) Technology of Functional Materials (2006)		

<b>Module title</b>		<b>Abbreviation</b>
Applied Spectroscopy 3		o8-PS3-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Praktische Spektroskopie 3"		Institute of Physical and Theoretical Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	Registration for assessment: Yes, as specified.
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
Students are able to work with different spectrometers and to interpret the resulting spectra. They are able to conduct error discussions.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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 minutes)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008)		

<b>Module title</b>		<b>Abbreviation</b>
Theoretical Models in Chemistry		o8-TC-o82-m01
<b>Module coordinator</b>		<b>Module offered by</b>
lecturer of lecture "Quantenchemie"		Institute of Physical and Theoretical Chemistry
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
3	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
<p>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 H<sub>2</sub><sup>+</sup>.</p>		
<b>Intended learning outcomes</b>		
Students are able to describe excited states of molecules with the help of key concepts and models.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V + Ü (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2008) Bachelor' degree (1 major) Mathematics (2008)		

<b>Module title</b>		<b>Abbreviation</b>
Advanced laboratory course		08-VP-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
head of the research group offering the module		Faculty of Chemistry and Pharmacy
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
This module gives students the opportunity to explore a research topic and apply the methods commonly used in the discipline in question.		
<b>Intended learning outcomes</b>		
Students are able to explore a specific research topic and present the results of their work in a written report or oral presentation.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
P (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Chemistry (2007)		
Bachelor' degree (1 major) Chemistry (2008)		



<b>Module title</b>		<b>Abbreviation</b>
Mathematics for students in Chemistry and Biology		10-M-MCB-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Dean of Studies Mathematik (Mathematics)		Institute of Mathematics
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
5	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
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.		
<b>Intended learning outcomes</b>		
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.		
<b>Courses</b> (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. <ul style="list-style-type: none"> <li>• 10-M-MCB-1-072: V (no information on SWS (weekly contact hours) and course language available)</li> <li>• 10-M-MCB-2-072: Ü (no information on SWS (weekly contact hours) and course language available)</li> </ul>		
<b>Method of assessment</b> (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.		
<b>Assessment in module component 10-M-MCB-1-072:</b> Mathematics for students in Chemistry and Biology <ul style="list-style-type: none"> <li>• 3 ECTS, Method of grading: numerical grade</li> <li>• written examination (120 minutes)</li> </ul> <b>Assessment in module component 10-M-MCB-2-072:</b> Exercises in Mathematics for students in Chemistry and Biology <ul style="list-style-type: none"> <li>• 2 ECTS, Method of grading: (not) successfully completed</li> <li>• exercises (to be submitted on a weekly basis, written examination)</li> </ul>		
<b>Allocation of places</b>		
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<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Biology (2007) Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008)		

<b>Module title</b>		<b>Abbreviation</b>
Introduction to Physics for Students of Non-physics-related Minor Subjects		11-EFNF-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
7	numerical grade	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
2 semester	undergraduate	--
<b>Contents</b>		
Mechanics, vibration theory, thermodynamics, optics, science of electricity, Atomic and Nuclear Physics.		
<b>Intended learning outcomes</b>		
The students have knowledge of the principles of Physics.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
V + V (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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)		
<b>Allocation of places</b>		
Only as part of pool of general key skills (ASQ): 10 places. Places will be allocated by lot.		
<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Biochemistry (2011) Bachelor' degree (1 major) Biochemistry (2013) Bachelor' degree (1 major) Biochemistry (2009) Bachelor' degree (1 major) Biology (2011) Bachelor' degree (1 major) Biology (2007) Bachelor' degree (1 major) Biology (2010) Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008) Bachelor' degree (1 major) Chemistry (2010) Bachelor' degree (1 major) Chemistry (2009) Bachelor' degree (1 major) Geography (2007) Bachelor' degree (1 major) Geography (2008) Bachelor' degree (1 major) Geography (2010) Bachelor' degree (1 major) Computer Science (2007) Bachelor' degree (1 major) Computer Science (2014) Bachelor' degree (1 major) Computer Science (2010) Bachelor' degree (1 major) Food Chemistry (2009) Bachelor' degree (1 major) Mathematics (2008) Bachelor' degree (1 major) Mathematics (2014) Bachelor' degree (1 major) Mathematics (2012) Bachelor' degree (1 major) Mathematics (2013)		
Bachelor's with 1 major Chemistry (2008)	JMU Würzburg • generated 11-Jan-2023 • exam. reg. data record Bachelor (180 ECTS) Chemie - 2008	page 34 / 36

Bachelor' degree (1 major) Mathematics (2007)  
 Bachelor' degree (1 major) Biomedicine (2009)  
 Bachelor' degree (1 major) Biomedicine (2013)  
 Bachelor' degree (1 major) Computational Mathematics (2009)  
 Bachelor' degree (1 major) Computational Mathematics (2014)  
 Bachelor' degree (1 major) Computational Mathematics (2012)  
 Bachelor' degree (1 major) Computational Mathematics (2013)  
 Bachelor' degree (1 major) FOKUS Chemistry (2011)

<b>Module title</b>		<b>Abbreviation</b>
Practical Course Physics for Students of Non-physics-related Minor Subjects		11-PFNF-072-m01
<b>Module coordinator</b>		<b>Module offered by</b>
Managing Director of the Institute of Applied Physics		Faculty of Physics and Astronomy
<b>ECTS</b>	<b>Method of grading</b>	<b>Only after succ. compl. of module(s)</b>
3	(not) successfully completed	--
<b>Duration</b>	<b>Module level</b>	<b>Other prerequisites</b>
1 semester	undergraduate	--
<b>Contents</b>		
Mechanics, vibration theory, thermodynamics, optics, X-rays, nuclear magnetic resonance, Atomic and Nuclear Physics.		
<b>Intended learning outcomes</b>		
The students have knowledge of the principles of Physics.		
<b>Courses</b> (type, number of weekly contact hours, language — if other than German)		
P (no information on SWS (weekly contact hours) and course language available)		
<b>Method of assessment</b> (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) oral test (approx. 15 minutes) during experiment and b) ungraded written examination (approx. 90 minutes)		
<b>Allocation of places</b>		
Only as part of pool of general key skills (ASQ): 10 places. Places will be allocated by lot.		
<b>Additional information</b>		
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<b>Workload</b>		
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<b>Referred to in LPO I</b> (examination regulations for teaching-degree programmes)		
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<b>Module appears in</b>		
Bachelor' degree (1 major) Biochemistry (2011) Bachelor' degree (1 major) Biochemistry (2013) Bachelor' degree (1 major) Biochemistry (2009) Bachelor' degree (1 major) Biology (2011) Bachelor' degree (1 major) Biology (2007) Bachelor' degree (1 major) Biology (2010) Bachelor' degree (1 major) Chemistry (2007) Bachelor' degree (1 major) Chemistry (2008) Bachelor' degree (1 major) Chemistry (2010) Bachelor' degree (1 major) Chemistry (2009) Bachelor' degree (1 major) Geography (2007) Bachelor' degree (1 major) Geography (2008) Bachelor' degree (1 major) Geography (2010) Bachelor' degree (1 major) Computer Science (2007) Bachelor' degree (1 major) Computer Science (2014) Bachelor' degree (1 major) Computer Science (2010) Bachelor' degree (1 major) Food Chemistry (2009) Bachelor' degree (1 major) Biomedicine (2009) Bachelor' degree (1 major) Biomedicine (2013) Bachelor' degree (1 major) FOKUS Chemistry (2011)		
Bachelor's with 1 major Chemistry (2008)	JMU Würzburg • generated 11-Jan-2023 • exam. reg. data record Bachelor (180 ECTS) Chemie - 2008	page 36 / 36