Module Catalogue
for the Subject
Chemistry
as vertieft studiertes Fach (studied with a focus on the scientific discipline)
with the degree "Erste Staatsprüfung für das Lehramt an Gymnasien"

Examination regulations version: 2015
Responsible: Faculty of Chemistry and Pharmacy
Contents

The subject is divided into

Abbreviations used, Conventions, Notes, In accordance with

Scientific Discipline

Compulsory Courses
  Principles of Inorganic Chemistry
  Concepts of Inorganic Chemistry
  Inorganic and Analytical Chemistry (lab) (teaching degree)
  Inorganic Chemistry of the Elements
  Solid State Chemistry
  Organic Chemistry 1
  Organic Chemistry 2
  Organic Chemistry - laboratory course (teaching degree for secondary schools)
  Organic Chemistry 4
  Practical spectroscopy 1
  Thermodynamics, Kinetics, Electrochemistry
  Molecular structure and spectroscopy
  Physical Chemistry lab (teaching degree)
  Praktikum der Physik für Lehramt Gymnasium
  Biochemistry 1
  Practical Reserarch Course for Grammar School Teachers
  Exercises in Experimental Presentation, Intermediate School

Teaching

Compulsory Courses
  Introduction into Teaching Chemistry for High School
  Teaching Chemical Practice for High School

Paper
  Internship at High Schools

Freier Bereich (general as well as subject-specific electives)

Chemistry
  Practical spectroscopy 2
  Elemental Organic Chemistry
  Organic Chemistry 3
  Quantum Chemistry
  Symmetry, chemical bonding and light - Part 1
  Toxicology and legal studies
  Basic Mathematics
  Training for Exams in Inorganic Chemistry
  Training for Exams in Organic Chemistry
  Training for Exams in Chemistry Teaching for High School Teachers
  Instructions for Scientific Research
  Chemistry SchoolLabs
  Collecting Data with CASSY System
  Microscale Experiments in Chemistry Teaching
  Out-Of-School Education
  W- and P-Seminars in High Schools

Paper
  Final Thesis according to § 29 LPO I in Chemistry for High School Teachers
The subject is divided into

<table>
<thead>
<tr>
<th>section / sub-section</th>
<th>ECTS credits</th>
<th>starting page</th>
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<tbody>
<tr>
<td>Scientific Discipline</td>
<td>92</td>
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<td>Compulsory Courses</td>
<td>92</td>
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<td>Paper</td>
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<td>31</td>
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<tr>
<td>Paper</td>
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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:

LASPO2015

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

08-Sep-2015 (2015-126)

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.
Scientific Discipline
(92 ECTS credits)
Compulsory Courses

(92 ECTS credits)
### Module title
**Principles of Inorganic Chemistry**

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<th>Abbreviation</th>
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<tr>
<td>08-AC1-152-m01</td>
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### Module coordinator
Lecturer of lecture "Experimentalchemie" (Experimental Chemistry)

### Module offered by
Institute of Inorganic Chemistry

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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
(V (4) + V (2))

### Method of assessment
(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
Concepts of Inorganic Chemistry

### Abbreviation
08-AC-KAC-152-m01

### Module coordinator

#### Lecturers of lecture "Konzepte der Anorganischen Chemie" (Concepts of Anorganic Chemistry)

### Module offered by
Institute of Inorganic Chemistry

### ECTS
5

### Method of grading
Numerical grade

### Only after succ. compl. of module(s)
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### Duration
1 semester

### Module level
Undergraduate

### Other prerequisites
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### Contents
The module provides an introduction to atoms and the MO theory. Topics are the orbital model, the VSEPR theory, and the valence bond theory. Further focuses are redox reactions, acids and bases, and electrochemistry.

### Intended learning outcomes
The student is able to outline the bonding situation and the structure of simple molecules based on different basic theories. He/She can assign oxidation numbers to atoms in chemical compounds and knows different acid-base concepts.

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

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### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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
§ 62 I Nr. 1
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**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. Therefor 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)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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**

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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
§ 62 I Nr. 1
<table>
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<td>Inorganic Chemistry of the Elements</td>
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### Module coordinator

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### ECTS | Method of grading | Only after succ. compl. of module(s) |
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### Duration | Module level | Other prerequisites |
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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 is creditable for 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)

§ 62 I Nr. 1
<table>
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<td>Institute of Inorganic Chemistry</td>
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</table>

**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.

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

V (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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)

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
§ 62 I Nr. 1
<table>
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<th>Abbreviation</th>
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<tr>
<td>Organic Chemistry 1</td>
<td>08-OC1-152-m01</td>
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| Module coordinator Module offered by |
|--------------------------------------|------------------------------|
| holder of the Professorship of Organic Chemistry | Institute of Organic Chemistry |

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</table>

**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 is creditable for 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)

§ 62 I Nr. 2
# Module Catalogue for the Subject Chemistry

## LA Gymnasien

### Module title

**Organic Chemistry 2**

### Abbreviation

08-OC2-VL-152-m01

### Module coordinator

holder of the Chair of Physically Organic Chemistry

### Module offered by

Institute of Organic Chemistry

### ECTS

6

### Method of grading

numerical grade

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

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### Duration

1 semester

### Module level

undergraduate

### Other prerequisites

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## Contents

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

## 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.

## 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 is creditable for 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. 2 and § 22 II Nr. 1 h)

§ 62 I Nr. 2
### Module title
Organic Chemistry - laboratory course (teaching degree for secondary schools)

<table>
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<th>Abbreviation</th>
<th>08-OCP-LAGY-152-m01</th>
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### Module coordinator
lecturers Organische Chemie (Organic Chemistry)

### Module offered by
Institute of Organic Chemistry

### ECTS
6

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

### (not) successfully completed
08-OC1

### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
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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. 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 analyise 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 (9) |

### Method of assessment
(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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
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### Additional information
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### Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 62 I Nr. 2
### Module title
Organic Chemistry 4

### Abbreviation
08-OC4-152-m01

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

### Module offered by
Institute of Organic Chemistry

### ECTS
5

### Method of grading
numerical grade

### Only after succ. compl. of module(s)
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### Duration
1 semester

### Module level
undergraduate

### Other prerequisites
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### Contents
This module discusses biologically important bonding classes, their reactions and syntheses, working with special hazardous substances, complicated working and synthesis techniques, purification methods and product analysis.

### Intended learning outcomes
Students are able to name important heteroaromatics and to formulate their reactions and syntheses. They are able to characterise and categorise dyes. Students are able to describe the structure and selective synthesis of proteins. In addition, they are able to describe the structure of the DNA, carbohydrates, fats, terpenes and steroids.

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

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<thead>
<tr>
<th>Type</th>
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<td>V</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 is creditable for bonus)

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

- § 22 II Nr. 1 h)
- § 22 II Nr. 2 f)
- § 62 I Nr. 2
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<td>Practical spectroscopy 1</td>
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<td>1 semester</td>
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</table>

## Contents

This module introduces students to the spectroscopic methods of infrared spectroscopy, mass spectrometry and NMR spectroscopy.

### Intended learning outcomes

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 (2)

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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)

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
§ 62 I Nr. 2
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<th>Method of grading</th>
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<tbody>
<tr>
<td>1 semester</td>
<td>undergraduate</td>
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</table>

**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 is creditable for 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**

--

**Additional information**

--

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

§ 62 I Nr. 1
Module title | Abbreviation
---|---
Molecular structure and spectroscopy | 08-PC-MBS-152-m01

Module coordinator | Module offered by
Instructor of lecture "Molekülbau and Spektroskopie" | Institute of Physical and Theoretical Chemistry

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

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

Contents
The module provides an introduction to the fundamental basics of molecular structure, spectroscopy and quantum mechanics. Via the particle in a box model and a quantum mechanical view of the hydrogen atom one gets to atomic orbitals, molecular orbitals and a basic understanding of the chemical bond. Molecules are analyzed based on the harmonic oscillator and the rigid rotor models. Spectroscopically focuses are UV/Vis spectroscopy, vibrational spectroscopy and rotational spectroscopy.

Intended learning outcomes
The student is able to explain basic models of quantum mechanics and to apply them on molecules. He/She can outline different spectroscopical methods.

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

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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
--

Additional information
--

Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 62 I Nr. 1
### Module title
Physical Chemistry lab (teaching degree)

### Abbreviation
08-PCP-LA-152-m01

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

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

### ECTS
3

### Method of grading
Not successfully completed

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

### 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.

### 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 (3)

### Method of assessment
Type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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, 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)

- § 42 I Nr. 1
- § 62 I Nr. 1
Module title
Praktikum der Physik für Lehramt Gymnasium

Abbreviation
08-PHP-LAGY-152-m01

Module coordinator
Lecturers Physikalische Chemie (Physical Chemistry)

Module offered by
Institute of Physical and Theoretical Chemistry

ECTS
3

Method of grading
(not) successfully completed

Duration
1 semester

Module level
undergraduate

Other prerequisites
--

Contents
This module deals with basic experiments in physics.

Intended learning outcomes
Students are able to plan, perform and evaluate key experiments in physics.

Courses (type, number of weekly contact hours, language — if other than German)
P (3)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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
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Additional information
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Referred to in LPO I (examination regulations for teaching-degree programmes)
§ 62 I Nr. 3
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<td>Biochemistry 1</td>
<td>08-BC1-152-m01</td>
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<td>1 semester</td>
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</table>

**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 is creditable for bonus)

written examination (approx. 60 to 90 minutes)

**Allocation of places**

--

**Additional information**

--

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

§ 42 I Nr. 2
§ 62 I Nr. 2
### Module title

**Practical Research Course for Grammar School Teachers**

### Abbreviation

08-Forsch-LAGY-152-m01

### Module coordinator

Lecturer of the respective research group

### Module offered by

Faculty of Chemistry and Pharmacy

### ECTS

8

### Method of grading

Only after successfully completed

### Duration

undergraduate

### Module level

Depending on their choice of topic, students who are writing their Hausarbeit (thesis) pursuant to Section 29 LPO I (examination regulations for teaching-degree programmes) in the vertieft studiertes Fach (subject studied with a focus on the scientific discipline) Chemie (Chemistry) are highly recommended to complete module 08-Forsch-LAGY directly before completing module 08-Ch-HA-GY.

### 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)

P (16)

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

Log (approx. 20 pages)

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. 4
## Module title
Exercises in Experimental Presentation, Intermediate School

## Abbreviation
08-ÜIVmD-LAGY-152-m01

## Module coordinator
Lecturers of the three lectures offered in this module

## Module offered by
Faculty of Chemistry and Pharmacy

## ECTS
5

## Method of grading
Only after successful completion of module(s)

## Duration
1 semester

## Module level
Undergraduate

## Other prerequisites
--

### Contents
Students will design, prepare and deliver presentations on a range of topics in chemistry. Presentations will include live demonstrations.

### Intended learning outcomes
Students are able to deliver detailed and scientifically correct presentations on given topics in inorganic, organic and physical chemistry that are tailored to the specific needs of their audience. They are able to select experiments on the topics in question that support particular teaching goals as well as to plan and safely perform them. Students will be expected to apply both their chemistry knowledge and skills and their teaching skills.

### Courses
(3) + Ü (3) + Ü (3)

### Method of assessment
One talk each in the fields of inorganic, organic and physical chemistry including demonstrations (approx. 45 minutes each)
Assessment offered: Once a year, winter semester
Language of assessment: German and/or English

### Allocation of places
--

### Additional information
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### Referred to in LPO I
(Examination regulations for teaching-degree programmes)

§ 62 I Nr. 5
Teaching
(10 ECTS credits)
Compulsory Courses
(10 ECTS credits)
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<td>Introduction into Teaching Chemistry for High School</td>
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<tr>
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Contents

No information on contents available.

Intended learning outcomes

No information on intended learning outcomes available.

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

V (2) + S (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 90 minutes) and b) presentation (approx. 20 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. 6
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<td>Teaching Chemical Practice for High School</td>
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**Contents**

No information on contents available.

**Intended learning outcomes**

No information on intended learning outcomes available.

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

S (2) + S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

a) written examination (approx. 60 minutes) and b) portfolio (approx. 15 pages)

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. 6
Paper
(4 ECTS credits)

Students studying for a teaching degree Gymnasium must complete a practical training in didactics and teaching methodology (studienbegleitendes fachdidaktisches Praktikum) which refers to one of the subjects they selected as vertieft studiertes Fach (subject studied with a focus on the scientific discipline) pursuant to Section 34 Subsection 1 No. 4 LPO I (examination regulations for teaching-degree programmes). The obligatory accompanying tutorial is offered by the respective subject. The ECTS credits obtained are counted in the subject Erziehungswissenschaften pursuant to Section 10 Subsection 3 LASPO (general academic and examination regulations for teaching-degree programmes).
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Contents

No information on contents available.

Intended learning outcomes

No information on intended learning outcomes available.

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

P (0) + S (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written elaboration of teaching practice to be prepared at home (approx. 8 pages)

Allocation of places

--

Additional information

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

§ 34 l 1 Nr. 4
Freier Bereich (general as well as subject-specific electives) (0-15 ECTS credits)

Teaching degree students must take modules worth a total of 15 ECTS credits in the area Freier Bereich (general as well as subject-specific electives) (Section 9 LASPO (general academic and examination regulations for teaching-degree programmes)). To achieve the required number of ECTS credits, students may take any modules from the areas below.

Freier Bereich -- interdisciplinary: The interdisciplinary additional offer for a teaching degree can be found in the respective Annex "Ergänzende Bestimmungen für den "Freien Bereich" im Rahmen des Studiums für ein Lehramt".
Chemistry
(ECTS credits)

(Freier Bereich (general as well as subject-specific electives) -- subject specific)
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<td>Practical spectroscopy 2</td>
<td>08-AC-Spec-152-m01</td>
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<td>Institute of Inorganic Chemistry</td>
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<td>1 semester</td>
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</table>

**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 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)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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)

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
§ 22 II Nr. 3 f)
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<td>lecturer of lecture &quot;Elementorganische Chemie&quot; (Elemental Organic Chemistry)</td>
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<td>1 semester</td>
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</table>

**Contents**

This module equips students with an advanced knowledge of organometallics. It focuses on their structures and properties, special material classes, reactivity and technical processes.

**Intended learning outcomes**

Students are able to describe the structure and properties of organometallics in an appropriate manner. They are able to systemise them and characterise their structure and reactivity. In addition, they are able to develop and explain principles for the synthesis of elementary organic compounds.

**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 is creditable for 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)

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§ 22 II Nr. 2 f)  
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<td>1 semester</td>
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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.

### 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)

V (2) + Ü (2)

### Method of assessment

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for 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

(examination regulations for teaching-degree programmes)

§ 22 II Nr. 1 h)  
§ 22 II Nr. 2 f)  
§ 22 II Nr. 3 f)
Module title | Abbreviation
--- | ---
Quantum Chemistry | 08-TC-152-m01

Module coordinator | Module offered by
lecturer of lecture "Quantenchemie" | Institute of Physical and Theoretical Chemistry

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

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

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 is creditable for 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
--

Additional information
--

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 Catalogue for the Subject Chemistry

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<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Symmetry, chemical bonding and light - Part 1</td>
<td>08-PC-SBL1-152-m01</td>
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#### Module coordinator

- lecturer of lecture "Symmetrie, chemische Bindung and Licht"
  - Institute of Physical and Theoretical 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 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 is creditable for 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)

- § 22 II Nr. 1 h)
- § 22 II Nr. 2 f)
- § 22 II Nr. 3 f)
<table>
<thead>
<tr>
<th>Module title</th>
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<tr>
<td>Toxicology and legal studies</td>
<td>03-TR-152-m01</td>
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<tbody>
<tr>
<td>lecturer of lecture &quot;Toxikologie und Rechtskunde&quot;</td>
<td>Faculty of Medicine</td>
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<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 is creditable for bonus)
written examination (approx. 90 minutes)

**Allocation of places**
--

**Additional information**
--

**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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<tr>
<td>Basic Mathematics</td>
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**Module coordinator**

lecturer of block course "Mathematik" (Mathematics)

**Module offered by**

Institute of Physical and Theoretical Chemistry

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</table>

**Duration**

1 semester

**Module level**

undergraduate

**Other prerequisites**

--

**Contents**

This module provides an introduction to mathematical concepts and methods used in physical/theoretical chemistry. It trains students in those methods with the help of examples taken from thermodynamics and kinetics.

**Intended learning outcomes**

Students have been trained in mathematical methods. They are able to apply those methods to problems in chemistry.

**Courses**

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

V (1) + Ü (1)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

written exercises (approx. 20)

Language of assessment: German and/or English

**Allocation of places**

--

**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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<tbody>
<tr>
<td>lecturer of the seminar</td>
<td>Faculty of Chemistry and Pharmacy</td>
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<tbody>
<tr>
<td>1 semester</td>
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</table>

**Contents**

Repetition of relevant topics and work on selected state examination issues in Inorganic Chemistry.

**Intended learning outcomes**

The student is able to solve selected state examination issues of the previous years in Inorganic Chemistry.

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

S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

2 to 4 short talks on selected exercises (approx. 10 minutes each)
Language of assessment: German and/or English

**Allocation of places**

--

**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)
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<td>Training for Exams in Organic Chemistry</td>
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<tbody>
<tr>
<td>Lecturer of the seminar</td>
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<tbody>
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<td>undergraduate</td>
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</table>

**Contents**

Repetition of relevant topics and work on selected state examination issues in Organic Chemistry.

**Intended learning outcomes**

The student is able to solve selected state examination issues of the previous years in Organic Chemistry.

**Courses**

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

S (2)

**Method of assessment**

(type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

4 to 8 short talks on selected assignments (approx. 10 minutes each)

Language of assessment: German and/or English

**Allocation of places**

--

**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)
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<td>Training for Exams in Chemistry Teaching for High School Teachers</td>
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<td>holder of the Professorship of Didactics of Chemistry</td>
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**Contents**
No information on contents available.

**Intended learning outcomes**
No information on intended learning outcomes available.

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

- S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

talk on 3 selected assignments (approx. 30 minutes each)
Language of assessment: German and/or English

**Allocation of places**
--

**Additional information**
--

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

§ 22 II Nr. 3 f)
### Module Catalogue for the Subject Chemistry

<table>
<thead>
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<th>Module title</th>
<th>Abbreviation</th>
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<tbody>
<tr>
<td>Instructions for Scientific Research</td>
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### Contents

No information on contents available.

### Intended learning outcomes

No information on intended learning outcomes available.

### Courses

**Type**: Presentation (approx. 30 minutes)

- Language of assessment: German and/or English

### Method of assessment

- **Type**: Presentation (approx. 30 minutes)
- **Language**: German and/or English

### Allocation of places

--

### Additional information

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### Referred to in LPO I

- § 22 II Nr. 1 h)
- § 22 II Nr. 2 f)
- § 22 II Nr. 3 f)
<table>
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Contents

No information on contents available.

Intended learning outcomes

No information on intended learning outcomes available.

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

P (3)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

practical assignment (successful supervision of 2 sessions in learn-teach-lab, approx. 4 to 6 hours each)
Language of assessment: German and/or English

Allocation of places

--

Additional information

--

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)
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<td>Collecting Data with CASSY System</td>
<td>08-FD-CAS-152-m01</td>
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**Contents**

No information on contents available.

**Intended learning outcomes**

No information on intended learning outcomes available.

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

S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

presentation of a project (approx. 30 minutes)
Language of assessment: German and/or English

**Allocation of places**

--

**Additional information**

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

§ 22 II Nr. 2 f)
§ 22 II Nr. 3 f)
§ 22 II Nr. 1 h)
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<td>Microscale Experiments in Chemistry Teaching</td>
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Contents
No information on contents available.

Intended learning outcomes
No information on intended learning outcomes available.

Courses (type, number of weekly contact hours, language — if other than German)
S (2)

Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)
project: presentation of a project (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)
§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
§ 22 II Nr. 3 f)
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**Contents**

No information on contents available.

**Intended learning outcomes**

No information on intended learning outcomes available.

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

S (2)

**Method of assessment** (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus)

project: presentation of a project (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)

§ 22 II Nr. 1 h)
§ 22 II Nr. 2 f)
§ 22 II Nr. 3 f)
## Module Title
**W- and P-Seminars in High Schools**

### Abbreviation
08-FD-WP-152-m01

### Module Coordinator
holders of the Professorships of Chemistry Teaching and Physics Teaching

### Module Offered by
Institute of Inorganic Chemistry

### ECTS
2

### Method of Grading
(Not) successfully completed

### Only after Succ. Compl. of Module(s)
--

### Duration
1 semester

### Module Level
undergraduate

### Other Prerequisites
--

## Contents
Project seminars (P-Seminars) and academic skills seminars (W-Seminars) for Oberstufe students at Gymnasium schools: What do they teach and how are they designed?; sitting in on classes at a Gymnasium school; careers advice and project management in the context of a P-Seminar; supervising seminar papers and introducing Oberstufe students to good academic practice in the context of a W-Seminar; designing a W-Seminar and a P-Seminar.

## Intended Learning Outcomes
Students are able to independently design and teach W-Seminars and P-Seminars for Oberstufe students at Gymnasium schools.

## Courses
**Type, Number of Weekly Contact Hours, Language** — If other than German

<table>
<thead>
<tr>
<th>Type</th>
<th>Number of Weekly Contact Hours</th>
<th>Language</th>
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<tbody>
<tr>
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## Method of Assessment
**Type, Scope, Language** — If other than German, Examination Offered — If Not Every Semester, Information on Whether Module is Creditable for Bonus

- Project: presentation of a project (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)

§ 22 II Nr. 3 f)
Paper
(10 ECTS credits)

Preparation of a written Hausarbeit (thesis) in accordance with the provisions of Section 29 LPO I (examination regulations for teaching-degree programmes) is a prerequisite for teaching degree students to be admitted to the Erste Staatsprüfung (First State Examination). In accordance with the provisions of Section 29 LPO I, students studying for a teaching degree Gymnasium may write this thesis in one of the subjects they selected as vertieft studiertes Fach (subject studied with a focus on the scientific discipline) or in the subject Erziehungswissenschaften (Educational Science). Pursuant to Section 29 Subsection 1 Sentence 2 LPO I, students may also choose to write an interdisciplinary thesis.
Module title | Final Thesis according to § 29 LPO I in Chemistry for High School Teachers
---|---
Abbreviation | 08-Ch-HA-GY-152-m01

Module coordinator

head of the research group offering the module

Module offered by

Faculty of Chemistry and Pharmacy

<table>
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<tr>
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<tbody>
<tr>
<td>10</td>
<td>numerical grade</td>
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</table>

Duration | 1 semester

Module level | undergraduate

Other prerequisites

Depending on their choice of topic, students who are writing their Hausarbeit (thesis) pursuant to Section 29 LPO I (examination regulations for teaching-degree programmes) in the vertieft studiertes Fach (subject studied with a focus on the scientific discipline) Chemie (Chemistry) are highly recommended to complete module 08-Forsch-LAGY directly before completing module 08-Ch-HA-GY.

Contents

Adhering to the principles of good scientific practice, students will independently research and write on a topic in chemistry or chemistry didactics they have agreed upon with an authorised examiner in accordance with the provisions of Section 29 LPO (examination regulations for teaching degree programmes).

Intended learning outcomes

To pass this module, students will be expected to:
- be able to independently write an academic paper (define and analyse a problem, conduct a literature search, refer to relevant theories, interpret data, draw logical conclusions, and offer approaches to the solution of said problem).
- be able to work to deadlines.
- prepare an appropriate written account of the results of their work.

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 is creditable for bonus)

Hausarbeit (thesis) pursuant to Section 29 LPO I (examination regulations for teaching-degree programmes) (30 to 50 pages)
Language of assessment: German; exceptions pursuant to Section 29 Subsection 4 LPO I (examination regulations for teaching-degree programmes)

Allocation of places

--

Additional information

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

§ 29