## Fundamentals Chemistry I

### Code
8203371784

### ECTS credits
12

### Attendance time
12

### Language of instruction
German

### Duration
2 Semester

### Cycle
starts every Winter Semester

### Coordinator
Dean of Studies - Department of Chemistry

### Instructor(s)
Prof. Dr. Gerhard Taubmann and other lecturers of the Department of Chemistry

### Allocation of study programmes
Bachelor Chemical Engineering, compulsory module, Semester 1 and 2

### Recommended prerequisites
none

### Learning objectives
Students who have successfully completed this module,

- Lecture Chemistry for Physicists and Engineers
  - have basic knowledge in general, inorganic and organic chemistry
  - have knowledge of the chemistry of the elements
  - have the skill for stoichiometric calculation
  - are able to solve simple chemical problems
  - have an overview of the most important substance classes and basic structural principles of simple chemical compounds

- Basic practical course in chemistry
  Students who have successfully completed this module,
- have extended and developed general chemical knowledge
- learn basic preparative techniques for the synthesis and analysis of inorganic compounds and the reactions characteristic of the individual elements
- have the ability to solve applied tasks and problems with the acquired knowledge
- have knowledge for critical evaluation of analytical methods and measurement results

**Syllabus**

In this module the following subject-specific contents are taught:

**Lecture Chemistry for Physicists and Engineers**
- Description of states of matter
- Methods of separation of substances
- Chemical elements
- Quantity of mass and stoichiometry
- Atomic structure, atomic properties, periodic table of the elements
- Prototypes of the chemical bond and models for their description
- Fundamentals of the kinetics of chemical reactions, law of mass action, buffer solutions
- Fundamentals of thermodynamics of chemical reactions
- Acid-base reactions (proton transfer equilibria)
- Redox reactions (electron transfer equilibria)
- Basics and applications of electrochemistry
- Exemplary treatment of chemical reactivities: Development of reactivity trends against the background of the periodic table
- Hydrogen compounds: Bond diversity and reactivity patterns
- Typical halogen reactivities of selected halogen compounds
- Selected alkali and alkaline-earth metals: important compounds and bonding properties
- Basics of organic chemistry (by substance classes)
- bond ratios of carbon
- isomerism, stereochemistry
- Hydrocarbons and reactions (alkanes, alkenes, alkynes, aromatics)
- Single bonds of carbon to heteroatom
- Organic halogen compounds
- carbon-oxygen bonds: Alcohols, ethers, phenols
- Carbon-nitrogen bonds: Amines, nitro compounds
- carbon-oxygen double bond: Aldehydes, ketones, carboxylic acids and derivatives, carbonic acid derivatives
- Peptides and proteins

**Basic practical course in chemistry**
- Density measurements
- Determination of the simplest formula (total formula calculation of copper oxide by combustion of copper powder)
- Determination of the equivalent mass of an unknown element (determination of an element from its chloride by precipitation of the chloride)
- pH value and concentration, titration
- spectrum analysis
- preliminary samples (solder tube reaction, phosphorus salt bead...)
- Simple verifications, part 1
- Simple verifications, part 2
- complex chemistry
- redox reactions
- Resolution of metals (electromotive series)
- solubilization
- Analysis of a pure substance
- Analysis of a mixture of substances (3 salts, one of which is sparingly soluble)
- solubility product
- heat of reaction
- equilibrium constant
- Measurement solution (preparation and factor determination of a 0.1 m HCl solution)

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<tr>
<th>Literature</th>
<th>Lecture notes or will be announced at the beginning of the event</th>
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| Teaching and learning methods | Lecture and exercise, (4+2 SWS, 8 LP)  
Practical course (6 SWS, 4 LP)  
- Test certificate before the start of the test  
- experimental procedure  
- Discussion of the test results  
- final report |
| Workload | Presence study: 180 h  
Self study: 180 h |
| Assessment | The credit points will be awarded once the written module examination and the lab have been passed. No prerequisites are necessary to register for the written exam or the lab. The written exam is also part of the orientation exam according to §6 (6) of the general framework of the university of Ulm. |
| Grading procedure | The grade of the module will be the grade of the exam. |
| Basis for | Bachelor Chemical Engineering |