FH AACHEN
UNIVERSITY OF APPLIED SCIENCES

Modulhandbuch

BA Applied Chemistry (AOS)

März 2012

Modulhandbuch zum Studiengang Applied Chemistry des Fachbereichs Chemie und Biotechnologie der FH Aachen, Campus Jülich

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1. Semester

Module title: Mathematics 1

Module code: 101100	**Credits: 10**

In charge of module: Prof. Dr. rer. nat. habil. Werner Stulpe

Teaching and learning methods:

Lecture:	5	SWS	Contact hours:	112	Hours
Exercise:	5	SWS	Preparation an postprocessing:	150	Hours
Laboratory:		SWS	Papers / Presentation:	38	Hours
Sum:	10	SWS	Total workload:	300	Hours

Learning outcomes:

The students learn an essential part of basic mathematics being substantial for every person educated in science or engineering.

Description of content:

- Real numbers, functions and limits
- Differentiation
- Integration
- Taylor's formula and power series
- Vector algebra and geometry

Entry requirements: Knowledge of school-level calculation techniques.

Assessment method:

• Written exam of 120 minutes

Literature and Scripts:

S. Lang, A First Course in Calculus, Springer-Verlag (New York,1991)

A. Fetzer, H. Fränkel, Mathematik 1, Springer-Verlag (Berlin, 1997)

Module title: Physics 1

Module code: 91140	**Credits: 4**

In charge of module: Prof. Dr. Hoyler

Teaching and learning methods:

Lecture:	2	SWS	Contact hours:	45	Hours
Exercise:	2	SWS	Preparation an post processing:	55	Hours
Laboratory:		SWS	Papers / Presentation:	20	Hours
Sum:	4	SWS	Total workload:	120	H

Learning outcomes:

Understanding the formulation of physical models and their application in engineering. Learning the methods by which problems encountered in the natural sciences can be formulated and solved using mathematical methods. Being ale to perform basic experimental work, including written documentation of the results. Tutorials and laboratory work will enable the student to present information to other people and to experience teamwork in small groups.

Description of content:

- Introduction in the basics of physics, SI units.
- Mechanics: kinematics, Newton's laws, examples of forces (gravity, harmonic oscillation, friction), energy, linear momentum, angular momentum, moment of inertia, qualitative survey of classification of gases, fluids and solids, amount of substance, introduction to fluid dynamics.
- Thermodynamics: temperature, gas laws (ideal gases), laws of thermodynamics, entropy

Entry requirements: none

Assessment method:
Written examination of 90 min duration at the end of the semester Examination is only validated if the candidate has 3 times presented successfully the solution of a problem at the blackboard
Literature an Scripts:
Any physics textbook. Very condensed and low-cost: M.Browne "Physics for Engineering and Science", detailed textbook with high availability in the library: P.A.Tipler "Physics for Scientists and Engineers" Standard Edition -additional material is made available via the internet

Module title: General and Inorganic Chemistry

Module code: 312304	**ECTS-Credits: 10**

In charge of module: Prof. Dr. Merschenz-Quack

Teaching and learning methods:

Lecture:	6	SWS	Contact hours:	124	Hours
Exercise:	3	SWS	Preparation and post processing:	176	Hours
Laboratory:	2	SWS	Papers / Presentations:		Hours
Sum:	11		Total workload:	300	Hours

Learning outcomes:

General Chemistry:

The students are able to interpret the structure of the periodic table and to judge the properties of the elements. They know the chemical bonding and can predict and sketch the geometry of the molecules. The students are able to apply the law of mass and the chemical equilibrium to acids, base, salts, buffer systems and almost insoluble compounds. The students have the capability to use the electrochemical reactions for analytical applications and electrolytic production of elements.

Stoichiometry:

The students know the basic calculations for laboratory work and production yield.

Inorganic Chemistry

The students describe the properties of the elements out of the PTE-groups 1,2,and 13 to 18.
They characterise the peculiarity of the chemical compounds and the properties. They know the production and the use of the elements and are able to find new applications.

Description of content:
General Chemistry: lecture 3 SWS, exercise 1 SWS; practical course 2 SWS
Inorganic Chemistry: lecture 3 SWS, exercise 1SWS, stoichiometric exercises 1 SWS

General chemistry:

Lectures:

- Electronic structure of atoms, periodic table, periodic properties
- Concepts of chemical bonding: Lewis structures, molecular geometry, covalent bonds, ionic bonds, metals, intermolecular forces
- Properties of gases, liquids and solids
- Chemical reaction and chemical equilibrium: ion product constant of water, acid-base equilibrium, salts, buffer, precipitation reactions, redox reactions
- Electrochemistry: galvanic cells, electrodes, electrolysis

Exercises:
- Explain and discus the periodic table
- Sketch Lewis-structures and predict the geometry of molecules
- Construct phase diagrams
- Calculation: law of mass and chemical equilibrium
- Practise of redox reactions and electrode reactions

Laboratory:
Experiments to learn practice of laboratory techniques and deepening of the knowledge gained from theory classes according to the Züricher Concept:
- Reducing of chemical
- Working in reaction cycles
- Cleaning and recycle the waste
- Elaborating material data sheets
- Recycling the products

This model is realized making a product in five steps, starting with copper sulphate over several complex compounds and ending with copper sulphate.
Furthermore titration curves of strong bases with weak and strong acids are made and discussed.

Inorganic chemistry
Lecture and Exercises
- Chemistry of the elements of group 1, 2, 13, 14, 15, 16, 17, 18 of the periodic table

Stoichiometry:
- Calculation of mass relationships and reaction yields
- Interpretation of analytical results
- Calculation of chemical equilibriums

Entry requirements: none

Assessment method:

Written exams:

general chemistry :90 minutes
inorganic chemistry: 90 minutes

Scripts: lecture notes

Literature:

General chemistry:

- **Chemistry**
  J. McMurry, R. C. Fay
  Prentice Hall
- **Chemistry – The Central Science**
  T. L. Brown, H. E. Le May, B. E. Bursten
  Prentice Hall
- **General Chemistry**
  R. H. Petrucci, W. S: Harwood
  Prentice Hall
- **Basic Solid State Chemistry**
  R. West
  John Wiley & Sons
- **General Chemistry Principles and Structure**
  J. E. Brady
  John Wiley & Sons
- **Chemistry & Chemical Reactivity**
  Kotz, Treichel, Townsend
  Brooks/Cole
- **Principles of Modern Chemistry**
  Oxtoby, Gillid, Campion
  Brooks/Cole

Inorganic chemistry:

- **Inorganic Chemistry**
  D. F. Shriver, P. W: Atkins, C. H. Langford
  Oxford University Press
- Inorganic Structural Chemistry
  U. Müller
  John Wiley & Sons
- **Inorganic Chemistry Principles of Structure and Reactivity**
  J. E. Huheey, E. A. Keiter, R. L. Keiter
  Harper Collins College Publishers
- **Basic Solid State Chemistry**
  A. R. West
  John Wiley & Sons
- **Inorganic Chemistry Main Group Elements**
  R. Bruce King
  VCH

Module title: Introduction into Information Processing

Module code: 101220	**Credits: 5**

In charge of module: Prof. Dr. Hoffmann

Teaching and learning methods:

Lecture:	2	SWS	Contact hours:	56	Hours
Exercise:	1	SWS	Preparation an post processing:	56	Hours
Laboratory:	2	SWS	Papers / Presentations:	38	Hours
Sum:	5	SWS	Total workload:	120	Hours

Learning outcomes:

In this basic studies module students are introduced to information technology. In addition to understanding the fundamentals of computer science, the focus is also on learning a problem-oriented programming language.

Description of content:

Fundamentals of Computer Science: Introduction to computer science, basic concepts of computer organisation, introduction to data communication, algorithm types and programming languages
Usage of operating systems: Concepts, processing of commands and processes, shell functions, file system, web-based working, and editors. Introduction to programming languages.

Entry requirements:

PC skills may be an advantage.

Assessment method: Written exam of 120 minutes

Literature and Scripts:

Books on the fundamentals of computer science, as, for instance: Hartmut Ernst, Grundkurs Informatik.

Module title: German for foreign students 1

Module code: 318004	**Credits: 3**

In charge of module: Sprachenakademie

Teaching and learning methods:

Lecture:	SWS	Contact hours:	Hours
Exercise:	SWS	Preparation an post processing:	Hours
Laboratory:	SWS	Papers / Presentations:	Hours
Sum:	SWS	Total workload:	Hours

Learning outcomes:

To be published

Description of content:

Entry requirements:

Assessment method:

Literature and Scripts:

2. Semester

Module title: Mathematics 2

Module code: 32200	**Credits: 4**

In charge of module: Prof. Dr. rer. nat. habil. Werner Stulpe

Teaching and learning methods:

Lecture:	2	SWS	Contact hours:	45	Hours
Exercise:	2	SWS	Preparation an postprocessing:	75	Hours
Laboratory:		SWS	Papers / Presentations:		Hours
Sum:	4	SWS	Total workload:	120	Hours

Learning outcomes:

The lectures and exercises provide an essential part of basic mathematics for scientists and engineers which enables the students to transform physical and technical problems into mathematical tasks.

Description of content:

- Differentiation of functions of several variables
- Integration of functions of several variables
- Complex numbers
- Differential equations

Entry requirements: Mathematics I

Assessment method: Written exam of 120 minutes

Literature and Scripts:

S. Lang, Calculus of Several Variables, Springer-Verlag (New York,1988)

A. Fetzer, H. Fränkel, Mathematik 1, 2, Springer-Verlag (Berlin, 1997)

Module title: Physics 2

Module code:	**Credits: 6**

In charge of module: Prof. Dr. Hoyler

Teaching an learning methods:

Lecture:	2	SWS	Contact hours:	68	Hours
Exercise:	2	SWS	Preperation an post processing:	82	Hours
Laboratory:	2	SWS	Papers / Presentations:	30	Hours
Sum:	6	SWS	Total workload:	180	Hours

Learning outcomes:

Understanding the formulation of physical models and their application in engineering. Learning the methods by which problems in natural sciences can be formulated an solved using mathematical tools. Tutorials will enable the student to present information to other people. Being able to perform basics experimental work, including written documentation of the results.

Description of content:

• Electrodynamics: Coulomb force, electrical fields, direct currents, magnetic fields, electromagnetic induction
• Optics, waves, propagation of light, optical instruments

Entry requirements: non

Assessment methods:

Written examination 120 min

Literature and Scripts:

Any physics textbook.
Very condensed and low-cost:M.Brown "Physics for Engineering and Science", detailed with high availability in the library:
P.A. Tipler "Physics for Scientists and Engineers"

Module title: Physical Chemistry 1

Module code: 32210	**Credits: 6**

In charge of module: Prof. Dr. Günter Lauth, Prof. Dr. Franz Prielmeier

Teaching an learning methods:

Lecture:	3	SWS	Contact hours:	56	Hours
Exercise:	2	SWS	Preperation an post processing:	124	Hours
Laboratory:		SWS	Papers / Presentations:		Hours
Sum:	5	SWS	Total workload:	200	Hours

Learning outcomes:

Students are familiar with the fundamentals of thermodynamics and their applications: Laws of thermodynamics, calculation of physical changes of state, thermochemical calculations, properties of solutions. They are able to interpret phase diagrams of pure substances and of mixtures and are able to calculate phase boundaries.

Description of content:

Lecture:

- Properties of Gases, equations of state, kinetic theory of gases
- Thermodynamics: First and Second Law, thermochemistry, chemical potential
- Phase diagrams of pure substances
- Solutions: ideal and ideal-dilute solutions, colligative properties, activity
- Phase diagrams of binary mixtures
- Chemical equilibrium

Tutorial: Calculations of numerical problems from the topics of the lecture

Entry requirements:

Assessment methods:

Written exam, 120 min

Literature and Scripts:

P. Atkins, J. de Paula: Physical Chemistry, Oxford University Press

Module title: Analytical and Inorganic Chemistry	
Module code:32220	**ECTS-Credits: 10**
In charge of module: Prof. Dr. Merschenz-Quack	

Teaching and learning methods:

Lecture:	3	SWS	Contact hours	113	hours
Exercise:	2	SWS	Preparation and post processing	187	hours
Laboratory:	5	SWS	Papers / Presentations:		hours
Sum	10		Total workload:	300	hours

Learning outcomes:

Analytical Chemistry:

The students are qualified in laboratory techniques for classic qualitative and quantitive analyses. They are able to identify very quickly most of the cation and anions with simple tests. The students have the capability to carry out, evaluate and develop volumetric, gravimetric and electrochemical analyses.

Stoichiometry:

The students know the basic calculations for laboratory work and production yield.

Inorganic Chemistry

The students have knowledge in coordination chemistry. They are able to predict properties and molecule geometries of complex compounds with the help of electron configuration and die position in the periodic table. They are able to decide a coordination compound to be suitable for production and refinement of elements. They are competent to use coordination compounds for analytical problems. The students are well grounded in transition elements of the groups 3 to 12 of the periodic table. They characterise the peculiarity of the chemical compounds and the properties. The students are able to develop new applications of elements and compounds.

Description of content:

Analytical Chemistry: lecture 2 SWS, exercise 1 SWS; practical course 5 SWS
Inorganic Chemistry: lecture 1 SWS, exercise 1SWS,

Analytical chemistry:

Lectures:

- Qualitative analysis: cations and anions, Separation process, test reactions
- Qualitative analysis: gravimetric analysis, acid-base titrations, redox titrations, complex titrations, potentiometric titration, photometric analysis

Exercises:
- Explanation and discussion the separation systems
- Calculation and discussion of analytical results

Laboratory:
- Qualitative analysis of cations and anions: 3 Samples
- Quantitative analysis: gravimetric (2), Titration (4), photometry (1), potentiometry (2)

Inorganic chemistry
Lectures:
- Theory of coordination chemistry)
- Methods of producing Metals
- Chemistry of the transition elements (group 3 to 12 of the periodic table)

Exercises:
- Discussion of the crystal-field-theory (colours, magnetism, structure, spinels)
- Formulation of the production of the transition elements
- Discussion of the special properties

Entry requirements: none

Assessment method:

Written exams: Analytical chemistry: 120 minutes, Inorganic chemistry: 60 minutes

Scripts: lecture notes

Literature:

Analytical Chemistry:

- **Introduction to Semimicro Qualitative Analysis**
  J. J. Lagowski; C. H. Sorum
  Prentice-Hall International
- **General Chemistry with Qualitative Analysis**
  H. F. Holtzelaw; W.R. Robinson; J. D. Odom
  D.C. Heath and Company
- **Principles of Quantitative Chemical Analysis**
  R. de Levie
  McGraw-Hill International editions
- **Analytical Chemistry**
  G. D. Christian
  John Wiley & Sons
- **Analytical Chemistry**
  R. Kellner; J.-M. Mermet; M. Otto; H. M. Widmer
  Wiley-VCH

Inorganic chemistry

- **Inorganic Chemistry**
  D. F. Shriver, P. W: Atkins, C. H. Langford
  Oxford University Press
- Inorganic Structural Chemistry
  U. Müller
  John Wiley & Sons
- **Inorganic Chemistry Principles of Structure and Reactivity**
  J. E. Huheey, E. A. Keiter, R. L. Keiter
  Harper Collins College Publishers
- **Basic Solid State Chemistry**
  A. R. West
  John Wiley & Sons
- **Inorganic Chemistry Main Group Elements**
  R. Bruce King
  Wiley-VCH
- **Descriptive inorganic coordination and solid state chemistry**
  G.E. Rodgers
  Brooks/Cole

Module title: German for foreign students 2

Module code: 35800	**Credits: 3**

In charge of module: Sprachenakademie

Teaching and learning methods:

Lecture:	SWS	Contact hours:	Hours
Exercise:	SWS	Preparation an post processing:	Hours
Laboratory:	SWS	Papers / Presentations:	Hours
Sum:	SWS	Total workload:	Hours

Learning outcomes:

To be published.

Description of content:

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Entry requirements:

Assessment method:

Literature and Scripts:

Modulbeschreibungen 3. bis 6. Semester

Siehe Studiengang Angewandte Chemie