

# Opasraportti

## LuTK - Chemistry (2009 - 2010)

### Tutkintorakenteisiin kuulumattomat opintokokonaisuudet ja -jaksot

783633S: Adhesion Chemistry, 3 op  
781625S: Aquatic Chemistry, 4 op  
782626S: Atmospheric Chemistry, 3 - 4 op  
781637S: Atomic Spectrometric Methods, 4 op  
780109P: Basic Principles in Chemistry, 4 op  
780372A: Basic Principles of Green Chemistry, 4 op  
782625S: Basic Principles of Quantum Chemistry, 3 - 4 op  
784637S: Biological NMR Spectroscopy, 3 op  
782621S: Catalysis, 3 op  
782627S: Chemical Applications in Hazardous Waste Management and Environmental Technology, 4 op  
780321A: Chemical Legislation in Finland, 1 op  
780395A: Chemistry for Teachers, 4 op  
782634S: Chemistry in industrial applications, 3 op  
781610S: Chemistry of Metal Complexes, 3 op  
783627S: Chemistry of Natural Substances I, 3 op  
783641S: Chemistry of Natural Substances II, 3 op  
781621S: Chemistry of Non-Metals, 3 op  
783635S: Chemistry of Paints and Surface Coatings, 3 op  
781613S: Chemistry of Rare Earth Elements, 3 op  
781645S: Chemistry of Solid Fuels Ashes, 3 op  
781644S: Computational Inorganic Chemistry, 3 op  
784626S: Computer Analysis of NMR Spectra, 2 op  
780396A: Demonstrations in Physics and Chemistry, 2 op  
781632S: Determination of Trace Elements, 3 op  
780373A: Environmental Chemistry, 3 op  
781633S: Experimental Design, 4 op  
781600S: Final Examination in Inorganic Chemistry, 7 op  
783600S: Final Examination in Organic Chemistry, 7 op  
782600S: Final Examination in Physical Chemistry, 7 op  
784600S: Final Examination in Structural Chemistry, 7 op  
782618S: High Pressure Kinetics, 3 op  
781638S: ICP-MS Workshop, 3 op  
780341A: Industrial Training I, 2 op  
780342A: Industrial Training II, 4 op  
780343A: Industrial Training III, 6 op  
780344A: Industrial Training IV, 8 op  
780353A: Inorganic Chemistry I, 6 op  
781642S: Inorganic Chemistry II, 4 op  
780328A: Instrumental Analysis, 4 - 5 op  
782629S: Interactions between Molecules, 4 op  
780111P: Introduction to Analytical Chemistry, 4 op  
780113P: Introduction to Chemistry, 12 op  
783638S: Introduction to Fiber Chemistry of Polysaccharides, 3 op  
780102P: Introduction to Inorganic Chemistry, 5 op

780103P: Introduction to Organic Chemistry, 6 op  
780112P: Introduction to Organic Chemistry, 4 op  
780101P: Introduction to Physical Chemistry, 7 op  
780326A: Introduction to Polymer Chemistry, 2 op  
780122P: Introductory Laboratory Course in Chemistry, 3 op  
780697S: Laboratory Course (Teachers), 20 op  
780330A: Laboratory Course I in Inorganic Chemistry, 7 op  
780329A: Laboratory Course I in Organic Chemistry, 4 op  
780332A: Laboratory Course I in Organic Chemistry, 4 op  
780331A: Laboratory Course I in Physical Chemistry, 5 op  
780382A: Laboratory Course in Physical Chemistry (TECH), 2 op  
781641S: Laboratory Course in Synthetic Chemistry, 4 op  
783605S: Literature Survey in Organic Chemistry, 9 op  
780379A: Literature of Chemistry and Communication Skills, 2 op  
781627S: Main Group Chemistry, 5 op  
781601S: Master's Thesis in Inorganic Chemistry, 38 op  
781602S: Master's Thesis in Inorganic Chemistry, 20 op  
783601S: Master's Thesis in Organic Chemistry, 38 op  
783602S: Master's Thesis in Organic Chemistry, 20 op  
782601S: Master's Thesis in Physical Chemistry, 38 op  
782602S: Master's Thesis in Physical Chemistry, 20 op  
784601S: Master's Thesis in Structural Chemistry, 38 op  
784602S: Master's Thesis in Structural Chemistry, 20 op  
780699S: Maturity Test, 0 op  
780381A: Maturity test, 0 op  
782624S: Molecular Modelling, 3 - 4 op  
781626S: Molecular Modelling Workshop, 3 - 4 op  
781639S: Molecular Symmetry and Spectroscopy, 5 op  
784617S: Multinuclear NMR Spectroscopy in Structure Elucidation, 4 op  
784610S: NMR Spectroscopy in Organic Chemistry, 3 op  
784636S: NMR Spectroscopy of Polymers, 4 op  
784623S: NMR Workshop I, 4 op  
784624S: NMR Workshop II, 4 op  
784638S: NMR Workshop III, 4 op  
784639S: NMR Workshop IV, 4 op  
780389A: Organic Chemistry I, 6 op  
783643S: Organic Chemistry II, 4 op  
783639S: Organic Chemistry III, 5 op  
783614S: Organic Chemistry of Drug Compounds, 3 op  
783640S: Organometallic Chemistry, 3 op  
780078Y: Orientation Course for New Students, 1 op  
783645S: Pericyclic chemistry, 3 op  
780347A: Physical Chemistry I, 6 op  
782631S: Physical Chemistry II, 4 op  
783620S: Polymer Chemistry, 3 op  
783636S: Polymer Chemistry in Materials Sciences, 3 - 4 op  
782630S: Quantum mechanics and Spectroscopy, 3 op  
781623S: Reaction Mechanisms in Inorganic Chemistry, 3 op  
780601S: Research Project, 12 op  
783634S: Research Seminar in Organic Chemistry, 2 op  
787602J: Research Seminar in Organic and Polymer Chemistry, 3 op  
780301A: Research Training, 9 op  
780301A-01: Research Training, 3 op  
780301A-03: Research Training, 3 op  
780301A-02: Research Training, 3 op  
781640S: Sampling and Sample Preparation, 4 op  
781647S: Scanning electron microscopy, 3 op  
780690S: Seminar, 3 op  
780380A: Seminar for the Degree of B.Sc., 1 op  
781630S: Seminar in Inorganic Chemistry, 2 op  
782623S: Seminar in Physical Chemistry, 2 op  
788602S: Seminar in Structural Chemistry, 2 op  
781611S: Solid State Chemistry, 4 op  
781631S: Statistical Methods in Analytical Chemistry, 4 op

780317A: Structural Chemistry I, 5 op  
 781614S: Structural Methods in Inorganic Chemistry, 3 op  
 782620S: Surface Chemistry I, 3 op  
 782633S: Surface chemistry II, 3 op  
 783642S: Synthetic Methods in Green Chemistry, 4 op  
 780300A: Thesis for the Degree of B.Sc., 6 op  
 780079Y: Tutoring, 1 op  
 783619S: Wood Chemistry, 3 op  
 781646S: X-Ray Crystallography, 6 op

## Opintojaksojen kuvaukset

### Tutkintorakenteisiin kuulumattomien opintokokonaisuuksien ja -jaksojen kuvaukset

#### 783633S: Adhesion Chemistry, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

Skeits, I., , 1990

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the composition of an adhesive formulation and is also familiar with the basics of adhesion theory.

**Contents:**

Adhesion theory, surface treatment methods, thermoplastic block copolymers, polyurethanes, poly(vinyl acetate), acrylates, anaerobic adhesives, cyanoacrylates.

**Learning activities and teaching methods:**

24 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Introduction to Polymer Chemistry (780326A) and Physical Chemistry of Surfaces (782620S).

**Recommended or required reading:**

Skeits, I.: Handbook of Adhesives, 3rd ed., Van Nostrand Reinhold, New York, 1990.

**Person responsible:**

Prof. O. Hormi

#### 781625S: Aquatic Chemistry, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen oppimateriaali:**

**Stumm, Werner** , , 1996

**Buffle, Jacques** , , 1988

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the chemistry of natural waters: chemical equilibria and reaction rates in them. Models of natural waters, influences of pollution on them.

**Contents:**

Atmosphere-water-solid-interactions and regulation of the chemical composition of natural waters.

**Learning activities and teaching methods:**

32 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Introduction to Analytical Chemistry (780111P).

**Recommended or required reading:**

Stumm, W. and Morgan, J.J.: Aquatic Chemistry - Chemical Equilibria and Rates in Natural Waters, 3rd ed., John Wiley & Sons, New York, 1995; Buffle, J.: Complexation Reactions In Aquatic Systems: An Analytical Approach, Ellis Horwood Limited, Chichester, 1988.

**Person responsible:**

Lecturer L. Kaila

## 782626S: Atmospheric Chemistry, 3 - 4 op

**Voimassaolo:** - 21.07.2010

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laasonen Kari

**Opintokohteen oppimateriaali:**

**Seinfeld, John H.** , , 1998

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th autumn. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the physical chemistry of several atmospheric processes including the ozone depletion, acid rain and greenhouse gases.

**Contents:**

The course concentrates on atmospheric phenomena, especially the physical chemistry related to atmospheric pollutions. Topics include: the chemical reaction on different parts of atmosphere (including ozone depletion, atmospheric sulphur chemistry), aerosoles, formation of small droplets and their impurities, acid rain and global warming.

**Learning activities and teaching methods:**

30 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry I (780347A) and Physical Chemistry II (782631S) or P.W. Atkins, Physical Chemistry, part 3.

**Recommended or required reading:**

Material given by the lecturer (in Finnish) and Seinfeld, J.H. and Pandis, S. N.: Atmospheric Chemistry and Physics, Willey-Interscience, 1998.

**Person responsible:**

Prof. K. Laasonen

## 781637S: Atomic Spectrometric Methods, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen oppimateriaali:**

Lajunen, Lauri H. J. , , 2004

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

After the course student is familiar with modern AAS and ICP-OES techniques and their advantages and "weak points" in the point of view of elements and samples to be analysed.

**Contents:**

Theoretical background of the different atomic spectrometric techniques (atomic absorption spectrometry, atomic emission spectrometry employing plasma sources, plasma mass spectrometry), modern instrumentation and determination of various elements, interference effects and their correction, optimisation of the determination procedures, instrument diagnostics.

**Learning activities and teaching methods:**

30 hours of lectures + seminar + practical exercise, one final examination.

**Target group:**

Chemistry, optional.

**Recommended or required reading:**

Lajunen, L.H.J. and Perämäki, P.: Spectrochemical Analysis by Atomic Absorption and Emission, 2<sup>nd</sup> ed., The Royal Society of Chemistry, 2004

**Person responsible:**

Prof. P. Perämäki

## 780109P: Basic Principles in Chemistry, 4 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Tiainen

**Opintokohteen oppimateriaali:**

Petrucci, Ralph H., , 2002

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780120P	Basic Principles in Chemistry	5.0 op
ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op
780115P	General and Inorganic Chemistry II	6.0 op
780114P	General and Inorganic Chemistry I	6.0 op
780113P	Introduction to Chemistry	12.0 op
780101P	Introduction to Physical Chemistry	7.0 op
780101P2	Physical Chemistry I	4.0 op
780107P	Basic Course in Inorganic and Physical Chemistry	7.5 op
780152P	Inorganic and Physical Chemistry I	7.5 op
780153P	General and Inorganic Chemistry	7.5 op
780154P	Basic Inorganic Chemistry	7.5 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

1st autumn.

**Learning outcomes:**

After this course the student is familiar with basic chemistry phenomenon; equilibrium of acids and bases, chemical equilibrium, redox reactions and stoichiometry.

**Contents:**

Introduction to chemistry, stoichiometry, redox reactions, chemical equilibrium, the equilibrium of acid and bases, buffer solutions, titration.

**Learning activities and teaching methods:**

36 hours of lectures, one final examination.

**Target group:**

Biology, Geology, Mechanical Engineering, Process Engineering, compulsory.  
Geography, optional.

**Recommended or required reading:**

Petrucci, R.H., Harwood, W.S., and Herring, F.G.: General Chemistry: Principles and Modern Applications, Prentice Hall, 8th edition (2002) or a newer edition.

**Person responsible:**

Lecturer M. Tiainen

**Other information:**

This course is only for students who have chemistry as a minor subject.

This course has partly the same contents as the course Introduction to Chemistry (780113P) (and the course Introduction to Physical Chemistry). If a student performs also the course Introduction to Chemistry, this course will be cancelled in his/hers study register.

**780372A: Basic Principles of Green Chemistry, 4 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Toivo Kuokkanen, Minna Tiainen

**Opintokohteen oppimateriaali:**

Lancaster, Mike , , 2002

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780355A	Environmental Chemistry and Hazardous Wastes	4.0 op
---------	--	--------

780360A	Environmental Chemistry and Hazardous Wastes	5.5 op
780375A	Basic Principles of Green Chemistry	2.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish.

**Timing:**

Spring.

**Learning outcomes:**

After this course the student is familiar with the twelve principles of green chemistry.

**Contents:**

Environmental friendly chemistry. The principles of green chemistry with examples of real life. Utilization, refining and disposal of environmentally hazardous wastes, hazardous wastes.

**Learning activities and teaching methods:**

37 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Introduction to Physical Chemistry (780101P) and Introduction to Inorganic Chemistry (780102P) or Basic Principles in Chemistry (780109P).

**Recommended or required reading:**

Lancaster M.: Green Chemistry: An introductory text, RSC, 2002. Material given in the lecture (hazardous wastes).

**Person responsible:**

Lecturer Minna Tiainen and Doc. Toivo Kuokkanen.

**782625S: Basic Principles of Quantum Chemistry, 3 - 4 op****Voimassaolo:** - 31.07.2010**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Laasonen Kari**Opintokohteen oppimateriaali:****Cramer, Christopher J.,** , 2002**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th autumn/spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the basics of quantum chemical modelling.

**Contents:**

This course focuses on the quantum chemical modelling. The emphasis is on the many-electron methods like Hartree-Fock, configuration method and density functional theory. The computational aspects like the basis set are discussed in detail. Application to IR and Raman spectra are considered in detail. This course focuses on the theoretical aspects whereas the hands-on exercises are dealt in the course 781626S Molecular modelling workshop.

**Learning activities and teaching methods:**

30 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry II (782631S).

**Recommended or required reading:**

Material given in the lectures (in Finnish) and Cramer, C.J.: Essentials of Computational Chemistry, Willey, 2002.

**Person responsible:**

Prof. K. Laasonen

**784637S: Biological NMR Spectroscopy, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Mattila, Sampo Antero**Opintokohteen oppimateriaali:****Cavanagh, John**, , 1996**Opintokohteen kielet:** English**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish and English on demand.

**Timing:**

The course is lectured every other year.

**Learning outcomes:**

After this course the students are familiar with production of most common 2D, 3D and 4D double and triple resonance NMR spectra.

**Contents:**

During the course the students get hands on experience on setting up and acquiring multi dimensional spectra as well as processing and converting data to other formats and assigning protein backbones.

**Learning activities and teaching methods:**

14 hours of lectures + applications, 30 hours of exercises, one final examination.

**Target group:**

Chemistry, optional.

**Recommended or required reading:**

Cavanagh: Protein NMR Spectroscopy, Academic Press, 1995, ISBN: 0121644901.

**Person responsible:**

Senior assistant S. Mattila

**782621S: Catalysis, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Pursiainen Jouni**Opintokohteen oppimateriaali:****Gates, Bruce C.**, , 1992**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the theory of catalysis. Thermodynamic and kinetic background will be studied, including mechanisms of the most important catalytic reactions. Applications, preparation, characterisation and structure of homogenous, heterogeneous and enzymatic catalysts will be discussed.

**Contents:**

Principles of catalysis, homogeneous catalysis in solutions, polymer catalysis, zeolites, heterogeneous catalysis on surfaces.

**Learning activities and teaching methods:**

30 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry II (782631S).

**Recommended or required reading:**

Gates, B.C.: Catalytic Chemistry, John Wiley & Sons, 1992, partly. Examination based on the lectures.

**Person responsible:**

Prof. J. Pursiainen

## 782627S: Chemical Applications in Hazardous Waste Management and Environmental Technology, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Toivo Kuokkanen

**Opintokohteen oppimateriaali:**

Clark, J.H., , 1995

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After the course the student is familiar both in theory and practice with chemical applications in utilization and disposal of chemical wastes, especially hazardous wastes as well as with new chemical environmental technology

**Contents:**

Principles and activities in management of hazardous and other chemical wastes, modern treating methods of chemical wastes, new chemical methods and technologies in the utilization of chemical wastes, especially hazardous wastes

**Learning activities and teaching methods:**

30 hours of lectures + seminar + practical exercise, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Basic Principles in Green Chemistry (780372A).

**Recommended or required reading:**

Clark, J.H.: Chemistry of Waste Minimization, Blackie Academic & Professional, Glasgow 1995, partly and material handed out by the lecturer.

**Person responsible:**

Doc. T. Kuokkanen

## 780321A: Chemical Legislation in Finland, 1 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pentti Oksman

**Opintokohteen oppimateriaali:**

Sundquist Anna-Liisa, Koivumäki Tapani ja Aalto Asko, , 2007

Luhtanen, Raimo, , 2008

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780681S Chemical Legislation in Finland 1.0 op

**ECTS Credits:**

1 credits

**Language of instruction:**

Finnish

**Timing:**

3<sup>rd</sup> autumn.

**Learning outcomes:**

After the course the student is familiar with Finnish legislation concerning chemistry and occupational health. He /she is acquainted with the limitations of the use of dangerous chemicals and is able to find updated information of them. The student is also familiar with the main laws of pressure containers and tanks of compressed gases as well as of radiation.

**Contents:**

Safety at work, sanitarily and environmentally hazardous chemicals, explosive materials and combustible liquids, pressure containers and tanks of compressed gases.

**Learning activities and teaching methods:**

10 hours of lectures, one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended or required reading:**

Työpaikan lakikirja 2008. Työpaikan kemikaalilainsäädäntö 2008.

**Person responsible:**

Senior Laboratory Manager P. Oksman, PhD

## 780395A: Chemistry for Teachers, 4 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

## 782634S: Chemistry in industrial applications, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Ulla Lassi

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with chemical applications in process and environmental technology. In particular, new applications of chemistry are considered.

**Contents:**

Catalytic applications in water purification, catalytic oxidation, preparation of biofuels from biomass, biomass gasification and the utilisation of biogas, chemistry and chemical reactions in mining processes etc. (visiting lecturers from the companies)

**Learning activities and teaching methods:**

30 hours of lectures, one final examinations.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry I (780347A) and Physical Chemistry II (782631S).

**Recommended or required reading:**

Material given by the lecturer, scientific review papers.

**Person responsible:**

Prof. U. Lassi.

## 781610S: Chemistry of Metal Complexes, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

A profound understanding of concepts of coordination equilibria, complex compounds in aqueous solutions and their solution equilibria.

**Contents:**

Concepts of metal complexes in aqueous solutions, experimental methods, methods for construction and refinement of equilibrium models, applications.

**Learning activities and teaching methods:**

20 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Lecturer L. Kaila

## 783627S: Chemistry of Natural Substances I, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marja Lajunen

**Opintokohteen oppimateriaali:**

Davis, Benjamin G. , , 2002

Dewick, Paul M. , , 1997

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th autumn or spring. The course is lectured every other year.

**Learning outcomes:**

The student knows what are natural compounds and their tasks in nature. Carbohydrates, their types, structures and reactivity. Anomeric effect, mutarotation and their consequences. Protection, glycosylation. Lipids: Fatty acids, eicosanoids, prostaglandins, phospholipids. Their biosynthesis, chemistry and role in life science.

**Contents:**

Natural products: Carbohydrates and lipids.

**Learning activities and teaching methods:**

20 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Organic Chemistry I (780389A) and Organic Chemistry II (783643S).

**Recommended or required reading:**

Material handed out by the lecturer and Davis, B.G. and Fairbanks, A.J.: Carbohydrate Chemistry, Oxford Chemistry Primers, 2002, partly; Dewick, Paul M.: Medicinal Natural Products, A Biosynthetic Approach, Wiley & Sons Ltd, 1998.

**Person responsible:**

Prof. M. Lajunen

## 783641S: Chemistry of Natural Substances II, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marja Lajunen

**Opintokohteen oppimateriaali:**

Dewick, Paul M. , , 1997

Mann, J., Davidson, R.S., Hobbs, J.B., Banthorpe, D.V. ja Harborne, J.B. , , 1994

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

The student knows types of natural products: terpenoids, steroids, and alkaloids. Their varieties, properties, biosynthetic background and occurrence.

**Contents:**

Natural products from secondary metabolism: Terpenoids, steroids and alkaloids.

**Learning activities and teaching methods:**

20 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Organic Chemistry I (780389A) and Organic Chemistry II (783643S).

**Recommended or required reading:**

Material handed out by the lecturer and Mann, J., Davidson, R.S., Hobbs, J.B., Banthorpe, D.V. ja Harborne, J.B.: Natural Products, Their Chemistry and Biological Significance, Longman Scientific & Technical, 1995. Dewick, Paul M.: Medicinal Natural Products, A Biosynthetic Approach, Wiley & Sons Ltd, 1998.

**Person responsible:**

Prof. M. Lajunen

## 781621S: Chemistry of Non-Metals, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Raija Oilunkaniemi

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

This course will give the student an overview of the development of chemistry of non-metals by examining the current literature of the field.

**Contents:**

New methods in the synthesis of non-metallic compounds, structural chemistry, and chemical properties of non-metallic compounds.

**Learning activities and teaching methods:**

18 hours of lectures + seminar, one final examination, attendance at the lectures.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Inorganic Chemistry I (780353A).

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Doc. R. Oilunkaniemi

## 783635S: Chemistry of Paints and Surface Coatings, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

Paul, Swaraj , , 1985

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the chemical composition of paints and coatings and modern technologies used in the preparation of paint / coating formulations.

**Contents:**

Most important polymers used as binders in paints / coatings, introduction to colour theory, new technologies used in the preparation of paints / coatings.

**Learning activities and teaching methods:**

24 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Introduction to Polymer Chemistry (780326A).

**Recommended or required reading:**

Paul, S.: Surface Coatings Science and Technology, John Wiley & Sons, New York, 1986.

**Person responsible:**

Prof. O. Hormi

**781613S: Chemistry of Rare Earth Elements, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laitinen Risto

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish or English

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

This course will familiarise students with the properties and applications of rare earths.

**Contents:**

Occurrence and separation properties of rare earths, chemical and physical characteristics (especially spectroscopic), coordination chemistry, and most important applications.

**Learning activities and teaching methods:**

18 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Inorganic Chemistry I (780353A) and Inorganic Chemistry II (781642S).

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Doc. R. Oilunkaniemi

**781645S: Chemistry of Solid Fuels Ashes, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Tiainen

**Opintokohteen oppimateriaali:**

**Raiko, R., Saastamoinen, J., Hupa, M. & Kurki-Suonio, I., , 2002**

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with chemistry of combustion process, formation mechanisms of ashes and ash related problems.

**Contents:**

Solid fuels, ash forming material, combustion techniques, heterogeneous combustion, ash formation mechanisms, ash related problems in boiler, analytical methods (SEM-EDS).

**Learning activities and teaching methods:**

20 hours of lectures + seminar, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

780353A Inorganic Chemistry I.

**Recommended or required reading:**

Raiko, R., Saastamoinen, J., Hupa, M. ja Kurki-Suonio, I., Poltto ja palaminen, Gummerus Oy, Jyväskylä (in Finnish).

**Assessment methods and criteria:**

Problem based learning, portfolio.

**Person responsible:**

Lecturer M. Tiainen

**781644S: Computational Inorganic Chemistry, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laitinen Risto

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English

**Timing:**

4th or 5th year. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with review of computational methods in quantum inorganic chemistry.

**Contents:**

Review of computational methods in quantum chemistry (molecular mechanics, semiempirical methods, ab initio methods, DFT methods), basis sets, computation of molecular properties, transition states, spectroscopic properties. The application of the methods in inorganic chemistry will be illustrated by examples from current literature.

**Learning activities and teaching methods:**

28 hours of lectures, 14 hours of exercises.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Inorganic Chemistry I (780353A), Inorganic Chemistry II (781642S) and Quantum Mechanics and Spectroscopy (782630S).

**Recommended or required reading:**

Recommended reading: Young, D.: Computational Chemistry: A Practical Guide for Applying Techniques to Real World Problems, Wiley-Interscience, 2001; Hinchliffe, A.: Molecular Modelling for Beginners, John Wiley & Sons Ltd, 2003.

**Person responsible:**

Prof. R. Laitinen

## 784626S: Computer Analysis of NMR Spectra, 2 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Günther, Harald , , 1995

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with computer aided NMR spectral processing and production, and assignment tools.

**Contents:**

The basic theory for analysing NMR spectra; the structure, function and use of simulating and iterating analysis programs.

**Learning activities and teaching methods:**

8 hours of lectures + 28 hours of exercises, one final examination.

**Target group:**

Chemistry, optional.

**Recommended or required reading:**

Günther, H.: NMR Spectroscopy, 2nd ed., Wiley, 1995, partly. Laatikainen, R. ja Niemitz, M.: Perch, An Integrated software for Analysis of NMR spectra on PC, University of Kuopio, 1994.

**Person responsible:**

Senior assistant S. Mattila

## 780396A: Demonstrations in Physics and Chemistry, 2 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

766309A Demonstrations in Physics and Chemistry 2.0 op

**ECTS Credits:**

2 credits

## 781632S: Determination of Trace Elements, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course student is familiar with special tasks when very low element concentrations are measured.

**Contents:**

Sampling and sample preparation in trace and ultra trace elemental analysis, systematic errors (losses and contamination), clean rooms, separation and preconcentration techniques, hyphenated techniques.

**Learning activities and teaching methods:**

24 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Sampling and Sample Preparation (781640S).

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Prof. P. Perämäki

**780373A: Environmental Chemistry, 3 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Minna Tiainen**Opintokohteen oppimateriaali:****VanLoon, Gary W.** , , 2000**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

780359A	Environmental Chemistry	4.0 op
780355A	Environmental Chemistry and Hazardous Wastes	4.0 op
780316A	Environmental Chemistry	2.0 op
780360A	Environmental Chemistry and Hazardous Wastes	5.5 op

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish

**Timing:**3<sup>rd</sup> autumn.**Learning outcomes:**

After this course the student is familiar with chemistry of atmosphere, hydrosphere and terrestrial environment.

**Contents:**

Fundamentals of environmental chemistry; chemistry of the soil, natural and waste waters and atmosphere, circulation of chemical compounds in the nature, chemical releases, environmentally toxic and other noxious compounds, environmental analytics and basics of physical measurements.

**Learning activities and teaching methods:**

30 hours of lectures, one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Introduction to Physical Chemistry (780101P) and Introduction to Inorganic Chemistry (780102P) or Basic Principles in Chemistry (780109P).

**Recommended or required reading:**

van Loon, G.W. &amp; Duffy, S.J.: Environmental Chemistry, A Global Perspective, Oxford, 2000.

**Person responsible:**

Lecturer M. Tiainen.

**781633S: Experimental Design, 4 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Paavo Perämäki**Opintokohteen oppimateriaali:****Massart, D.L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. ja Smeyers-Verbeke, J., , 1997****Opintokohteen kielet:** Finnish**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course student becomes aware of importance experimental design and is able to apply most common experimental designs in the field of chemistry.

**Contents:**

Factorial designs, mixture designs, D-optimal designs, response surface methodology. Computer programmes are applied during the course in the design and analysis of experiments.

**Learning activities and teaching methods:**

30 hours of lectures, exercises: computer aided analysis of experimental data, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Statistical Methods in Analytical Chemistry (781631S).

**Recommended or required reading:**

Massart, D.L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. and Smeyers-Verbeke, J.: Handbook of Chemometrics and Qualimetrics: Part A, Elsevier, 1997.

**Person responsible:**

Prof. P. Perämäki

**781600S: Final Examination in Inorganic Chemistry, 7 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen oppimateriaali:****Cotton, F. Albert , , 1995****Huheey, James E. , , 1993****Clayden, J., Greeves, N., Warren, S. ja Wothers, P., , 2001****Opintokohteen kielet:** Finnish**ECTS Credits:**

7 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

5th spring.

**Contents:**

The final examination may be an oral and/or written examination. There are two teachers present in the oral examinations. The grade of the Final Examination may be improved by taking the examination again.

**Target group:**

Chemistry, compulsory.

**Recommended or required reading:**

Inorganic Chemistry: Huheey, J.E., Keiter, E.A. and Keiter, R.L., Inorganic Chemistry: Principles of Structure and Reactivity, 4th ed., Harper Collins College Publishers, 1993.

**Person responsible:**

Professors.

## 783600S: Final Examination in Organic Chemistry, 7 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen oppimateriaali:**

Clayden, J., Greeves, N., Warren, S. ja Wothers, P., , 2001

Cotton, F. Albert , , 1995

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

7 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

5th spring.

**Contents:**

The final examination may be an oral and/or written examination. There are two teachers present in the oral examinations. The grade of the Final Examination may be improved by taking the examination again.

**Target group:**

Chemistry, compulsory.

**Recommended or required reading:**

Organic Chemistry: Clayden, J., Greeves, N., Warren, S. and Wothers, P.: Organic Chemistry, Oxford University Press, 2001 and one book by separate agreement.

**Person responsible:**

Professors.

## 782600S: Final Examination in Physical Chemistry, 7 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen oppimateriaali:**

Clayden, J., Greeves, N., Warren, S. ja Wothers, P., , 2001

Cotton, F. Albert , , 1995

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

7 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

5th spring.

**Contents:**

The final examination may be an oral and/or written examination. There are two teachers present in the oral examinations. The grade of the Final Examination may be improved by taking the examination again.

**Target group:**

Chemistry, compulsory.

**Recommended or required reading:**

Physical Chemistry: by separate agreement.

**Person responsible:**

Professors.

**784600S: Final Examination in Structural Chemistry, 7 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen oppimateriaali:****Clayden, J., Greeves, N., Warren, S. ja Wothers, P.,** , 2001**Cotton, F. Albert** , , 1995**Opintokohteen kielet:** Finnish**ECTS Credits:**

7 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

5th spring.

**Contents:**

The final examination may be an oral and/or written examination. There are two teachers present in the oral examinations. The grade of the Final Examination may be improved by taking the examination again.

**Target group:**

Chemistry, compulsory.

**Recommended or required reading:**

Structural Chemistry: by separate agreement.

**Person responsible:**

Professors.

**782618S: High Pressure Kinetics, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Toivo Kuokkanen**Opintokohteen oppimateriaali:****Porter G.,** , 1970**Van Eldik, R.,** , 1986**Reichardt, Christian** , , 2003**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th year. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with different effects of pressure on various chemical reactions, especially on reaction rates

**Contents:**

Chemical applications of high pressure, determination and calculation of activation volumes, activation volumes of different reaction classes, reaction kinetics by UV/Vis spectrometric methods, especially organic host-guest reactions

**Learning activities and teaching methods:**

20 hours of lectures + two home works, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry I (780347A) and Physical Chemistry II (782631S).

**Recommended or required reading:**

Material given in the lecture and partly: Porter, G.: Progress in Reaction Kinetics, Pergamon Press, Oxford, 1970., van Eldik, R.: Inorganic High Pressure Chemistry, Elsevier, New York 1986 and Reichardt, C.: Solvents and Solvent Effects in Organic Chemistry, 3<sup>th</sup> ed., Wiley-VCH Verlag GmbH, Weinheim 2003

**Person responsible:**

Doc. T. Kuokkanen.

## 781638S: ICP-MS Workshop, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course student is familiar with modern ICP-MS technique and various applications of the technique.

**Contents:**

ICP as an ion source, instrumentation (e.g. mass analysers) and their properties, matrix and other interference effects and their elimination, special sample introduction techniques.

**Learning activities and teaching methods:**

20 hours of lectures and demonstrations, and practical exercise, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Instrumental Analysis (780328A).

**Recommended or required reading:**

Material handed out by lecturer.

**Person responsible:**

Prof. P. Perämäki

## 780341A: Industrial Training I, 2 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Timing:**

2nd or 3rd year

**Target group:**

Chemistry, optional.

### **780342A: Industrial Training II, 4 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Timing:**

2nd or 3rd year.

**Target group:**

Chemistry, optional.

### **780343A: Industrial Training III, 6 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Timing:**

2nd or 3rd period.

**Target group:**

Chemistry, optional.

### **780344A: Industrial Training IV, 8 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Practical training

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

8 credits

**Timing:**

2nd or 3rd year.

**Target group:**

Chemistry, optional.

### **780353A: Inorganic Chemistry I, 6 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

Arvostelu: 1 - 5, pass, fail

**Opintokohteen oppimateriaali:**

Atkins, P., Overton, T., Rourke, J., Weller, M. ja Armstrong, F., , 2006

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780356A Inorganic Chemistry 9.0 op

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

2<sup>nd</sup> spring.

**Learning outcomes:**

After this course the student is familiar with most important basic principles of modern inorganic chemistry.

**Contents:**

Atomic structure, chemical bond and molecular structure, solid state chemistry, acid-base theories, oxidation-reduction reactions, overview of main group chemistry.

**Learning activities and teaching methods:**

40 hours of lectures + 16 hours of exercises, (8 home assignments), one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Introduction to Physical Chemistry (780101P) and Introduction to Inorganic Chemistry(780102P) or Basic Principles in Chemistry (780109P).

**Recommended or required reading:**

Atkins, P., Overton, T., Rourke, J., Weller, M., and Armstrong, F., Inorganic Chemistry, 4th ed., Oxford University Press, 2006.

**Person responsible:**

Prof. R. Laitinen

## 781642S: Inorganic Chemistry II, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

Arvostelu: 1 - 5, pass, fail

**Opintokohteen oppimateriaali:**

Atkins, P., Overton, T., Rourke, J., Weller, M. ja Armstrong, F., , 2006

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780391A Inorganic Chemistry II 4.0 op

780361A Inorganic Chemistry II 4.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th autumn.

**Learning outcomes:**

After this course the student is familiar with basic concepts of coordination chemistry of transition metal complexes.

**Contents:**

Structure and bonding of complexes of transition metals and their chemical and spectroscopic properties, organometallic chemistry, catalysis.

**Learning activities and teaching methods:**

22 hours of lectures + 16 hours of exercises, (8 home assignments), one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Inorganic Chemistry I (780353A).

**Recommended or required reading:**

Atkins, P., Overton, T., Rourke, J., Weller, M., and Armstrong, F., Inorganic Chemistry, 4th ed., Oxford University Press, 2006.

**Person responsible:**

Prof. R. Laitinen

## 780328A: Instrumental Analysis, 4 - 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen oppimateriaali:**

Skoog, Douglas A. , , 1992

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780324A Analytical Chemistry II 4.0 op

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

3<sup>rd</sup> autumn.

**Learning outcomes:**

After this course student is familiar with the principles of most common instrumental methods of analysis that are used, for example, in industry and research.

**Contents:**

Atomic absorption and emission spectrometry, X-ray fluorescence spectrometry, molecular fluorescence, phosphorescence and chemiluminescence, NMR spectrometry, Mass spectrometry, Electroanalytical methods, Thermal analysis.

**Learning activities and teaching methods:**

40 hours of lectures + 6 hours of exercises, two intermediate examinations or one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Introduction to Analytical Chemistry (780111P).

**Recommended or required reading:**

Skoog, D.A., Holler, F.J., Crouch, S.R.: Principles of Instrumental Analysis, 6<sup>th</sup> ed., Thomson Brooks/Cole, 2007, partly.

**Person responsible:**

Prof. P. Perämäki

## 782629S: Interactions between Molecules, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pursiainen Jouni

**Opintokohteen oppimateriaali:**

Atkins, P. W. , , 1998

Reichardt, Christian , , 1988

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish or English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the principles and applications of intermolecular interactions. Non-covalent intermolecular interactions have fundamental effects in practically all the applications of modern chemistry, including solvent interactions, surface chemistry, catalysis and supramolecular chemistry.

**Contents:**

Principles and applications of intermolecular interactions. Electrostatic, van der Waals and pi-pi bonding. Host-guest interactions. Solvent effects and Huges-Ingold rules. Applications to solvent interactions, surface chemistry, catalysis and supramolecular chemistry.

**Learning activities and teaching methods:**

40 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry I (780347A) and Physical Chemistry II (782631S).

**Recommended or required reading:**

Atkins, P.W.: Physical Chemistry, Oxford University Press, Oxford, 6th ed.(1998) or 7th ed. (2002), Chapters 21-22. Reichart, C.: Solvents and Solvent Effects in Organic Chemistry, 2nd ed., VCH, 1990, partly.

**Person responsible:**

Prof. K. Laasonen and Prof. J. Pursiainen.

## 780111P: Introduction to Analytical Chemistry, 4 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen oppimateriaali:**

Saarinen, Heikki (1) , , 2004

Kellner, R., Mermet, J.-M., Otto, M., , 2004

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780110P Analytical Chemistry I 5.5 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

1<sup>st</sup> Spring.

**Learning outcomes:**

After this course student is familiar with basic concepts of quantitative chemical analysis employing classical methods of analysis.

**Contents:**

Steps in quantitative analysis, statistical evaluation of analytical data, chemical equilibrium in aqueous solutions, gravimetry, titrimetry, spectrophotometry.

**Learning activities and teaching methods:**

30 hours of lectures plus 10 hours of exercises, two intermediate examinations or one final examination.

**Target group:**

Biochemistry, Chemistry, compulsory.  
Mathematical Sciences, Physical Sciences, optional.

**Recommended optional programme components:**

Introduction to Chemistry (780113P) or 780101P Introduction to Physical Chemistry and 780102P Introduction to Inorganic Chemistry or Basic Principles in Chemistry (780109P).

**Recommended or required reading:**

Kellner, R., Mermet, J.-M., Otto, M., Valcárcel, M. and Widmer, H.M.: Analytical Chemistry, 2<sup>nd</sup> ed., Wiley-VCH 2004, partly.

**Person responsible:**

Prof. Paavo Perämäki

## 780113P: Introduction to Chemistry, 12 op

**Voimassaolo:** 01.08.2009 -

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen oppimateriaali:**

Petrucci, R.H., Harwood, W.S., Herring, F.G. ja Madura, J.D., , 2007

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780118P	General and Inorganic Chemistry B (OPEN UNI)	5.0 op
780101P	Introduction to Physical Chemistry	7.0 op
780102P	Introduction to Inorganic Chemistry	5.0 op
780109P	Basic Principles in Chemistry	4.0 op

**ECTS Credits:**

12 credits

**Language of instruction:**

Finnish

**Timing:**

1<sup>st</sup> autumn.

**Learning outcomes:**

After this course the student is familiar with basic concepts of chemistry as described in international general chemistry curriculum.

**Contents:**

Basic concepts of chemistry, chemical formula, chemical reaction, chemical equation, oxidation-reduction reactions, stoichiometry, gases, thermodynamics, electrons in atoms, periodic table, chemical bond, phase equilibria, reaction kinetics, chemical equilibrium, acid-base equilibria, equilibria in water solutions of slightly soluble salts.

**Learning activities and teaching methods:**

70 hours of lectures and applications plus 50 hours of exercises, two intermediate examinations or one final examination.

**Target group:**

Biochemistry, Chemistry, compulsory.

Physical sciences, Mathematical sciences, optional.

**Recommended optional programme components:**

Upper secondary school chemistry.

**Recommended or required reading:**

Petrucci, R.H., Harwood, W.S., Herring, F.G. ja Madura, J.D.: General Chemistry: Principles and Modern Applications, 9<sup>th</sup> ed. (or 7<sup>th</sup> and 8<sup>th</sup> ed.), Pearson Prentice Hall, New Jersey, 2007.

**Person responsible:**

Lecturer L. Kaila

## 783638S: Introduction to Fiber Chemistry of Polysaccharides, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

Eklund, Dan , , 1991

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the most important chemicals used in papermaking.

**Contents:**

The fibre and its behaviour during papermaking, dry strength, wet strength, colloidal stability, retention and dewatering, water penetration and sizing, fillers and pigments, dyes, foam control, slime control.

**Learning activities and teaching methods:**

24 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Introduction to Polymer Chemistry (780326A).

**Recommended or required reading:**

Eklund, D. ja Lindström, T.: Paper Chemistry, An Introduction, DT Paper Science Publication, Grankulla, 1991.

**Person responsible:**

Prof. O. Hormi

## 780102P: Introduction to Inorganic Chemistry, 5 op

**Voimassaolo:** - 03.06.2013

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen oppimateriaali:**

Petrucci, R.H., Harwood, W.S., Herring, F.G. and Madura, J.D., , 2007

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780117P	General and Inorganic Chemistry A (OPEN UNI)	5.0 op
ay780118P	General and Inorganic Chemistry B (OPEN UNI)	5.0 op
780113P	Introduction to Chemistry	12.0 op
780102P2	Inorganic Chemistry I	4.0 op
780107P	Basic Course in Inorganic and Physical Chemistry	7.5 op
780152P	Inorganic and Physical Chemistry I	7.5 op
780153P	General and Inorganic Chemistry	7.5 op
780154P	Basic Inorganic Chemistry	7.5 op

**ECTS Credits:**

5 credits

**Person responsible:**

Lecturer L. Kaila.

**Other information:**

The course is not lectured after the academic year 2008-2009. It can be completed by final examination until 2011. The course has been united with the course Introduction to Physical Chemistry to a new course Introduction to Chemistry 12 credits (780113P).

## 780103P: Introduction to Organic Chemistry, 6 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Koskela, Juha Pekka, Marja Lajunen

**Opintokohteen oppimateriaali:**

Hart, Harold , , 1999

Hart, Harold , , 1999

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780112P Introduction to Organic Chemistry 4.0 op

780103P2 Organic Chemistry I 6.0 op

780108P Basic Course in Organic Chemistry 6.0 op

**Voidaan suorittaa useasti:** Kyllä

**Required proficiency level:**

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish

**Timing:**

1<sup>st</sup> autumn and 1<sup>st</sup> spring.

**Learning outcomes:**

After this course the student is familiar with fundamentals of organic chemistry: structures and properties of organic compounds, basic reactions and basic types of mechanisms.

**Contents:**

Basic reactions of organic compounds, basic principles of stereochemistry and reaction mechanisms: Addition, eliminations, substitutions, including aromatic electrophilic one, reactions of carbonyl group. Applications.

**Learning activities and teaching methods:**

52 hours of lectures and applications plus 6 hours of exercises, three intermediate examinations or one final examination.

**Target group:**

Biochemistry, Chemistry, compulsory.

Physical Sciences, Mathematical Sciences, optional.

**Recommended optional programme components:**

Upper secondary school chemistry.

**Recommended or required reading:**

Hart, H., Hart, D.J. and Craine, L.E.: Organic Chemistry: A Short Course, 10<sup>th</sup> ed. or the newer edition, Houghton Mifflin Boston, 1999; Hart, H., Hart, D.J. and Craine, L.E.: Study Guide & Solutions Book, Organic Chemistry: A Short Course, 10<sup>th</sup> ed. or the newer edition, Houghton Mifflin Boston, 1999.

**Person responsible:**

Prof. Marja Lajunen and Dr. Juha P. Koskela

## 780112P: Introduction to Organic Chemistry, 4 op

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Koskela, Juha Pekka

**Opintokohteen oppimateriaali:**

**Hart, Harold** , , 1999

**Hart, Harold** , , 1999

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780112P Introduction to Organic Chemistry (OPEN UNI) 4.0 op

780103P Introduction to Organic Chemistry 6.0 op

780103P2 Organic Chemistry I 6.0 op

780108P Basic Course in Organic Chemistry 6.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

1<sup>st</sup> autumn and 1<sup>st</sup> spring.

**Learning outcomes:**

After this course the student is familiar with fundamentals of organic chemistry: structures and properties of organic compounds, basic reactions and basic types of mechanisms.

**Contents:**

Basic reactions of organic compounds, applications, basic principles of stereochemistry and some mechanisms.

**Learning activities and teaching methods:**

32 hours of lectures and applications, two intermediate examinations or one final examination.

**Target group:**

Biology, Process Engineering, compulsory.

Physical Sciences, Geology, Geophysics, Mathematical Sciences, optional.

**Recommended optional programme components:**

Upper secondary school chemistry.

**Recommended or required reading:**

Hart, H., Hart, D.J. and Craine, L.E.: Organic Chemistry: A Short Course, 10<sup>th</sup> ed. or the newer edition, Houghton Mifflin Boston, 1999; Hart, H., Hart, D.J. and Craine, L.E.: Study Guide & Solutions Book, Organic Chemistry: A Short Course, 10<sup>th</sup> ed. or the newer edition, Houghton Mifflin Boston, 1999.

**Person responsible:**

Senior Assistant. Dr. J. Koskela

**Other information:**

Students attend the lectures of 780103 P Introduction of Organic Chemistry.

## 780101P: Introduction to Physical Chemistry, 7 op

**Voimassaolo:** - 31.12.2010

**Opiskelumuoto:** Basic Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen oppimateriaali:**

**Petrucci, Ralph H.** , , 2002

**Petrucci, R.H., Harwood, W.S., Herring, F.G. and Madura, J.D.** , , 2007

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

ay780117P General and Inorganic Chemistry A (OPEN UNI) 5.0 op

ay780118P General and Inorganic Chemistry B (OPEN UNI) 5.0 op

780113P Introduction to Chemistry 12.0 op

780109P	Basic Principles in Chemistry	4.0 op
780101P2	Physical Chemistry I	4.0 op
780107P	Basic Course in Inorganic and Physical Chemistry	7.5 op
780152P	Inorganic and Physical Chemistry I	7.5 op
780153P	General and Inorganic Chemistry	7.5 op
780154P	Basic Inorganic Chemistry	7.5 op

**ECTS Credits:**

7 credits

**Other information:**

The course is not lectured after the academic year 2008-2009. It can be completed by final examination until 2011. The course has been united with the course Introduction to Inorganic Chemistry to a new course Introduction to Chemistry 12 credits (780113P).

Responsible person: Lecturer Leena Kaila

**780326A: Introduction to Polymer Chemistry, 2 op****Opiskelumuoto:** Intermediate Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Hormi Osmo**Opintokohteen oppimateriaali:****Stevens, Malcolm P.** , , 1999**Opintokohteen kielet:** Finnish**Leikkaavuudet:**

783650S Introduction to Chemistry 2.0 op

**ECTS Credits:**

2 credits

**Language of instruction:**

Finnish

**Timing:**1<sup>st</sup> spring.**Learning outcomes:**

After this course the student is familiar with the basic chemistry of polymeric materials with emphasis on commodity plastics.

**Contents:**

Different classifications of polymeric materials, most important terms in polymer chemistry, basics in the nomenclature of polymers, most important molecular weights of polymers, additives, glass transition temperature, the chemistry involved in the preparation of commodity plastics.

**Learning activities and teaching methods:**

20 hours of lectures, one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Introduction to Organic Chemistry (780103P or 780112P).

**Recommended or required reading:**Stevens, M.P.: Polymer Chemistry, An Introduction, 3<sup>rd</sup> ed, Oxford University Press, Oxford, 1999.**Person responsible:**

Prof. Osmo Hormi

**780122P: Introductory Laboratory Course in Chemistry, 3 op****Opiskelumuoto:** Basic Studies**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Language of instruction:**

Finnish.

**Timing:**

1st autumn or spring.

**Learning outcomes:**

After this course the student is familiar with safety aspects in laboratory, can handle and use laboratory equipments in experiments. The student knows micro and semi-micro inorganic, analytical methods, is familiar with inorganic or organic synthesis and can analyze the yield and purity..

**Contents:**

Laboratory safety, bunsen burner, balances, volumetric measures, gravimetric determination, acid-base titration,, pH, titration curves, acid-base indicators, buffer solutions, synthesis and analysis of Fe(II)oxalate, spectrophotometric determination, synthesis of acetyl salicylic acid, TLC.

**Learning activities and teaching methods:**

40 hours of laboratory work + demonstrations, one final examination.

**Target group:**

Biochemistry, Biology, Chemistry, Process Engineering, compulsory. Physical Sciences, Geology, Mathematical Sciences, optional.

**Recommended optional programme components:**

The course Basic Principles in Chemistry (780109P) passed or Biochemistry, Chemistry and teacher education students of Mathematics and Physics: simultaneous participation in the course Introduction to Chemistry (780113P).

**Recommended or required reading:**

Instruction Book (in Finnish): Kemian perustyöt

**Assessment methods and criteria:**

Laboratory works and final examination has to be completed within two following terms.

**Grading:**

Pass/fail

**Person responsible:**

Prof. M. Lajunen and teaching assistants.

## **780697S: Laboratory Course (Teachers), 20 op**

**Voimassaolo:** - 31.07.2010

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

Ei opintojaksokuvauksia.

## **780330A: Laboratory Course I in Inorganic Chemistry, 7 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

7 credits

**Timing:**

Part 1 (780330A-01): 1<sup>st</sup> spring.

Part 2 (780330A-02): 2<sup>nd</sup> spring.

**Learning outcomes:**

After this course the student is familiar with basic qualitative inorganic chemistry, classical quantitative inorganic chemistry and basic inorganic synthetic chemistry.

**Contents:**

Part 1: Introduction to inorganic ion reactions and a qualitative analysis

Part 2: Water analysis, neutralization, synthesis and characterization of two complex compounds

**Learning activities and teaching methods:**

Part 1: 45 hours of laboratory work, 10 hours of work reports + final examination.

Part 2: 80 hours of laboratory work, 45 hours of work reports + final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Part 1.: Introduction to Chemistry (780113p) or Introduction to Physival Chemistry (780101P9 and Introduction to Inorganic Chemsity (780102P). Introductory Laboratory Course in Chemistry (780122P).

Part 2.: Introduction to Chemistry (780113P) or Introduction to Physival Chemistry (780101P) and Introduction to Inorganic Chemistry (780102P), Introduction to Organic Chemistry (780103P or 780112P). Introductory Laboratory Course in Chemistry (780122P) and the first part of this laboratory course completed.

**Recommended or required reading:**

Material handed out in the laboratory.

**Grading:**

75 % laboratory work 25 % final examination.

**Person responsible:**

Lecturer L. Kaila, Lecturer M. Tiainen and teaching assistants

## 780329A: Laboratory Course I in Organic Chemistry, 4 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand, material in English (partly).

**Timing:**

2<sup>nd</sup> autumn.

**Learning outcomes:**

After this course the student is familiar with basic techniques of organic chemistry such as distillation, extraction, crystallization, TLC, as well as safety issues, glassware and equipment, laboratory notebooks and written reporting of laboratory experiments. Student familiarises with practical laboratory work by carrying out reactions in aromatic substitution with protective group strategy, organometallic chemistry, Aldol condensation, elimination and disproportionation.

**Contents:**

Review of methods in organic chemistry and TLC analysis. Producing of spectra, and GC analysis, Aldol condensation, Cannizzaro reaction, preparation of benzoic acid, preparation of cyclohexene, and preparation of 2-nitroresorcinol.

**Learning activities and teaching methods:**

22 h/week laboratory works.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Courses 780101P, 780102P, 780103P, and 780122P passed. Simultaneous participation in the lecture course 780389A.

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S. and Wothers, P.: Organic Chemistry, Oxford University Press, 2001. Laboratory Course Manual.

**Grading:**

Laboratory works and reporting 2/3 and exam 1/3.

**Person responsible:**

Senior Assistant Dr. J. Koskela.

## 780332A: Laboratory Course I in Organic Chemistry, 4 op

**Voimassaolo:** - 31.07.2013

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Koskela, Juha Pekka

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

2nd autumn.

**Learning outcomes:**

After this course the student is familiar with basic techniques of organic chemistry such as distillation, extraction, crystallization, TLC, as well as safety issues, glassware and equipment, laboratory notebooks and written reporting of laboratory experiments. Student familiarises with practical laboratory work by carrying out reactions in aromatic substitution with protective group strategy, organometallic chemistry, Aldol condensation, elimination and disproportionation.

**Contents:**

Review of methods in organic chemistry and TLC analysis. Producing of spectra, and GC analysis, Aldol condensation, Cannizzaro reaction, preparation of benzoic acid, preparation of cyclohexene, and preparation of 2-nitroresorcinol.

**Learning activities and teaching methods:**

22 h/week laboratory works.

**Target group:**

Biochemistry, compulsory.

**Recommended optional programme components:**

Courses 780101P, 780102P, 780103P, and 780122P passed.

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S. and Wothers, P.: Organic Chemistry, Oxford University Press, 2001.  
Laboratory Course Manual.

**Person responsible:**

Senior assistant Dr. J. Koskela.

## 780331A: Laboratory Course I in Physical Chemistry, 5 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Toivo Kuokkanen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish, material in Finnish, English on demand.

**Timing:**

2<sup>nd</sup> autumn.

**Learning outcomes:**

After this course the student is familiar with the practise of the theory learned in course 780347A Physical Chemistry I.

**Contents:**

Calorimetric studies, distribution law, vapour pressure of solvent, partial mole volume, distillation of a mixture of liquids, crystallization of a liquid mixture, potentiometric acid-base titration, absorption, and electromotive force

**Learning activities and teaching methods:**

2 hours of lectures of safety at work, 80 hours (7 weeks) of laboratory experiments and 45 hours of reports, one preliminary exam.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Courses 780101P, 780122P, and a preliminary test of the Laboratory course passed. Simultaneous participation in the course 780347A Physical Chemistry I.

**Recommended or required reading:**

Practical work handout; Atkins, P. W.: Physical Chemistry, 7<sup>th</sup> ed., Oxford University Press, 2002, partly.

**Assessment methods and criteria:**

Experiments and reports passed.

**Person responsible:**

Doc. T. Kuokkanen and Assistants

## 780382A: Laboratory Course in Physical Chemistry (TECH), 2 op

**Voimassaolo:** - 31.07.2010

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Toivo Kuokkanen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Language of instruction:**

Finnish.

**Timing:**

Autumn term.

**Learning outcomes:**

After this course the student is familiar with the practise of the theory learned in course 780347A Physical Chemistry I.

**Contents:**

Four experiments of the following topics: Calorimetric studies, determination of equilibrium constant by UV-Vis spectrometry, vapour pressure of solvent, distillation of a mixture of liquids, crystallization of a liquid mixture, adsorption in solution.

**Learning activities and teaching methods:**

4 laboratory works.

**Target group:**

Process Engineering.

**Recommended optional programme components:**

Courses 780109P, 780122P and a preliminary test of the Laboratory course passed. Simultaneous participation in the course 780347A Physical Chemistry I.

**Recommended or required reading:**

Practical work handout; Atkins, P. W.: Physical Chemistry, 7th ed. 2002, Oxford University Press, partly.

**Assessment methods and criteria:**

Experiments and reports.

**Person responsible:**

Doc. Toivo Kuokkanen and Assistants.

## 781641S: Laboratory Course in Synthetic Chemistry, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The courses is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with most important advanced techniques in modern inorganic and organic synthetic chemistry.

**Contents:**

Selected syntheses, characterization of products. The content varies from year to year.

**Learning activities and teaching methods:**

6 hours of lectures, 60 hours of laboratory courses, written report, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Laboratory courses in Inorganic Chemistry, Physical Chemistry and Organic Chemistry, Structural Chemistry I (780317A).

**Recommended or required reading:**

Dean, J. R.: Methods for Environmental Trace Analysis, Wiley, 2003 and material handed out by the lecturers.

**Person responsible:**

Prof. R. Laitinen, Prof. M. Lajunen and Prof. J. Pursiainen.

## 783605S: Literature Survey in Organic Chemistry, 9 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

9 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

5th autumn, beginning.

**Contents:**

The survey can be, but does not necessarily have to be, on the same topic as the research project. The length of the survey should be about 40-60 pages with approximately 50 references.

**Target group:**

Chemistry, compulsory.

**Grading:**

1 - 5.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

## 780379A: Literature of Chemistry and Communication Skills, 2 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Language of instruction:**

Finnish

**Timing:**

2<sup>nd</sup> autumn and 3<sup>rd</sup> autumn.

**Learning outcomes:**

After this course the student is familiar with types of chemistry literature and information, information retrieval, principles of scientific writing, a preparation and presentation of a poster or a seminar talk.

**Contents:**

Types of chemistry literature: Periodicals, patents, reference works, reviews and series, numerical data compilations and textbooks, Information retrieval (SciFinder, MDL CrossFire Commander), word processing and chemical drawing etc. and their use in the preparation of the thesis. Ethical principles related to research. Preparation of a treatise or seminar talk. Preparation and presentation of a poster.

**Learning activities and teaching methods:**

2<sup>nd</sup> autumn 4 hours and 3<sup>rd</sup> autumn 18 hours of lectures and exercises, poster.

**Target group:**

Chemistry, compulsory.

**Assessment methods and criteria:**

Preparation and presentation of a poster. Compulsory attendance at the lecture.

**Person responsible:**

Prof. M. Lajunen and Science and Technology Library Tellus.

## 781627S: Main Group Chemistry, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laitinen Risto

**Opintokohteen oppimateriaali:**

Atkins, P., Overton, T., Rourke, J., Weller, M. ja Armstrong, F., , 2006

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with recent progress in modern main group chemistry.

**Contents:**

Periodic system, hydrogen, alkali and alkaline earth metals, half- and non-metals.

**Learning activities and teaching methods:**

28 hours of lectures, 14 hours of exercises, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Inorganic Chemistry I (780353A).

**Recommended or required reading:**

Atkins, P., Overton, T., Rourke, J., Weller, M. ja Armstrong, F.: Inorganic Chemistry, 4th ed., Oxford University Press, Oxford 2006.

**Person responsible:**

Prof. R. Laitinen

**781601S: Master's Thesis in Inorganic Chemistry, 38 op****Opiskelumuoto:** Advanced Studies**Laji:** Diploma thesis**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opintokohteen kielet:** Finnish**ECTS Credits:**

38 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

5th autumn, beginning.

**Contents:**

The Theses for the degree of M.Sc. consists of two parts: a research project (Master's Thesis) with a written report and survey of literature. The completion of the laboratory work and the research report is expected to take approximately four months of full-time work. Together, they are worth 38 ECTS credits. In addition, the student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The survey can be, but does not necessarily have to be, on the same topic as the research project. The length of the survey should be about 40-60 pages with approximately 50 references. It is worth of 9 ECTS credits. The completion of the whole thesis (47 ECTS credits altogether) requires about six months of full-time work.

**Target group:**

Chemistry, compulsory.

**Assessment methods and criteria:**

A research project (Master's Thesis) with a written report and a survey of literature.

**Grading:**

Approbatu,..., laudatur.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

**781602S: Master's Thesis in Inorganic Chemistry, 20 op****Opiskelumuoto:** Advanced Studies**Laji:** Diploma thesis**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** A,B,N,C,M,EX,L**Opintokohteen kielet:** Finnish**ECTS Credits:**

20 credits

**Language of instruction:**

Finnish, English on demand

**Timing:**

5th autumn, beginning.

**Contents:**

The student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The length of the survey should be about 40-60 pages with approximately 50 references.

**Target group:**

Teachers.

**Assessment methods and criteria:**

-

**Grading:**

Approbatu,..., laudatur.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department

**783601S: Master's Thesis in Organic Chemistry, 38 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** A,B,N,C,M,EX,L

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

38 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

5th autumn, beginning.

**Contents:**

The Theses for the degree of M.Sc. consists of two parts: a research project (Master's Thesis) with a written report and survey of literature. The completion of the laboratory work and the research report is expected to take approximately four months of full-time work. Together, they are worth 38 ECTS credits. In addition, the student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The survey can be, but does not necessarily have to be, on the same topic as the research project. The length of the survey should be about 40-60 pages with approximately 50 references. It is worth of 9 ECTS credits. The completion of the whole thesis (47 ECTS credits altogether) requires about six months of full-time work.

**Target group:**

Chemistry, compulsory.

**Assessment methods and criteria:**

A research project (Master's Thesis) with a written report and a survey of literature.

**Grading:**

Approbatur, ..., laudatur.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

## 783602S: Master's Thesis in Organic Chemistry, 20 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** A,B,N,C,M,EX,L

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

20 credits

**Language of instruction:**

Finnish, English on demand

**Timing:**

5th autumn, beginning.

**Contents:**

The student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The length of the survey should be about 40-60 pages with approximately 50 references.

**Target group:**

Teachers.

**Assessment methods and criteria:**

-

**Grading:**

Approbatur, ..., laudatur.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

## 782601S: Master's Thesis in Physical Chemistry, 38 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

38 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

5th autumn, beginning.

**Contents:**

The Theses for the degree of M.Sc. consists of two parts: a research project (Master's Thesis) with a written report and survey of literature. The completion of the laboratory work and the research report is expected to take approximately four months of full-time work. Together, they are worth 38 ECTS credits. In addition, the student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The survey can be, but does not necessarily have to be, on the same topic as the research project. The length of the survey should be about 40-60 pages with approximately 50 references. It is worth of 9 ECTS credits. The completion of the whole thesis (47 ECTS credits altogether) requires about six months of full-time work

**Target group:**

Chemistry, compulsory.

**Assessment methods and criteria:**

A research project (Master's Thesis) with a written report and a survey of literature.

**Grading:**

Approbatur, ..., laudatur.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

## 782602S: Master's Thesis in Physical Chemistry, 20 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** A,B,N,C,M,EX,L

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

20 credits

**Language of instruction:**

Finnish, English on demand

**Timing:**

5th autumn, beginning.

**Contents:**

The student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The length of the survey should be about 40-60 pages with approximately 50 references.

**Target group:**

Teachers.

**Assessment methods and criteria:**

-

**Grading:**

Approbatur, ... laudatur.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

## 784601S: Master's Thesis in Structural Chemistry, 38 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

38 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

5th autumn, beginning.

**Contents:**

The Theses for the degree of M.Sc. consists of two parts: a research project (Master's Thesis) with a written report and survey of literature. The completion of the laboratory work and the research report is expected to take approximately four months of full-time work. Together, they are worth 38 ECTS credits. In addition, the student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The survey can be, but does not necessarily have to be, on the same topic as the research project. The length of the survey should be about 40-60 pages with approximately 50 references. It is worth of 9 ECTS credits. The completion of the whole thesis (47 ECTS credits altogether) requires about six months of full-time work.

**Target group:**

Chemistry, compulsory.

**Assessment methods and criteria:**

A research project (Master's Thesis) with a written report and a survey of literature.

**Grading:**

Approbatur, ..., laudatur.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

## 784602S: Master's Thesis in Structural Chemistry, 20 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Diploma thesis

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** A,B,N,C,M,EX,L

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

20 credits

**Language of instruction:**

Finnish, English on demand

**Timing:**

5th autumn, beginning.

**Contents:**

The student is required to write a survey of literature on a topic which will be decided together with the student's advisor. The length of the survey should be about 40-60 pages with approximately 50 references.

**Target group:**

Teachers.

**Assessment methods and criteria:**

-

**Grading:**

Approbatur, ..., laudatur.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

## 780699S: Maturity Test, 0 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

0 credits

**Language of instruction:**

Finnish, Swedish or English

**Timing:**

5th year.

**Contents:**

Maturity test will be agreed with the responsible person of a survey of literature. Maturity test is a written essay type test, which shows students knowledge of the topic of the research area written with good language.

**Target group:**

Chemistry.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

### 780381A: Maturity test, 0 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

0 credits

**Language of instruction:**

Finnish

**Timing:**

3<sup>rd</sup> spring.

**Target group:**

Chemistry, compulsory.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

### 782624S: Molecular Modelling, 3 - 4 op

**Voimassaolo:** - 31.07.2010

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laasonen Kari

**Opintokohteen oppimateriaali:**

Leach, Andrew R. , , 1996

Leach, Andrew R. , , 2001

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th autumn/spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with molecular modelling using empirical and ab initio molecular dynamics.

**Contents:**

Principles of molecular dynamics and the statistical mechanics related to molecular modelling. Reasoning of the empirical force fields used in molecular mechanics. Ab initio molecular dynamics. Several examples of molecular dynamics studies. This course focuses on the theoretical aspects whereas the practical aspects will be dealt in the course 781626S Molecular modelling workshop.

**Learning activities and teaching methods:**

30 hours of lectures + 8 hours of exercises, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry II (782631S) and Basic Principles of Quantum Chemistry (782625S).

**Recommended or required reading:**

Material given by the lecturer (in Finnish) and Leach, A.R.: Molecular Modelling, Longman, 1996 or 2nd ed.

**Person responsible:**

Prof. K. Laasonen

## 781626S: Molecular Modelling Workshop, 3 - 4 op

**Voimassaolo:** - 31.07.2010

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laasonen Kari

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with basics of state-of-the-art molecular modelling program like Gaussian or Gromacs and their use.

**Contents:**

Practical workshop where students learn to use some state-of-the-art molecular modelling program like Gaussian or Gromacs. If possible student's own problem is tried to solve using molecular modelling tools. A report of the work is done.

**Learning activities and teaching methods:**

8 hours of lectures, demonstration, practical exercise.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry II (782631S), Molecular Modelling (782624S), Basic Principles of Quantum Chemistry (782625S).

**Recommended or required reading:**

Material handed out by the lecturer, Gaussian or Gromacs Manuals.

**Assessment methods and criteria:**

Report of practical exercise.

**Person responsible:**

Prof. K. Laasonen

## 781639S: Molecular Symmetry and Spectroscopy, 5 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Raija Oilunkaniemi

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780327A Structural Chemistry II 5.5 op

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th spring.

**Learning outcomes:**

After this course the student is familiar with molecular symmetry and application of molecular symmetry in vibration spectroscopy and electronic absorption spectroscopy.

**Contents:**

Molecular symmetry, group theory, vibrational spectroscopy, electronic absorption spectroscopy.

**Learning activities and teaching methods:**

34 h lectures, 3 home assignments, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Prerequisites: Inorganic Chemistry I (780353A).

**Recommended or required reading:**

Material handed out by lecturer.

**Person responsible:**

Doc. R. Oilunkaniemi

## 784617S: Multinuclear NMR Spectroscopy in Structure Elucidation, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Mason, J. (ed), , 1987

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the NMR characteristics and use of various magnetic isotopes.

**Contents:**

The correlation of structural factors to spin-spin coupling constants and relaxation times of the nuclei in  $^{14}\text{N}$ ,  $^{15}\text{N}$ ,  $^{17}\text{O}$ ,  $^{19}\text{F}$ ,  $^{29}\text{Si}$ ,  $^{31}\text{P}$ ,  $^{77}\text{Se}$  and  $^{195}\text{Pt}$ . A practical exercise and a report.

**Learning activities and teaching methods:**

20 hours of lectures + applications + demonstrations, one final examination.

**Target group:**

Chemistry, optional.

**Recommended or required reading:**

Mason, J. (ed.): Multinuclear NMR, Plenum Press, New York, 1987.

**Person responsible:**

Senior assistant S. Mattila

## 784610S: NMR Spectroscopy in Organic Chemistry, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Breitmaier, Eberhard , , 1993

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th autumn. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the principles, methods, techniques and practise of structure elucidation of organic compounds by NMR spectroscopy.

**Contents:**

Modern multidimensional NMR techniques. Spectral runs, analysis and report of an unknown compound.

**Learning activities and teaching methods:**

14 hours of lectures + applications, 60 hours of exercises, one final examinations.

**Target group:**

Chemistry, optional.

**Recommended or required reading:**

Breitmaier, E.: Structure Elucidation by NMR in Organic Chemistry, A Practical Guide, Wiley, 1993.

**Person responsible:**

Senior assistant S. Mattila

## 784636S: NMR Spectroscopy of Polymers, 4 op

**Voimassaolo:** - 31.07.2011

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Väänänen, Taito Lauri Johannes

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with basic principles of NMR spectroscopy of polymers.

**Contents:**

Preparation of liquid and solid state sample, the effect of concentration and temperature. Chemical shift and nit's anisotropy. Dipole-dipole interaction, relaxation time and crosspolarisation and their connection to microstructure of polymers. Identification and quantification. A practical exercise and a report.

**Learning activities and teaching methods:**

20 hours of lectures + demonstrations + practical exercise + one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

NMR Spectroscopy of Organic Chemistry (784610S) and NMR workshop I (784623S).

**Recommended or required reading:**

Alan E. Tonelli: NMR spectroscopy and polymer microstructure: The conformational connection, VCH, New York (1989). Richard A. Komoroski (ed.): High Resolution NMR Spectroscopy of Synthetic Polymers in Bulk, Methods in Stereochemical Analysis vol. 7, VCH, Florida (1986). P. Diehl et al. (ed.): NMR Basic Principles and Progress 29, Springer-Verlag, Berlin (1993). Colin A. Fyfe: Solid State NMR for Chemists, C.F.C. Press, Guelph (1983). S. Braun et al.: 150 and More Basic NMR experiments: A Practical Course - Second Expanded Edition, VCH, Weinheim (1998).

**Person responsible:**

Doc. Taito Väänänen.

## 784623S: NMR Workshop I, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Derome, Andrew E. , , 1987

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th autumn or spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the common 1D and 2D NMR methods and their principles.

**Contents:**

A1D, 2D NMR techniques. Optimization of NMR measurement parameters: Theory and practice. NMR data processing.

**Learning activities and teaching methods:**

20 hours of lectures + demonstrations, 80 hours of exercises, one final examination.

**Target group:**

Chemistry, optional.

**Recommended or required reading:**

Derome, A. E., Modern NMR Techniques for Chemistry Research, Pergamon Press, partly.

**Person responsible:**

Senior assistant S. Mattila

## 784624S: NMR Workshop II, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Derome, Andrew E. , , 1987

Levitt, Malcolm H. , , 2001

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the advanced 1D and 2D NMR methods and has detailed understanding of pulse sequences in NMR.

**Contents:**

Product Operator Formalism. Pulse sequences: Design and programming. Use and programming of automatized spectrometer workflows.

**Learning activities and teaching methods:**

20 hours of lectures + demonstrations, 80 hours of exercises, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

NMR-workshop I (784623S).

**Recommended or required reading:**

Levitt, M.: Spin Dynamics: Basics of Nuclear Magnetic Resonance, John Wiley & Sons, 2001, partly, Derome, A. E., Modern NMR Techniques for Chemistry Research, Pergamon Press, partly.

**Person responsible:**

Senior Assistant S. Mattila

## 784638S: NMR Workshop III, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Derome, Andrew E. , , 1987

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the techniques commonly used in elucidation of organic compounds and natural products.

**Contents:**

Sample preparation. Spetrometer setup. Use of automatized workflows of recording series of 1-3D NMR experiments. Spectral processing. Assignment of NMR data.

**Learning activities and teaching methods:**

20 hours of lectures + demonstrations, 80 hours of exercises, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

NMR workshop I (784623S).

**Recommended or required reading:**

Derome, A. E., Modern NMR Techniques for Chemistry Research, Pergamon Press, partly.

**Person responsible:**

Senior assistant S. Mattila

## 784639S: NMR Workshop IV, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

**Levitt, Malcolm H.** , , 2001

**Cavanagh, John** , , 1996

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the 2-4D techniques commonly used in biomacromolecular NMR analysis.

**Contents:**

Protein backbone and sidechain 3D experiments. Other multidimensional methods. Magnetization transfer functions. Resolution and S/N. Processing of multidimensional NMR data.

**Learning activities and teaching methods:**

20 hours of lectures + demonstrations, 80 hours of exercises, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

NMR workshop I (784623S).

**Recommended or required reading:**

Levitt, M.: Spin Dynamics: Basics of Nuclear Magnetic Resonance, John Wiley & Sons, 2001, partly and Cavanagh: Protein NMR Spectroscopy, Academic Press, 1995, ISBN: 0121644901.

**Person responsible:**

Senior assistant S. Mattila

## 780389A: Organic Chemistry I, 6 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

**Clayden, J., Greeves, N., Warren, S. ja Wothers, P.** , , 2001

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780385A Organic Chemistry I 9.0 op

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

2<sup>nd</sup> autumn.

**Learning outcomes:**

After this course the student is familiar with molecular orbitals in simple organic compounds such as ethane, basics in physical organic chemistry especially Hammett plot, details in nucleophilic substitution, conformation and stereochemistry in organic compounds.

**Contents:**

Molecular orbitals in organic compounds, conformation theory, Hammett plot, nucleophilic substitution and stereochemistry.

**Learning activities and teaching methods:**

50 hours of lectures, two intermediate examinations or one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Introduction to Organic Chemistry (780103P) and Introduction to Physical Chemistry (780101P).

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S. and Wothers, P.: Organic Chemistry, Oxford University Press, 2001. Chapters 1-4, 7, 16-18, 34 ja 42 and pages 1090-1100.

**Person responsible:**

Prof. O. Hormi.

**783643S: Organic Chemistry II, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marja Lajunen

**Opintokohteen oppimateriaali:**

Clayden, J., Greeves, N., Warren, S. ja Wothers, P., , 2001

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780393A Organic Chemistry II 4.0 op

780390A Organic Chemistry II 4.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th autumn.

**Learning outcomes:**

The student has a profound knowledge of mechanisms of polar additions and eliminations, carbonyl compounds as nucleophilic reagents, properties and reactions of aromatic heterocyclics. The student can evaluate the reaction mechanism of the reaction on the basis of given data, predict results of these reactions and apply data in practice.

**Contents:**

Polar additions and eliminations, enolates and their alkylation, aldol reaction, aromatic heterocycles their reactivity and reactions.

**Learning activities and teaching methods:**

35 hours of lectures + 7 hours of exercises, one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Organic Chemistry I (780389A).

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S. ja Wothers, P.: Organic Chemistry, Oxford University Press, 2001. Chapters 19, 20, 21, 26, 27, 43.

**Person responsible:**

Prof. M. Lajunen

**783639S: Organic Chemistry III, 5 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

Corey, E. J. , , 1989

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

5th autumn.

**Learning outcomes:**

After this course the student is familiar with the way of thinking in modern synthetic organic chemistry. The student can also give a detailed presentation of the synthesis of a challenging goal molecule.

**Contents:**

Detailed examination of reactions used in the synthesis of complicated organic compounds such as Retigeranic Acid.

**Learning activities and teaching methods:**

26 hours of lectures + seminar.

**Target group:**

Chemistry.

**Recommended optional programme components:**

Organic Chemistry I (780389A) and Organic Chemistry II (783643S).

**Recommended or required reading:**

Corey, E.J. ja Chen, X-M.: The Logic of Chemical Synthesis, John Wiley & Sons, New York, 1989, p. 1 - 100.

**Assessment methods and criteria:**

Written report on the synthesis of a complex target molecule and an oral presentation of the synthesis.

**Person responsible:**

Prof. O. Hormi

## 783614S: Organic Chemistry of Drug Compounds, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marja Lajunen

**Opintokohteen oppimateriaali:**

Patrick, Graham L. , , 2001

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Learning outcomes:**

After this course the student is familiar with basic principles and techniques of medicinal chemistry, tactics and tools used in drug design and development.

**Contents:**

Drug discovery and drug development, QSAR, combinatorial synthesis, computers in medicinal chemistry, drug action at enzymes and receptors, drugs interacting with DNA, drug metabolism, prodrugs and their activation.

**Learning activities and teaching methods:**

20 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Organic Chemistry I (780389A) and Organic Chemistry II (783643S).

**Recommended or required reading:**

Patrick, G.L.: An Introduction to Medicinal Chemistry, Oxford University Press, 2001, partly.

**Person responsible:**

Prof. M. Lajunen

**783640S: Organometallic Chemistry, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Marja Lajunen**Opintokohteen oppimateriaali:****Clayden, J., Greeves, N., Warren, S. ja Wothers, P., , 2001****Jenkins, Paul R. , , 1992****Thomas, Susan E. , , 1991****Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th autumn. The course is lectured every other year.

**Learning outcomes:**

The student knows properties and preparation of essential organometallic compounds and can use them in synthetic applications.

**Contents:**

Li, Mg, Cu, B, and Si chemistry in asymmetric reaction design and practical synthesis.

**Learning activities and teaching methods:**

24 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Organic Chemistry II (783643S).

**Recommended or required reading:**

Clayden, J., Greeves, N., Warren, S., and Wothers, P., Organic Chemistry, Oxford University Press, 2001 (partly);

Jenkins, P.: Organometallic Reagents in Synthesis, Oxford Science Publications, 1997, partly. Thomas, S.E.:

Organic Synthesis, The Role of Boron and Silicon, Oxford Science Publications, 1997, partly.

**Person responsible:**

Prof. M. Lajunen

**780078Y: Orientation Course for New Students, 1 op****Opiskelumuoto:** General Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Kopsa-Moilanen, Vieno Maria**Opintokohteen kielet:** Finnish**ECTS Credits:**

1 credits

**Language of instruction:**

Finnish

**Timing:**1<sup>st</sup> autumn and 1<sup>st</sup> spring.**Learning outcomes:**

After this course the student is familiar with the learning environment, the Department of Chemistry and the University, trends of present-day chemistry, and planning his/her studies.

**Contents:**

The course comprises of three modules: Orientation in small groups, Chemistry To-Day lecture course, and PSP (Personal Study Plan).

**Learning activities and teaching methods:**

Orientation in small groups: autumn term, 10-15 hours of visits and discussions with the group tutor. Chemistry to Day: autumn term, 10 hours of lectures, attendance compulsory. PSP (Personal Study Plan): spring term, 2 hours of lectures, planning of PSP.

**Target group:**

Chemistry, compulsory

**Assessment methods and criteria:**

Participation in small group meetings and Chemistry To-Day classes, and making a Personal Study Plan for B.Sc. Degree (and M.Sc. Degree).

**Person responsible:**

Prof. K. Laasonen, Amanuensis, Lecturer L. Kaila, and Small group tutors.

**Other information:**

The course is completed when all the three parts are passed.

**783645S: Pericyclic chemistry, 3 op**

**Voimassaolo:** 01.01.2008 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Marja Lajunen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish.

**Timing:**

4th or 5th spring.

**Learning outcomes:**

After this course unit the student is familiar with a nature and types of pericyclic reactions. He/she understands the occurrence of separate pericyclic reactions, basics of click chemistry and synthetic uses of pericyclic reactions.

**Contents:**

Pericyclic reaction types: cycloadditions, sigmatropic rearrangements, group transfer and electrocyclic reactions. The Woodward-Hoffman rules, thermal, photochemical, 1,3-dipolar cycloaddition and basics of click chemistry alike.

**Learning activities and teaching methods:**

20 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

780389A Orgaaninen kemia I and 783643S Organic Chemistry II.

**Recommended or required reading:**

Fleming, I.: Pericyclic Reactions, Oxford University Press, 2002 and Clayden, J., Greeves, N., Warren, S. ja Wothers, P.: Organic Chemistry, Oxford University Press, 2001, partly.

**Person responsible:**

Prof. Marja Lajunen.

**780347A: Physical Chemistry I, 6 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Pursiainen Jouni

**Opintokohteen oppimateriaali:**

Atkins, P.W., , 2002

Atkins, P. W. , , 1998

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780318A Physical Chemistry II 6.5 op

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish, material in Finnish, material in English (partly).

**Timing:**

2<sup>nd</sup> autumn.

**Learning outcomes:**

After this course the student is familiar with the main topics of chemical thermodynamics and kinetics. During the course such concepts are introduced that are needed for the discussion of equilibria in chemistry. Much emphasis is in enthalpy, entropy and Gibbs energy. A unified view of equilibrium and the directions of spontaneous change are obtained in terms of chemical potentials of substances. Chemical kinetics shows how the systems can reach equilibrium.

**Contents:**

Properties of gases, the first and second laws of thermodynamics, physical transformations of pure substances, properties of simple mixtures, chemical equilibrium.

**Learning activities and teaching methods:**

56 hours of lectures + applications + 14 hours of exercises, two intermediate examinations or one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Introduction to Physical Chemistry (780101P) and Introduction to Inorganic Chemistry(780102P).; or Basic Principles in Chemistry(780109P). Laboratory Course I in Physical Chemistry (780331A) has to be taken simultaneously with this course.

**Recommended or required reading:**

Atkins, P.W.: Physical Chemistry, Oxford University Press, Oxford, 6 Ed. (1998) or Atkins, P.W.: Physical Chemistry, 7<sup>th</sup> ed., 2002.

**Person responsible:**

Prof. J. Pursiainen

## 782631S: Physical Chemistry II, 4 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laasonen Kari

**Opintokohteen oppimateriaali:**

Atkins, Peter , , 2006

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

780392A Physical Chemistry II 4.0 op

780349A Physical Chemistry II 4.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

4th autumn.

**Learning outcomes:**

After this course the student is familiar with the basics of quantum mechanics and statistical mechanics. And their role in physical chemistry.

**Contents:**

Basic of quantum mechanics, particle-in-box, hydrogen atoms, LCAO model for molecules. Basics of statistical mechanics, partition function and how to derive statistical properties from it. Ideal and real gases. Diffusion and electrical conductivity.

**Learning activities and teaching methods:**

36 hours of lectures + 8 hours of assignment exercises, one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Physical Chemistry I (780347A).

**Recommended or required reading:**

P.W. Atkins and J. de Paula, Atkins Physical Chemistry, 8th ed., 2006 (or 7th ed., 2002), Oxford University Press, Chapters 8-11, 16-17, 21.

**Person responsible:**

Prof. K. Laasonen

**783620S: Polymer Chemistry, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

Elias, Hans-Georg , , 1993

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th autumn. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the most important technical quantities of polymeric materials including the mathematical background of the quantities.

**Contents:**

Polymer molecular weights, conformation of polymers, the visco-elastic behaviour of polymers, the conduction of heat and electricity in polymers.

**Learning activities and teaching methods:**

28 hours of lectures, one final examination.

**Target group:**

Chemistry.

**Recommended optional programme components:**

Introduction to polymer chemistry (780326A).

**Recommended or required reading:**

Elias, H-G: An Introduction to Plastics, VCH, Weinheim, 1993.

**Person responsible:**

Prof. O. Hormi

**783636S: Polymer Chemistry in Materials Sciences, 3 - 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

**Fawcett, A.H. (toim.),** , 1991

**Metals Park,** , 1988

**Joseph N. Epel. (et al.),** , 1988

**Flinn, Richard A. ,** , 1990

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with technical characteristics such as strength, modulus and heat deflection temperature of the most important polymeric materials.

**Contents:**

Commodity plastics, engineering polymers, carbon fibre, aramid fibres, liquid crystalline polymers, heat stable polymers, epoxy resins.

**Learning activities and teaching methods:**

24 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Introduction to Polymer Chemistry (780326A) (recommended).

**Recommended or required reading:**

Flinn, R.A. and Trojan, P.K., Engineering Materials and Their Applications, International Student Edition, Houghton Mifflin Comp., 4th ed., Boston 1990 (partly); Fawcett, A.H. (Editor): High Value Polymers, The Royal Society of Chemistry, Redwood Press Ltd., Melksham, 1991; Engineered Materials handbook, Part 1 and Part 2, ASM International, Metals Park, OH, 1993 (Part 1) and 1988 (Part 2).

**Person responsible:**

Prof. O. Hormi

## **782630S: Quantum mechanics and Spectroscopy, 3 op**

**Voimassaolo:** - 31.07.2010

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laasonen Kari

**Opintokohteen oppimateriaali:**

**Atkins, Peter** , , 2006

**Atkins, P. W.,** , 1997

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish or English on demand.

**Timing:**

4th spring.

**Learning outcomes:**

After this course the student is familiar with the quantum mechanics related to various types of spectroscopies

**Contents:**

Quantum mechanics of radiation field and matter. Quantum description of molecular rotation and vibrations. IR and Raman spectra. Fluorescence and phosphorescence.

**Learning activities and teaching methods:**

30 hours of lectures + 6 hours of assignment exercises, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry II (782631S).

**Recommended or required reading:**

P. Atkins and J. De Paula. Atkins' Physical Chemistry, 8th ed. Chapters 13-15 (also 6th ed., 1998 or 7th ed., 2002, and Atkins, P.W. ja Friedman, R.S., Molecular Quantum Mechanics, 3th ed., Oxford University Press.

**Person responsible:**

Prof. K. Laasonen

**781623S: Reaction Mechanisms in Inorganic Chemistry, 3 op**

**Voimassaolo:** - 31.07.2012

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laitinen Risto

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with present state of inorganic reaction mechanisms.

**Contents:**

Mechanistic implications of reaction kinetics, collision theory, transition state theory, study of reaction mechanisms, molecular structure and mechanisms, orbital symmetry, substitution reactions, electron transfer reactions, catalysis, photochemical reactions.

**Learning activities and teaching methods:**

24 hours of lectures + 2 home assignments, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Inorganic Chemistry I (780353A) and Inorganic Chemistry II (781642S).

**Recommended or required reading:**

Tobe, M. L. and Burgess, J.: Inorganic Reaction Mechanisms, Longman, New York, 1999.

**Person responsible:**

Prof. R. Laitinen

**780601S: Research Project, 12 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

12 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th autumn-spring.

**Learning outcomes:**

This laboratory course familiarises the students with research work

**Contents:**

Laboratory work and written report.

**Learning activities and teaching methods:**

240 h laboratory works.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

B.Sc. studies and Research Training (780301A).

**Recommended or required reading:**

Material given by teachers.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

## 783634S: Research Seminar in Organic Chemistry, 2 op

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish.

**Timing:**

Autumn + spring.

**Learning outcomes:**

After taking part in seminars the student is familiar with scientific reporting and oral presentation of results.

**Contents:**

Design and following of projects in organic chemistry.

**Target group:**

Chemistry.

**Person responsible:**

Prof. Osmo Hormi and Prof. Marja Lajunen.

## 787602J: Research Seminar in Organic and Polymer Chemistry, 3 op

**Voimassaolo:** - 31.07.2012

**Opiskelumuoto:** Post-graduate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

Autumn + spring.

**Learning outcomes:**

After this course the student is familiar with current projects in the research laboratory of polymer chemistry and can present own research results in English.

**Contents:**

Compulsory attendance and oral presentation of own projects during a period of one year.

**Learning activities and teaching methods:**

30 hours.

**Target group:**

Chemistry.

**Recommended optional programme components:**

All required advanced courses in organic chemistry and polymer chemistry.

**Person responsible:**

Prof. O. Hormi and Prof. M. Lajunen

**780301A: Research Training, 9 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila, Toivo Kuokkanen

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

9 credits

**Language of instruction:**

Finnish, English on demand, materials in English (partly).

**Timing:**

3<sup>rd</sup> autumn-spring.

**Learning outcomes:**

After this course the student is able to work independently in the laboratory and ability to write a scientific report and in Organic Chemistry after this course the student can perform a reaction sequence, is familiar with a chemical resolution and reduction, can solve qualitative multicomponent analysis by chemical separation and using IR, NMR, UV and MS analysis.

**Contents:**

Laboratory works in Inorganic Chemistry: Three laboratory projects on different fields of inorganic chemistry: AAS-analysis, protonation constant, synthesis of an air sensitive compound

in Physical Chemistry: NIR-spectrophotometric study of hydrogen bonding, conductivity of an electrolytic solution, molecule modeling, adsorption, and surface tension

in Organic Chemistry: Preparation of UV- and IR samples, preparation of enamine, acylation of enamine, reduction of trans-cinnamaldehyde, chemical resolution of  $\alpha$ -phenyl ethyl amine and qualitative analysis of three compounds.

Additionally, written laboratory reports, one per practical.

**Learning activities and teaching methods:**

240 hours of laboratory works (80 h/laboratory).

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

In Inorganic Chemistry: The compulsory courses of chemistry in the first and second year and in Physical Chemistry: Simultaneous participating in the course 782631S Physical Chemistry II and in Organic Chemistry: Courses 780389A and 780329A passed. Simultaneous participation in the lecture course 783643S.

**Recommended or required reading:**

In Inorganic Chemistry: Material handed out in the laboratory, in Physical Chemistry: Practical work handout. Atkins, P.W. Physical Chemistry, 7<sup>th</sup> ed. 2002, Oxford University Press, partly and in Organic Chemistry: Clayden, J., Greeves, N., Warren, S. and Wothers, P.: Organic Chemistry, Oxford University Press, 2001., Department of Chemistry. Practical Organic Chemistry, 780332, 780389 and 780390. Laboratory Course Manual.

**Assessment methods and criteria:**

Laboratory works and reports.

**Person responsible:**

Lecturer L. Kaila, Doc. T. Kuokkanen, Senior Assistant Dr. J. Koskela.

**780301A-01: Research Training, 3 op**

**Voimassaolo:** 01.08.2006 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Leena Kaila

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

### **780301A-03: Research Training, 3 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Person responsible:**

Senior assistant Juha Koskela + assistants.

### **780301A-02: Research Training, 3 op**

**Voimassaolo:** 01.08.2006 -

**Opiskelumuoto:** Intermediate Studies

**Laji:** Partial credit

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

### **781640S: Sampling and Sample Preparation, 4 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki

**Opintokohteen oppimateriaali:**

Dean, John R. , , 2003

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

781335A Sampling and Sample Preparation 4.0 op

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course student becomes aware of the importance of correct sampling. The student also gets knowledge how to i) sample and ii) prepare samples for various types of inorganic and organic analysis.

**Contents:**

Sampling errors and representative sampling, overview of sampling and sample preparation in the context of environmental analysis (both inorganic and organic analysis).

**Learning activities and teaching methods:**

24 hours of lectures + seminar presentation, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Introduction to Analytical Chemistry (780111P)

**Recommended or required reading:**

Dean, J.R.: Methods for Environmental Trace Analysis, Wiley, 2003 and material handed out by the lecturers.

**Person responsible:**

Prof. P. Perämäki

## 781647S: Scanning electron microscopy, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Minna Tiainen

**Opintokohteen oppimateriaali:**

Goodhew, Peter J. , , 2001

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with terminology of microscopy, function of SEM-EDS and applications of SEM-EDS.

**Contents:**

Basic terminology, Scanning electron microscope and EDS, image formation and processing, applications.

**Learning activities and teaching methods:**

20 hours of lectures, problem based learning, portfolio, attendance is compulsory.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Inorganic Chemistry I (780353A).

**Recommended or required reading:**

Goodhew P.J.: Humphreys J. and Beanland R., Electron Microscopy and Analysis, 3rd ed., Taylor & Francis, 2000.

**Person responsible:**

Lecturer M. Tiainen

## 780690S: Seminar, 3 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

5th spring.

**Contents:**

The student gives two presentations (20 min/each) on given scientific subjects related to the pro gradu (M.Sc.) thesis and distributes an abstract to the audience.

**Target group:**

Chemistry, compulsory.

**Grading:**

1 (pass), 3 (good), 5 (excellent)

**Person responsible:**

Senior Assistant Dr. Juha Koskela

### **780380A: Seminar for the Degree of B.Sc., 1 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1 credits

**Language of instruction:**

Finnish

**Timing:**

3<sup>rd</sup> spring.

**Learning outcomes:**

Improving oral/aural skills connected to the student's academic field as well as in everyday conversational situations.

**Contents:**

The student gives one presentation on a given scientific subject related to B.Sc. thesis (20 min.) and distributes an abstract to the audience.

**Learning activities and teaching methods:**

Students register for the course in the beginning of autumn or spring term. Compulsory attendance.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Thesis for the degree of B.Sc. (780300A).

**Grading:**

Oral presentation skills, 1 (pass), 3 (good) or 5 (excellent).

**Person responsible:**

Senior Assistant Dr. Juha P. Koskela

### **781630S: Seminar in Inorganic Chemistry, 2 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Paavo Perämäki, Laitinen Risto

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

4th and 5th year.

**Learning outcomes:**

After this course the student is familiar with recent development in inorganic chemistry.

**Contents:**

Varies from year by year. The student gives two presentations on given subjects. Attendance is compulsory.

**Learning activities and teaching methods:**

20 h.

**Target group:**

Chemistry, optional.

**Person responsible:**

Prof. R. Laitinen and prof. P. Perämäki

## 782623S: Seminar in Physical Chemistry, 2 op

**Voimassaolo:** 01.08.2012 -

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**Voidaan suorittaa useasti:** Kyllä

**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish, English on demand.

**Contents:**

Designing and following projects in Physical Chemistry.

**Person responsible:**

Prof. K. Laasonen and J. Pursiainen

## 788602S: Seminar in Structural Chemistry, 2 op

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

2 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

Spring and autumn.

**Contents:**

Student gives two presentations on a given scientific subject and distributes an abstract to the audience.

**Learning activities and teaching methods:**

20 hours of seminars.

**Target group:**

Chemistry, optional.

**Person responsible:**

Senior assistants S. Mattila

**781611S: Solid State Chemistry, 4 op****Voimassaolo:** - 31.07.2015**Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Laitinen Risto**Opintokohteen oppimateriaali:**

West, Anthony R. , , 1988

**Opintokohteen kielet:** Finnish**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

Knowledge of synthesis, structures, spectroscopic properties, reactions, and applications of solid materials.

**Contents:**

Preparation of solid materials, structures of solids, crystal defects, thermodynamics and reaction kinetics, the effect of outer conditions on some reactions, phase diagrams and their applications, optical, magnetic and electric properties of solid materials, and industrial applications.

**Learning activities and teaching methods:**

28 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry I (780347A) and Inorganic Chemistry I (780353A).

**Recommended or required reading:**

West, A. R.: Basic Solid State Chemistry, 2nd Ed., John Wiley &amp; Sons, Norwich, 1989.

**Person responsible:**

Prof. R. Laitinen.

**781631S: Statistical Methods in Analytical Chemistry, 4 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Paavo Perämäki**Opintokohteen oppimateriaali:**

Massart, D.L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. ja Smeyers-Verbeke, J., , 1997

**Opintokohteen kielet:** Finnish**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After the course student is familiar with most common statistical techniques that are applied in validation of analytical methods and in quality control in analytical laboratories.

**Contents:**

Significance tests, analysis of variance, regression methods, measurement uncertainty, validation and optimisation of methods.

**Learning activities and teaching methods:**

30 hours of lectures + 10 hours of exercises and practical exercise, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Introduction to Analytical Chemistry (780111P).

**Recommended or required reading:**

Massart, D. L., Vandeginste, B.G.M., Buydens, L.M.C., De Jong, S., Lewi, P.J. and Smyers-Verbeke, J.: Handbook of Chemometrics and Qualimetrics: Part A, Elsevier, 1997.

**Person responsible:**

Prof. P. Perämäki

**780317A: Structural Chemistry I, 5 op**

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Mattila, Sampo Antero

**Opintokohteen oppimateriaali:**

Williams, Dudley H. , , 1995

**Opintokohteen kielet:** Finnish

**Leikkaavuudet:**

784640S Structural Chemistry I 5.0 op

**ECTS Credits:**

5 credits

**Language of instruction:**

Finnish

**Timing:**

3<sup>rd</sup> autumn.

**Learning outcomes:**

After this course the student is familiar with the basics of interpretation of IR, NMR and mass spectra.

**Contents:**

Principles of chromatography, the interpretation of IR, NMR and mass spectra and methods of problem solving with the aid of IR, NMR and mass spectra.

**Learning activities and teaching methods:**

40 hours of lectures, 20 hours of demonstrations and exercises, one final examination.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

Physical Chemistry I (780347A) and Introduction to Analytical Chemistry (780111P).

**Recommended or required reading:**

Williams, D.H. & Fleming, I.: Spectroscopic Methods in Organic Chemistry, 5th ed., McGraw-Hill, Avon, 1995.

**Person responsible:**

Senior Assistant S. Mattila

**781614S: Structural Methods in Inorganic Chemistry, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Raija Oilunkaniemi

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

4th or 5th year. The courses is lectured every other year.

**Contents:**

Applications of NMR Spectroscopy in inorganic chemistry.

**Learning activities and teaching methods:**

20 hours of lectures + seminar, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Inorganic Chemistry I (780353A), Structural Chemistry I (780317A).

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Doc. R. Oilunkaniemi

## **782620S: Surface Chemistry I, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laasonen Kari

**Opintokohteen oppimateriaali:**

Adamson, Arthur W. , , 1997

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th autumn. The course is lectured every other year.

**Learning outcomes:**

After this course the students have good knowledge of properties of liquid surfaces and interfaces. The role of surfactants is emphasised.

**Contents:**

This course focuses on properties of soft surfaces. A detailed view of liquid-gas, liquid-liquid interfaces are given. The roles of surfactant and liquid mixtures are studied in detail. A wide range of applications are discussed, for example emulsion, foams, flotation, nucleation, soaps on molecular level.

**Learning activities and teaching methods:**

30 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry II (782631S).

**Recommended or required reading:**

Adamson, A.W.: Physical Chemistry of Surfaces, 6th ed., John Wiley & Sons, New York, 1997, partly. Examination based on the lectures.

**Person responsible:**

Prof. K. Laasonen

**782633S: Surface chemistry II, 3 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Ulla Lassi**Opintokohteen oppimateriaali:****Adamson, Arthur W.** , , 1997**Somorjai, Gabor A.** , , 1994**Opintokohteen kielet:** Finnish**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After the course the student is familiar with interfaces (solid-gas, solid-liquid), properties of surfaces and surface phenomena. Student knows the most important surface structures and methods used in surface science studies. Surface phenomena are significant in several industrial applications, and those applications are theoretically studied during the course.

**Contents:**

Properties of solid-gas and solid-liquid interfaces, Surface structures, Surface phenomena and Surface analytical methods. Heterogeneous catalysis at solid surfaces is studied as an application.

**Learning activities and teaching methods:**

30 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Physical Chemistry I (780347A) and Physical Chemistry II (2631S).

**Recommended or required reading:**

Adamson, A.W. : Physical Chemistry of Surfaces, 6<sup>th</sup> edition, John Wiley and Sons, New York, 1997 (to the appropriate extent); Somorjai, G.A. : Introduction to Surface Chemistry and Catalysis, John Wiley and Sons, New York, 1994 (to the appropriate extent). Lecture notes (in English).

**Person responsible:**

Prof. U. Lassi

**783642S: Synthetic Methods in Green Chemistry, 4 op****Opiskelumuoto:** Advanced Studies**Laji:** Course**Vastuuyksikkö:** Department of Chemistry**Arvostelu:** 1 - 5, pass, fail**Opettajat:** Marja Lajunen**Opintokohteen kielet:** Finnish**ECTS Credits:**

4 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th autumn or spring. The course is lectured every other year.

**Learning outcomes:**

The student is familiar with the principles of green chemistry, knows basics of alternative solvents: Ionic liquids, water, supercritical liquids or fluoruous, two-phase systems and their uses in synthetic applications. Fundamentals of microwave technique, new purification techniques.

**Contents:**

Ionic liquids and their properties and use in synthetic applications. Introduction to microwave technique and microwave-assisted organic synthesis. Organic reactions in water. Supercritical liquids as solvents. Syntheses in fluoruous, two-phase systems.

**Learning activities and teaching methods:**

20 hours of lectures, 2 hours of demonstrations, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Organic Chemistry I (780389A) and Organic Chemistry II (783643S).

**Recommended or required reading:**

Material given by the lecturer.

**Person responsible:**

Prof. M. Lajunen

## 780300A: Thesis for the Degree of B.Sc., 6 op

**Opiskelumuoto:** Intermediate Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish, English on demand.

**Timing:**

3<sup>rd</sup> autumn (beginning).

**Learning outcomes:**

Student will be able to show a perfect command of either Finnish or Swedish and a good knowledge of the subject of the thesis.

**Contents:**

A thesis of approximately 20-40 pages including about 30 references. In addition, the student takes a maturity examination on the subject of the B.Sc. thesis.

**Target group:**

Chemistry, compulsory.

**Recommended optional programme components:**

The first and second year courses in chemistry.

**Grading:**

Pass/fail.

**Person responsible:**

Professors, Docents, Dr level Senior Assistants and Lectures of the Chemistry Department.

## 780079Y: Tutoring, 1 op

**Opiskelumuoto:** General Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Kopsa-Moilanen, Vieno Maria

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

1 credits

**Language of instruction:**

Finnish

**Timing:**

2<sup>nd</sup> autumn or 3<sup>rd</sup> autumn.

**Learning outcomes:**

After this course the student has work experience as a group leader and a tutor for new students.

**Target group:**

Chemistry.

**Person responsible:**

Amanuensis and Student Services

**783619S: Wood Chemistry, 3 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Hormi Osmo

**Opintokohteen oppimateriaali:**

Sjöström, Eero , , 1981

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

3 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th autumn or spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with the detailed chemical composition of wood and the chemistry involved in chemical pulping of wood.

**Contents:**

The structure of wood, chemistry of carbohydrates, polysaccharides of wood, lignin, extractives, bark, pulping chemistry, bleaching.

**Learning activities and teaching methods:**

24 hours of lectures, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Introduction to Organic Chemistry (780103P).

**Recommended or required reading:**

Sjöström, E.: Wood Chemistry: Fundamentals and Applications, Academic Press, New York 1981.

**Person responsible:**

Prof. O. Hormi

**781646S: X-Ray Crystallography, 6 op**

**Opiskelumuoto:** Advanced Studies

**Laji:** Course

**Vastuuyksikkö:** Department of Chemistry

**Arvostelu:** 1 - 5, pass, fail

**Opettajat:** Laitinen Risto

**Opintokohteen kielet:** Finnish

**ECTS Credits:**

6 credits

**Language of instruction:**

Finnish/English on demand.

**Timing:**

4th or 5th spring. The course is lectured every other year.

**Learning outcomes:**

After this course the student is familiar with basic concepts of crystal symmetry, the fundamentals of crystal structure determination, and has some hands-on experience in the structure determination.

**Contents:**

Crystal classes, crystal symmetry, scattering of X-rays in crystalline material, determination of the crystal structure from single crystals.

**Learning activities and teaching methods:**

36 hours of lectures + 8 hours of demonstrations + practical exercise with a written report, one final examination.

**Target group:**

Chemistry, optional.

**Recommended optional programme components:**

Inorganic Chemistry I (780353A) and Molecular Symmetry and Spectroscopy (781639S).

**Recommended or required reading:**

Material handed out by the lecturer.

**Person responsible:**

Prof. J. Valkonen (University of Jyväskylä) and Prof. R. Laitinen.