CHEMISTRY (CHEM)

College of Natural Science and Mathematics
Department of Chemistry and Biochemistry (https://www.uaf.edu/chem/)
907-474-5510

CHEM F100X Chemistry in Complex Systems (n)
4 Credits
Offered Fall, Spring and Summer
This course introduces students to environmental chemistry through investigating the air, water and soil quality of the Arctic environment as affected by natural and anthropogenic cycling of nutrients and contaminants. The lab component will focus on characterization of natural waters collected around the state. Presented both on-campus and by distance.
Prerequisites: Placement in WRTG F111X; placement in MATH F151X; or a B- or better in CHEM F103X; or permission of instructor and department.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0

CHEM F103X Introduction to General Chemistry (n)
4 Credits
Offered Fall
Introductory chemistry survey course for health science majors and prepares them for subsequent training in chemistry in CHEM F104X and CHEM F105X.
Prerequisites: Placement in WRTG F111X; placement in MATH F105.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0

CHEM F104X Introduction to Organic Chemistry and Biochemistry (n)
4 Credits
Offered Spring
This is the second semester course in the sequence for health science majors and comprises a survey of the fundamentals of chemistry as applied to biological systems. Topics include nomenclature of organic compounds, organic functional groups and reactions, biochemical processes and pathways, biological macromolecules, and metabolites.
Prerequisites: CHEM F103X; placement in WRTG F111X; placement in MATH F105.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0

CHEM F105X General Chemistry I (n)
4 Credits
Offered Fall, Spring and Summer
This course is an introduction to general chemistry and explores topics to a much greater depth than preparatory courses. Topics include: measurement, energy and matter, periodic trends, chemical composition, chemical reactions, solutions, bond theory, gases, thermodynamics, problem-solving (applied mathematics), and special topics. Students must be enrolled in both CHEM F105X and CHEM F105L to receive full credit.
Prerequisites: Placement in WRTG F111X; placement in MATH F151X; or a B- or better in CHEM F103X; or permission of instructor and department.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0

CHEM F106X General Chemistry II (n)
4 Credits
Offered Fall, Spring and Summer
The second semester in the general chemistry sequence. Topics include: kinetics, equilibrium chemistry (including acids and bases, solubility, and complex ion formation), nuclear chemistry, electrochemistry, thermodynamics, and special topics. Students must be enrolled in both CHEM F106X and CHEM F106L to receive full credit.
Prerequisites: Grade of C- or better in CHEM F105X; placement in WRTG F111X; placement in MATH F151X; or permission of instructor and department.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0

CHEM F111X Introduction to Environmental Chemistry of the Arctic
4 Credits
Offered As Demand Warrants
This course introduces students to environmental chemistry through investigating the air, water and soil quality of the Arctic environment as affected by natural and anthropogenic cycling of nutrients and contaminants. The lab component will focus on characterization of natural waters collected around the state. Presented both on-campus and by distance.
Prerequisites: MATH F105.
Attributes: UAF GER Natural Science Req
Lecture + Lab + Other: 3 + 3 + 0
Chemistry (CHEM)

CHEM F190  Alaska Statewide High School Science Symposium
2 Credits
Offered Spring
Students employ the scientific method to approach a problem of personal
interest. Student work is molded into a research paper delivered orally in
a formal scientific presentation for judges with wide-ranging experiences.
Prerequisites: High School student grades 9-12.
Recommended: Research completion, abstract and paper writing/
submission, ASHSSS presentation.
Lecture + Lab + Other: 0 + 10 + 0

CHEM F202  Basic Inorganic Chemistry  (n)
3 Credits
Offered Spring
Introduction to coordination theory, crystal field theory, kinetics and
mechanisms of substitutions and redox reactions, unit cells and ionic
bonding, periodic law, and descriptive chemistry of selected main group
elements.
Prerequisites: CHEM F106X.
Lecture + Lab + Other: 2 + 3 + 0

CHEM F212  Chemical Equilibrium and Analysis  (n)
4 Credits
Offered Fall
Aqueous chemical equilibrium as applied to chemical analysis,
separations, spectrophotometry, potentiometry and factors considered in
the analytical approach. Lab portion will include introductory experiments
in analytical and instrumental techniques.
Prerequisites: Grade of C or better in CHEM F106X; MATH F151X.
Lecture + Lab + Other: 3 + 3 + 0

CHEM F288  Introduction to Chemical Research
2 Credits
Offered As Demand Warrants
Scientific research is creative and engaging when properly planned and
executed. This course introduces students to the process of planning and
executing a research project. We will begin with an idea, review primary
literature, brainstorm project ideas, pose a testable hypothesis, plan
experiments and execute a small research project.
Prerequisites: CHEM F212, CHEM F321.
Lecture + Lab + Other: 1 + 3 + 0

CHEM F314  Analytical Instrumental Laboratory  (n)
3 Credits
Offered Spring
A laboratory course focusing on the acquisition and interpretation of
spectroscopic and chromatographic data for qualitative characterization
and quantitative chemical measurements. Students will learn to design
and execute experiments with a variety of instruments, critically evaluate
experimental data, and communicate their findings through scientific
writing.
Prerequisites: CHEM F212; WRTG F211X, WRTG F212X, WRTG F213X or
WRTG F214X; must be a chemistry major.
Lecture + Lab + Other: 1 + 6 + 0

CHEM F321  Organic Chemistry I  (n)
4 Credits
Offered Fall
A systematic study of the more important functional groups of carbon
compounds, including their mechanisms of reaction, methods of
synthesis, and physical and spectroscopic properties. Lab portion will
include an introduction to synthetic techniques and spectroscopy.
Prerequisites: CHEM F106X.
Lecture + Lab + Other: 3 + 3 + 0

CHEM F325  Organic Chemistry II  (n)
4 Credits
Offered Spring
A systematic study of the more important functional groups of carbon
compounds, including their mechanisms of reaction, methods of
synthesis and physical and spectroscopic properties. Lab portion will
include synthesis and characterization by spectroscopy.
Prerequisites: CHEM F321.
Lecture + Lab + Other: 3 + 3 + 0

CHEM F331  Physical Chemistry I  (n)
4 Credits
Offered Fall
Principles of thermodynamics and kinetics with applications to phase
equilibria, solutions, chemical equilibrium and electrochemistry. Course
teaches these concepts using both lecture and laboratory instruction.
Prerequisites: CHEM F106X; MATH F252X; PHYS F124X or PHYS F212X.
Lecture + Lab + Other: 3 + 3 + 0

CHEM F332  Physical Chemistry II  (n)
4 Credits
Offered Fall
Atomic and molecular structure, and spectroscopy, and statistical
mechanics. Course teaches these concepts using both lecture and
laboratory instruction.
Prerequisites: CHEM F331; MATH F253X.
Lecture + Lab + Other: 3 + 3 + 0

CHEM F360  Cell and Molecular Biology  (n)
3 Credits
Offered Fall and Spring
An introduction to the structure and function of cells. Topics include:
the structure and function of cellular components, including proteins,
membranes and organelles; understanding how cells communicate; and
how information is processed in the cell via DNA replication, transcription
and translation.
Prerequisites: BIOL F260; CHEM F105X; CHEM F106X (may be taken
concurrently).
Cross-listed with BIOL F360.
Special Notes: Taught asynchronously online in fall, face to face in
spring.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F402  Inorganic Chemistry  (n)
3 Credits
Offered Fall
Symmetry and group theory, molecular orbital theory, solid state
chemistry, acids and bases, redox reactions, non-aqueous solvents,
descriptive chemistry of some main group elements.
Prerequisites: CHEM F202; CHEM F325.
Lecture + Lab + Other: 1 + 6 + 0

CHEM F403  Biological Inorganic Chemistry
3 Credits
Offered Fall
Survey of structure, functions, and chemical properties of natural
metalloproteins and metalloenzymes, roles of metalloproteins in nucleic
acid formation and replication, metal-based medicines.
Prerequisites: CHEM F202; CHEM F449.
Stacked with CHEM F603.
Lecture + Lab + Other: 3 + 0 + 0
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<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
<th>Offered</th>
<th>Prerequisites</th>
<th>Corequisites</th>
<th>Corequisites 2</th>
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<tbody>
<tr>
<td>CHEM F406</td>
<td>Atmospheric Chemistry</td>
<td>3</td>
<td>Spring</td>
<td>Prerequisites: CHEM F332.</td>
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<td>CHEM F419</td>
<td>Practical Nuclear Magnetic Resonance</td>
<td>2</td>
<td>Spring</td>
<td>Prerequisites: CHEM F321.</td>
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<td>CHEM F420</td>
<td>Applications of NMR Spectroscopy</td>
<td>3</td>
<td>Fall</td>
<td>Prerequisites: CHEM F321.</td>
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<td>CHEM F434</td>
<td>Chemistry Capstone Laboratory (n)</td>
<td>3</td>
<td>Fall</td>
<td>Prerequisites: WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; CHEM F212; CHEM F202.</td>
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<td>CHEM F449</td>
<td>General Biochemistry: Metabolism</td>
<td>3</td>
<td>Spring</td>
<td>Prerequisites: CHEM F321.</td>
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<td>CHEM F450</td>
<td>Information Storage and Transfer: Molecules and Pathways</td>
<td>3</td>
<td>Fall</td>
<td>Prerequisites: CHEM F321.</td>
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<td>CHEM F455</td>
<td>Environmental Toxicology</td>
<td>3</td>
<td>Fall</td>
<td>Prerequisites: CHEM F449; or one semester each of organic chemistry and cell or molecular biology; WRTG F111X; WRTG F211X, WRTG F212X, WRTG F213X or WRTG F214X; COJO F121X or COJO F131X or COJO F141X.</td>
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<td>Cross-listed with BIOL F455.</td>
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<td>CHEM F466</td>
<td>Advanced Cell and Molecular Laboratory</td>
<td>3</td>
<td>Spring</td>
<td>Prerequisites: BIOL F360 or CHEM F360 may be taken concurrently.</td>
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<td>Cross-listed with BIOL F466.</td>
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<td>CHEM F470</td>
<td>Cellular and Molecular Neuroscience</td>
<td>3</td>
<td>Fall</td>
<td>Prerequisites: Two F300-level courses in BIOL or CHEM; MATH F251X or MATH F230X.</td>
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<td>Stacked with CHEM F670 and BIOL F679.</td>
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<td>Special Notes: Recommended MATH F252X.</td>
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CHEM F474  Neurochemistry
3 Credits
Offered Fall Odd-numbered Years
Covers basic and applied aspects of interneuronal signaling of specific neurotransmitter systems. Lectures will be based on chapters from assigned text as well as recent and historical literature relevant to these topics. Basic concepts introduced in lectures will be applied through guided discussion of original research papers.
Prerequisites: BIOL F115X; CHEM F325; BIOL F417 or CHEM F470 or PSY F335.
Stacked with CHEM F676.
Special Notes: Students will learn to prepare "peer reviews" of selected papers and critically discuss original research.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F481  Seminar
1 Credit
Offered Fall and Spring
Introduction to the techniques and style of technical oral presentation generally accepted by professional chemists. Class will meet two hours per week, the first hour in closed session, the second, open to the public. Seminar attendance and participation in observing and critiquing presentations by graduate students, chemistry faculty, and their peers is required.
Prerequisites: COJO F131X or COJO F141X.
Special Notes: Oral communication intensive credit is earned upon successful completion of CHEM F482.
Lecture + Lab + Other: 2 + 0 + 0

CHEM F482  Seminar
2 Credits
Offered Fall and Spring
Introduction to the techniques and style of technical oral presentation generally accepted by professional chemists. Class will meet two hours per week, the first hour in closed session, the second, open to the public. Preparation of a 40 minute presentation to be delivered twice, first, to others in the course.
Prerequisites: CHEM F481; COJO F131X or COJO F141X.
Lecture + Lab + Other: 2 + 0 + 0

CHEM F488  Undergraduate Chemistry and Biochemistry Research
2-3 Credits
Offered Fall and Spring
Advanced research topics from outside the usual undergraduate laboratory offerings. The student will be required to make presentations and turn in a final report. Research areas range from atmospheric chemistry to molecular biology. A substantial level of chemistry or biochemistry background is assumed.
Prerequisites: CHEM F434 or CHEM F314.
Lecture + Lab + Other: 0 + 6-9 + 0

CHEM F498  Research
1-9 Credits
Lecture + Lab + Other: 0 + 0 + 0

CHEM F601  Introduction to Atmospheric Sciences
3 Credits
Offered Fall
Fundamentals of atmospheric science. Includes energy and mass conservation, internal energy and entropy, atmospheric water vapor, cloud microphysics, equations of motion, hydrostatics, phase oxidation, heterogeneous chemistry, the ozone layer, fundamentals of biogeochemical cycles, solar and terrestrial radiation and radiative-convective equilibrium. Also includes molecular, cloud and aerosol absorption and scattering.
Prerequisites: Graduate standing.
Cross-listed with ATM F601.
Stacked with ATM F401.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F603  Biological Inorganic Chemistry
3 Credits
Offered Fall
Survey of structure, functions, and chemical properties of natural metalloproteins and metalloenzymes, roles of metalloproteins in nucleic acid formation and replication, metal-based medicines.
Stacked with CHEM F403.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F605  Aquatic Chemistry
3 Credits
Offered Fall
Chemistry of aquatic systems, including the development of equilibrium and kinetic models to understanding the speciation, transformation and partitioning of inorganic chemical species in aqueous systems. Emphasis is on the study of acid-base chemistry, complexation, precipitation-dissolution and reduction-oxidation reactions.
Prerequisites: Graduate standing.
Cross-listed with ENVE F641.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F606  Atmospheric Chemistry
3 Credits
Offered As Demand Warrants
Chemistry of atmospheric systems, including the development of equilibrium and kinetic models to understanding the speciation, transformation and partitioning of inorganic chemical species in aqueous systems. Emphasis is on the study of acid-base chemistry, complexation, precipitation-dissolution and reduction-oxidation reactions.
Prerequisites: Graduate standing.
Cross-listed with ATM F601.
Stacked with ATM F606.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F609  Aquatic and Environmental Geochemistry
3 Credits
Offered Spring Odd-numbered Years
Chemistry of aquatic and terrestrial environments, including thermodynamic, kinetic and structural principles applied to aqueous geochemical systems. Emphasis on aqueous speciation and heterogeneous interactions (e.g., dissolution/precipitation and sorption) involved in the partitioning, transformation and transport of chemical species in the environment.
Prerequisites: CHEM F331 or Graduate standing.
Cross-listed with GEOS F633.
Lecture + Lab + Other: 3 + 0 + 0
CHEM F620 Applications of NMR Spectroscopy
3 Credits
Offered Fall Even-numbered Years
Applications of nuclear magnetic resonance (NMR) spectroscopy in the chemical and biochemical sciences. The course will focus on the implementation and interpretation of NMR experiments for solving research problems. Topics include the basic theory of NMR and one- and two-dimensional techniques.
Prerequisites: Graduate standing.
Stacked with CHEM F420.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F631 Environmental Fate and Transport
3 Credits
Offered Spring Even-numbered Years
Examination of the physical properties that govern the behavior, fate and transport of contaminants released into the environment. Topics include air-water partitioning and exchange, organic solvent-water partitioning, diffusion, sorption, chemical and biological transformation reactions, and modeling concepts.
Cross-listed with ATM F631.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F632 Molecular Spectroscopy
3 Credits
Offered Fall Odd-numbered Years
Application of quantum mechanics to molecular bonding and spectroscopy. Topics include: applications of lasers to probe chemical reactivity, photochemistry and the detection of trace compounds in mixtures. Variable content. May be repeated for credit.
Prerequisites: CHEM F332.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F654 Protein Structure and Function
3 Credits
Offered Spring Even-numbered Years
Contemporary topics in peptide and protein biochemistry. Topics include peptide synthesis, protein modification, comparative aspects of structure, protein engineering, enzyme and receptor function as well as molecular modeling.
Prerequisite: CHEM F449.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F655 Environmental Toxicology
3 Credits
Offered Fall
Environmental toxicology will focus on the general properties and principles of persistent and/or poisonous (toxic) chemicals commonly encountered in air, water, fish and wildlife. Numerous natural and synthetic chemicals in the environment will be discussed from a global perspective with some bias towards Arctic and sub-Arctic regions.
Prerequisites: CHEM F449; or one semester each of organic chemistry and cell or molecular biology.
Cross-listed with BIOL F656.
Stacked with BIOL F455; CHEM F455.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F657 Molecular Foundations of Gene Expression
3 Credits
Offered Spring Even-numbered Years
The molecular regulation of gene expression in prokaryotes and eukaryotes in the context of development and disease. Major topics include: protein/DNA interactions, structure-function relations of transcription factors, signal transduction, control of transcription and translation, chromatin structure and DNA replication.
Prerequisites: CHEM F449; CHEM F450.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F660 Chemical Oceanography
3 Credits
Offered Spring
An integrated study of the chemical, biological, geological and physical processes that control the chemical composition of seawater. Boundary interactions with the atmosphere and lithosphere, biogeochemical cycles and tracers of these complex cycles are examined. The marine chemistry of inorganic carbon is considered in detail.
Prerequisites: Graduate standing.
Cross-listed with MSL F660.
Stacked with MSL F461.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F666 Scientific Teaching
2 Credits
Offered Spring Even-numbered Years
This course explores methods for teaching science at the university level. Emphasis is placed on methods of course design, instructional techniques, assessment, and course management that have been shown by research to improve student learning. This course is intended for graduate students who have an interest in science teaching.
Prerequisites: Graduate standing.
Lecture + Lab + Other: 2 + 0 + 0

CHEM F670 Cellular and Molecular Neuroscience
3 Credits
Offered Fall Even-numbered Years
The cellular and molecular underpinnings of signaling in the nervous system. Topics include properties of excitable membranes, synaptic transmission, neurological integration, the cellular and molecular basis of learning and memory, and pharmacological treatment of neuronal pathologies.
Prerequisites: Two F300-level courses in BIOL or CHEM; MATH F251X or MATH F230X.
Cross-listed with BIOL F679.
Stacked with CHEM F470.
Special Notes: Recommended MATH F252X.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F671 Receptor Pharmacology
3 Credits
Offered Fall Even-numbered Years
Covers basic drug/receptor theory to train students to assess affinity and efficacy of receptor ligands, interpret functional assays and binding results, and critically evaluate original research regarding receptor pharmacology with an emphasis on ligand-gated ion channels and G-protein coupled receptors. Special Notes:
Prerequisites: Upper-division or graduate biochemistry or neurochemistry course.
Recommended: BIOL F417.
Lecture + Lab + Other: 3 + 0 + 0
CHEM F674  Membrane Biochemistry and Biophysics
3 Credits
Offered Fall Even-numbered Years
Basic biophysical and molecular processes associated with membrane-mediated events in the context of cellular physiology. Major topics includes biochemical and biophysical characteristics of membrane lipids; structure-function relation of membrane proteins; protein trafficking/targeting; vesicle transport and membrane fusion/exocytosis; the nature of membrane excitability; and the role of membrane in bioenergetics.
Prerequisites: CHEM F449; CHEM F450.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F675  Cellular Signaling
3 Credits
Offered Spring Odd-numbered Years
Cellular signaling is vitally important in complex biomolecular systems, development, physiology, and pathology and thus constitutes a major topic in modern medical and pharmacological research. This course concentrates on cellular signal transduction and regulation in higher mammals. Major topics include G-proteins, protein kinases, signaling molecules, lipid mediators, and adaptor proteins.
Prerequisites: Upper division or graduate biochemistry or neurochemistry course.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F676  Neurochemistry
3 Credits
Offered Fall Odd-numbered Years
Covers basic and applied aspects of interneuronal signaling of specific neurotransmitter systems. Lectures will be based on chapters from assigned text as well as recent and historical literature relevant to these topics. Basic concepts introduced in lectures will be applied through guided discussion of original research papers.
Prerequisites: BIOL F115X; CHEM F325; BIOL F417 or CHEM F470 or PSY F335.
Stacked with CHEM F474.
Special Notes: Students will learn to prepare "peer reviews" of selected papers and critically discuss original research.
Lecture + Lab + Other: 3 + 0 + 0

CHEM F686  Chemical Research Mentoring
2 Credits
Offered As Demand Warrants
This course provides graduate students the opportunity to mentor undergraduates in chemical research within a structured environment, from developing a research idea to executing a small research project. The focus of this course is to refine mentoring skills that contribute to the professional development of maturing chemical professionals.
Prerequisites: Graduate standing in a scientific discipline.
Lecture + Lab + Other: 1 + 3 + 0

CHEM F688  Biochemical and Molecular Biology Seminar
1 Credit
Offered Fall and Spring
A seminar on various topics related to biochemistry and molecular biology including discussions of recent literature and research results.
Lecture + Lab + Other: 1 + 0 + 0

CHEM F691  Research Presentation Techniques
1 Credit
Offered Fall
Review of recent research in chemistry to expose students to recent findings, methodologies and concepts in a broad range of chemistry and related disciplines. How to present and defend research proposals. Course may be repeated for credit.
Lecture + Lab + Other: 1 + 0 + 0

CHEM F692  Seminar
1-6 Credits
Graded Pass/Fail.
Lecture + Lab + Other: 1-6 + 0 + 0

CHEM F698  Non-thesis Research/Project
1-9 Credits
Graded Pass/Fail.
Lecture + Lab + Other: 0 + 1-9 + 0

CHEM F699  Thesis
1-12 Credits
Offered Fall, Spring and Summer
Lecture + Lab + Other: 0 + 0 + 0