CHEMISTRY

Bayly Foundation

PROFESSORS PLEVA, GOEHRING, SETTLE
ASSOCIATE PROFESSORS ALTY, DESJARDINS
ASSISTANT PROFESSORS FRANCE, TUCHLER, UFFELMAN
INSTRUCTOR DAVIS

MAJOR

The major in **chemistry** leading to a Bachelor of Arts degree requires completion of 44 credits as follows:

1. Chemistry 111, 112, 241, 242, 243, 250, 261, 341; Physics 111, 112, 113, 114
2. Chemistry 252 or 254
3. Five additional credits chosen from biology, chemistry (numbered 200 or above), geology, or physics (numbered 200 or above).

Additional courses required as prerequisites for completion of the above include Mathematics 101 and 102, or their equivalents.

The major in **chemistry** leading to a Bachelor of Science degree requires completion of at least 53 credits in the sciences and mathematics including the following:

1. Chemistry 111, 112, 210, 241, 242, 243, 250, 252, 261, 262, 311, 341; Mathematics 221; Physics 111, 112, 113, 114
2. One course chosen from Chemistry 345, 347, 350, and 365

Mathematics 221 and Physics 109 must be completed by the end of the sophomore year; Chemistry 262 must be completed by the end of the junior year. Chemistry 254 and Mathematics 222 are recommended. Additional courses required as prerequisites for completion of the above include Mathematics 101 and 102, or their equivalents.

The major in **chemistry** leading to a specialized Bachelor of Science with Special Attainments in Chemistry degree certified by the American Chemical Society requires completion of 60 credits as follows:

1. Chemistry 111, 112, 210, 241, 242, 243, 250, 252, 261, 262, 266, 267, 311, 341, 350, 471. These courses must be completed with a 2.000 grade-point average or higher.
2. Mathematics 221, 222
3. Physics 111, 112, 113, 114

Students pursuing this degree must complete six credits in English (usually covered by the general education requirements in composition and literature). Mathematics 221 and Physics 112 and 114 must be completed by the end of the sophomore year; Chemistry 262 must be completed by the end of the junior year. Additional advanced courses in chemistry, Mathematics 332, and either German 261-262 or Russian 261-262 are highly recommended in preparation for graduate school. Additional courses required as prerequisites for completion of the above include Mathematics 101 and 102, or their equivalents.

The major in **chemistry-engineering** leading to a Bachelor of Science degree is designed for students interested in the field of chemical engineering. The requirements are described under Engineering.

HONORS: An Honors Program in chemistry is offered for qualified students; see department head for details.

★CHEMISTRY 100 (4)—Modern Descriptive Chemistry

Prerequisite: Permission of the department. Enrollment limited. An elementary study of the structure and reactions of molecules. Laboratory work illustrates some fundamental procedures in chemistry. Designed for non-science students fulfilling general education requirements or desiring a science elective. No credit given for this course if a 200-level chemistry course has been successfully completed. Laboratory course. *Desjardins.*

Fall 2000 and alternate years

★CHEMISTRY 104 (Physics 104) (3)—The Conceptual Foundations of Quantum Theory

An introduction to what is currently the fundamental theory of nature. Quantum behavior is considered in the context of classical (Newtonian) notions of waves and particles and is applied to atomic, molecular, and nuclear systems. The practical and philosophical implications of quantum theory are considered in detail. No mathematics beyond high school algebra is assumed. *Desjardins, Williams.*

Winter

★CHEMISTRY 105 (3)—Foundations of Chemistry

An historical review of the development of chemistry, with emphasis on the applications of chemistry during its development. Designed particularly for non-science students fulfilling general education requirements or desiring a science elective. (May not be used for credit in the interdepartmental major in the natural sciences and mathematics.) *Staff.*

Spring

★CHEMISTRY 106 (3)—Disorder and Chaos

An elementary introduction to the concepts underlying non-linear dynamics and statistical thermodynamics. Emphasis is placed on examining physical and social systems using both deterministic (dynamic) and statistical (Monte Carlo) approaches. Practical implementation of these methodologies is achieved through the use of computer modelling and simulation. Topics include computer simulation methods, deterministic chaos and fractal geometry, and information theory. No previous computer experience is required. *Desjardins and Pleva.*

Spring

★CHEMISTRY 110 (4)—Chemistry of the Earth

*Note: This course serves as a prerequisite for Chemistry 112 but **not** for Chemistry 241.* The fundamental principles of chemistry as applied to geological and environmental systems. Emphasis is on stoichiometry, the basic structure of matter and the thermodynamics of chemical and physical processes, including phase, solution and chemical equilibrium. Lecture topics are presented in the context of an appropriate geological or environmental problem, while the laboratory portion consists of small group projects involving theoretical and analytical aspects of samples collected in the field. Laboratory course. *Knapp, Desjardins, Pleva.*

Fall 1999 and alternate years

★CHEMISTRY 111 (4)—General Chemistry

The fundamental principles of general chemistry, with emphasis on atomic and molecular structure, phases of matter, and energy relations. Laboratory work includes qualitative inorganic analysis. No previous knowledge of chemistry is required, though it is advantageous. Laboratory course. *Goehring, Uffelman, Pleva, Davis.*

Fall

★CHEMISTRY 112 (4)—Aqueous Inorganic Quantitative Chemistry

Prerequisite: Chemistry 111. A continuation of Chemistry 111, with emphasis on inorganic systems exhibiting aqueous solution equilibria. Topics covered include acid/base, redox, complexation, and precipitation reactions, along with solution kinetics. Laboratory work emphasizes techniques of chemical quantitative analysis and data handling. Designed for students planning to continue with more advanced science courses. Laboratory course. *Goehring, Pleva, Davis.*

Winter

★CHEMISTRY 195 (3)—The Atomic Bomb: Origins, Production, Use and Legacy

This seminar reviews the science, with an emphasis on chemistry, and technology leading to the development and production of the atomic bomb. Students then examine the decision to use the bomb against Japan and the political, social and environmental legacies of this weapon. Students write briefs, based on their reading of primary and secondary sources, which form the basis for group discussions throughout the seminar. *Settle.*

Spring

CHEMISTRY 205 (1)—Literature of Chemistry

Prerequisite: Chemistry 112. Systematic training in the use of the chemical library. *Staff.*

Not offered in 1999-2000

CHEMISTRY 210 (2)—The Structure and Reactivity of Molecules

Prerequisites: Chemistry 112 and Mathematics 102. An introduction to the basic physical principles underlying molecular structure and chemical reactivity, with an emphasis on organic molecules. Topics include molecular potential energies and charge distributions as both the basis of molecular geometry and a guide to reactive behavior. Quantum mechanical pictures of molecules are also considered, both in the molecular orbital and valence bond approaches. Computational methods including molecular mechanics, molecular dynamics, and semi-empirical quantum mechanics are discussed and applied to example systems. *Desjardins.*

Spring

CHEMISTRY 241 (4)—Organic Chemistry I

Prerequisite: An average grade of 2.5 or better in Chemistry 111 and 112 or permission of the department. General theory of organic chemistry directed toward the basic functional groups of organic compounds. Laboratory work includes the preparation of typical organic compounds and an introduction to organic spectroscopic methods. This is the first course of a sequence which will satisfy the entrance requirements of all medical schools. Laboratory course. *France.*

Fall

CHEMISTRY 242 (4)—Organic Chemistry II

Prerequisite: Chemistry 241. A continuation of Chemistry 241. Laboratory course. *France.*

Winter

CHEMISTRY 243 (3)—Organic Spectroscopic Methods

Prerequisite: Chemistry 242. Introduction to mass spectroscopy, infrared spectroscopy and proton and carbon nuclear magnetic resonance spectroscopy, including two-dimensional techniques. Emphasis is on interpreting spectra to determine structures of organic molecules. Laboratory work uses the instruments to identify unknown organic molecules. *Alty, Davis.*

Spring

CHEMISTRY 250 (2)—Inorganic Chemistry

Prerequisites: Chemistry 243 and 261; corequisite: Chemistry 252, or, by permission of the instructor, Chemistry 254. A survey of main group and transition metal chemistry, as well as fundamentals of point group symmetry. Main group chemistry will be discussed from the perspective of the "classic" compounds from the alkali metals, the alkaline earths, the boron family, the carbon family, the pnicogens, the chalcogens, the halogens, and the noble gases. Transition metal chemistry will be examined from the standpoint of characteristic coordination geometries, kinetics and mechanism, electron transfer (inner and outer sphere), and catalysis. *Uffelman.*

Winter

CHEMISTRY 252 (2)—Inorganic Chemistry Laboratory

Prerequisites: Chemistry 243 and 261; corequisite: Chemistry 250. A survey of modern inorganic synthesis and spectroscopy. Topics will include manipulation of air-sensitive compounds, NMR of diamagnetic and paramagnetic complexes, dynamic NMR, IR, and UV-VIS spectroscopies. *Uffelman.*

Winter

CHEMISTRY 254 (2)—Bioinorganic Chemistry

Prerequisites: Chemistry 243 and 261; corequisites: Chemistry 250 and permission of instructor. A survey of the major metalloproteins and metalloenzymes. *Uffelman.*

Winter

CHEMISTRY 261 (4)—Physical Chemistry I

Prerequisites: Chemistry 112 and Mathematics 102. An introduction to classical thermodynamics, and chemical kinetics. Biological applications of thermodynamic principles will be emphasized with examples. Polymer and enzyme kinetics will also be stressed. *Tuchler.*

Fall

CHEMISTRY 262 (4)—Physical Chemistry II

Prerequisites or Corequisites: Chemistry 210, 261, Mathematics 221, and Physics 112 and 114. An introduction to quantum mechanics as it applies to atomic and molecular systems. The emphasis is placed on spectroscopic methods and the modern picture of chemical bonding and molecular structure. Semi-empirical and *ab initio* quantum chemistry is considered in some detail. The elements of statistical thermodynamics are considered with regard to the structure of matter and chemical equilibrium. *Tuchler.*

Winter

CHEMISTRY 266 (1)—Physical Chemical Measurements

Prerequisite or Corequisite: Chemistry 261. Laboratory work illustrating the principles and instruments of physical chemistry. Laboratory course. *Tuchler.*

Fall

CHEMISTRY 267 (1)—Physical Chemical Measurements

Prerequisite: Chemistry 261. Laboratory work illustrating the principles and instruments of physical chemistry. Laboratory course. *Tuchler.*

Winter

CHEMISTRY 295 (1)—Special Topics in Chemistry

Prerequisite or corequisite: 16 credits in chemistry or departmental permission. One-credit studies of special topics. May be repeated for degree credit with permission and if the topics are different. Possible topics include Solid State Chemistry, Metabolic Diseases, Developments in Physical Chemistry, Data Handling, Nuclear Chemistry and Reaction Dynamics. *Staff.*

Offered when interest is expressed and departmental resources permit.

CHEMISTRY 296 (1)—Hazardous Materials

Prerequisite or corequisite: Chemistry 241 or permission of the instructor. Pass/Fail only. Introduction to safe and responsible practices in the laboratory. Evaluation of hazards and risk assessment in the laboratory, management of chemicals, working safely with chemicals and equipment and disposal of waste. *Pleva.*

Fall

CHEMISTRY 297 (2)—Special Topics in Chemistry

Prerequisite or corequisite: 16 credits in chemistry or departmental permission. Two-credit studies of special topics. May be repeated for degree credit with permission and if the topics are different. Possible topics include Electrochemistry, Medicinal Chemistry, Atmospheric Chemistry and the Environment, and The Dynamics of Photchemistry. *Staff.*

Offered when interest is expressed and departmental resources permit.

CHEMISTRY 311 (3)—Advanced Analytical Chemistry

Prerequisite: Chemistry 262. This course deals with the process of experimentation. Topics include: statistics, statistical decision-making, sampling, wet-chemical preparation, and measurement of analyte by modern instrumental (spectroscopic, chromatographic) as well as more traditional techniques (with an emphasis on electrochemistry). Laboratory course. *Settle.*

Fall

CHEMISTRY 341 (4)—Biochemistry

Prerequisite: Chemistry 242. A study of the structure, function, biosynthesis and breakdown of biomolecules, including proteins, nucleic acids, carbohydrates and lipids. Enzymes, biological membranes and membrane transport, and regulation of metabolism are studied in greater detail. *Alty.*

Fall

CHEMISTRY 347 (2)—Advanced Organic Synthesis

Prerequisite: Chemistry 242. A study of selected modern synthetic organic reactions, with an emphasis on stereocontrol. Synthetic methodology as well as examples of natural product synthesis is discussed. *France.*

Spring

CHEMISTRY 350 (3)—Advanced Inorganic Chemistry

Prerequisites: Chemistry 250, 252, and 262. An introduction to group theory and its application to inorganic spectroscopy and an introduction to organometallic chemistry and organometallic catalytic processes. *Uffelman.*

Spring

CHEMISTRY 365 (2)—Advanced Physical Chemistry

Prerequisite: Chemistry 262. An introduction to phenomenological transport theory and time dependent chemical systems. Applications to industrial and biological systems are considered, with the emphasis depending on the nature of student interest. *Desjardins.*

Winter

CHEMISTRY 421 (1), 422 (2), 423 (3)—Directed Individual Research

Prerequisite: Chemistry 242 or permission of the in-structor. Literature search, conferences, tri-weekly reports and laboratory work on a project supervised by the instructor and designed by the student and instructor. A final written report on the project is required. *Staff.*

CHEMISTRY 433 (3), 436 (6), 439 (9)—Tutorial

Prerequisite: Honors candidacy or permission of the department. Directed reading, conferences, laboratory experiments, and papers on topics mutually agreeable to the student and the staff. Laboratory course. *Staff.*

CHEMISTRY 443 (3)—Honors Tutorial

Prerequisite: Honors candidacy with senior standing. Directed reading and conferences in preparation for a comprehensive examination. *Staff.*

Spring

CHEMISTRY 471 (1), 472 (2), 473 (3)—Senior Thesis

Prerequisite: Senior standing in chemistry. Literature search, conferences, reports and laboratory. Maximum of six credits. Laboratory course. *Staff.*

CHEMISTRY 493 (3-3)—Honors Thesis

Prerequisite: Honors candidacy. Literature search, conferences, reports and laboratory work resulting in a thesis exhibiting a significant understanding of an important problem. *Staff.*

Fall-Winter

CHEMISTRY SEMINAR

Regular meetings of the staff and chemistry majors are held weekly throughout the academic year to discuss selected topics. All interested students are invited to attend.