

DEPARTMENT OF CHEMISTRY

<http://www.uvm.edu/cas/chemistry>

Chemistry is the center of science. Chemists seek understanding of all aspects of the physical and biological worlds at the molecular level, developing methodologies to probe the structure of molecules and chemical reactions. These techniques are critical to solving biological and biomedical problems and also provide tools to address important problems in materials science, geology, and in the environmental sciences.

Chemistry students gain the intellectual skills needed to confront and solve difficult problems and develop a rigorous lifelong commitment to learning. In conjunction with the Chemistry Department's active Ph.D. program, undergraduate Chemistry majors work with faculty members and graduate students engaged in cutting-edge research. This participation brings state-of-the-art perspectives to undergraduate learning that can only be obtained at a modern research university.

Chemistry students learn to be creative thinkers, scientists, and clear communicators, under the guidance of internationally recognized faculty who are deeply committed to teaching, advising, and research. Faculty regularly garner funding from the National Science Foundation, National Institutes of Health, and the U.S. Department of Energy, among others, for research in areas that include biomedical applications and drug development, environmental science, and materials science.

MAJORS

CHEMISTRY MAJORS

Chemistry B.A.

Chemistry B.S.

MINORS

CHEMISTRY MINOR

Chemistry

GRADUATE

Chemistry AMP

Chemistry M.S.

Chemistry Ph.D.

See the online Graduate Catalogue for more information.

Courses

CHEM 1010. Topics In: First-Year Seminar. 3 Credits.

Intensive first-year seminar focused on specific themes and/or disciplinary perspectives. Emphasis on developing critical reading and writing skills, substantive revision, information literacy, and analytical thinking. First-year seminars are frequently organized to meet one of the disciplinary Catamount Core requirements. Topics vary by offering; periodic offering at intervals that may exceed four years. Catamount Core: WIL1.

CHEM 1020. Topics In: LASP Writing. 3 Credits.

Intensive course in a broad disciplinary area (humanities, social sciences, arts, or natural sciences). Part of an integrated first-year experience in which students take 2-4 classes exploring aesthetic, humanistic, social, linguistic, environmental, or scientific issues. May repeat for credit with different content. Topics vary by offering; periodic offering at intervals that may exceed four years. Co-requisite: Enrollment in the appropriate Liberal Arts Scholars Program. Catamount Core: WIL1.

CHEM 1025. Topics In: LASP Seminar. 3 Credits.

Intensive course in a broad disciplinary area (humanities, social sciences, arts, or natural sciences). Part of an integrated first-year experience in which students take 2-4 classes exploring aesthetic, humanistic, social, linguistic, environmental, or scientific issues. May repeat for credit with different content. Topics vary by offering; periodic offering at intervals that may exceed four years. Co-requisite: Enrollment in the appropriate Liberal Arts Scholars Program.

CHEM 1050. Topics in Current Chem w/lab. 0 or 4 Credits.

Subjects vary by semester. Includes a laboratory component that may be in-person or may combine online software with experiments that can be performed safely by students at home. Background in science is helpful, but generally not required. Representative topics: Chemical Herbalism; Chemical Gastronomy. May be repeated for credit with different content. Topics vary by offering; periodic offering at intervals that may exceed four years. Catamount Core: N2.

CHEM 1052. Topics in Current Chem. 3 Credits.

Subjects vary by semester. Background in science is helpful, but generally not required. Representative topics: Environmental Risk; Chemistry of Honeybees. May be repeated for credit with different content. Topics vary by offering; periodic offering at intervals that may exceed four years. Catamount Core: N1.

CHEM 1070. Discovering Chemistry. 1 Credit.

First-year Chemistry majors will gain an understanding of some of the core concepts and vocabulary in the discipline and be introduced to the scientific research going on in the department. Showcases academic and student services resources on campus. Provides an opportunity to meet and interact with other first-year students in the major.

CHEM 1100. Outline: General Chem w/lab. 0 or 4 Credits.

One-semester survey of principles and concepts of general chemistry, topics covered include bonding, mole ratios, equilibrium, and nuclear chemistry. Credit not awarded for both CHEM 1100 and CHEM 1102, CHEM 1400, or CHEM 1405. Catamount Core: N2, QD.

CHEM 1102. Outline: General Chem. 3 Credits.

One-semester survey of principles and concepts of general chemistry, topics covered include bonding, mole ratios, equilibrium, and nuclear chemistry. No laboratory. Credit not awarded for both CHEM 1102 and CHEM 1100, CHEM 1400, or CHEM 1405. Catamount Core: N1, QD.

CHEM 1150. Outline: Organic & BIOC w/lab. 0 or 4 Credits.

Broad overview of most important facts and principles of organic and biochemistry and interrelationships between these branches of chemistry. Credit not awarded for both CHEM 1150 and CHEM 1152, CHEM 1580, or CHEM 1582. Prerequisite: CHEM 1100 or CHEM 1400. Catamount Core: N2, QD.

CHEM 1152. Outline: Organic & BIOC. 3 Credits.

Broad overview of most important facts and principles of organic and biochemistry and of interrelationships between these branches of chemistry. No laboratory. Credit not awarded for both CHEM 1152 and CHEM 1150, CHEM 1580, or CHEM 1582. Prerequisite: CHEM 1100, CHEM 1102, or CHEM 1400. Catamount Core: N1, QD.

CHEM 1400. General Chemistry 1. 0 or 4 Credits.

First semester of a two-semester sequence. Topics include matter, stoichiometry, gas laws, thermochemistry, quantum theory, atomic structure, electronic configurations, bonding, and intermolecular forces. Credit not awarded for both CHEM 1400 and CHEM 1100, CHEM 1102, or CHEM 1405. Catamount Core: N2, QD.

CHEM 1410. Exploring Chemistry 1. 1 Credit.

First-year laboratory addressing foundational chemical principles and experimental methods. For first-year Biochemistry majors also enrolled in CHEM 1500. Co-requisite: CHEM 1500.

CHEM 1450. General Chemistry 2. 0 or 4 Credits.

Second semester of a two-semester sequence. Topics include solutions, kinetics, equilibrium, acid-base chemistry, aqueous ionic equilibria, thermodynamics, electrochemistry, and nuclear chemistry. Credit not awarded for both CHEM 1450 and CHEM 1455. Prerequisite: CHEM 1400 or CHEM 1405. Catamount Core: N2, QD.

CHEM 1460. Exploring Chemistry 2. 1 Credit.

Second semester of a first-year laboratory addressing foundational chemical principles and experimental methods. For first-year Biochemistry majors also enrolled in CHEM 1550. Prerequisites: CHEM 1500 and CHEM 1410. Co-requisite: CHEM 1550.

CHEM 1500. Organic Chemistry for Majors 1. 0 or 4 Credits.

An exploration of the basic principles of Organic Chemistry including structure, bonding, conformational analysis, stereochemistry and reactivity. Designed for Chemistry and Biochemistry majors who have a strong high school chemistry background. Catamount Core: N2, QD.

CHEM 1550. Organic Chemistry for Majors 2. 0 or 4 Credits.

A survey of the reactivity of organic functional groups from a mechanistic standpoint. Organic synthesis will be emphasized. Prerequisite: CHEM 1500 or Instructor permission. Catamount Core: N2, QD.

CHEM 1580. Intro Organic Chemistry w/lab. 0 or 4 Credits.

Properties and reactivity of basic organic compounds of technological and biological significance. Not recommended for pre-medical students. Credit not awarded for both CHEM 1580 and CHEM 1150, CHEM 1152, CHEM 1582, CHEM 1500, or CHEM 2580. Prerequisite: CHEM 1100 or CHEM 1450. Catamount Core: N2, QD.

CHEM 1582. Intro Organic Chemistry. 3 Credits.

Properties and reactivity of organic molecules of technological and biological significance. No laboratory. Not recommended for pre-medical students. Credit not awarded for both CHEM 1582 and CHEM 1150, CHEM 1152, CHEM 1580, CHEM 1500, or CHEM 2580. Prerequisite: CHEM 1100 or CHEM 1102 or CHEM 1450. Catamount Core: N1, QD.

CHEM 1990. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.

CHEM 2010. 2nd Year Seminar: Writing. 1 Credit.

Development of chemical information literacy skills through critical analysis and written reporting on areas of current chemical interest. Emphasizes scientific writing. Prerequisite: CHEM 1450 or CHEM 1460.

CHEM 2012. 2nd Year Seminar: Presentation. 1 Credit.

Presentation on a subject of current chemical interest, building on chemical information literacy skills. Emphasizes oral presentation techniques. Prerequisite: CHEM 2010.

CHEM 2014. Professional Development. 1 Credit.

Skills necessary for senior Chemistry majors to transition to postgraduate careers, including resume and proposal writing, presentations, and other techniques. Prerequisite: CHEM 2012 or CHEM 2020.

CHEM 2020. Communication Skills Seminar. 3 Credits.

Seminar focusing on information literacy, writing, and presentation skills relevant to the chemical sciences. Students will use discipline-specific search tools and evaluate primary literature to complete written and oral assignments. Prerequisite: CHEM 1550 or CHEM 2585. Catamount Core: OC, WIL2.

CHEM 2050. Advanced Synthesis Techniques. 3 Credits.

Laboratory for Chemistry majors that covers advanced inorganic and organic techniques in synthesis, purification, and spectroscopic characterization. Prerequisite: CHEM 1550 or CHEM 2585.

CHEM 2310. Quantitative Analysis. 0 or 4 Credits.

Theory and practice of volumetric and gravimetric analysis. Theoretical discussion of indicators, buffers, pH, etc. Introduction to data analysis, spectrophotometry, and chromatography. Prerequisite: CHEM 1450 or CHEM 1455 or CHEM 1460.

CHEM 2400. Inorganic Chemistry. 3 Credits.

Symmetry, group theory, molecular structure; electronic structure of atoms; bonding models including MO, crystal field, and ligand field; solid state, acid-base, and simple organometallic systems. Prerequisite: CHEM 1500 or CHEM 2580.

CHEM 2580. Organic Chemistry 1. 0 or 4 Credits.

Properties and reactivity of organic compounds with consideration of bonding, stereochemistry, and reaction mechanisms. For premedical and biological sciences students. Credit not awarded for both CHEM 2580 and CHEM 1580, CHEM 1582, or CHEM 1500. Prerequisite: CHEM 1450 or CHEM 1455.

CHEM 2585. Organic Chemistry 2. 0 or 4 Credits.

Reactivity of organic compounds and applications to synthesis. Spectroscopy is discussed in relation to compound characterization. For premedical and biological sciences students. Credit not awarded for both CHEM 2585 and CHEM 1550. Prerequisite: CHEM 1500 or CHEM 2580.

CHEM 2600. Physical Chem for Life Science. 3 Credits.

Introduction to physical chemistry concepts spanning thermodynamics, solution equilibrium, enzyme kinetics, and other topics. Appropriate for students from Biochemistry and other life science disciplines. Background in calculus and physics is required. Prerequisites: CHEM 1450, CHEM 1455, or CHEM 1460; MATH 1224, MATH 1248, or MATH 1242; PHYS 1400, PHYS 1500, or PHYS 1600.

CHEM 2605. Physical Chemistry Lab. 1 Credit.

Laboratory course following CHEM 2600. Topics include quantum chemistry and thermodynamics. Prerequisites: CHEM 1550 or CHEM 2585; CHEM 2600.

CHEM 2990. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.

CHEM 2995. Undergraduate Research. 1-18 Credits.

Undergraduate students work on research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

CHEM 3320. Instrumental Analysis. 3 Credits.

Systematic survey of modern methods of chemical analysis. Fundamental principles and applications of spectroscopy, electrochemistry, and separation techniques. Credit not awarded for both CHEM 3320 and CHEM 5320. Prerequisite: CHEM 2310. Pre/Co-requisite: CHEM 2600 is strongly recommended.

CHEM 3325. Instrumental Analysis Lab. 1 Credit.

Laboratory for undergraduates following CHEM 3320. Application of chemical and physical principles to qualitative and quantitative chemical problems. Study of the interplay of data, hypotheses, and hypothesis-driven experimentation through application of the scientific method. Prerequisites: CHEM 3320.

CHEM 3400. Advanced Inorganic Chemistry. 3 Credits.

Molecular symmetry and group theory with an emphasis on applications (vibrational and electronic spectra, bonding and reactivity); introduction to transition metal processes; bioinorganic chemistry. Credit not awarded for both CHEM 3400 and CHEM 5400. Prerequisite: CHEM 2600; CHEM 1500 or CHEM 2580.

CHEM 3600. Advanced Physical Chemistry. 3 Credits.

Builds on the concepts from Introductory Physical Chemistry (CHEM 2600). The three major areas of quantum chemistry, thermodynamics, and kinetics are extended in greater depth, and at a higher level of mathematical rigor. Credit not awarded for both CHEM 3600 and CHEM 5600. Prerequisite: CHEM 2600. Co-requisites: CHEM 3602 or MATH 2248.

CHEM 3602. Physical Chemistry Preparation. 1 Credit.

Review of relevant mathematical and physical concepts as applied to physical chemistry. Prerequisites: CHEM 1450 or CHEM 1455 or CHEM 1460; MATH 1248.

CHEM 3610. Chemical Thermodynamics. 3 Credits.

Calculus-based exploration of the fundamental principles of thermodynamics (gases, equilibrium, free energy, laws of thermodynamics, statistical thermodynamics, phase transitions, mixtures, chemical reactions), from both a chemistry and physics perspective. This topic is a cornerstone of many scientific and engineering disciplines. Appropriate for students in Chemistry and other STEM fields. Prerequisites: CHEM 1070, CHEM 1450, or CHEM 1455; MATH 1224, MATH 1248, or MATH 1242; PHYS 1450, PHYS 1550, or PHYS 1650. Co-requisite: CHEM 3602.

CHEM 3620. Quantum Mechanics and Kinetics. 3 Credits.

Exploration of chemical thermodynamics and basic statistical mechanics, with a significant level of mathematical rigor. Background in calculus and physics is required. Designed for Chemistry majors, but also suitable for students from other STEM disciplines. Prerequisites: CHEM 3610; PHYS 1550 or PHYS 1650. Pre/Co-requisites: MATH 2248.

CHEM 3990. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.

CHEM 3991. Internship. 1-18 Credits.

On-site supervised work experience combined with a structured academic learning plan directed by a faculty member or a faculty-staff team in which a faculty member is the instructor of record, for which academic credit is Offered at department discretion.

CHEM 3993. Independent Study. 1-18 Credits.

A course which is tailored to fit the interests of a specific student, which occurs outside the traditional classroom/laboratory setting under the supervision of a faculty member, for which credit is awarded. Offered at department discretion.

CHEM 3995. Undergraduate Research. 1-18 Credits.

Undergraduate students work on research projects under the supervision of a faculty member, for which credit is awarded. Offered at department discretion. Prerequisite: Departmental permission.

CHEM 4300. Topics in Analytical Chemistry. 1-3 Credits.

Selected topics of current interest in analytical chemistry. New techniques and methodologies, especially in chemical instrumentation. See Schedule of Courses for specific titles. May be repeated for credit with different content. Topics vary by offering; periodic offering at intervals that may exceed four years. Prerequisite: CHEM 3320.

CHEM 4580. Advanced Organic Chemistry 1. 3 Credits.

Stereochemistry, conformational analysis, stereoelectronic effects, transition state theory, molecular orbital theory, and reactivity criteria are discussed in regards to reaction mechanisms and functional group manipulations. Credit not awarded for both CHEM 4580 and CHEM 5580. Prerequisite: CHEM 2585.

CHEM 4990. Special Topics. 1-18 Credits.

See Schedule of Courses for specific titles.

CHEM 4994. Teaching Assistantship. 1-3 Credits.

Undergraduate student service as a teaching assistant, usually in an introductory-level course in the discipline, for which credit is awarded. Offered at department discretion.

CHEM 4996. Honors. 1-6 Credits.

College honors thesis or other department/program honors, under the supervision of a faculty member. Offered at department discretion.