

Chemistry

Department of Chemistry

College of Arts and Sciences
363 Natural Sciences Building
North Campus
Buffalo, NY 14260-3000

PH: 716.645.6626
Fax: 716.645.6963
Email: chemug@buffalo.edu
Web: www.chemistry.buffalo.edu

Overview

Chemistry offers two degree programs, either of which serves as adequate preparation for graduate work. The BA program is designed for students who wish to pursue a very flexible course of study, and the BS program is for those who desire a more complete training in chemistry and plan to continue professionally in the field after graduation, either in graduate school or in industry. The curriculum for the BS degree meets the certification requirements of the American Chemical Society. A handbook describing these programs is available in the department undergraduate office.

About our Degrees

Acceptance Information

Deadlines: Rolling
Number of applicants/year: 60
Number of accepted majors/year: 60
Total number of majors currently enrolled: 210

Degree Requirements

Please see [Degrees and Policies](#).

About our Courses

Suggested Introductory Courses

- [CHE 105](#) Chemistry: Principles and Applications (preferred) or [CHE 101](#) General Chemistry I
- [MTH 141](#) College Calculus I or [MTH 121](#) Survey of Calculus and its Applications I (BA degree only)
- [PHY 107](#) General Physics I or [PHY 101](#) College Physics I (BA degree only)
- [CHE 105-CHE 106](#) is suggested for chemistry majors and students intending to major in a chemistry-related field. [CHE 101-CHE 102](#) is also acceptable for chemistry majors. Similarly, [CHE 251-CHE 252](#) is an alternative to [CHE 201-CHE 202](#) for qualified students and is strongly recommended to students intending to major in chemistry or a chemistry related field.

The typical class size for:

Freshman/introductory courses is: 50-300 (lecture), 25 (recitation)
Sophomore/intermediate courses is: 16-250
Upper level/advanced courses is: 10-35

In the Department of Chemistry, what do teaching assistants (TAs) do?

TAs commonly conduct recitation and laboratory sessions under faculty supervision. TAs also frequently assist in the grading of quizzes and exams.

For course descriptions, please see [Courses](#).

About our Faculty

Teaching Awards

Chemistry

Faculty members within the Department of Chemistry have been repeatedly recognized for their teaching abilities. Six professors have been awarded the prestigious SUNY Chancellor's Award for Excellence in Teaching. Other awards include the UB Student Association's Teaching Award, the SUNY Chancellor's Medal for Excellence in Faculty Service, the SUNY at Buffalo Lilly Teaching Fellow, the Distinguished Service Award from the New York Science Teacher's Association, the Chemical Manufacturer Association Catalyst Award (National Award for Excellence Chemistry Teaching) and the Faculty of Natural Sciences and Mathematics Dean's Award for Excellence in Teaching, and the Graduate Student Association of SUNY at Buffalo Most Outstanding Graduate Faculty Award. Two of our professors have also received the Milton Plesur Teaching Award. Additional awards include the CAS Excellence in Teaching Award and the Ernest A. Lynton Award for Faculty Public Service and Academic Outreach.

Research Awards

Faculty members within the Department of Chemistry are also very active in research in their fields. As such, the UB Department of Chemistry faculty has won numerous prestigious awards and fellowships. The faculty includes four Alfred P. Sloan Foundation Fellows, as well as Fellows of the Lawrence M. Gelb Foundation, the American Association for the Advancement of Science, the American Vacuum Society, the Electrochemical Society, the Japan Society for the Promotion of Science, the International Union of Pure and Applied Chemistry and the Royal Society of Chemistry. A number of professors have received the Western New York Section of the American Chemical Society's Jacob F. Schoellkopf Medal. In addition, faculty members have received the Buck-Whitney Award, the Benedetti-Pichler Award, the Cope Award, the Morley Medal, the Gregori Aminoff Prize of the Royal Swedish Academy of Sciences, the Martin Buerger Award of the American Crystallographic Association, the Chancellor's Award for Excellence in Research, and the Research Innovation Award. Some of our professors have also been awarded the following distinctions: SUNY or UB Distinguished Professor, SUNY Outstanding Inventors Award, New York Section of the Society for Applied Spectroscopy Gold Medal Award, the National Science Foundation Creativity Award and the James D. Watson Investigator Award. Several of our professors hold Chaired positions: the A. Conger Goodyear Chair, the Capen Chair, the Larkin Chair, the Larkin Chair of Organic Chemistry, and the Woodburn Chair. Professors on staff have also received the SUNY First Patent Award, the UB Young Investigator Award, the SUNY Excellence in Pursuit of Knowledge, the Walton Visitor Award of the Irish Science Foundation, as well as the SUNY Entrepreneur Award and the Exxon Educational Foundation Fellowship. Additional awards include the Inventor of the Year from the local Niagara Frontier Technical Societies Council, which has been accepted by four of our professors. We are fortunate to have as members of our faculty the Chair of the Bioinorganic Division of the American Chemical Society for 2006 as well as the Chair of the Organic Division of the American Chemical Society. Professors have been elected secretary of the Division of Biology Chemistry, ACS.

See a list of our [Undergraduate Faculty](#).

Transfer Policy

It is recommended that students complete general chemistry (two semesters, plus lab) and calculus I-II (two semesters) in the freshman year; organic chemistry (two semesters, plus lab), analytical chemistry (at least one semester of lecture and one semester of lab), calculus III (one semester), and calculus-based physics (two semesters, one semester lab) in the sophomore year to facilitate transfer into the department. If there is a choice, courses specifically designated for science and/or engineering students should be selected. Transfer students must complete a minimum of 14 credit hours of University at Buffalo Chemistry department courses to receive the B.S. degree, and a minimum of 8 credit hours of UB Chemistry department courses to receive the B.A. degree.

Extracurricular Activities

[Student Affiliates of the American Chemical Society](#) (SAACS)

See the [UB Student Association](#).

Practical Experience and Special Academic Opportunities

Notable Program Features

Awards

Career Information and Further Study

The chemical industry introduces over a thousand new chemicals every year. Research chemists make new substances to order, predicting beforehand what characteristics can be expected. They prepare small amounts of the substances, while other scientists test samples. A new pharmaceutical, for example, must be widely tested for effectiveness and for possibly dangerous side effects. Chemical engineers design

Chemistry

equipment and develop process details for large-scale economic production and packaging. Processes are tested on a small scale in a pilot plant before full-scale production begins.

Skills gained in this program include:

- Preparing chemicals by combining other chemicals
- Developing new products for specific purposes
- Using heat, light, energy, and chemical catalysts to change substances
- Improving industrial processes
- Developing new, more economical methods for making chemicals
- Setting up, standardizing and using scientific instruments and equipment
- Devising new equipment for making, analyzing, storing, or transporting chemicals
- Analyzing substances (such as ores or drugs) to discover their composition
- Analyzing biological substances, such as herbal cures or hormones, and finding ways to duplicate them artificially
- Testing products to see if they meet specifications
- Identifying contaminants in products or in the air and water
- Finding uses for chemicals, including byproducts
- Predicting what will happen when chemicals are mixed under various conditions, and warning of hazards
- Using logic, scientific thinking, and knowledge of natural laws to solve problems in industry, agriculture, mining, medicine, or space
- Organizing large projects by harnessing the talents of diverse groups of people and allocating responsibilities accordingly
- Teaching, instructing, and consulting various people and organizations on complex issues and theories
- Using complex pieces of equipment for data input and analysis
- Impacting political environments to produce changes
- Writing and explaining complex information in a way that is readily understandable to others

Career Choices

Various specializations are possible in chemistry. Environmental chemists study the chemistry of air, soil, and water pollution. Organic chemists specialize in carbon compounds. Biochemists study the chemical reactions (involving acids, proteins, steroids, and enzymes) that make life possible. Clinical chemists specialize in diagnostic tests, pharmaceutical chemists in drugs, and metallurgists in metals and alloys. Forensic chemists work with law enforcement to solve crimes.

What percentage of graduates goes on to find related employment?

>90%

Potential career areas include:

- Education
- Electronics
- Environmental science
- Food and drug administration worker
- Forensic science
- Government lab research
- Industrial research
- Medicine and health related fields
- NASA
- Oceanography
- Patent or environmental law
- Petroleum products
- Pharmaceuticals
- Pollution analysis
- Specialty chemicals
- Veterinary medicine
- Waste disposal research

Work settings include:

- Ceramic/glass distributors
- Chemical/pharmaceutical sales and retail
- Chemical producers
- Clothing manufacturers companies
- Conservation labs
- Dairy producers
- Drug research centers
- Engineering firms

Chemistry

- Equipment (chemical) manufacturers
- Food manufacturers
- Government agencies
- Government health agencies
- Hospitals
- Industrial firms
- Industries with pollution
- Insurance companies
- Law office/self employed lawyer
- Medical schools
- Mining companies
- Museums
- National/state parks service
- Pharmaceutical companies
- Pharmacy
- Petroleum refineries
- Private research foundations
- Secondary schools
- Technical libraries
- Technical publishers/journal editors
- Universities/colleges
- U.S. Patent Office

Degree Level Required

An advanced degree is needed for research; a Ph.D. for teaching in a college or university. Without an advanced degree, chemists work as assistants or technicians, doing analyses, preparing chemicals to formula, or doing quality-control work. According to the ACS salary survey 2004, the median base salary for bachelor's degree graduates is \$52,766 (with median salaries of \$63,000, \$58,000, and \$36,000 for industry, government, and academia respectively). The median base salary for chemical engineers was \$73,000 with a bachelor's degree.

Salary Information

Salaries can vary greatly among different occupations, geographic areas, organizations and companies.

What percentage of graduates goes on to graduate school?

45%

Degrees Offered

Undergraduate: BA, BS, Minor

Graduate: MA, PhD

Links to Further Information About this Program

- [Undergraduate Catalog](#)
- [Undergraduate Admissions](#)
- [Graduate Admissions](#)
- [Department of Chemistry](#)
- [College of Arts and Sciences](#)

Chemistry - B.S.

Acceptance Criteria

Minimum GPA of 2.0 overall.

Pre- or corequisites for admission are [CHE 101-CHE 102](#) or [CHE 105-CHE 106](#) or [CHE 107-CHE 108](#), and [MTH 141-MTH 142](#), or permission of the Director of Undergraduate Studies.

Advising Notes

Students should apply for admission to the department as soon as possible.

Chemistry

Prerequisite Courses

[MTH 141](#) College Calculus I
[MTH 142](#) College Calculus II
[CHE 101-CHE 102](#) General Chemistry or [CHE 105-CHE 106](#) Chemistry: Principles and Applications (recommended) or [CHE 107-CHE 108](#) General Chemistry for Engineers

Required Courses

[CHE 201-CHE 202](#) Organic Chemistry
[CHE 214](#) Introduction to Analytical Chemistry
[CHE 215](#) Introduction to Analytical Chemistry Laboratory
[CHE 301](#) Intermediate Organic Lab or [CHE 330](#) Physical Chemistry Laboratory II
[CHE 312](#) Chemistry of Biological Systems
[CHE 319](#) Physical Chemistry Lecture I
[CHE 320](#) Physical Chemistry Lecture II
[CHE 321](#) Inorganic Chemistry I
[CHE 322](#) Inorganic Chemistry II
[CHE 329](#) Physical Chemistry Laboratory I
[CHE 376](#) Introduction to Chemical Literature
[CHE 413](#) Instrumental Analysis
[CHE 414](#) Instrumental Analysis Lab
[MTH 141](#) College Calculus I
[MTH 142](#) College Calculus II
[MTH 241](#) College Calculus III
[PHY 107](#) General Physics I
[PHY 108](#) General Physics II
[PHY 158](#) General Physics II Lab
 One advanced math course ([MTH 306](#) or [MTH 309](#) recommended)
 One science or math elective
 One 400-level chemistry lecture course (excluding [CHE 498](#))

Summary

Total required credit hours for the major: 80-83

See [Baccalaureate Degree Requirements](#) for general education and remaining university requirements.

Recommended Sequence of Program Requirements

FIRST YEAR

Fall [MTH 141](#), [PHY 107](#), [CHE 105](#)
 Spring [MTH 142](#), [PHY 108](#), [PHY 158](#), [CHE 106](#)

SECOND YEAR

Fall [CHE 214](#), [MTH 241](#)
 Spring [CHE 215](#), [CHE 201-CHE 202](#), and one advanced math course ([MTH 306](#) or [MTH 309](#) recommended)

THIRD YEAR

Fall [CHE 301*](#), [CHE 319](#), [CHE 321](#), [CHE 329](#)
 Spring [CHE 312](#), [CHE 320](#), [CHE 322](#), [CHE 330*](#), [CHE 376](#)

FOURTH YEAR

Fall [CHE 413](#), one science or math elective
 Spring [CHE 414](#); [CHE 498](#) Senior Research (recommended, but not required)
 Fall or Spring One 400-level chemistry lecture course

**Students may take one or the other of the labs. Both are recommended.*

Chemistry - B.A.

Acceptance Criteria

Minimum GPA of 2.0 overall.
 Pre- or corequisites for admission are [CHE 101-CHE 102](#) or [CHE 105-CHE 106](#) or [CHE 107-CHE 108](#), and [MTH 121-MTH 122](#), or permission of the Director of Undergraduate Studies.

Chemistry

Advising Notes

Students should apply for admission to the department as early as possible.

Students who follow the B.A. program cannot switch from the B.A. to the B.S. program until [PHY 107-PHY 108-PHY 158](#) and [MTH 141- MTH 142-MTH 241](#) are completed, or with permission of the Director of Undergraduate Studies.

Prerequisite Courses

[CHE 101-CHE 102](#) General Chemistry or [CHE 105-CHE 106](#) Chemistry: Principles and Applications (recommended) or [CHE 107-CHE 108](#) General Chemistry for Engineers

[MTH 121](#) Survey of Calculus and Its Applications I or [MTH 141](#) College Calculus I

[MTH 122](#) Survey of Calculus and Its Applications II or [MTH 142](#) College Calculus II

Required Courses

[CHE 201-CHE 202](#) Organic Chemistry

[CHE 214](#) Introduction to Analytical Chemistry

[CHE 215](#) Introduction to Analytical Chemistry Laboratory

[CHE 321](#) Inorganic Chemistry I

[CHE 349](#) Physical Chemistry for Life Sciences*

[PHY 101-PHY 102](#) and [PHY 151-PHY 152](#) College Physics I-II w/lab or [PHY 107](#) and [PHY 108/PHY 158](#) General Physics I-II w/lab

One laboratory course chosen from [CHE 301](#), [CHE 322](#), [CHE 329](#), [CHE 330](#), [CHE 350](#)

Three science or math electives at or above the 200 level (See advisor for choices)

Summary

Total required credit hours for the major: 55-65

See [Baccalaureate Degree Requirements](#) for general education and remaining university requirements.

Recommended Sequence of Program Requirements

FIRST YEAR

Fall [MTH 121](#) or [MTH 141](#); [PHY 101/PHY 151](#) or [PHY 107](#); [CHE 105](#)

Spring [MTH 122](#) or [MTH 142](#); [PHY 102/PHY 152](#) or [PHY 108/PHY 158](#); [CHE 106](#)

SECOND YEAR

Fall [CHE 214](#); [CHE 201](#); one science or math elective

Spring [CHE 215](#); [CHE 202](#)

THIRD YEAR

Fall [CHE 321](#), [CHE 349](#)*

Fall and/or Spring Two science or math electives

Fall or Spring One laboratory course

FOURTH YEAR

Fall and Spring Electives

Fall and/or Spring [CHE 498](#) Senior Research (recommended but not required)

*Students may substitute the two lecture courses [CHE 319-CHE 320](#) Physical Chemistry for [CHE 349](#) Physical Chemistry for Life Sciences. If students elect to enroll in [CHE 319-CHE 320](#), they must complete both semesters.

Chemistry - Minor

Acceptance Criteria

Completion of [CHE 101](#) or [CHE 105](#) or [CHE 107](#); [MTH 121](#) or [MTH 141](#); or permission of the director of undergraduate studies.

Minimum GPA of 2.0 in prerequisite courses.

Prerequisite Courses

[CHE 101](#) or [CHE 105](#) or [CHE 107](#)

[MTH 121](#) or [MTH 141](#)

Required Courses

Chemistry

[CHE 102](#) or [CHE 106](#) or [CHE 108](#); [CHE 201-CHE 202](#); [MTH 122](#) or [MTH 142](#)

10 additional credit hours in 300/400-level chemistry courses. [CHE 214-CHE 215](#) can be used as one of these courses.

CHE 101: General Chemistry Lecture

Credits: 5

Semester(s): Fall, Spring, Summer

Type: LEC

This course is a limited enrollment (impacted) course. Students who have previously attempted the course and received a grade other than W may not register for this course during the fall or spring semester.

Introduces fundamental concepts of chemistry, and surveys important chemical elements and their compounds. Three hours of lecture plus one four-hour recitation/laboratory period weekly. This course is a controlled enrollment (impacted) course. Students who have previously attempted the course and received a grade other than W may repeat the course in the summer or only in the fall or spring semester with a petition to the College of Arts and Sciences Deans' Office.

CHE 102: General Chemistry Lecture

Credits: 5

Semester(s): Fall, Spring, Summer

Type: LEC

This course is a limited enrollment (impacted) course. Students who have previously attempted the course and received a grade other than W may not register for this course during the fall or spring semester.

Introduces fundamental concepts of chemistry, and surveys important chemical elements and their compounds. Three hours of lecture plus one four-hour recitation/laboratory period weekly. This course is a controlled enrollment (impacted) course. Students who have previously attempted the course and received a grade other than W may repeat the course in the summer or only in the fall or spring semester with a petition to the College of Arts and Sciences Deans' Office.

CHE 105: Chemistry: Principles and Applications

Credits: 5

Semester(s): Fall

Type: LEC/LAB/REC

Introduces the principles of chemistry and their applications. For students who are interested in majoring in a chemistry-related science. Three hours of lecture plus one four-hour recitation/laboratory period weekly.

CHE 106: Chemistry: Principles and Applications

Credits: 5

Semester(s): Spring

Pre-requisites: [CHE 105](#)

Type: LEC/LAB/REC

Introduces the principles of chemistry and their applications. For students who are interested in majoring in a chemistry-related science. Three hours of lecture plus one four-hour recitation/laboratory period weekly.

CHE 107: General Chemistry for Engineers Lecture

Credits: 4

Semester(s): Fall

Pre-requisites: Engineering major

Co-requisites: Students must enroll in CHE 107LEC and CHE 107LBR in the same term.

Type: LEC

This course is a limited enrollment (impacted) course. Students who have previously attempted the course and received a grade other than W may not register for this course during the fall or spring semester.

Meets the general chemistry requirement for students wishing to receive an engineering degree.

CHE 108: General Chemistry for Engineers

Credits: 4

Semester(s): Spring

Pre-requisites: [CHE 107](#)

Type: LEC/LAB/REC

This course is a limited enrollment (impacted) course. Students who have previously attempted the course and received a grade other than W may not register for this course during the fall or spring semester.

Meets the general chemistry requirement for students wishing to receive an engineering degree in four years. Cannot be used for science distribution credit.

CHE 111: General Chemistry

Credits: 4

Semester(s): Fall, Spring, Summer

Type: LEC/REC

Consists of the lecture and recitation components of [CHE 101](#) without laboratory.

CHE 112: General Chemistry

Credits: 4

Semester(s): Fall, Spring, Summer

Type: LEC/REC

Chemistry

Consists of the lecture and recitation components of [CHE 102](#) without laboratory.

CHE 113: General Chemistry

Credits: 1
Semester(s): Fall, Spring, Summer
Type: LAB/REC

Consists of the recitation and lab components of [CHE 101](#) without lecture.

CHE 114: General Chemistry

Credits: 1
Semester(s): Fall, Spring, Summer
Pre-requisites: [CHE 101](#)
Type: LAB/REC

Consists of the recitation and lab components of [CHE 102](#) without lecture.

CHE 121: Introduction to General, Organic, and Biological Chemistry

Credits: 3
Type: LEC

This is a one-semester course that surveys basic principles of chemistry as they apply to careers in the health-related sciences (e.g., nursing). The student will be exposed to basic chemical principles, mathematical reasoning and understanding of numerical data, chemical reactivity and stoichiometry, measurements and matter, and how these are related to living organisms.

CHE 201: Organic Chemistry Lecture

Credits: 5
Semester(s): Fall, Summer
Pre-requisites: [CHE 102](#) Or [CHE 106](#) Or [CHE 108](#)
Co-requisites: Students must enroll in CHE 201LEC and CHE 201LBR in the same term.
Type: LEC

This course is a limited enrollment (impacted) course. Students who have previously attempted the course and received a grade other than W may not register for this course during the fall or spring semester.

Comprehensive survey of major classes of aliphatic and aromatic compounds, emphasizing bonding, reaction mechanisms, stereochemistry, and synthesis. This course is a controlled enrollment (impacted) course. Students who have previously attempted the course and received a grade other than W may repeat the course in the summer or only in the fall or spring semester with a petition to the College of Arts and Sciences Deans' Office.

CHE 202: Organic Chemistry Lecture

Credits: 5
Semester(s): Spring, Summer
Pre-requisites: [CHE 201](#)
Type: LEC

This course is a limited enrollment (impacted) course. Students who have previously attempted the course and received a grade other than W may not register for this course during the fall or spring semester.

Continuation of [CHE 201](#). Three hours of lecture and one hour of recitation weekly plus a minimum of three hours of laboratory weekly. This course is a controlled enrollment (impacted) course. Students who have previously attempted the course and received a grade other than W may repeat the course in the summer or only in the fall or spring semester with a petition to the College of Arts and Sciences Deans' Office.

CHE 203: Organic Chemistry

Credits: 3
Semester(s): Fall, Summer
Pre-requisites: [CHE 102](#) or [CHE 106](#) or [CHE 108](#)
Type: LEC

Consists of the lecture component of [CHE 201](#) without laboratory.

CHE 204: Organic Chemistry

Credits: 3
Semester(s): Spring, Summer
Pre-requisites: [CHE 201](#) or [CHE 203](#)
Type: LEC

Consists of the lecture component of [CHE 202](#) without laboratory.

CHE 214: Introduction to Analytical Chemistry

Credits: 3
Semester(s): Fall
Pre-requisites: [CHE 102](#) or [CHE 106](#) or [CHE 108](#)
Type: LEC

Surveys classical methods of chemical analysis and underlying concepts. Introduces instrumental analysis theory, particularly spectroscopy and separations.

CHE 215: Introduction to Analytical Chemistry Laboratory

Credits: 2
Semester(s): Spring
Pre-requisites: [CHE 214](#)
Type: LAB

Surveys laboratory methods and techniques in analytical chemistry. Introduces instrumental analysis.

CHE 251: Contemporary Organic Chemistry

Credits: 5
Semester(s): Fall
Pre-requisites: [CHE 102](#) Or [CHE 106](#) Or [CHE 108](#)
Type: LEC/LAB/REC

For chemistry majors and interested students who are majoring in related sciences. Serves as a small class-setting alternative to [CHE 201-CHE 202](#). Both [CHE 251](#) and [CHE 252](#) provide three hours of lecture and one hour of recitation plus a minimum of three hours of

Chemistry

laboratory weekly.

CHE 252: Contemporary Organic Chemistry

Credits: 5
Semester(s): Spring
Pre-requisites: [CHE 251](#)
Type: LEC/LAB/REC

For chemistry majors and interested students who are majoring in related sciences. Serves as a small class-setting alternative to [CHE 201-CHE 202](#). Both [CHE 251](#), and [CHE 252](#) provide three hours of lecture and one hour of recitation plus a minimum of three hours of laboratory weekly.

CHE 290: Undergraduate Research

Credits: 1
Semester(s): Fall, Spring, Summer
Pre-requisites: [CHE 102](#) Or [CHE 106](#) Or [CHE 108](#) Or Permission of Instructor
Type: LAB

The content of this course is variable and therefore it is repeatable for credit. The [University Grade Repeat Policy](#) does not apply.

Introduces research methods in chemistry under the direction of a chemistry faculty member.

CHE 301: Intermediate Organic Chemistry Lab

Credits: 1
Semester(s): Fall
Pre-requisites: [CHE 202](#) or [CHE 252](#) or Permission of Instructor
Co-requisites: Students must complete CHE 301LAB, LEC, and REC in the same semester.
Type: LAB

This laboratory-based course is designed to prepare the student for independent laboratory research. The experiments will build on knowledge obtained from sophomore organic chemistry. The curriculum integrates techniques, organic synthesis, purification and spectroscopic analysis. Observational skills and record keeping are also emphasized. The lab curriculum includes experiments with the student's data summarized in a formal lab report. Four experiments will be done, emphasizing the importance of metal-catalyzed reactions in modern organic synthesis. The course has one weekly lecture (required, every week) and two 3-hour lab periods held on alternating weeks. The A lecture goes together with the A labs and the B lecture goes together with the B labs. Section A labs meet on odd-numbered weeks and section B labs meet on even-numbered weeks. The first week of the semester is odd-numbered. If you register for lecture A, you will enroll in either of the two lab sections, A1 or A2. The labs for the A-lecture meet on odd weeks of the semester, weeks 1,3,5,7,9,11,13 and no lab will be held on the even weeks. During the even weeks, you will not meet for lab. More detailed information will be available in the syllabus. The first week of lab is check-in and a technique assignment: section A students, please be sure to bring lab goggles, a combination lock and your lab notebook to the first week of class.

CHE 312: Chemistry of Biological Systems

Credits: 3
Semester(s): Spring

Pre-requisites: [CHE 202](#) or [CHE 252](#); and [CHE 319](#) or [CHE 349](#); or permission of instructor
Type: LEC

Develops and integrates chemical principles from sophomore- and junior- level courses into lectures on the structure and function of biological molecules. Emphasizes concepts and methods from the core disciplines of chemistry.

CHE 319: Physical Chemistry

Credits: 3
Semester(s): Fall
Type: LEC

Examines elementary physical chemistry, including chemical thermodynamics, phase equilibria, chemical equilibria, electrochemistry, and chemical kinetics. Introduces chemical bonding, molecular structure, and spectroscopy.

CHE 320: Physical Chemistry

Credits: 3
Semester(s): Spring
Pre-requisites: [CHE 319](#)
Type: LEC

Examines elementary physical chemistry, including chemical thermodynamics, phase equilibria, chemical equilibria, electrochemistry, and chemical kinetics. Introduces chemical bonding, molecular structure, and spectroscopy.

CHE 321: Inorganic Chemistry I

Credits: 3
Semester(s): Fall
Type: LEC

Surveys the chemistry of the elements. Emphasizes atomic and molecular structure, bonding theories, and relevant application. Three hours of lecture weekly.

CHE 322: Inorganic Chemistry II

Credits: 3
Semester(s): Spring
Pre-requisites: [CHE 321](#) or Permission of Instructor
Type: LEC/LAB

Consists of a laboratory in the solution of chemical problems, dealing with inorganic and organometallic compounds, by experimental methods.

CHE 329: Physical Chemistry Laboratory I

Credits: 2
Semester(s): Fall
Type: LAB

Consists of both laboratory and lecture. Involves techniques of making physical measurements on chemical systems and the statistical treatment of experimental data. Illustrates the theoretical development of physical chemistry given in [CHE 319-CHE 320](#). Alternates one five-hour laboratory or one two-hour

Chemistry

lecture/discussion weekly.

CHE 330: Physical Chemistry Laboratory II

Credits: 2
Semester(s): Spring
Pre-requisites: [CHE 319](#) or Permission of Instructor
Type: LAB

Explores applications of computers in chemistry: numeric and symbolic computation, statistical analysis of experimental data, molecular modeling, quantum chemistry.

CHE 334: Physical Chemistry for Chemical Engineers

Credits: 3
Semester(s): Fall
Type: LEC

Complements [CE 304](#). For chemical engineering majors. Topics include kinetic molecular theory, statistical thermodynamics, reaction rate theory, quantum chemistry, spectroscopy and surface chemistry.

CHE 349: Physical Chemistry for Life Sciences

Credits: 3
Semester(s): Fall
Pre-requisites: [CHE 202](#) or [CHE 252](#); [MTH 122](#) or [MTH 142](#); or permission of instructor
Type: LEC

A one-semester course in physical chemistry covering the same general topics as [CHE 319-CHE 320](#), but in less depth, focusing on applications to biological systems. Three hours of lecture per week.

CHE 350: Physical Chemistry for Life Sciences Laboratory

Credits: 1
Semester(s): Fall
Type: LAB

Consists of the laboratory portion of [CHE 349](#).

CHE 376: Introduction to Chemical Literature

Credits: 3
Semester(s): Spring
Pre-requisites: Chemistry Major; [CHE 202](#) or [CHE 252](#); [CHE 214](#); [CHE 319](#) or [CHE 349](#); or permission of instructor
Type: LEC/LAB

Explores sources and techniques of chemical literature use. Technical report writing. Three hours weekly of discussion plus assignments.

CHE 413: Instrumental Analysis

Credits: 3
Semester(s): Fall
Pre-requisites: [CHE 202](#) or [CHE 252](#); [CHE 215](#); [CHE 319](#) or [CHE 349](#); or permission of instructor
Type: LEC

Explores instrumental techniques for chemical analysis, including electrochemistry, theory, and methods of separation, spectroscopic methods.

CHE 414: Instrumental Analysis Laboratory

Credits: 1
Semester(s): Spring
Pre-requisites: [CHE 413](#)
Type: LAB

Consists of the laboratory portion of [CHE 413](#).

CHE 416: Chemical Spectroscopy

Credits: 3
Semester(s): Fall
Type: LEC

A one-semester introduction to concepts and methods of molecular spectroscopy. Emphasizes the physical principles rather than applications. Subjects include: rotational, vibrational, electronic and nuclear magnetic resonance transitions as measured by microwave, infrared, visible, ultraviolet, Raman (including resonance Raman) and NMR spectroscopies, normal mode analysis; and the principles of Fourier transform methods as applied to NMR and to FTIR (including traditional FTIR based on the Michelson interferometer and to more recently developed time-resolved FTIR for observing very fast chemical processes). Appropriate for upper-level undergraduate chemistry majors and others with a similar chemistry background. Three hours of lecture/recitation weekly.

CHE 423: Advanced Inorganic Chemistry

Credits: 3
Semester(s): Fall
Pre-requisites: [CHE 321](#); and [CHE 319](#) or [CHE 349](#); or Permission of Instructor
Type: LEC

Consists of advanced topics in inorganic chemistry, usually including chemical applications of group theory. Three hours of lecture weekly. Not offered every year.

CHE 455: Advanced Organic Chemistry

Credits: 3
Semester(s): Spring
Pre-requisites: [CHE 202](#) or [CHE 252](#); and [CHE 319](#) or [CHE 349](#); or Permission of Instructor
Type: LEC

Consists of selected advanced topics in organic chemistry. Three hours of lecture weekly.

CHE 457: Advanced Physical Chemistry

Credits: 3
Semester(s): Fall
Pre-requisites: [CHE 202](#) or [CHE 252](#); [CHE 319](#); or permission of instructor.
Type: LEC

Chemistry

Selected topics, including quantum theory, molecular structure, statistical mechanics, thermodynamics, and chemical kinetics.

CHE 458: Advanced Physical Chemistry

Credits: 3

Semester(s): Spring

Pre-requisites: [CHE 202](#) or [CHE 252](#); [CHE 319](#); or permission of instructor

Type: LEC

Selected topics: quantum theory, molecular structure, statistical mechanics, thermodynamics, chemical kinetics.

CHE 470: Analytical Chemistry of Pollutants

Credits: 2

Semester(s): Spring

Pre-requisites: [CHE 202](#) or [CHE 252](#); [CHE 214](#); [CHE 319](#) or [CHE 349](#); or permission of instructor

Type: LEC/LAB

Involves techniques of sampling, interpretation of data, and instrumentation dealing primarily with trace contaminants in air, water, and soils. Laboratory project required. May not be offered every year.

CHE 498: Senior Research

Credits: 1-3

Semester(s): Fall, Spring, Summer

Pre-requisites: Senior or Junior standing in the Department and Permission of Instructor

Type: TUT

Supervised research under the direction of a chemistry faculty member. May be taken more than one semester.