Program
BS in Chemistry
Options in:
  Biochemistry
  Professional Chemistry
American Chemical Society
Certificate in Chemistry
Minor in Chemistry
Pre-professional Programs:
  Dentistry
  Medicine
  Optometry
  Pharmacy
Pre-physical Therapy
Single Subject Teaching
Credential in Science

Faculty and Facilities
The Committee on Professional Training of the American Chemical Society has approved the chemistry faculty, facilities, and curriculum. This is a clear statement of the quality of our program and our graduates to anyone in the field.

There are eleven permanent faculty with Ph.D.’s in chemistry, representing the major areas of the science. The small size of most major courses assures students of friendly, close contact with the faculty allowing for hands-on learning of techniques and instrumentation. Short-term research projects with faculty are accessible to all chemistry students. The Department of Chemistry is housed in the Physical Science Building and includes eleven laboratories and a number of specialized instrument and project rooms.

Career Outlook
A bachelor’s degree in chemistry is the minimum requirement for starting a career as a chemist. Graduate training is necessary for most research and college teaching positions. Nearly two-fifths of all chemists are involved in research and development — extending scientific knowledge and creating new products. Nearly one-fifth work in production and inspection activities. Others work as analysts in forensics or environmental laboratories, professors in colleges and universities, as consultants in industry and government agencies, and marketing or sales representatives.

Growth in demand for industrial products (plastics, man-made fibers, pharmaceuticals, and fertilizers), the recognition of the need for pollution control, and improved health care programs will increase opportunities for chemists. In addition, new and more efficient fuels or fuel cells must be developed to stem energy shortages. Larger enrollments in chemistry education in the future will increase the need for chemists to teach at universities, community colleges, and high schools.
THE BACHELOR OF SCIENCE IN CHEMISTRY

Total Course Requirements for the Bachelor's Degree: 128 units

See “Requirements for the Bachelor's Degree” in The University Catalog for complete details on general degree requirements. A minimum of 40 units, including those required for the major, must be upper division.

The department has prepared a suggested Four Year Advising Plan to help students meet all graduation requirements within four years. Please request a plan from your major adviser or view it and other current advising information on the CSU, Chico Web.

General Education Requirements: 48 units

See “General Education Requirements” in The University Catalog and The Class Schedule for the most current information on General Education Requirements and course offerings. The course requirements marked below with an asterisk (*) may also be applied toward General Education.

BIOL 006A may be used to fulfill General Education Breadth Area B2 for the Option in Biochemistry or the Option in Professional Chemistry.

Cultural Diversity Course Requirements: 6 units

See “Cultural Diversity” in The University Catalog. Most courses used to satisfy these requirements may also apply to General Education.

American Institutions Requirement: 6 units

See the “American Institutions Requirement” under “Bachelor's Degree Requirements.” This requirement is normally fulfilled by completing HIST 050 and POLS 055. Courses used to satisfy this requirement do not apply to General Education.

Literacy Requirement:

See “Mathematics and Writing Requirements” in The University Catalog. Writing proficiency in the major is a graduation requirement and may be demonstrated through satisfactory completion of a course in your major which has been designated as the Writing Proficiency (WP) course for the semester in which you take the course. Students who earn below a C- are required to repeat the course and earn a C- or better to receive WP credit. See The Class Schedule for the designated WP courses for each semester. You must pass ENGL 001 (or its equivalent) with a C- or better before you may register for a WP course.

Course Requirements for the Major: 69-78 units

The following courses, or their approved transfer equivalents, are required dependent upon the option chosen. Students must select one of the following options for completion of the major course requirements.

THE OPTION IN PROFESSIONAL CHEMISTRY: 16-18 units

6 courses required:

CHEM 214A Intermediate Inorganic Chemistry 3.0 FS
Prerequisites: CHEM 210A.
CHEM 215A Integrated Chemistry Lab I 3.0 FA
Prerequisites: Concurrent enrollment in or prior completion of CHEM 210A and CHEM 214A.
CHEM 215B Integrated Chemistry Lab II 2.0 SP
Prerequisites: CHEM 210A, CHEM 214A, CHEM 215A; concurrent enrollment in or prior completion of CHEM 210B, CHEM 218.
CHEM 215C Integrated Chemistry Lab III 2.0 FA
Prerequisites: CHEM 215A, CHEM 215B.
CHEM 218 Instrumental Analysis 2.0 SP
Prerequisites: CHEM 210A, CHEM 211A; concurrent enrollment in CHEM 215B.
CHEM 250A Biochemistry 3.0 FS
Prerequisites: CHEM 170.

1-3 units selected from:

CHEM 172 Advanced Organic Laboratory 2.0 FS
Prerequisites: CHEM 170.
CHEM 198 Special Topics 1.0-3.0 FS
Prerequisites: CHEM 038.
CHEM 200 Research in Chemistry 1.0-2.0 FS
Prerequisites: CHEM 210B.
CHEM 214B Intermediate Inorganic Chemistry 2.0 SP
Prerequisites: CHEM 214A.
CHEM 227 Physical Organic Chemistry 3.0 SP
Prerequisites: CHEM 170, CHEM 210B.
CHEM 228 Synthetic Organic Chemistry 1.0-3.0 FA
Prerequisites: CHEM 170; CHEM 170L or CHEM 170M.
CHEM 250B Biochemistry 3.0 SP
Prerequisites: CHEM 250A.

CHEM 251 Biochemistry Laboratory 2.0 FS
Prerequisites: CHEM 105, CHEM 250A; CHEM 170L or CHEM 170M.
CHEM 252 Clinical Chemistry 3.0 SP
Prerequisites: CHEM 105, CHEM 250A; CHEM 170L or CHEM 170M.
CHEM 271 Seminar Organic Spectroscopy 1.0 FS
Prerequisites: Concurrent enrollment in or prior completion of CHEM 170.
CHEM 280 Selected Topics in Chemistry 1.0-3.0 FS
Prerequisites: CHEM 210B, CHEM 214A, CHEM 215B, CHEM 218.
CHEM 281 Selected Topics in Chemistry 1.0-3.0 SP
Prerequisites: CHEM 170, CHEM 210A, CHEM 250A.
CHEM 285A Research Project 3.0 FA
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; faculty permission.

Lower-Division Chemistry Requirement: 12 units

3 courses required:

CHEM 037 General Chemistry 4.0 FS *
Prerequisites: Second-year high school algebra; one year high school chemistry or CHEM 016. (One year of high school physics and one year of high school mathematics past Algebra II are recommended.)
CHEM 038 General Chemistry 4.0 FS
Prerequisites: CHEM 037.
CHEM 070 Organic Chemistry 4.0 FS
Prerequisites: CHEM 038.

Lower-Division Core Program: 53 units

Lower-Division Core: 36 units

Mathematics Requirement: 12 units

3 courses required:

MATH 007A Analytic Geometry and Calculus 4.0 FS *
Prerequisites: Completion of ELM requirement; both MATH 004 and MATH 006 (or high school equivalent); a score that meets department guidelines on a department administered calculus readiness exam.
MATH 007B Analytic Geometry and Calculus 4.0 FS
Prerequisites: Completion of ELM requirement; MATH 007A with a grade of C- or higher.
MATH 007C Analytic Geometry and Calculus 4.0 FS
Prerequisites: Completion of ELM requirement; MATH 007B with a grade of C- or higher.

Physics Requirement: 12 units

3 courses required:

PHYS 004A Mechanics 4.0 FS *
Prerequisites: High school physics or faculty permission. Concurrent enrollment in or prior completion of MATH 007B (second semester of calculus) or equivalent.
PHYS 004B Electricity and Magnetism 4.0 FS
Prerequisites: MATH 007B, PHYS 004A.
PHYS 004C Heat/Wave Motion/Sound/Light 4.0 FS
Prerequisites: MATH 007B, PHYS 004A.
The Advising Requirement:

Credit/No Credit grading only.

The Electives Requirement:

To complete the total units required for the bachelor’s degree, select additional elective courses from the total university offerings. You should consult with an adviser regarding the selection of courses which will provide breadth to your university experience and apply to a supportable second major or minor.

Grading Requirement:

All courses taken to fulfill major course requirements must be taken for a letter grade, except those courses specified by the department as Credit/No Credit grading only.

Advising Requirement:

Advising is mandatory for all majors in this degree program. Consult your department chair or undergraduate adviser for specific information.

Chemistry

Honors in the Major

Honors in the Major is a program of independent work in your major. It involves 6 units of honors course work completed over two semesters. Your Honors work will be recognized at your graduation, on your permanent transcripts, and on your diploma. It is often accompanied by letters of commendation from your mentor in the department or the department chair. Most importantly, however, the Honors in the Major program allows you to work closely with a faculty mentor in your area of interest on an original research project or research seminar. This year-long collaboration allows you to work in your field at a professional level and culminates in a public presentation of your work. Students sometimes take their projects beyond the university for submission in professional journals, presentation at conferences, or competition in shows; such experience is valuable for graduate school and later professional life.

Some common features of Honors in the Major program are:

1. You must take 6 units of Honors in the Major course work. At least 3 of these 6 units are independent study (299H) as specified by your department. You must complete each class with a minimum grade of B.
2. You must have completed 9 units of upper-division course work or 21 overall units in your major before you can be admitted to Honors in the Major. Check the requirements carefully, as there may be specific courses that must be included in these units.
3. Your cumulative GPA should be at least 3.5 or within the top 5 percent of majors in your department.
4. Your GPA in your major should be at least 3.5 or within the top 5 percent of majors in your department.
5. Most students apply for or are invited to participate in Honors in the Major during the second semester of their junior year. Then they complete the 6 units of course work over the two semesters of their senior year.
6. Your honors work culminates with a public presentation of your Honors project.

While Honors in the Major is part of the Honors Program, each department administers its own program. Please contact your major department or major adviser for further information.

American Chemical Society Certificate in Chemistry

Course Requirements for the Certificate: 73 units

The following courses, or their approved transfer equivalents, are required of all candidates for this certificate.

Students who complete this program will be awarded a degree in chemistry which will be certified by the American Chemical Society as well as a certificate from CSU, Chico. (Note: ACS requirements change only rarely, but interested students should verify requirements with the Chair of the Department of Chemistry.) Current requirements include the 53-unit core required in the chemistry major and the following additional 20 units. These courses also satisfy the Option in Professional Chemistry.

7 courses required:

CHEM 214A Intermediate Inorganic Chemistry 3.0 FA
Prerequisites: CHEM 210A.

CHEM 214B Intermediate Inorganic Chemistry 2.0 SP
Prerequisites: CHEM 214A.

CHEM 215A Integrated Chemistry Lab I 3.0 FA
Prerequisites: Concurrent enrollment in or prior completion of CHEM 210A and CHEM 214A.

CHEM 215B Integrated Chemistry Lab II 2.0 SP
Prerequisites: CHEM 210A, CHEM 214A, CHEM 215A; concurrent enrollment in or prior completion of CHEM 210B, CHEM 218.

CHEM 215C Integrated Chemistry Lab III 2.0 FA
Prerequisites: CHEM 215A, CHEM 215B.

CHEM 218 Instrumental Analysis 2.0 SP
Prerequisites: CHEM 210A, CHEM 215A; concurrent enrollment in CHEM 215B.

CHEM 250A Biochemistry 3.0 FS
Prerequisites: CHEM 170.

3 units selected from:

CHEM 172 Advanced Organic Laboratory 2.0 FS
Prerequisites: CHEM 170.

CHEM 200 Research in Chemistry 1.0-2.0 FS
Prerequisites: CHEM 210B.

CHEM 227 Physical Organic Chemistry 3.0 SP
Prerequisites: CHEM 170, CHEM 210B.

CHEM 228 Synthetic Organic Chemistry 1.0-3.0 FA
Prerequisites: CHEM 170; CHEM 170L or CHEM 170M.

CHEM 250B Biochemistry 3.0 SP
Prerequisites: CHEM 250A.
**Chemistry**

CHEM 251 Biochemistry Laboratory 2.0 FS
Prerequisites: CHEM 105, CHEM 250A, CHEM 170L or CHEM 170M.

CHEM 285A Research Project 3.0 FA
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; faculty permission.

CHEM 285B Research Project 3.0 SP
Prerequisites: CHEM 285A. Not open to students who have completed CHEM 299H; faculty permission.

CHEM 299H Honors Research Project 3.0 FS
Prerequisites: ENGL 001 (or its equivalent) with a grade of C- or higher; CHEM 105, CHEM 170M, CHEM 210A, CHEM 210B, MATH 007C, PHYS 004A, PHYS 004B, PHYS 004C, faculty permission.

With permission of the Chemistry Department, other courses may be substituted.

**PRE-PROFESSIONAL PROGRAMS**

**Pre-Dentistry: 32 units recommended**

Entrance into dental school requires from two to four years of pre-dental training. Ordinarily a pre-dental student should plan on pursuing a BS degree program. It is not necessary that this degree be in one of the sciences. Details about entrance requirements differ considerably from one dental school to another. Further information should be sought from one of the pre-dental advisers and from the booklet entitled, *Entrance Requirements of American Dental Schools*.

The following list represents the California State University equivalent of the requirements and recommendations common to practically all of the American Dental Schools.

**Recommended Courses**

**BIOL 008** Principles of Biology 3.0 FS *
Prerequisites: High school biology and chemistry.

**BIOL 010** General Zoology 3.0 FS
Prerequisites: BIOL 008 or faculty permission.

**CHEM 037** General Chemistry 4.0 FS *
Prerequisites: Second-year high school algebra; one year high school chemistry or CHEM 016. (One year of high school physics and one year of high school mathematics past Algebra II are recommended.)

**CHEM 038** General Chemistry 4.0 FS
Prerequisites: CHEM 037.

**CHEM 170** Organic Chemistry 4.0 FS
Prerequisites: CHEM 037 or concurrent enrollment.

**ENGL 001** Freshman Composition 3.0 FS *
Prerequisites: English Placement Test.

**PHYS 002A** General Physics 4.0 FS *
Prerequisites: High school physics or faculty permission. High school trigonometry and second-year high school algebra or equivalent (MATH 003 and MATH 004 at CSU, Chico).

**PHYS 002B** General Physics 4.0 FS
Prerequisites: PHYS 002A.

**Pre-Medicine**

It is recommended that pre-medical students plan to obtain a degree in a field of science, such as chemistry or biology. While students may apply for admission to medical school any time after their junior year, the majority of those admitted have completed a four-year degree, and a sizable number are admitted only after additional graduate work. The BS in Chemistry, therefore, is also appropriate for those seeking advanced training in graduate schools or employment in fields related to medicine. See also the Pre-Medicine program under Biological Sciences.

**Lower-Division Courses**

**BIOL 006A** Biological Principles 4.0 FS
Prerequisites: Recommend CHEM 037 or concurrent enrollment.

**BIOL 006B** Biological Principles 4.0 FS
Prerequisites: BIOL 006A; recommend CHEM 038 or concurrent enrollment.

**CHEM 037** General Chemistry 4.0 FS *
Prerequisites: Second-year high school algebra; one year high school chemistry or CHEM 016. (One year of high school physics and one year of high school mathematics past Algebra II are recommended.)

**CHEM 038** General Chemistry 4.0 FS
Prerequisites: CHEM 037.

**CHEM 070** Organic Chemistry 4.0 FS
Prerequisites: CHEM 038.

**MATH 007A** Analytic Geometry and Calculus 4.0 FS *
Prerequisites: Completion of ELM requirement; both MATH 004 and MATH 006 (or high school equivalent); a score that meets department guidelines on a department administered calculus readiness exam.

**MATH 007B** Analytic Geometry and Calculus 4.0 FS
Prerequisites: Completion of ELM requirement; MATH 007A with a grade of C- or higher.

**Upper-Division Courses**

**CHEM 008A** General Physics 4.0 FS *
Prerequisites: High school physics or faculty permission. High school trigonometry and second-year high school algebra or equivalent (MATH 003 and MATH 004 at CSU, Chico).

**PHYS 002B** General Physics 4.0 FS
Prerequisites: PHYS 002A.

**Recommended Upper-Division Electives**

**BIOL 205** Comparative Anatomy: Vertebrates 4.0 FS
Prerequisites: BIOL 008B, BIOL 010.

**BIOL 207** Genetics 4.0 FS
Prerequisites: BIOL 008B.

**BIOL 214** Vertebrate Physiology 4.0 FS
Prerequisites: BIOL 008B, CHEM 028 or CHEM 070.

**BIOL 220** Embryology 4.0 SP
Prerequisites: BIOL 008B; BIOL 010 or faculty permission.

**Pre-Optometry**

The requirements for optometry schools vary widely. The student should see the pre-optometry adviser in the Chemistry Department and the catalog of the school of his/her choice. The prospective student is encouraged to consult the Department Chair for further information.

**Pre-Pharmacy**

The requirements for pharmacy schools vary widely. The student should see the pre-pharmacy adviser in the Chemistry Department and the catalog of the school of his/her choice. The prospective student is encouraged to consult the Department Chair for further information.

**Pre-Physical Therapy**

See the listings under Biological Sciences.

**Forensic Science and Graduate Programs in Criminalistics**

Entry-level employment and graduate programs in criminalistics commonly require a major in one of the physical or biological sciences, including a year of general chemistry and a course in quantitative analysis. Please see the Anthropology section for a program in Forensic Identification.

**THE MINOR IN CHEMISTRY**

**Course Requirements for the Minor: 23 units**

The following courses, or their approved transfer equivalents, are required of all candidates for this minor.

**Lower-Division Courses: 12 units**

3 courses required:

**CHEM 037** General Chemistry 4.0 FS *
Prerequisites: Second-year high school algebra; one year high school chemistry or CHEM 016. (One year of high school physics and one year of high school mathematics past Algebra II are recommended.)

**CHEM 038** General Chemistry 4.0 FS
Prerequisites: CHEM 037.

**CHEM 070** Organic Chemistry 4.0 FS
Prerequisites: CHEM 038.

**Upper-Division Courses: 11 units**

3 courses required:

**CHEM 105** Quantitative Analysis 4.0 FS
Prerequisites: CHEM 038.

**CHEM 170** Organic Chemistry 3.0 FS
Prerequisites: CHEM 070.

**CHEM 170L** Organic Chem Laboratory 1.0 FS
Prerequisites: CHEM 170L may be taken as a prerequisite or concurrently with CHEM 170L.

3 units selected from:

**CHEM 140** Descriptive Inorganic Chemistry 3.0 Inq
Prerequisites: CHEM 038.

**CHEM 172** Advanced Organic Laboratory 2.0 FS
Prerequisites: CHEM 172.

**CHEM 175** Radiation/Radioisotopes 1.0-3.0 FS
Prerequisites: Completion of 4 units of physics or physical science and 5 units of chemistry.

**CHEM 198** Special Topics 1.0-3.0 FS
CHEM 199 Special Problems 1.0–3.0 FS
Prerequisites: CHEM 038.
CHEM 201 The Chemical Literature 1.0 FA
Prerequisites: ENGL 001 (or its equivalent) with a grade of C- or higher; CHEM 070.
CHEM 203B Environmental Toxicology 2.0 SP
Prerequisites: CHEM 026 or CHEM 038.
CHEM 204 Environmental Chemistry 3.0 FA
Prerequisites: CHEM 038.
CHEM 210A Physical Chemistry 3.0 FA
Prerequisites: CHEM 037, MATH 007C, PHYS 004B, PHYS 004C.
CHEM 250A Biochemistry 3.0 FS
Prerequisites: CHEM 170.
CHEM 277 Seminar Organic Spectroscopy 1.0 FS
Prerequisites: Concurrent enrollment in or prior completion of CHEM 170.
CHEM 285A Research Project 3.0 FA
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; faculty permission.

THE SINGLE SUBJECT TEACHING CREDENTIAL IN SCIENCE WITH A CONCENTRATION IN CHEMISTRY

Course Requirements for the Single Subject Teaching Credential: 83-88 units

In most majors, candidates for this credential will normally fulfill the single subject matter preparation program by completing the appropriate education option in the major. Any exceptions to this procedure are noted at the end of this section. In addition to the single subject matter preparation program, completion of an additional professional education program is required to qualify for a California teaching credential. Professional education (credential) programs are available through the School of Education. For prerequisites and other admission requirements to professional education programs, see the “Education” chapter of this catalog. All credential candidates recommended by CSU, Chico (under the SB 2042 standards) are authorized to teach all students including English learners in the regular classroom. You may also want to consider qualifying for BCLAD (Bilingual, Cross-cultural, Language, and Academic Development) emphasis and supplementary authorizations in additional subject matter areas as you plan your program.

Your departmental credential adviser is responsible for verifying that the subject matter preparation program has been completed. If you are interested in obtaining a teaching credential, confer with the appropriate credential adviser early in your university career. Department credential advisers can assist you in planning an educational program that meets both major and credential requirements.

Subject matter preparation requirements are governed by legislative action and approval of the California Commission on Teacher Credentialing. Requirements may change between catalogs. Please consult with your departmental credential adviser for current information.

The BS in Chemistry with either option described above and the additional courses listed below fulfill all requirements for the single subject matter preparation program in science with a concentration in chemistry.

4 courses required:

Biol 006A Biological Principles 4.0 FS
Prerequisites: Recommend CHEM 037 or concurrent enrollment.
Biol 006B Biological Principles 4.0 FS
Prerequisites: BIOL 006A; recommend CHEM 038 or concurrent enrollment.
GeoS 002 Physical Geology 3.0 FS
Prerequisites: High school chemistry or physics is recommended; students with no previous science courses are advised to enroll in GEO S 001. No college credit for those who have passed GEO S 001.
GeoS 100 Earth Science 3.0 FA
Prerequisites: ENGL 001 (or its equivalent) with a grade of C- or higher; CHEM 027 or equivalent; PHYS 002A; PHYS 002B.

Chemistry

The Faculty

Donald B. Alger, 1968, Professor, PhD, WA State U.
David B. Ball, 1974, Professor, PhD, UCSC.
Marvin C. Burnett, 1959, Professor Emeritus, PhD, U Missouri.
Marvin B. Gold, 1963, Professor Emeritus, PhD, UC Berkeley.
Mina L. Hector, 1975, Professor, PhD, U Colorado.
Frederick W. Hiller, 1966, Professor Emeritus, PhD, Oregon State Univ.
Larry L. Kirk, 1981, Professor, PhD, UCSC.
William D. Korte, 1966, Professor Emeritus, PhD, U Davis.
Karl F. Kumlin, 1964, Professor Emeritus, PhD, U Kansas.
Norman L. Lofgren, 1949, Professor Emeritus, PhD, UC Berkeley.
Brian G. McBurnett, 2000, Assist Professor, PhD, U Texas.
Barbara O. Mejia, 1973, Professor Emerita, PhD, U Davis.
Randy M. Miller, 1988, Assoc Professor, PhD, U Davis.
Tal M. Nahir, 1998, Assist Professor, Chemistry, U NC.
Christopher J. Nichols, 1999, Assist Professor, PhD, UCLA.
Cindy S. Phelps, 1999, Assist Professor, PhD, U Idaho.
James M. Postma, 1982, Chair, Professor, PhD, U Davis.
Rodney H. Quacchia, 1969, Professor Emeritus, PhD, U of WA.
Floyd E. Reese, 1956, Professor Emeritus, PhD, Purdue U.
Eugene D. Thomas, 1965, Professor Emeritus, PhD, Ohio St U.
Grover C. Willis, 1957, Professor Emeritus, PhD, U Oregon.

Chemistry Course Offerings

Please see the section on “Course Description Symbols and Terms” in The University Catalog for an explanation of course description terminology and symbols, the course numbering system, and course credit units. All courses are lecture and discussion and employ letter grading unless otherwise stated. Some prerequisites may be waived with faculty permission. Many syllabi are available on the Chico Web.

CHEM 004 Chemistry and Current Issues 3.0 Fa/Spr
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; consent of department.

An introduction to chemistry, with a special emphasis on problems related to our present society. This course serves as a foundation for all subsequent chemistry courses and is designed to introduce students to the fundamental principles of chemistry and to provide a framework for the study of chemistry. CHEM 004 is a required course for all students majoring in chemistry and is recommended for all students who plan to major in chemistry. CHEM 004 is a 3.0 unit course with a required 4.0 unit laboratory. CHEM 004 is open to all students, including those not majoring in chemistry.

CHEM 016 Chemical Problem-Solving 2.0 Fa/Spr
Prerequisites: Intermediate Algebra.

An introduction to chemistry, with a special emphasis on problem-solving. CHEM 016 is designed to supplement CHEM 027 with additional applications of general chemistry concepts to real-world problems. CHEM 016 is a 2.0 unit course with a required 4.0 unit laboratory. CHEM 016 is open to all students, including those not majoring in chemistry.

CHEM 026 Nursing Chemistry 4.0 Fall
Prerequisites: Previous chemistry course recommended.

A survey of the principles of chemistry, primarily for students in agriculture, industry, and technology, and pre-nursing. CHEM 026 is a 4.0 unit course with a required 4.0 unit laboratory. CHEM 026 is open to all students, including those not majoring in chemistry.

CHEM 027 General Chemistry for Applied Sciences 4.0 Fa/Spr
Prerequisites: Intermediate Algebra.

A survey of general chemistry concepts for students in agriculture, industry, and technology, and pre-nursing. CHEM 027 is a 4.0 unit course with a required 4.0 unit laboratory. CHEM 027 is open to all students, including those not majoring in chemistry.

CHEM 027X General Chemistry Problem Session 1.0 Fa/Spr
Prerequisites: Concurrent enrollment in CHEM 027.

A survey of general chemistry concepts for students in agriculture, industry, and technology, and pre-nursing. CHEM 027X is a 1.0 unit course with a required 4.0 unit laboratory. CHEM 027X is open to all students, including those not majoring in chemistry.

CHEM 028 Organic Chemistry for Applied Sciences 4.0 Fa/Spr
Prerequisites: Intermediate Algebra.

A survey of organic chemistry for students in agriculture, industry, and technology, and pre-nursing. CHEM 028 is a 4.0 unit course with a required 4.0 unit laboratory. CHEM 028 is open to all students, including those not majoring in chemistry.
CHEM 037X General Chemistry Problem Session 1.0 Fa/Spr
Prerequisites: Concurrent enrollment in CHEM 037.
This course is designed to be a problem-solving session in general chemistry. It is for students who have completed CHEM 037 and need additional practice in problem-solving. It is a 3.0 hour laboratory class.

CHEM 038 General Chemistry 4.0 Fa/Spr
Prerequisites: CHEM 037.
A continuation of CHEM 037, covering the principles of general chemistry. Emphasis on the chemistry of acids and bases, solubility, oxidation-reduction, and nuclear chemistry. This course is 3.0 hours lecture and 3.0 hours laboratory. CAN CHEM 4.

CHEM 038X General Chemistry Problem Session 1.0 Fa/Spr
Prerequisites: Concurrent enrollment in CHEM 038.
This course is designed to be a problem-solving session in general chemistry. It is for students who have completed CHEM 038 and need additional practice in problem-solving. It is a 2.0 hour laboratory class.

CHEM 060 Scientific Glass Blowing 1.0 Spring
Prerequisites: CHEM 027 or CHEM 037.
Instruction and practice in scientific glass-blowing. This course is 3.0 hours laboratory. Credit/no credit grading only.

CHEM 070 Organic Chemistry 4.0 Fa/Spr
Prerequisites: CHEM 038.
An introduction to the theory and mechanism of organic reactions. To be followed by CHEM 170, which completes the two-semester sequence for science majors. This course is 3.0 hours lecture and 3.0 hours laboratory.

CHEM 105 Quantitative Analysis 4.0 Fa/Spr
Prerequisites: CHEM 038.
This course covers precision and accuracy in measurements, interpretation of data by statistical analysis, and development of good quantitative techniques. Analysis by gravimetry, titrimetry, potentiometry, chromatography, and spectrometry. This course is 2.0 hours discussion and 6.0 hours laboratory.

CHEM 140 Descriptive Inorganic Chemistry 3.0 Inquire
Prerequisites: CHEM 038.
A systematic study of inorganic substances, with emphasis on environmental aspects of the chemical behavior of the elements and their compounds.

CHEM 153 Introductory Biochemistry 3.0 Fa/Spr
Prerequisites: CHEM 025.
A survey of biochemistry, principally for agriculture, child development, and nursing students. Normally not open to chemistry or biological sciences majors.

CHEM 154 Introductory Biochemistry Laboratory 1.0 Fa/Spr
Prerequisites: Concurrent enrollment in CHEM 153.
Fundamental laboratory studies and examination of the major classes of biological compounds. Principally for agriculture, child development, and nursing students. Normally not open to chemistry or biological sciences majors.

CHEM 170 Organic Chemistry 3.0 Fa/Spr
Prerequisites: CHEM 070.
Lecture continuation of the theory and mechanisms of organic reaction.

CHEM 170L Organic Chemistry Laboratory 1.0 Fa/Spr
Prerequisites: CHEM 170 may be taken as a prerequisite or concurrently with CHEM 170L.
Laboratory continuation of the theory and mechanisms of organic reactions. Completes the two-semester sequence for science majors.

CHEM 172 Advanced Organic Laboratory 2.0 Fa/Spr
Prerequisites: CHEM 170.
Application of modern techniques and spectroscopy in organic synthesis, product identification, reaction mechanisms, and natural product chemistry. This course is 6.0 hours laboratory.

CHEM 175 Radiation and Radioisotopes 1.0-3.0 Fa/Spr
Prerequisites: Completion of 4 units of physics or physical science and 5 units of chemistry.
This course is a special topic offered as 175A-C for 1.0 to 3.0 units respectively. You must register directly with a supervising faculty member. Radiochemical techniques, detection, and measurement of radiation, or radiation safety.

CHEM 190 Special Problems in Science Education 1.0-3.0 Fa/Spr
Prerequisites: CHEM 037.
This course is a supervised study in science outreach to K-14 schools and is offered as 190A-C for 1.0 to 3.0 units respectively. You must register with a supervising faculty member. Credit/no credit grading only.

CHEM 198 Special Topics 1.0-3.0 Fa/Spr
Prerequisites: CHEM 038.
This course is for special topics offered as 198A-C for 1.0 to 3.0 units respectively. Typically the topic is offered on a one-time-only basis and may vary from term to term and be different for different sections. See The Class Schedule for the specific topic being offered.

CHEM 200 Research in Chemistry 1.0-2.0 Fa/Spr
Prerequisites: CHEM 210B.
This course is an independent study offered as 200A-B, for 1-2 units respectively. You must register directly with a supervising faculty member. Original laboratory or library investigation under individual faculty supervision. You may take this course more than once for a maximum of 4.0 units.

CHEM 201 The Chemical Literature 1.0 Fall
Prerequisites: ENGL 001 (or its equivalent) with a grade of C- or higher, CHEM 070.
Supervised studies in individual literature searches, including the use of Chemical Abstracts. Emphasis on the structure, function, and application of chemical databases. This course is 2.0 hours activity.

CHEM 202 Senior Seminar in Chemistry 1.0 Spring
Prerequisites: CHEM 028 or CHEM 070.
Presentation and discussion of topics from chemical literature. 2.0 hours activity.

CHEM 203A Toxicology 1.0 Spring
Prerequisites: CHEM 028 or CHEM 070.
A brief introduction to the principles of toxicology and presentation of facts about current issues related to toxic substances.

CHEM 203B Environmental Toxicology 2.0 Spring
Prerequisites: CHEM 028 or CHEM 070.
A brief introduction to the principles of toxicology and presentation of facts about current issues related to toxic substances, with special expanded emphasis on environmental aspects of topics presented in CHEM 203A.

CHEM 204 Environmental Chemistry 3.0 Fall
Prerequisites: CHEM 038.
A general study of the chemistry of the geosphere, hydrosphere, and atmosphere; special focus on the sources and fates of inorganic environmental pollutants.

CHEM 210A Physical Chemistry 3.0 Fall
Prerequisites: CHEM 105, MATH 007C, PHYS 004B, PHYS 004C.
Thermodynamics of solids, liquids, gases, and solutions; electrochemistry, kinetics, chemical equilibria, introduction to quantum mechanics, and chemical statistics.

CHEM 210B Physical Chemistry 3.0 Spring
Prerequisites: CHEM 210A.
A continuation of CHEM 210A.

CHEM 214A Intermediate Inorganic Chemistry 3.0 Fall
Prerequisites: CHEM 210A.

CHEM 214B Intermediate Inorganic Chemistry 2.0 Spring
Prerequisites: CHEM 214A.
A continuation of CHEM 214A.

CHEM 215A Integrated Chemistry Laboratory I 3.0 Fall
Prerequisites: Concurrent enrollment in or prior completion of CHEM 210A and CHEM 214A.
Integrated application of concepts and techniques in analytical, inorganic, and physical chemistry. 1.0 hour discussion, 6.0 hours laboratory. Formerly CHEM 211A.

CHEM 215B Integrated Chemistry Laboratory II 2.0 Spring
Prerequisites: CHEM 210A, CHEM 214A, CHEM 215A; concurrent enrollment in or prior completion of CHEM 210B.
A continuation of CHEM 215A. 6.0 hours laboratory. Formerly CHEM 211B.

CHEM 215C Integrated Chemistry Laboratory III 2.0 Fall
Prerequisites: CHEM 215A, CHEM 215B.
A continuation of CHEM 215B with an emphasis on special projects. 6.0 hours laboratory. Formerly CHEM 214L.
CHEM 218 Instrumental Analysis 2.0 Spring
Prerequisites: CHEM 215A, concurrent enrollment in CHEM 215B.
Theory and procedures used in separations and instrumental analysis.

CHEM 227 Physical Organic Chemistry 3.0 Spring
Prerequisites: CHEM 170, CHEM 210B.
Resonance and orbital theory; mechanisms, kinetics, and thermodynamics of organic reactions.

CHEM 228 Synthetic Organic Chemistry 1.0-3.0 Fall
Prerequisites: CHEM 170, CHEM 170L or CHEM 170M.
This course is offered as 228A-C for 1.0 to 3.0 units respectively. Modern synthetic reactions and processes, with emphasis on rearrangement reactions, stereospecific methods, and synthetic design.

CHEM 250A Biochemistry 3.0 Fa/Spr
Prerequisites: CHEM 170.
A general study of the chemistry of biomolecules. Conformation and function of enzymes and other proteins; metabolism, energy generation, and storage; brief discussion of chemistry of DNA replication, transcription and translation, and of important physiological processes.

CHEM 250B Biochemistry 3.0 Spring
Prerequisites: CHEM 250A.
Advanced topics in biochemistry. Biosynthesis of lipids, steroids, amino acids, and nucleotides. Comprehensive study of the chemical role of DNA and RNA in replication, transcription, protein synthesis, and viral activity.

CHEM 251 Biochemistry Laboratory 2.0 Fa/Spr
Prerequisites: CHEM 105, CHEM 250A; CHEM 170L or CHEM 170M.
Separation, identification, and/or analysis of biological materials by modern procedures, such as spectrophotometry, chromatography (gas, paper, TLC, column, ion exchange), electrophoresis, enzymology, fluorimetry, and high-speed centrifugation. 6.0 hours laboratory.

CHEM 252 Clinical Chemistry 3.0 Spring
Prerequisites: CHEM 105, CHEM 250A; CHEM 170L or CHEM 170M.
An introduction to the biochemistry of blood and body fluids, with emphasis placed on laboratory analytical techniques and instrumentation. Intended for Microbiology majors with the Option in Clinical Laboratory Science. 1.0 hour discussion, 6.0 hours laboratory.

CHEM 255 Basic Instrumental Analysis 3.0 Spring
Prerequisites: CHEM 037, CHEM 038.
Basic theory and practices of analytical instruments. Care and use of instruments; interpretation of results. 2.0 hours discussion, 2.0 hours workshop.

CHEM 271 Seminar in Organic Spectroscopy 1.0 Fa/Spr
Prerequisites: Concurrent enrollment in or prior completion of CHEM 170.
Solving problems in organic chemistry using NMR, IR, UV, and mass spectral analysis.

CHEM 280 Selected Topics in Physical, Analytical, Inorganic Chemistry 1.0-3.0 Fa/Spr
Prerequisites: CHEM 210B, CHEM 214A, CHEM 215B, CHEM 218.
This course is a special topic offered as 280A-C, for 1.0 to 3.0 units respectively. Topics of current interest, such as in Physical: theories of x-ray diffraction, spectroscopy, NMR, etc.; Inorganic: reaction mechanisms, non-aqueous solvents; Analytical: ion exchange, selective ion electrodes. Three-hour laboratory optional.

CHEM 281 Selected Topics in Organic and Biochemistry 1.0-3.0 Spring
Prerequisites: CHEM 170, CHEM 210A, CHEM 250A.
This course is a special topic offered as 281A-C, for 1.3 units respectively. You must register directly with a supervising faculty member. Presentation of topics of current interest, such as in Organic: heterocyclic, polymer, organometallic, and natural product chemistry; Biochemistry: biosynthesis and metabolism, enzymes, biophysical chemistry, and bioenergetics.

CHEM 285A Research Project 3.0 Fall
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; faculty permission.
A research project within chemistry or an interdisciplinary project which involves chemistry. Students will be involved with design, laboratory, and data analysis aspects of a research problem.

CHEM 285B Research Project 3.0 Spring
Prerequisites: CHEM 285A. Not open to students who have completed CHEM 299H; faculty permission.
A continuation of CHEM 285A.

CHEM 289 Chemical Thermodynamics 3.0 Fa/Spr
Prerequisites: CHEM 210B.
Principles of thermodynamics, application to methods in chemical problems, introduction to the use of statistical thermodynamics, and calculations of thermodynamic functions from spectroscopic data.

CHEM 290 Chemical Thermodynamics Laboratory 1.0-4.0 Fa/Spr
Prerequisites: ENGL 001 (or its equivalent) with a grade of C- or higher, CHEM 105, CHEM 004C; faculty permission.
A research project within chemistry or an interdisciplinary project which involves chemistry. Students will be involved with design, library, laboratory, and data analysis aspects of a research problem.

CHEM 298 Independent Study 1.0-4.0 Fa/Spr
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; faculty permission.
Presentation and discussion of reports on current literature and special studies in chemistry.

CHEM 299 Master's Study 1.0-6.0 Fa/Spr
Prerequisites: CHEM 170, CHEM 210A, CHEM 250A.
Principles of thermodynamics, application to methods in chemical problems, introduction to the use of statistical thermodynamics, and calculations of thermodynamic functions from spectroscopic data.

CHEM 300 Special Topics in Chemistry 1.0-3.0 Fa/Spr
Prerequisites: CHEM 210A, CHEM 210B, faculty permission.
Presentation of selected topics of current interest, with emphasis on recent developments.

CHEM 301 Chemistry Seminar 1.0 Fa/Spr
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; faculty permission.
Principles of thermodynamics, application to methods in chemical problems, introduction to the use of statistical thermodynamics, and calculations of thermodynamic functions from spectroscopic data.

CHEM 385B Research Project 3.0 Spring
Prerequisites: CHEM 285A. Not open to students who have completed CHEM 299H; faculty permission.
A continuation of CHEM 285A.

CHEM 385C Research Project 3.0 Spring
Prerequisites: CHEM 285A. Not open to students who have completed CHEM 299H; faculty permission.
A continuation of CHEM 285A.

CHEM 390 Chemistry Seminar 1.0 Fa/Spr
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; faculty permission.
Principles of thermodynamics, application to methods in chemical problems, introduction to the use of statistical thermodynamics, and calculations of thermodynamic functions from spectroscopic data.

CHEM 398 Independent Study 1.0-4.0 Fa/Spr
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; faculty permission.
Presentation and discussion of reports on current literature and special studies in chemistry.

CHEM 399 Master's Study 1.0-6.0 Fa/Spr
Prerequisites: CHEM 170, CHEM 210A, CHEM 250A.
Principles of thermodynamics, application to methods in chemical problems, introduction to the use of statistical thermodynamics, and calculations of thermodynamic functions from spectroscopic data.

CHEM 400 Special Topics in Chemistry 1.0-3.0 Fa/Spr
Prerequisites: CHEM 210A, CHEM 210B, faculty permission.
Presentation of selected topics of current interest, with emphasis on recent developments.

CHEM 490 Chemistry Seminar 1.0 Fa/Spr
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; faculty permission.
Presentation and discussion of reports on current literature and special studies in chemistry.

CHEM 498 Independent Study 1.0-4.0 Fa/Spr
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; faculty permission.
Presentation and discussion of reports on current literature and special studies in chemistry.

CHEM 499 Master's Study 1.0-6.0 Fa/Spr
Prerequisites: Open by invitation to chemistry majors with a GPA of 3.0 or higher; faculty permission.
Presentation and discussion of reports on current literature and special studies in chemistry.

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