CHEMISTRY - BACHELOR OF ARTS (BA)

Chemistry major students are prepared for many different careers after graduation. About 50 percent of chemistry majors enter directly into industry or government positions that require scientific expertise, such as chemical, oil, electronics, mining and manufacturing industries, water districts, crime laboratories, biotechnology, health and safety, atmospheric science and environmental quality.

Approximately 25 percent of chemistry graduates are attracted by specialized graduate education in chemistry or biochemistry. Graduate work is often in one of the traditional areas of analytical, inorganic, organic or physical chemistry and, increasingly, in interdisciplinary areas such as atmospheric, bio-organic or organo-metallic chemistry, molecular biology, biotechnology and chemical physics for their advanced work. Another 25 percent of a typical graduating class goes on to professional school, pursuing advanced degrees in medicine, dentistry, pharmacy, law, business, engineering and computer science.

Career Services (http://www.colorado.edu/careerservices/) offers a number of programs and services designed to help students plan their career, including workshops, internships, and placement services after graduation. For an appointment with a career counselor or for more information call 303-492-6541 or stop by Center for Community, S440.

Announcements

See the CU Chemistry (https://www.colorado.edu/chemistry/) website for announcements, events and important information. Some examples include:

- Contact information and general announcements.
- Student opportunities: internship/job announcements, summer programs, events/programs offered by other campus offices and departments that may be of interest.
- Scholarship announcements: announcements of scholarships opportunities and information meetings.
- Seminars and conferences: seminar and conference announcements.
- Academic support: SASC workshop schedule, tutors, and other academic support opportunities.
- Career services: schedule of events offered by this office.
- Courses: information about new and/or interesting courses for core and elective credit.

Chemistry Honors Program

Opportunity is provided for qualified chemistry and chemistry/biochemistry double majors to participate in the departmental honors program and graduate with honors (*cum laude*, *magna cum laude*, or *summa cum laude*) in chemistry. Students interested in the honors program should contact the departmental honors advisor during their junior year.

American Chemical Society Certified Degree

The American Chemical Society maintains a certification program in which a student graduating with a specified minimum program is certified to the society upon graduation. To be certified, a graduate must satisfy requirements in addition to the minimum for graduation. The department offers this certificate for chemistry or chemistry/biochemistry double majors only. More information can be found here (https://www.colorado.edu/chemistry/undergraduate/major-minor/acs-certification/).

Research Opportunities

Undergraduate Research Opportunities Program

The Undergraduate Research Opportunities Program (UROP) offers students a chance to work alongside a faculty sponsor on original research. Learn to write proposals, conduct research, pursue creative work, analyze data, and present the results. For more information please visit the Undergraduate Research Opportunities Program (http://www.colorado.edu/suep/about-urop/) website.

Independent Study

Independent study (CHEM 4901), provides an opportunity for a student to work on a research project with an individual faculty member outside of the regular class structure. This generally provides an experience much more like real-life chemistry or biochemistry, where new results are being sought and the outcome of the research is not known in advance. The student may have a totally independent project or may become part of a research team working at the forefront of science. In favorable cases the project may result in publication of the results of the independent study in the scientific literature. As part of the research team in a particular group the student will usually participate in group seminars and informal discussions with other members of the group.

Teaching Certification

Chemistry majors can also earn certification as teachers through the School of Education. The program for a secondary school science-teaching certificate is challenging, requiring a broad, strong background in science, as well as coursework in education and practice teaching. It usually requires at least five years of study. Students interested in teacher certification are encouraged to contact the School of Education (http://www.colorado.edu/education/).

Requirements

Program Requirements

The chemistry major requires 30 credits of upper-division chemistry coursework, including courses in general, organic, physical and analytical/instrumental chemistry, as well as an introductory general chemistry sequence and ancillary work in calculus and physics.

Students must complete the general requirements of the College of Arts and Sciences and the required courses listed below. No more than 45 credits of CHEM and BCHM courses can be applied to the 120-credit minimum to graduate. All courses counted towards the major must be completed with a grade of C- or better and none of the courses may be taken for a pass/fail grade. The cumulative Grade Point Average (GPA) in courses that can count toward the major must be at least 2.0.

Transfer students who plan to take a chemistry major must complete at the Boulder campus a minimum of 12 credits of upper-division work covering at least two subdisciplines: organic, physical, analytical and inorganic for chemistry majors.

Required Courses and Credits

Code	Title	Credit Hours
General Chemistry		
Select one of the following general chemistry sequence options:		10
Option 1		
CHEM 1400 & CHEM 1401	Foundations of Chemistry and Foundations of Chemistry Lab	
CHEM 2100 & CHEM 2101	Foundations of Chemistry 2 and Laboratory in Foundations of Chemistry 2	
Option 2		
CHEM 1113 & CHEM 1114	General Chemistry 1 and Laboratory in General Chemistry 1	
CHEM 1133 & CHEM 1134	General Chemistry 2 and Laboratory in General Chemistry 2	
Organic Chemistry		
Organic Chemistry 1 Lecture		
Choose one of the following lectures:		4
CHEM 3451	Organic Chemistry 1 for Chemistry and Biochemistry Majors	
or CHEM 3311	Organic Chemistry 1	
Organic Chemisty 2 Lecture		
Choose one of the following lectures:		4
CHEM 3471	Organic Chemistry 2 for Chemistry Majors	
or BCHM 3491	Organic Chemistry 2 for Biochemistry Majors	
or CHEM 3331	Organic Chemistry 2	
Organic Chemistry Labs [1]		*4*
CHEM 3321 & CHEM 3341	Laboratory in Organic Chemistry 1 and Laboratory in Organic Chemistry 2	
In addition, choose one or more of the following to satisfy the organic chemistry lab requirement:		
CHEM 3381	Laboratory in Advanced Organic Chemistry	
or CHEM 4021	Inorganic Laboratory	
or CHEM 4901	Independent Study in Chemistry	
Required Advanced CHEM Coursework		
CHEM 4011	Modern Inorganic Chemistry	3
CHEM 4171	Instrumental Analysis - Lecture and Laboratory 1	3
CHEM 4181	Instrumental Analysis - Lecture and Laboratory 2	3
CHEM 4511 & CHEM 4581	Physical Chemistry 1 and Physical Chemistry Lab 1	4
CHEM 4531 & CHEM 4591	Physical Chemistry 2 and Physical Chemistry Lab 2	5
Total Credit Hours		**40**

Required Ancillary Coursework from Outside Chemistry

Code	Title	Credit Hours
Required Physics Courses		
PHYS 1110 & PHYS 1120	General Physics 1 and General Physics 2	8
PHYS 1140	Experimental Physics 1	1
Calculus		**12-15**
Complete three semesters of calculus (through Calculus 3):		
MATH 1300	Calculus 1	
or APPM 1350	Calculus 1 for Engineers	
MATH 2300	Calculus 2	
or APPM 1360	Calculus 2 for Engineers	
MATH 2400	Calculus 3	
or APPM 2350	Calculus 3 for Engineers	
Total Credit Hours		**21-24**

Recommended Chemistry Electives

All students, and especially those intending to go on to graduate school in chemistry, will benefit from additional advanced courses. Recommended electives include the following:

Code	Title	Credit Hours
CHEM 3151	Air Chemistry and Pollution	
CHEM 3251	Sustainable Energy from a Chemistry Perspective	
CHEM 4021	Inorganic Laboratory	
CHEM 4141	Environmental Water and Soil Chemistry	
CHEM 4251	Materials Chemistry and Properties	
CHEM 4261	Organic Materials: Structures and Functions	
CHEM 4271	Chemistry of Solar Energy	
BCHM 4611	Principles of Biochemistry	
BCHM 4720	Metabolic Pathways and Human Disease	
BCHM 4740	Biochemistry of Gene Transmission, Expression and Regulation	
CHEM 4901	Independent Study in Chemistry	
Graduate courses in various fields of chemistry		
Advanced courses in mathematics or physics		

Graduating in Four Years

Consult the Four-Year Guarantee Requirements for information on eligibility. The concept of "adequate progress" as it is used here only refers to maintaining eligibility for the four-year guarantee; it is not a requirement for the major. To maintain progress in chemistry students should declare the chemistry major in the first semester.

Students must consult with a major advisor to determine adequate progress toward completion of the major.

Recommended Four-Year Plan of Study

Through the required coursework for the major, students will fulfill all 12 credits of the Natural Sciences area of the Gen Ed Distribution Requirement, including the lab component, and the QRMS component of the Gen Ed Skills Requirement.

Year One

Fall Semester		Credit Hours
CHEM 1400	Foundations of Chemistry	4
CHEM 1401	Foundations of Chemistry Lab	1

MATH 1300 or APPM 1350	Calculus 1 or Calculus 1 for Engineers	4-5
Gen. Ed. Distribution course (example: Arts & Humanities)		3
Gen. Ed. Skills course (example: Lower-division Written Communication)		3
	Credit Hours	**15-16**
Spring Semester		
CHEM 3451	Organic Chemistry 1 for Chemistry and Biochemistry Majors	4
CHEM 3321	Laboratory in Organic Chemistry 1	1
MATH 2300 or APPM 1360	Calculus 2 or Calculus 2 for Engineers	4-5
Gen. Ed. Distribution/Diversity course (example: Social Sciences/US Perspective)		3
Elective		3
	Credit Hours	**15-16**
Year Two		
Fall Semester		
CHEM 3471	Organic Chemistry 2 for Chemistry Majors	4
CHEM 3341	Laboratory in Organic Chemistry 2	1
PHYS 1110	General Physics 1 ((Calculus-based))	4
MATH 2400 or APPM 2350	Calculus 3 or Calculus 3 for Engineers	4-5
Gen. Ed. Distribution course (example: Arts & Humanities)		3
	Credit Hours	**16-17**
Spring Semester		
CHEM 2100	Foundations of Chemistry 2	4
CHEM 2101	Laboratory in Foundations of Chemistry 2	1
PHYS 1120	General Physics 2	4
PHYS 1140	Experimental Physics 1	1
Gen. Ed. Distribution course (example: Arts & Humanities)		3
Elective		3
	Credit Hours	**16**
Year Three		
Fall Semester		
CHEM 4511	Physical Chemistry 1	3
CHEM 4581	Physical Chemistry Lab 1	1
Gen. Ed. Distribution/Diversity course (example: Social Sciences/Global Perspective)		3
Elective		3
Elective		3
Elective		3-0
	Credit Hours	**16-13**
Spring Semester		
CHEM 4531	Physical Chemistry 2	3
CHEM 4591	Physical Chemistry Lab 2	2
Gen. Ed. Distribution course (example: Arts & Humanities)		3
Gen. Ed. Skills course (example: Upper-division Written Communication)		3
Elective		3
	Credit Hours	**14**
Year Four		
Fall Semester		
CHEM 4011	Modern Inorganic Chemistry	3
CHEM 4171	Instrumental Analysis - Lecture and Laboratory 1	3
Gen. Ed. Distribution course (example: Social Sciences)		3
Upper-division Elective		3
Elective		3
	Credit Hours	**15**
Spring Semester		
CHEM 4181	Instrumental Analysis - Lecture and Laboratory 2	3
Gen. Ed. Distribution course (example: Social Sciences)		3
Upper-division Elective		3
Upper-division Elective		3
Upper-division Elective		3
	Credit Hours	**15**
	Total Credit Hours	**122**

Learning Outcomes

By the completion of the program, students will be able to:

- Use chemical models to describe the behavior of matter and analyze chemical problems.
- Make quantitative predictions based on chemical models.
- Know and demonstrate appropriate safety practices in the laboratory.
- Develop a scientific hypothesis and conduct an appropriate investigation using a safe and technically sound approach.
- Communicate chemical knowledge and research results clearly in both written and oral format.
- Utilize a range of scientific apparatus and instruments to synthesize molecules, measure their properties and quantify the amount of a substance.
- Demonstrate critical thinking skills and logical approaches to problem solving.