

Chemistry, BS

Learning Outcomes

The Department of Chemistry is committed to maintaining excellence in teaching and mentoring, and to providing the maximum educational benefit to each chemistry graduate. The desired outcomes will prepare students for success in graduate or professional school, industry or government employment, and a wide variety of career choices.

The graduate with a bachelor's degree in chemistry will be able to use the knowledge and skills obtained in the program to demonstrate the following.

Knowledge and Understanding of Chemistry

Graduates will be able to demonstrate:

- mastery of major concepts, theoretical principles, and experimental findings in chemistry;
- an understanding of the relationship between molecular structure and physical/chemical properties;
- an understanding of the relationship between the microscopic, macroscopic, and symbolic descriptions of matter and the changes it undergoes; and
- an understanding of the conditions that affect stability and factors that control rates of change.

Laboratory Skills

Graduates will be able to:

- assess chemical and procedural hazards involved in laboratory work;
- use strategies to minimize the risks associated with laboratory work;
- maintain a clearly organized laboratory notebook;
- use a variety of synthetic techniques;
- use instrumentation and laboratory techniques to separate, purify, identify, quantify, and characterize chemical species; and
- use computers as tools for data acquisition, management, and analysis.

Scientific Thinking

Graduates will be able to:

- pose scientific questions with a clear hypothesis;
- plan and carry out scientific investigations;
- analyze data in order to make inferences about chemical and physical behavior and properties, and construct scientific arguments to support conclusions;
- use scientific theory and/or interpretations of experimental results to explain chemical phenomena;
- use mathematics and computational thinking to understand and predict chemical behavior;
- identify and quantify uncertainties in measurements and limitations in methods; and
- use graphs, diagrams, and other models to communicate chemical information.

Chemical Information Skills

Graduates will be able to:

- use modern library search tools to locate and retrieve chemical information;
- read, analyze, and critically evaluate journal articles; and
- reference and cite chemical literature appropriately using designated citation styles.

Professional Skills

Graduates will be able to:

- report scientific findings in oral presentations in a clear and organized fashion using appropriate visual tools;
- report on experimental work and scientific findings in written reports;
- communicate results of scientific work to nontechnical audiences;
- work collaboratively with peers to plan and conduct experiments, interpret chemical information, and solve problems; and
- engage in responsible and ethical scientific conduct.

Requirements

The Bachelor of Science with a major in chemistry requires a minimum of 120 s.h., including 69 s.h. of work for the major (20 s.h. in foundation chemistry courses, 27 s.h. in advanced chemistry, and 22 s.h. in supporting coursework). Students must earn at least 20 s.h. in advanced chemistry courses at the University of Iowa. They must maintain a grade-point average of at least 2.00 in all courses for the major and in all UI courses for the major. Students also must complete the College of Liberal Arts and Sciences GE CLAS Core.

The BS degree with a major in chemistry is certified by the American Chemical Society (ACS) when a biochemistry course is included. An ACS-approved program offers a broad-based and rigorous chemistry education that provides students with the intellectual, experimental, and communication skills to become effective scientific professionals in chemical and other related fields. The program also provides all the prerequisites for graduate work in chemistry or biochemistry and in other biomedical areas with a molecular focus.

Courses in the chemistry major have prerequisites, so they must be taken in the correct order. Advanced chemistry courses are built on the chemistry foundation courses. Most advanced courses are taught only once a year. Students should consult their academic advisors and plan their course schedules carefully. They should take CHEM:2021 Fundamentals of Chemical Measurements during the first semester of the second year.

Students may not use a course to fulfill more than one requirement.

The BS with a major in chemistry requires the following coursework.

Requirements	Hours
Chemistry Foundation Courses	20
Advanced Chemistry Courses	27
Mathematics Courses	8
Introductory Physics Courses	8
Science Electives and Research Courses	6

Chemistry Foundation Courses

Students complete the following foundation courses.

Course #	Title	Hours
All of these:		
CHEM:1110 & CHEM:1120	Principles of Chemistry I-II	8
CHEM:2021	Fundamentals of Chemical Measurements	3
One of these sequences:		
CHEM:2210 & CHEM:2220	Organic Chemistry I-II	6
CHEM:2230 & CHEM:2240	Organic Chemistry I for Majors - Organic Chemistry II for Majors (preferred)	6
One of these:		
CHEM:2410	Organic Chemistry Laboratory	3
CHEM:2420	Organic Chemistry Laboratory for Majors (preferred)	3

Advanced Chemistry Courses

Course #	Title	Hours
All of these:		
CHEM:3110 & CHEM:3120	Equilibria and Electrochemistry - Spectroscopy and Separations	6
CHEM:3250	Inorganic Chemistry	3
CHEM:3430	Analytical Measurements	3
CHEM:3440	Physical Measurements	3
CHEM:3530	Inorganic Chemistry Laboratory	3
CHEM:4270	Advanced Inorganic Chemistry	3
CHEM:4431- & CHEM:4432	Chemical Thermodynamics - Quantum Mechanics and Chemical Kinetics	6

Mathematics Courses

Course #	Title	Hours
One of these sequences:		
MATH:1550 & MATH:1560	Engineering Mathematics I: Single Variable Calculus - Engineering Mathematics II: Multivariable Calculus	8
MATH:1850 & MATH:1860	Calculus I-II (preferred)	8

Introductory Physics Courses

Course #	Title	Hours
One of these sequences:		
PHYS:1511- & PHYS:1512	College Physics I-II	8
PHYS:1611- & PHYS:1612	Introductory Physics I-II (preferred)	8

Science Electives and Research Courses

Course #	Title	Hours
A total of 6 s.h. from these:		
CHEM:3994	Undergraduate Research	1-4

BMB:3110	Biochemistry	3
BMB:3120	Biochemistry and Molecular Biology I	3
BMB:3130	Biochemistry and Molecular Biology II	3
Advanced science elective courses		

ACS Certification Requirement

Students who want an ACS-certified degree complete one of these optional courses (also in the "Science Electives and Research Courses" list).

Course #	Title	Hours
BMB:3110	Biochemistry	3
BMB:3120	Biochemistry and Molecular Biology I	3

Teacher Licensure

Students interested in teaching in elementary and/or secondary schools should seek admission to the Teacher Education Program (TEP) in the College of Education.

To qualify for licensure in secondary teaching, students in the TEP complete a degree in education as well as a related College of Liberal Arts and Sciences degree. See Apply on the College of Education website for details on requirements and deadlines for applying to the College of Education and about TEP choices of majors leading to licensure.

Honors

Honors in the Major

Majors are able to graduate with departmental honors. Students must maintain a cumulative University of Iowa grade-point average (GPA) of at least 3.33, as required by the College of Liberal Arts and Sciences; additionally, students must maintain a 3.33 cumulative GPA in the major, a GPA set by the Department of Chemistry.

Students also must complete an undergraduate research project acceptable to their research advisor and must write an honors thesis based on their research. Students should register for CHEM:3994 Undergraduate Research or HONR:3994 Honors Research Practicum to earn credit for their research. They are encouraged but not required to present their research at local and regional meetings and to publish their results in professional journals.

University of Iowa Honors Program

In addition to honors in the major, students have opportunities for honors study and activities through membership in the University of Iowa Honors Program. Visit Honors at Iowa to learn about the university's honors program.

Membership in the UI Honors Program is not required to earn honors in the chemistry major.

Financial Support

Scholarships and Awards

A number of awards and scholarships are available to chemistry majors, including the American Institute of Chemists Award, the Undergraduate Award in Analytical

Chemistry, the Chemistry Alumni Awards (one each for a sophomore, a junior, and a senior), the Merck Index Award, and the Viksnins, Harris & Padys PLLP Award.

Chemistry majors also may apply for the Donald J. and Margaret Burton Scholarship, E. David Cater Scholarship, and Russell K. Simms Scholarship.

For more information, visit Undergraduate Scholarships and Awards on the Department of Chemistry website.

Career Advancement

The undergraduate major in chemistry provides a strong foundation for success in graduate and professional study and for positions in academic or industrial chemistry.

Students with a chemistry degree can pursue careers or graduate study in a wide range of fields. Learn more about career options for chemistry majors on the American Chemical Society website.

The Pomerantz Career Center offers multiple resources to help students find internships and jobs.

Academic Plans

Four-Year Graduation Plan

The following checkpoints list the minimum requirements students must complete by certain semesters in order to stay on the university's Four-Year Graduation Plan. Courses in the major are those required to complete the major; they may be offered by departments other than the major department.

Courses in the chemistry major have prerequisites, so they must be taken in the correct order. Most advanced courses are taught only once a year. Students should consult their academic advisors and plan their course schedules carefully. They should take CHEM:2021 Fundamentals of Chemical Measurements during the first semester of the second year. Typical chemistry course schedules and a regression list are available at Undergraduate Program in Chemistry on the Department of Chemistry website.

Before the third semester begins: math through MATH:1550 Engineering Mathematics I: Single Variable Calculus or MATH:1850 Calculus I; CHEM:1110 Principles of Chemistry I and CHEM:1120 Principles of Chemistry II, or equivalent coursework.

Before the fifth semester begins: CHEM:2021 Fundamentals of Chemical Measurements; CHEM:3250 Inorganic Chemistry; CHEM:2210 Organic Chemistry I, CHEM:2220 Organic Chemistry II, and CHEM:2410 Organic Chemistry Laboratory, or CHEM:2230 Organic Chemistry I for Majors, CHEM:2240 Organic Chemistry II for Majors, and CHEM:2420 Organic Chemistry Laboratory for Majors; MATH:1560 Engineering Mathematics II: Multivariable Calculus or MATH:1860 Calculus II; and PHYS:1511-PHYS:1512 or PHYS:1611-PHYS:1612.

Before the seventh semester begins: six more courses in the major and at least 90 s.h. earned toward the degree.

Before the eighth semester begins: three more courses in the major.

During the eighth semester: enrollment in all remaining coursework in the major, all remaining GE CLAS Core courses, and a sufficient number of semester hours to graduate.

Sample Plan of Study

Sample plans represent one way to complete a program of study. Actual course selection and sequence will vary and should be discussed with an academic advisor. For additional sample plans, see MyUI.

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Course	Title	Hours
Academic Career		
Any Semester		
GE CLAS Core: Sustainability ^a		
Hours		0
First Year		
Fall		
CHEM:1110	Principles of Chemistry I ^b	4
MATH:1850	Calculus I ^c	4
ENGL:1200 or RHET:1030	The Interpretation of Literature or Rhetoric	3 - 4
GE CLAS Core: Understanding Cultural Perspectives ^d		3
CSI:1600	Success at Iowa	2
Hours		16-17
Spring		
CHEM:1120	Principles of Chemistry II	4
MATH:1860	Calculus II	4
ENGL:1200 or RHET:1030	The Interpretation of Literature or Rhetoric	3 - 4
GE CLAS Core: World Languages First Level Proficiency or elective course ^e		4 - 5
Hours		15-17
Second Year		
Fall		
CHEM:2021	Fundamentals of Chemical Measurements ^f	3
CHEM:2230	Organic Chemistry I for Majors ^g	3
PHYS:1611	Introductory Physics I	4
GE CLAS Core: World Languages Second Level Proficiency or elective course ^e		4 - 5
Hours		14-15
Spring		
CHEM:2240	Organic Chemistry II for Majors ^h	3
CHEM:2420	Organic Chemistry Laboratory for Majors ^h	3
CHEM:3250	Inorganic Chemistry ^h	3
GE CLAS Core: Historical Perspectives ^d		3
GE CLAS Core: World Languages Third Level Proficiency or elective course ^e		4 - 5
Hours		16-17
Third Year		
Any Semester		
Students are strongly encouraged to be active participants in research within the Department of Chemistry. It is recommended that students begin research by their third year.		
Hours		0
Fall		
CHEM:3530	Inorganic Chemistry Laboratory ^g	3
CHEM:4270	Advanced Inorganic Chemistry ^g	3

CHEM:4431	Chemical Thermodynamics	3
GE CLAS Core: International and Global Issues ^d		3
GE CLAS Core: World Languages Fourth Level Proficiency or elective course ^e		4 - 5
Hours		16-17
Spring		
CHEM:4432	Quantum Mechanics and Chemical Kinetics	3
PHYS:1612	Introductory Physics II	4
Major: science elective or research ⁱ		3
GE CLAS Core: Literary, Visual, and Performing Arts ^d		3
Elective course ^j		3
Hours		16
Fourth Year		
Fall		
CHEM:3110	Equilibria and Electrochemistry ^g	3
CHEM:3440	Physical Measurements ^g	3
BMB:3110	Biochemistry ^{i, k}	3
GE CLAS Core: Social Sciences ^d		3
Elective course ^j		2 - 3
Hours		14-15
Spring		
CHEM:3120	Spectroscopy and Separations	3
CHEM:3430	Analytical Measurements ^h	3
GE CLAS Core: Values and Society ^d		3
Elective course ^j		3
Elective course ^j		3
Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall) ^l		
Hours		15
Total Hours		122-129

- a Sustainability must be completed by choosing a course that has been approved for Sustainability AND for one of these General Education areas: Natural Sciences; Quantitative and Formal Reasoning; Social Sciences; Historical Perspectives; International and Global Issues; Literary, Visual, and Performing Arts; or Values and Society.
- b Enrollment in chemistry courses requires completion of a placement exam.
- c Enrollment in math courses requires completion of a placement exam.
- d GE CLAS Core courses may be completed in any order unless used as a prerequisite for another course. Students should consult with an advisor about the best sequencing of courses.
- e Students who have completed four levels of a single language or two levels of two different languages in high school or college have satisfied the GE CLAS Core World Languages requirement. Students who have completed three levels of a single language may complete a fourth-level course in the same language or may choose an approved World Language and Cultural Exploration course. Enrollment in world languages courses requires a placement exam, unless enrolling in a first-semester-level course. Contact your academic advisor or CLAS Undergraduate Programs Office with questions concerning the World Languages requirement.
- f Students should take CHEM:2021 during the first semester of the second year.

g Typically this course is offered in fall semesters only. Check MyUI for course availability since offerings are subject to change.

h Typically this course is offered in spring semesters only. Check MyUI for course availability since offerings are subject to change.

i Students are required to complete 6 s.h. in science electives and research toward the major; refer to the General Catalog for list of approved courses.

j Students may use elective courses to earn credit towards the total s.h. required for graduation or to complete a double major, minors, or certificates.

k Students who want an ACS certified degree must complete one of these optional courses: BMB:3110 or BMB:3120.

l Please see Academic Calendar, Office of the Registrar website for current degree application deadlines. Students should apply for a degree for the session in which all requirements will be met. For any questions on appropriate timing, contact your academic advisor or Degree Services.