Chemistry, BA

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 Arts with a major in chemistry requires a minimum of 120 s.h., including 53–54 s.h. of work for the major (20 s.h. in foundation chemistry courses, 12 s.h. in advanced chemistry, and 21–22 s.h. in supporting coursework). Students must earn at least 11 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 must also complete the College of Liberal Arts and Sciences GE CLAS Core.

The BA degree is a good choice for students interested in medical or other professional schools, or those interested in a teaching career (see the following section titled "Teacher Licensure"). The program provides students with the flexibility to earn a degree in chemistry while they also complete related courses required for medical school, such as biology and biochemistry. Compared to the BS degree, the BA has modified mathematics requirements that include a one-semester physical chemistry course, an analytical chemistry course, and a single, integrated capstone laboratory that incorporates analytical, inorganic, and physical chemistry experiments.

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.

In planning coursework, students should be guided by the College of Liberal Arts and Sciences maximum hours rule: students earning a BA may apply a maximum of 56 s.h. earned in one department to the minimum 120 s.h. required for graduation, whether or not the coursework is accepted toward requirements for the major; students who earn more than 56 s.h. from one department may use the additional semester hours to satisfy requirements for the major (if the department accepts them), and the grades they earn become part of their grade-point average, but they cannot apply the additional semester hours to the minimum 120 s.h. required for graduation.

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

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

Requirements	Hours
Chemistry Foundation Courses	20
Advanced Chemistry Courses	12
Mathematics Courses	7-8
Introductory Physics Courses	8
Science Electives	6

Chemistry Foundation Courses

Students complete the following foundation courses.

Course #	Title	Hours
All of these:		
CHEM:1110 & CHEM:1120	Principles of Chemistry I and Principles of Chemistry II	8
CHEM:2021	Fundamentals of Chemical Measurements	3
One of these sequences:		
CHEM:2210 & CHEM:2220	Organic Chemistry I and Organic Chemistry II	6
CHEM:2230 & CHEM:2240	Organic Chemistry I for Majors and 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
One of these:		
CHEM:3110	Equilibria and Electrochemistry	3
CHEM:3120	Spectroscopy and Separations (preferred)	3
All of these:		
CHEM:3250	Inorganic Chemistry	3
CHEM:4430	Principles of Physical Chemistry	3
CHEM:4450	Synthesis and Measurement	3

Mathematics Courses

Course #	Title	Hours
One of these:		
MATH:1460	Calculus for the Biological Sciences (preferred)	4
MATH:1550	Engineering Calculus I	4
MATH:1850	Calculus I	4
One of these:		
MATH:1560	Engineering Calculus II	4
MATH:1860	Calculus II	4
STAT:2010	Statistical Methods and Computing	3
STAT:3510/ IGPI:3510	Biostatistics (preferred)	3

Introductory Physics Courses

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

Science Electives

Some of these courses may be used to fulfill other requirements for the major; students who have used a course from this list to fulfill another requirement for the major may not use that course as an elective. Students should consult their advisor to gain approval for a course that is not on the list. Undergraduate Research (CHEM:3994) may not be used to satisfy the science electives requirement.

Course #	Title	Hours
A total of 6 s.h. from these:		
CHEM:3110	Equilibria and Electrochemistry	3
CHEM:3120	Spectroscopy and Separations	3
CHEM:3430	Analytical Measurements	3
CHEM:3440	Physical Measurements	3
CHEM:3530	Inorganic Chemistry Laboratory	3
CHEM:4270	Advanced Inorganic Chemistry	3
CHEM:4372	Advanced Organic Chemistry	3
CHEM:4431	Chemical Thermodynamics	3
CHEM:4432	Quantum Mechanics and Chemical Kinetics	3
CHEM:4480	Introduction to Molecular Modeling	3
CHEM:4760	Radiochemistry: Energy, Medicine, and the Environment	3
CHEM:4873	Atmospheric and Environmental Chemistry	3
BMB:3110	Biochemistry	3
BMB:3120	Biochemistry and Molecular Biology I	3
BMB:3130	Biochemistry and Molecular Biology II	3
CEE:4150/CBE:4420	Environmental Chemistry	3
SEES:4490	Elements of Geochemistry	3
SEES:4540	Isotope Geochemistry	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.

Combined Programs

BA/MAT (Science Education Subprogram)

Students who are interested in pursuing a graduate degree in teaching may apply to the combined Bachelor of Arts/Master of Arts in Teaching with a science education subprogram offered by the College of Liberal Arts and Sciences and the College of Education. Designed for undergraduates majoring in biology, chemistry, environmental sciences, or physics, the combined program enables students to earn a BA and MAT in five years by beginning to earn graduate credit during their fourth year of undergraduate study and by counting a maximum of 19 s.h. of qualifying credit toward both degrees. For more information, see "Combined Program" under Science Education in the Master of Arts in Teaching (College of Education) section of the catalog. Interested students should consult an advisor.

Honors

Honors in the Major

Chemistry majors may 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 must also complete an undergraduate research project acceptable to their research advisor and 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 may also 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:1460 Calculus for the Biological Sciences, MATH:1550 Engineering Calculus I, 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: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; and STAT:2010 Statistical Methods and Computing, STAT:3510 Biostatistics, MATH:1560 Engineering Calculus II, or MATH:1860 Calculus II.

Before the seventh semester begins: two more courses in the major; PHYS:1511 College Physics I–PHYS:1512 College Physics II or PHYS:1611 Introductory Physics I–PHYS:1612 Introductory Physics II; and at least 90 s.h. earned toward the degree.

Before the eighth semester begins: CHEM:4430 Principles of Physical Chemistry and one more course 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.

Chemistry, BA

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
ENGL:1200 or RHET:1030	Interpreting Literature or Rhetoric: Writing and Communication	3 - 4
MATH:1440	Mathematics for the Biological Sciences [c]	4
GE CLAS Core: Understanding Cultural Perspectives [d]		3
CSI:1600	Success at Iowa	1
	Hours	**15-16**
Spring		
CHEM:1120	Principles of Chemistry II	4
MATH:1460	Calculus for the Biological Sciences	4
GE CLAS Core: World Languages First Level Proficiency or elective course [e]		4 - 5
Elective course [f]		3
	Hours	**15-16**
Second Year		
Fall		
CHEM:2021	Fundamentals of Chemical Measurements	3
CHEM:2230	Organic Chemistry I for Majors [g]	3
RHET:1030 or ENGL:1200	Rhetoric: Writing and Communication or Interpreting Literature	3 - 4
GE CLAS Core: World Languages Second Level Proficiency or elective course [e]		4 - 5
Elective course [f]		3
	Hours	**16-18**
Spring		
CHEM:2240	Organic Chemistry II for Majors [h]	3
CHEM:2420	Organic Chemistry Laboratory for Majors [h]	3
STAT:3510	Biostatistics	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		
Fall		
CHEM:3110 or CHEM:3120	Equilibria and Electrochemistry [i] or Spectroscopy and Separations	3
PHYS:1511	College Physics I	4
GE CLAS Core: Values and Society [d]		3
GE CLAS Core: World Languages Fourth Level Proficiency or elective course [e]		4 - 5
Elective course [f]		3
	Hours	**17-18**
Spring		
CHEM:3250	Inorganic Chemistry [h]	3
PHYS:1512	College Physics II	4
Major Elective: science elective course [j]		3
GE CLAS Core: Literary, Visual, and Performing Arts [d]		3
Elective course [f]		3
	Hours	**16**
Fourth Year		
Fall		
CHEM:4430	Principles of Physical Chemistry [k]	3
Major Elective: science elective course [j]		3
GE CLAS Core: International and Global Issues [d]		3
Elective course [f]		3
Elective course [f]		3
	Hours	**15**
Spring		
CHEM:4450	Synthesis and Measurement [h]	3
GE CLAS Core: Social Sciences [d]		3
Elective course [f]		3
Elective course [f]		3
Elective course [f]		3
Degree Application: apply on MyUI before deadline (typically in February for spring, September for fall) [l]		
	Hours	**15**
	Total Hours	**125-131**

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

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 Typically CHEM:3110 is offered in fall semesters only and CHEM:3120 is offered spring semesters only. Check MyUI for course availability since offerings are subject to change.
j Students are required to complete 6 s.h. of science electives chosen from a list of approved courses. Students who have used a course to fulfill another requirement for the major may not use that course as a science elective.
k This course is offered in both fall and spring semesters and is a prerequisite for CHEM:4450. If taken in spring, it should be planned for the spring semester of the third year.
l Please see Academic Calendar, on 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.