Chemistry, B.A.

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 g.p.a. 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 B.A. degree is a good choice for students interested in medical or other professional schools, or those interested in a teaching career (see ‘Teacher Licensure’ below). 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 B.S. degree, the B.A. 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.

Students may not use a course to fulfill more than one requirement.
The B.A. with a major in chemistry requires the following coursework.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemistry Foundation Courses</td>
<td></td>
<td>20</td>
</tr>
<tr>
<td>Advanced Chemistry Courses</td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Mathematics Courses</td>
<td></td>
<td>7-8</td>
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<tr>
<td>Introductory Physics Courses</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Science Electives</td>
<td></td>
<td>6</td>
</tr>
<tr>
<td>Total Hours</td>
<td></td>
<td>53-54</td>
</tr>
</tbody>
</table>

**Chemistry Foundation Courses**

Students complete the following foundation courses.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>All of these:</td>
<td>Principles of Chemistry I-II</td>
<td>8</td>
</tr>
<tr>
<td>CHEM:2021</td>
<td>Fundamentals of Chemical Measurements</td>
<td>3</td>
</tr>
<tr>
<td>One of these sequences:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM:2210 &amp; 2220</td>
<td>Organic Chemistry I-II</td>
<td>6</td>
</tr>
<tr>
<td>CHEM:2230 &amp; 2240</td>
<td>Organic Chemistry I for Majors - Organic Chemistry II for Majors (preferred)</td>
<td>6</td>
</tr>
<tr>
<td>One of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM:2410</td>
<td>Organic Chemistry Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:2420</td>
<td>Organic Chemistry Laboratory for Majors (preferred)</td>
<td>3</td>
</tr>
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</table>

**Advanced Chemistry**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM:3110</td>
<td>Analytical Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:3120</td>
<td>Analytical Chemistry II (preferred)</td>
<td>3</td>
</tr>
<tr>
<td>All of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM:3250</td>
<td>Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4430</td>
<td>Principles of Physical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4450</td>
<td>Synthesis and Measurement</td>
<td>3</td>
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</table>

**Mathematics**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of these:</td>
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<td></td>
</tr>
<tr>
<td>MATH:1460</td>
<td>Calculus for the Biological Sciences (preferred)</td>
<td>4</td>
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<tr>
<td>MATH:1550</td>
<td>Engineering Mathematics I: Single Variable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH:1850</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>One of these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>MATH:1560</td>
<td>Engineering Mathematics II: Multivariable Calculus</td>
<td>4</td>
</tr>
<tr>
<td>MATH:1860</td>
<td>Calculus II</td>
<td>4</td>
</tr>
<tr>
<td>STAT:2010</td>
<td>Statistical Methods and Computing</td>
<td>3</td>
</tr>
<tr>
<td>STAT:3510/IGPI:3510</td>
<td>Biostatistics (preferred)</td>
<td>3</td>
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</tbody>
</table>

**Introductory Physics**

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>One of these sequences:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PHYS:1511-1512</td>
<td>College Physics I-II (preferred)</td>
<td>8</td>
</tr>
<tr>
<td>PHYS:1611-1612</td>
<td>Introductory Physics I-II</td>
<td>8</td>
</tr>
</tbody>
</table>

**Science Electives**

Some of these courses may be used to fulfill other requirements for the major, as listed above; 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.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>A total of 6 s.h. from these:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM:3110</td>
<td>Analytical Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:3120</td>
<td>Analytical Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:3430</td>
<td>Analytical Measurements</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:3440</td>
<td>Physical Measurements</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:3530</td>
<td>Inorganic Chemistry Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4171</td>
<td>Advanced Analytical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4270</td>
<td>Advanced Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4372</td>
<td>Advanced Organic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4431</td>
<td>Physical Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4432</td>
<td>Physical Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4480</td>
<td>Introduction to Molecular Modeling</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4760</td>
<td>Radiochemistry: Energy, Medicine, and the Environment</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4873</td>
<td>Atmospheric and Environmental Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM:4875</td>
<td>Introduction to Polymer Chemistry</td>
<td>2-3</td>
</tr>
<tr>
<td>BIOC:3110</td>
<td>Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>BIOC:3120</td>
<td>Biochemistry and Molecular Biology I</td>
<td>3</td>
</tr>
<tr>
<td>BIOC:3130</td>
<td>Biochemistry and Molecular Biology II</td>
<td>3</td>
</tr>
<tr>
<td>CEE:4150/CBE:4420</td>
<td>Environmental Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>EES:4490</td>
<td>Elements of Geochemistry</td>
<td>3</td>
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<tr>
<td>EES:4520</td>
<td>Isotope Geochemistry</td>
<td>3</td>
</tr>
</tbody>
</table>

**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
Teacher Education Program Application and Admission 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

B.A./M.A.T. (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 B.A. and M.A.T. in five years by beginning to earn graduate credit during their fourth year of undergraduate study and by counting up to 18 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.

B.A./M.S. in Business Analytics (Career Subprogram)
Students majoring in chemistry who are interested in earning a master's degree in business analytics with a career subprogram may apply to the combined B.A./M.S. program offered by the College of Liberal Arts and Sciences and the Tippie College of Business. The program enables students to begin the study of business analytics before they complete their bachelor's degree. Students are able to complete both degrees in five years rather than six.

Separate application to each degree program is required. Applicants must be admitted to both programs before they may be admitted to the combined degree program. For more information about the business analytics program, see the Program section of the Catalog. Interested students should consult an advisor.

B.A./M.S. in Finance
Students majoring in chemistry who are interested in earning a master's degree in finance may apply to the combined B.A./M.S. program offered by the College of Liberal Arts and Sciences and the Tippie College of Business. The program enables students to earn an undergraduate degree in chemistry before they complete their bachelor's degree. Students are able to complete both degrees in five years rather than six.

Separate application to each degree program is required. Applicants must be admitted to both programs before they may be admitted to the combined degree program. For more information about the finance program, see the M.S. in finance (Tippie College of Business) in the Catalog.

Honors

Honors in the Major
Majors are able to graduate with departmental honors. Students must maintain a cumulative University of Iowa g.p.a. of at least 3.33, as required by the College of Liberal Arts and Sciences; additionally, students must maintain a 3.33 cumulative g.p.a. in the major, a g.p.a. 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.

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 or 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; organic chemistry I, II, and lab; and biostatistics or calculus II

Before the seventh semester begins: two more courses in the major; physics I and 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, B.A.

#### First Year

**Fall**
- **ENGL:1200** or **RHET:1030** The Interpretation of Literature or Rhetoric 3 - 4
- **CHEM:1110** Principles of Chemistry I 4
- **Elective course** 3
- **MATH:1020** Elementary Functions 4
- **CSI:1600** Success at Iowa 2
- **Hours** 16-17

**Spring**
- **CHEM:1120** Principles of Chemistry II 4
- **MATH:1850** Calculus I 4
- **GE CLAS Core: World Languages First Level** Proficiency or elective course 3
- **ENGL:1200** or **RHET:1030** The Interpretation of Literature or Rhetoric 3 - 4
- **Hours** 16-18

#### Second Year

**Fall**
- **CHEM:2230** Organic Chemistry I for Majors 3
- **CHEM:2021** Fundamentals of Chemical Measurements 3
- **Elective course** 3
- **GE CLAS Core: World Languages Second Level** Proficiency or elective course 4
- **ENGL:1200** or **RHET:1030** The Interpretation of Literature or Rhetoric 3 - 4
- **Hours** 16-17

**Spring**
- **CHEM:2240** Organic Chemistry II for Majors 3
- **CHEM:2420** Organic Chemistry Laboratory for Majors 3
- **STAT:3510** Biostatistics 3
- **GE CLAS Core: World Languages Second Level** Proficiency or elective course 4
- **GE CLAS Core: Historical Perspectives** 3
- **Hours** 16-17

#### Third Year

**Fall**
- **CHEM:3110** or **CHEM:3120** Analytical Chemistry I or Analytical Chemistry II 3
- **PHYS:1511** College Physics I 4
- **GE CLAS Core: Values and Culture** 3
- **GE CLAS Core: World Languages Fourth Level** Proficiency or elective course 4
- **Elective course** 3
- **Hours** 17-18

**Spring**
- **CHEM:3250** Inorganic Chemistry 3
- **PHYS:1512** College Physics II 4
- **Major: science elective course** 3
- **GE CLAS Core: Literary, Visual, and Performing Arts** 3
- **GE CLAS Core: Diversity and Inclusion** 3
- **Hours** 16

### Fourth Year

**Fall**
- **CHEM:4430** Principles of Physical Chemistry 3
- **GE CLAS Core: International and Global Issues** 3
- **Major: science elective course** 3
- **Elective course** 3
- **Hours** 15

**Spring**
- **CHEM:4450** Synthesis and Measurement 3
- **GE CLAS Core: Social Sciences** 3
- **Elective course** 3
- **Elective course** 3
- **Elective course** 3
- **Degree Application: apply on MyUI before deadline** (typically in February for spring, September for fall) 15
- **Total Hours** 126-132

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### 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 Viaksins, Harris & Pady PLLP Award. Chemistry majors also may apply for the Donald J. and Margaret Burton Scholarship, Ken Sando Scholarship,
Shoemaker-Strickler Scholarship, E. David Cater Scholarship, and Russell K. Simms Scholarship.

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.