The Department of Chemistry and Biochemistry offers the following undergraduate and graduate programs. Specific requirements for these programs are listed within this Department of Chemistry and Biochemistry section in the following order:

**Undergraduate Majors (B.S.)**
- Biochemistry
- Chemistry

**Undergraduate Majors (B.A.)**
- Biochemistry
- Chemistry
- Chemistry-Teaching

**Minors**
- Chemistry

Major programs are offered by the Department of Chemistry and Biochemistry in two baccalaureate degree areas:
- the Bachelor of Science and
- the Bachelor of Arts

1. Students considering a baccalaureate chemistry major should complete two semesters of general chemistry, CHEM 1110 (860:044) and CHEM 1120 (860:048), in the freshman year. Well-prepared students may be permitted to take CHEM 1130 (860:070), an accelerated course in general chemistry, during their first semester. It is strongly recommended that chemistry majors complete requirements in mathematics and physics within the first two years.

2. Prior to enrollment in a chemistry course, all pre-requisite courses must be completed with a grade of C- or higher.

3. A student enrolled in a chemistry course during fall or spring semester and who wishes to enroll in the same course in the subsequent spring or fall semester should contact the department. The student will be allowed to register only if space remains after all advance registrations are completed.

**Bachelor of Science Degree Programs**

**Biochemistry Major**
The B.S. Biochemistry major requires a minimum of 126 total hours to graduate. This total includes Liberal Arts Core requirements and the following specified major requirements, plus electives to complete the minimum of 126 hours.

The Bachelor of Science Biochemistry major is accredited by the American Chemical Society. This major prepares students for careers and/or advanced study in biochemistry. It also provides partial preparation appropriate for medical school and other health-related programs.

**Required**

<table>
<thead>
<tr>
<th>Mathematics:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 1420 (800:060)</td>
<td>Calculus I</td>
</tr>
<tr>
<td>MATH 1421 (800:061)</td>
<td>Calculus II</td>
</tr>
<tr>
<td>BIOL 2052 (840:052)</td>
<td>General Biology: Cell Structure and Function</td>
</tr>
<tr>
<td>BIOL 3140 (840:140)</td>
<td>Genetics</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Chemistry and Biochemistry:</th>
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</thead>
<tbody>
<tr>
<td>CHEM 1120 (860:048)</td>
<td>General Chemistry II</td>
</tr>
<tr>
<td>or CHEM 1110 (860:044)</td>
<td>General Chemistry I (*)</td>
</tr>
<tr>
<td>or CHEM 1130 (860:070)</td>
<td>General Chemistry I-II</td>
</tr>
<tr>
<td>CHEM 2110 (860:110)</td>
<td>Descriptive Inorganic Chemistry</td>
</tr>
<tr>
<td>CHEM 2210 (860:120)</td>
<td>Organic Chemistry I</td>
</tr>
<tr>
<td>CHEM 2220 (860:123)</td>
<td>Organic Chemistry II</td>
</tr>
<tr>
<td>CHEM 2230 (860:121)</td>
<td>Organic Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 2310 (860:132)</td>
<td>Chromatography and Quantitative Analysis</td>
</tr>
<tr>
<td>CHEM 3600 (860:180)</td>
<td>Undergraduate Research in Chemistry</td>
</tr>
<tr>
<td>CHEM 4010/5010</td>
<td>Chemical Safety Seminar</td>
</tr>
<tr>
<td>CHEM 4220/5220 (860:161g)</td>
<td>Organic Structure Analysis</td>
</tr>
<tr>
<td>or CHEM 4310/5310 (860:137g)</td>
<td>Instrumental Analysis</td>
</tr>
<tr>
<td>CHEM 4420/5420 (860:140g)</td>
<td>Physical Chemistry I</td>
</tr>
<tr>
<td>CHEM 4430/5430 (860:141g)</td>
<td>Physical Chemistry II</td>
</tr>
<tr>
<td>CHEM 4440/5440 (860:143g)</td>
<td>Physical Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 4510/5510 (860:154g)</td>
<td>Biochemistry I</td>
</tr>
<tr>
<td>CHEM 4520/5520 (860:155g)</td>
<td>Biochemistry II</td>
</tr>
<tr>
<td>CHEM 4530/5530 (860:156g)</td>
<td>Biochemistry Laboratory</td>
</tr>
</tbody>
</table>

**Physics:**

Select one of the following:

<table>
<thead>
<tr>
<th>PHYSICS 1511 (880:054) &amp; PHYSICS 1512 (880:056)</th>
<th>General Physics I and General Physics II</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 1701 (880:130) &amp; PHYSICS 1702 (880:131)</td>
<td>Physics I for Science and Engineering and Physics II for Science and Engineering</td>
</tr>
</tbody>
</table>

**Electives**

3-4
### Chemistry Major

The B.S. Chemistry major requires a minimum of 126 total hours to graduate. This total includes Liberal Arts Core requirements and the following specified major requirements, plus electives to complete the minimum of 126 hours.

The Bachelor of Science Chemistry major is accredited by the American Chemical Society. This program is recommended for students who wish to prepare for careers as professional chemists. It also provides the most complete preparation for post-graduate study in the field of chemistry.

#### Required

**Mathematics:**

- **MATH 1420 (800:060)** Calculus I * 4
- **MATH 1421 (800:061)** Calculus II 4

**Chemistry and Biochemistry:**

- **CHEM 1120 (860:048)** General Chemistry II and General Chemistry I (*) 5-8
- **CHEM 1110 (860:070)** General Chemistry I-II
- **CHEM 2110 (860:110)** Descriptive Inorganic Chemistry 4
- **CHEM 2210 (860:120)** Organic Chemistry I 3
- **CHEM 2220 (860:123)** Organic Chemistry II 3
- **CHEM 2230 (860:121)** Organic Chemistry Laboratory 2
- **CHEM 2310 (860:132)** Chromatography and Quantitative Analysis 4
- **CHEM 3600 (860:180)** Undergraduate Research in Chemistry 2
- **CHEM 4010/5010** Chemical Safety Seminar 1
- **CHEM 4110/5110 (860:145g)** Inorganic Chemistry 3
- **CHEM 4310/5310 (860:137g)** Instrumental Analysis 4
- **CHEM 4420/5420 (860:140g)** Physical Chemistry I 3
- **CHEM 4430/5430 (860:141g)** Physical Chemistry II 3
- **CHEM 4440/5440 (860:143g)** Physical Chemistry Laboratory 2
- **CHEM 4510/5510 (860:154g)** Biochemistry I 3
- **CHEM 4610/5610 (860:149g)** Advanced Synthesis Laboratory 2

**Physics:**

- **PHYSICS 1701 (880:130g)** Physics I for Science and Engineering 8
- **PHYSICS 1702 (880:131g)** Physics II for Science and Engineering

* Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

** Students taking the 3 hour course CHEM 4220/5220 (860:149g) Organic Structure Analysis as an alternative to the 4 hour course CHEM 4310/5310 (860:137g)

Instrumental Analysis are required to take a 4 hour elective that includes a lab component.

### Notes:

1. To satisfy American Chemical Society guidelines for certification of the Chemistry major, the two hours of CHEM 3600 (860:180) Undergraduate Research required for this program must include completion of a final written report.
2. Elective courses should be chosen with the help of the major advisor. This is particularly important for students wishing to earn a certified degree, to assure consistency with the certification guidelines of the American Chemical Society. An appropriate advanced course in another science may be substituted with department head approval.
3. Students wishing to earn a non-certified Bachelor of Science degree may omit CHEM 4110/5110 (860:145g) . CHEM 4610/5610 (860:149g) , and CHEM 4510/5510 (860:154g), but must include three additional elective hours in chemistry at the 100/4000-level or higher.

### Emphasis-Honors Research

This emphasis is available to qualified students pursuing the Bachelor of Science program by invitation at the beginning of their junior year. Completion of Honors Research requires 5 credit hours in CHEM 3600 (860:180) Undergraduate Research and the writing of a senior research thesis. The research credit may be applied to the elective hours of the B.S. degree.

### Bachelor of Arts Degree Programs

#### Biochemistry Major

The B.A. Biochemistry major requires a minimum of 120 total hours to graduate. This total includes Liberal Arts Core requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

This program provides experience in most basic areas of chemistry, with a focus on biochemistry. With appropriate choice of university electives, the B.A. Biochemistry major meets the needs of pre-medical students and students preparing for additional study in related areas such as pharmacology, medicinal chemistry, clinical chemistry, and toxicology. It is also suitable for students who wish to combine a chemistry major with a major in another discipline.

#### Required

**Mathematics:**

- **MATH 1420 (800:060)** Calculus I * 4

**Biology:**

- **BIOL 2052 (840:052)** General Biology: Cell Structure and Function 4
- **BIOL 3140 (840:140)** Genetics 4

**Chemistry and Biochemistry:**

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1110</td>
<td>General Chemistry I-II</td>
<td>5-8</td>
</tr>
<tr>
<td>CHEM 2110</td>
<td>Descriptive Inorganic Chemistry</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 2210</td>
<td>Organic Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 2220</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 2230</td>
<td>Organic Chemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 2310</td>
<td>Chromatography and Quantitative Analysis</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 4510</td>
<td>Biochemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 4610</td>
<td>Advanced Synthesis Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>PHYSICS 1701</td>
<td>Physics I for Science and Engineering</td>
<td>8</td>
</tr>
<tr>
<td>PHYSICS 1702</td>
<td>Physics II for Science and Engineering</td>
<td>8</td>
</tr>
</tbody>
</table>
Department of Chemistry and Biochemistry

CHEM 1120 (860:048) General Chemistry II 5-8
& CHEM 1110 (860:044) and General Chemistry I (*)

or CHEM 1130 (860:070) General Chemistry I-II

CHEM 2110 (860:110) Descriptive Inorganic Chemistry 4

or CHEM 2310 (860:132) Chromatography and Quantitative Analysis

CHEM 2210 (860:120) Organic Chemistry I 3
CHEM 2220 (860:123) Organic Chemistry II 3
CHEM 2230 (860:121) Organic Chemistry Laboratory 2
CHEM 2310 (860:132) Chromatography and Quantitative Analysis 4

CHEM 4010/5010 Chemical Safety Seminar 1

CHEM 4100/5100 General Physics I 4
& CHEM 4310/5310 (860:137g) Physical Chemistry I 3
CHEM 4420/5420 (860:140g) Physical Chemistry II 3

Physics:

Select one of the following: 8

PHYSICS 1511 (880:054) & PHYSICS 1512 (880:056) General Physics I and General Physics II

or

PHYSICS 1701 (880:130) & PHYSICS 1702 (880:131) Physics I for Science and Engineering and Physics II for Science and Engineering

Total Hours 48-51

* Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

Chemistry Major-Teaching

The B.A. Chemistry-Teaching major requires a minimum of 120 total hours to graduate. This total includes Liberal Arts Core requirements, the Professional Education Requirements, and the following specified major requirements, plus electives to complete the minimum of 120 hours.

This program provides preparation for chemistry teachers with successful completion leading to recommendation for State of Iowa licensure in 5-12 Chemistry. Coursework that leads to additional endorsements is recommended and should be selected in consultation with your advisor.

Required

Mathematics:
MATH 1420 (800:060) Calculus I * 4
MATH 1421 (800:061) Calculus II 4

Chemistry and Biochemistry:
CHEM 1120 (860:048) & CHEM 1110 (860:044) General Chemistry II and General Chemistry I (*) 5-8

or CHEM 1130 (860:070) General Chemistry I-II 4

CHEM 2110 (860:110) Descriptive Inorganic Chemistry 4
CHEM 2210 (860:120) Organic Chemistry I 3
CHEM 2220 (860:123) Organic Chemistry II 3
CHEM 2230 (860:121) Organic Chemistry Laboratory 2
CHEM 2310 (860:132) Chromatography and Quantitative Analysis 4

CHEM 4010/5010 Chemical Safety Seminar 1
CHEM 4100/5010 General Physics I 4
& CHEM 4310/5310 (860:137g) Physical Chemistry I 3
CHEM 4420/5420 (860:140g) Physical Chemistry II 3

Physics:

Select one of the following: 8

PHYSICS 1511 (880:054) & PHYSICS 1512 (880:056) General Physics I and General Physics II

or

PHYSICS 1701 (880:130) & PHYSICS 1702 (880:131) Physics I for Science and Engineering and Physics II for Science and Engineering

Total Hours 48-51

* Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

Notes:

1. To satisfy American Chemical Society guidelines for certification of the Biochemistry major, the two hours of CHEM 3600 (860:180) Undergraduate Research required for this program must include completion of a final written report.

Chemistry Major

The B.A. Chemistry major requires a minimum of 120 total hours to graduate. This total includes Liberal Arts Core requirements and the following specified major requirements, plus electives to complete the minimum of 120 hours.

This program provides experience in all basic areas of chemistry. With appropriate choice of university electives, the B.A. Chemistry major meets the needs of pre-medical students and students preparing for additional study in related areas such as biochemistry, industrial hygiene, pharmacology and medicinal chemistry, clinical chemistry, and toxicology. It is also suitable for students who wish to combine a chemistry major with a major in another discipline.

Required

Mathematics:
MATH 1420 (800:060) Calculus I * 4
MATH 1421 (800:061) Calculus II 4

Chemistry and Biochemistry:
CHEM 1120 (860:048) & CHEM 1110 (860:044) General Chemistry II and General Chemistry I (*) 5-8

or CHEM 1130 (860:070) General Chemistry I-II 4

CHEM 2110 (860:110) Descriptive Inorganic Chemistry 4
CHEM 2210 (860:120) Organic Chemistry I 3
CHEM 2220 (860:123) Organic Chemistry II 3
CHEM 2230 (860:121) Organic Chemistry Laboratory 2
CHEM 2310 (860:132) Chromatography and Quantitative Analysis 4

CHEM 4010/5010 Chemical Safety Seminar 1
CHEM 4100/5010 General Physics I 4
& CHEM 4310/5310 (860:137g) Physical Chemistry I 3
CHEM 4420/5420 (860:140g) Physical Chemistry II 3

Physics:

Select one of the following: 8

PHYSICS 1511 (880:054) & PHYSICS 1512 (880:056) General Physics I and General Physics II

or

PHYSICS 1701 (880:130) & PHYSICS 1702 (880:131) Physics I for Science and Engineering and Physics II for Science and Engineering

Total Hours 48-51

* Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.
Department of Chemistry and Biochemistry

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<table>
<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 1701 (880:130)</td>
<td>Physics I for Science and Engineering</td>
</tr>
<tr>
<td>&amp; PHYSICS 1702 (880:131)</td>
<td>and Physics II for Science and Engineering</td>
</tr>
</tbody>
</table>

**Methods**

<table>
<thead>
<tr>
<th>Science and Science Education:</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>SCI ED 3300/5300 (820:190g)</td>
<td>Orientation to Science Teaching</td>
</tr>
<tr>
<td>SCI ED 4700/5700 (820:193g)</td>
<td>Methods for Teaching Physical Science</td>
</tr>
<tr>
<td>TEACHING 3129</td>
<td>Secondary and Special-Area Classroom Management</td>
</tr>
</tbody>
</table>

**Total Hours**

44

* Has prerequisite of satisfactory score on ALEKS exam or subsequent remediation.

**Notes:**

1. Well-prepared students may substitute CHEM 1130 (860:070) for CHEM 1110 (860:044) and CHEM 1120 (860:048); these students must also substitute CHEM 2210 (860:120) and CHEM 2230 (860:121) and CHEM 2220 (860:123) for CHEM 2040.

**Minors**

**Chemistry Minor**

**Required**

<table>
<thead>
<tr>
<th>Chemistry and Biochemistry:</th>
<th>5-8</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 1120 (860:048)</td>
<td>General Chemistry II</td>
</tr>
<tr>
<td>&amp; CHEM 1110 (860:044)</td>
<td>and General Chemistry I (*)</td>
</tr>
<tr>
<td>or CHEM 1130 (860:070)</td>
<td>General Chemistry I-II</td>
</tr>
</tbody>
</table>

**Electives**

14

**Total Hours**

19-22

**Note:** Courses numbered 2000 and above may be used as electives for the Chemistry Minor, with the following exceptions: CHEM 4010/5010, CHEM 4630/5630, and any Cooperative Education, Independent Study, Readings, Research, and Seminar courses.

*Following are some suggested elective courses to complete the Chemistry Minor:

<table>
<thead>
<tr>
<th>CHEM 2040</th>
<th>Applied Organic and Biochemistry</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 2110 (860:110)</td>
<td>Descriptive Inorganic Chemistry</td>
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<tr>
<td>CHEM 2210 (860:120)</td>
<td>Organic Chemistry I</td>
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<td>Organic Chemistry II</td>
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<tr>
<td>CHEM 2230 (860:121)</td>
<td>Organic Chemistry Laboratory</td>
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<tr>
<td>CHEM 2310 (860:132)</td>
<td>Chromatography and Quantitative Analysis</td>
</tr>
<tr>
<td>CHEM 4200/5200 (860:144g)</td>
<td>Nanoscience</td>
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