BACHELOR OF ARTS IN CHEMISTRY

High school preparation for the chemistry and biochemistry degree programs should include two years of algebra, one year of geometry, one-half year of trigonometry, one year of chemistry, and one year of physics. Calculus is highly recommended.

Mandatory Advising

All undergraduate chemistry and biochemistry majors are required to meet with a major advisor several times over their academic career. First-time freshmen and new transfer students are required to meet with an advisor or attend a group advising session during the first semester of attendance. Continuing students enrolled in the following courses will be required to meet with an advisor that semester to avoid having a hold placed on their registration for the next semester.

CHEM 115 General Chemistry I: Essential Concepts of Chemistry 5
CHEM 233 Organic Chemistry I 3
CHEM 300 General Physical Chemistry I 3
CHEM 321 Quantitative Chemical Analysis 3
CHEM 351 Physical Chemistry I: Thermodynamics and Kinetics 3

- All courses used in the major program must be completed with letter grades (CR/NC not allowed) and a minimum GPA of 2.0 (SF State Major GPA).
- Grades of C or better are required in chemistry prerequisite courses.
- Other courses for the major must be completed with grades of C– or better with one exception.

Chemistry (B.A.) — 56 units

Lower Division Requirements (31 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 115</td>
<td>General Chemistry I: Essential Concepts of Chemistry</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 215</td>
<td>General Chemistry II: Quantitative Applications of Chemistry Concepts</td>
<td>5</td>
</tr>
<tr>
<td>&amp; CHEM 216</td>
<td>and General Chemistry II Laboratory: Quantitative Applications of Chemistry Concepts</td>
<td></td>
</tr>
<tr>
<td>CHEM 233</td>
<td>Organic Chemistry I</td>
<td>5</td>
</tr>
<tr>
<td>&amp; CHEM 234</td>
<td>and Organic Chemistry I Laboratory</td>
<td></td>
</tr>
<tr>
<td>MATH 226</td>
<td>Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>MATH 227</td>
<td>Calculus II</td>
<td>4</td>
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</table>

Select one of the following: 8

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYS 111</td>
<td>General Physics I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; PHYS 112</td>
<td>and General Physics I Laboratory</td>
<td></td>
</tr>
<tr>
<td>&amp; PHYS 121</td>
<td>and General Physics II</td>
<td></td>
</tr>
<tr>
<td>&amp; PHYS 122</td>
<td>and General Physics II Laboratory</td>
<td></td>
</tr>
<tr>
<td>PHYS 220</td>
<td>General Physics with Calculus I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; PHYS 222</td>
<td>and General Physics with Calculus I Laboratory</td>
<td></td>
</tr>
<tr>
<td>&amp; PHYS 240</td>
<td>and General Physics with Calculus III</td>
<td></td>
</tr>
<tr>
<td>&amp; PHYS 242</td>
<td>and General Physics with Calculus III Laboratory</td>
<td></td>
</tr>
</tbody>
</table>

Upper Division Requirements (25 units)

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 300</td>
<td>General Physical Chemistry I</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 321</td>
<td>Quantitative Chemical Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 322</td>
<td>Quantitative Chemical Analysis Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 325</td>
<td>Inorganic Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 335</td>
<td>Organic Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 336</td>
<td>Organic Chemistry II Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 340</td>
<td>Biochemistry I</td>
<td>3</td>
</tr>
<tr>
<td>or CHEM 349</td>
<td>General Biochemistry</td>
<td></td>
</tr>
<tr>
<td>CHEM 390GW</td>
<td>Contemporary Chemistry and Biochemistry Research - GWAR</td>
<td>3</td>
</tr>
</tbody>
</table>

Advanced Laboratory Electives

Students must complete at least three units of advanced laboratory electives selected from the list below. Courses from community colleges can not be substituted for the courses on the list below. Consult with an advisor regarding selection of elective courses and check course co- and prerequisites before enrolling.

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Title</th>
<th>Credits</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 327</td>
<td>Practical GC and HPLC</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 343</td>
<td>Biochemistry I Laboratory</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 370</td>
<td>Computer Applications in Chemistry and Biochemistry</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 420</td>
<td>Environmental Analysis</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 422</td>
<td>Instrumental Analysis</td>
<td>4</td>
</tr>
<tr>
<td>CHEM 426</td>
<td>Advanced Inorganic Chemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 451</td>
<td>Experimental Physical Chemistry Laboratory</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 470</td>
<td>Research</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 699</td>
<td>Independent Study</td>
<td>1-3</td>
</tr>
</tbody>
</table>

Note: A minimum of 40 upper division units must be completed for the degree (including upper division units required for the major, general education, electives, etc.). A student can complete this major yet not attain the necessary number of upper division units required for graduation. In this case additional upper division courses will be needed to reach the required total.

1 CHEM 351 may be substituted for CHEM 300 and CHEM 353 may be substituted for CHEM 301 if prerequisites for CHEM 351 and CHEM 353 are met.

2 CHEM 338 may be substituted for CHEM 336.

3 By petition only. CHEM 699 and CHEM 470 may not both be used to fulfill the elective requirements.

Complementary Studies

Students in the B.A. chemistry program will satisfy the Complementary Studies Requirement with the completion of courses in physics and mathematics that are required for the major.

Students who have earned AA-T or AS-T degrees and are pursuing a similar B.A. degree at SF State are required to fulfill the Complementary Studies requirement as defined by the major department. Students should consult with a major advisor about how transfer units and/or SF State units can best be applied to this requirement in order to ensure degree completion within 60 units.

General Education Requirements Met in the Chemistry Major or Undeclared with Interest in Chemistry

The requirements below are deemed “met in the major” upon completion of the courses listed (even though the courses and their prerequisites are not approved for GE). This is true whether or not the student completes the major.

Area B1 (Physical Science) is satisfied upon completion of CHEM 233.
Area B3 (Laboratory Science) is satisfied upon completion of CHEM 234.
### General Education Requirements

<table>
<thead>
<tr>
<th>Requirement</th>
<th>Course Level</th>
<th>Units</th>
<th>Area Designation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oral</td>
<td>LD</td>
<td>3</td>
<td>A1</td>
</tr>
<tr>
<td>Communication (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Written English Communication I (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>A2</td>
</tr>
<tr>
<td>Critical Thinking (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>A3</td>
</tr>
<tr>
<td>Written English Communication II (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>A4</td>
</tr>
<tr>
<td>Physical Science (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>B1</td>
</tr>
<tr>
<td>Life Science (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>B2</td>
</tr>
<tr>
<td>Lab Science (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>1</td>
<td>B3</td>
</tr>
<tr>
<td>Mathematics/ Quantitative Reasoning (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>B4</td>
</tr>
<tr>
<td>Arts (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>C1</td>
</tr>
<tr>
<td>Arts or Humanities (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>C1 or C2</td>
</tr>
<tr>
<td>Humanities: Literature (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>C3</td>
</tr>
<tr>
<td>Social Sciences (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>D1</td>
</tr>
<tr>
<td>Social Sciences: US History (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>D2</td>
</tr>
<tr>
<td>Social Sciences: US &amp; CA Government (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD</td>
<td>3</td>
<td>D3</td>
</tr>
<tr>
<td>Lifelong Learning and Self-Development (LLD) (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>LD or UD</td>
<td>3</td>
<td>E</td>
</tr>
<tr>
<td>Physical and/ or Life Science (bulletin.sfsu.edu/undergraduate-education/general-education/lower-division)</td>
<td>UD</td>
<td>3</td>
<td>UD-B</td>
</tr>
</tbody>
</table>
Bachelor of Arts in Chemistry

An ADT totals 60 units and includes completion of all lower-division General Education requirements and at least 18 units in a specific major. Students pursuing an ADT are guaranteed admission to the CSU if minimum eligibility requirements are met, though not necessarily to the CSU campus of primary choice.

Upon verification that the ADT has been awarded prior to matriculation at SF State, students are guaranteed B.A. or B.S. completion in 60 units if pursuing a “similar” major after transfer. Determinations about “similar” majors at SF State are made by faculty in the discipline.

Degree completion in 60 units cannot be guaranteed when a student simultaneously pursues an additional major, a minor, certificate, or credential.

A sample advising roadmap for students who have earned an ADT and continue in a “similar” major at SF State is available on the Roadmaps tab and displays:

- How many lower-division units required for the major have been completed upon entry based on award of a specific ADT;
- Which lower-division requirements are considered complete upon entry based on award of a specific ADT;
- How to complete the remaining 60 units for the degree in four semesters.

Students who have earned an ADT should seek advising in the major department during the first semester of attendance.

General Advising Information for Transfer Students

1. Before transfer, complete as many lower division requirements or electives for this major as possible.

2. The following courses are not required for admission, but are required for graduation. Students are strongly encouraged to complete these units before transfer; doing so will provide more flexibility in course selection after transfer.
   - a course in U.S. History
   - a course in U.S. & California Government
   - a 2nd-semester course in written English composition

For information about satisfying the requirements described in (1) and (2) above at a California Community College (CCC), please visit http://www.assist.org. Check any geographically accessible CCCs; sometimes options include more than one college. Use ASSIST to determine:

- Which courses at a CCC satisfy any lower division major requirements for this major, including 2nd-semester composition;

Remedial courses are not transferable and do not apply to the minimum 60 units/90 quarters required for admission.

Additional units for courses that are repeated do not apply to the minimum 60 units required for upper division transfer (for example, if course was not passed on the first attempt, or was taken to earn a better grade).

Before leaving the last California community college of attendance, obtain a summary of completion of lower division General Education units (IGETC or CSU GE Breadth). This is often referred to as a GE certification worksheet. SF State does not require delivery of this certification to Admissions, but students should retain this document for verifying degree progress after transfer.

Credit for Advanced Placement, International Baccalaureate, or College-Level Examination Program courses: AP/IB/CLEP credit is not automatically transferred from the previous institution. Units are transferred only when an official score report is delivered to SF State. Credit is based on the academic year
during which exams were taken. Refer to the University Bulletin in effect during the year of AP/IB/CLEP examination(s) for details regarding the award of credit for AP/IB/CLEP.

Students pursuing majors in science, technology, engineering and mathematics (STEM) disciplines often defer 6-9 units of lower division general education in areas C and D until after transfer in order to focus on preparation courses for the major. (This advice does not apply to students pursuing associate degree completion before transfer.)

**Transferring from institutions other than CCCs or CSUs**

Review SF State’s lower division General Education requirements. Note that, as described below, the four basic skills courses required for admission meet A1, A2, A3, and B4 in the SF State GE pattern. Courses that fulfill the remaining areas of SF State’s lower division GE pattern are available at most two-year and four-year colleges and universities.

Of the four required basic skills courses, a course in critical thinking (GE A3) may not be widely offered outside the CCC and CSU systems. Students should attempt to identify and take an appropriate course no later than the term of application to the CSU. To review more information about the A3 requirement, please visit [http://bulletin.sfsu.edu/undergraduate-education/general-education/lower-division/#AAEL](http://bulletin.sfsu.edu/undergraduate-education/general-education/lower-division/#AAEL).

Identify and complete a 2nd-semester written English composition course before transfer. This is usually the next course after the typical “freshman comp” course, with a focus on writing, reading and critical analytical skills for academic purposes, and developing skills in composing, revising, and the use of rhetorical strategies.

Waiting until after transfer to take a single course at SF State that meets both US and CA/local government requirements may be an appropriate option, particularly if transferring from outside of California.

**All students must meet the transfer eligibility requirements outlined below for admission. For more information, visit the Undergraduate Admissions section.**

- Complete 60 or more transferable semester units or 90 or more quarter units
- Earn a college grade point average of 2.00 or better in all transferable courses. Non-local area residents may be held to a higher GPA standard.
- Be in good standing at the last college or university attended
- Complete 30 semester units (45 quarter units) of general education, including four basic skills courses:
  a. One course in oral communication (same as CSU GE area A1)
  b. One course in written composition (same as CSU GE area A2)
  c. One course in critical thinking (same as CSU GE area A3)
  d. One course in mathematics or quantitative reasoning, with intermediate algebra as a prerequisite (same as CSU GE area B4)
- The four basic skills courses and a minimum of 60 transferable semester units (90 quarter units) must be completed by the spring semester prior to fall admission, or by the fall semester prior to spring admission. Earn a “C” or better grade in each basic skills course.