BACHELOR OF SCIENCE 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 (SFSU 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.S.) – 72 units

Lower Division Requirements (34 units)

CHEM 115  General Chemistry I: Essential Concepts of Chemistry  5
CHEM 215 & CHEM 216  General Chemistry II: Quantitative Applications of Chemistry Concepts and General Chemistry II Laboratory: Quantitative Applications of Chemistry Concepts  5
CHEM 233 & CHEM 234  Organic Chemistry I and Organic Chemistry I Laboratory  5
CHEM 251  Mathematics and Physics for Chemistry  3
MATH 226  Calculus I  4
MATH 227  Calculus II  4
PHYS 220 & PHYS 222  General Physics with Calculus I and General Physics with Calculus I Laboratory  4
PHYS 230 & PHYS 232  General Physics with Calculus II and General Physics with Calculus II Laboratory  4

Upper Division Requirements (38 units)

CHEM 321  Quantitative Chemical Analysis  3
CHEM 322  Quantitative Chemical Analysis Laboratory  2
CHEM 325  Inorganic Chemistry  3
CHEM 335  Organic Chemistry II  3
CHEM 336  Organic Chemistry II Laboratory  2
CHEM 340  Biochemistry I  3
CHEM 351  Physical Chemistry I: Thermodynamics and Kinetics  3
CHEM 353  Physical Chemistry II: Quantum Chemistry and Spectroscopy  3
CHEM 390GW  Contemporary Chemistry and Biochemistry Research - GWAR  3
CHEM 426  Advanced Inorganic Chemistry Laboratory  2
CHEM 451  Experimental Physical Chemistry Laboratory  2

Upper Division Electives

A minimum of nine units of electives must be selected from the following list of courses. Courses from community colleges can not be substituted for the courses on the list below.

CHEM 327  Practical GC and HPLC  4
CHEM 341  Biochemistry II  3
CHEM 343  Biochemistry I Laboratory  2
CHEM 370  Computer Applications in Chemistry and Biochemistry  3
CHEM 420  Environmental Analysis  3
CHEM 422  Instrumental Analysis  4
CHEM 433  Advanced Organic Chemistry  3
CHEM 443  Biophysical Chemistry Laboratory  4
CHEM 470  Research  3
CHEM 640  Advanced Topics in Biochemistry  3
CHEM 645  Research Trends in Chemistry and Biochemistry  3
CHEM 680  Chemical Oceanography  3
CHEM 699  Independent Study  1-3

1  CHEM 338 may be substituted for CHEM 336.
2  Students may substitute CHEM 343 for CHEM 426 or CHEM 451 upon prior approval of advisor. If CHEM 343 is used as a substitute, it can not also be used as an elective.
3  By petition only. CHEM 699 and CHEM 470 may not both be used to fulfill the elective requirements.

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</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Written English Communication I</td>
<td>LD</td>
<td>3</td>
<td>A2</td>
</tr>
</tbody>
</table>
Critical Thinking | LD | 3 | A3
Written English Communication II | LD | 3 | A4
Physical Science | LD | 3 | B1
Life Science | LD | 3 | B2
Lab Science | LD | 1 | B3
Mathematics/Quantitative Reasoning | LD | 3 | B4
Arts | LD | 3 | C1
Arts or Humanities | LD | 3 | C1 or C2
Humanities: Literature | LD | 3 | C3
Social Sciences | LD | 3 | D1
Social Sciences: US History | LD | 3 | D2
Social Sciences: US & CA Government | LD | 3 | D3
Lifelong Learning and Self-Development (LLD) | LD or UD | 3 | E
Physical and/or Life Science | UD | 3 | UD-B
Arts and/or Humanities | UD | 3 | UD-C
Social Sciences | UD | 3 | UD-D

**SF State Studies**
Courses certified as meeting the SF State Studies requirements may be upper or lower division in General Education (GE), in a major or minor, or an elective.

American Ethnic and Racial Minorities (AERM) | LD or UD | 3
Environmental Sustainability (ES) | LD or UD | 3
Global Perspectives (GP) | LD or UD | 3
Social Justice (SJ) | LD or UD | 3

Note: LD = Lower Division; UD = Upper Division.

**First-Time Student Roadmap (4 Year)**
This roadmap opens in a new tab. (bulletin.sfsu.edu/colleges/science-engineering/chemistry-biochemistry/bs-chemistry/roadmap.html)

**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.
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.