# Bachelor of Science in Biochemistry Roadmap

120 Total Units Required  
Minimum Number of Units in the Major: 72  

This roadmap is a suggested plan of study and does not replace meeting with an advisor. Please note that students may need to adjust the actual sequence of courses based on course availability. Please consult an advisor in your major program for further guidance.

## Course Title Units  
### First Semester  
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 115</td>
<td>General Chemistry I (Major Lower-Division)</td>
<td>5</td>
</tr>
<tr>
<td>ENG 114</td>
<td>Writing the First Year: Finding Your Voice (A2)</td>
<td>3</td>
</tr>
<tr>
<td>MATH 226</td>
<td>Calculus I (Major Lower-Division, B4)</td>
<td>4</td>
</tr>
<tr>
<td>GE Area A</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

### Second Semester  
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 215 &amp; CHEM 216</td>
<td>General Chemistry II: Quantitative Applications of Chemistry Concepts and General Chemistry II Laboratory. Quantitative Applications of Chemistry Concepts (Major Lower-Division)</td>
<td>5</td>
</tr>
<tr>
<td>MATH 227</td>
<td>Calculus II (Major Lower-Division)</td>
<td>4</td>
</tr>
<tr>
<td>GE Area A</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>GE Area E</td>
<td></td>
<td>3</td>
</tr>
</tbody>
</table>

### Third Semester  
<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 233 &amp; CHEM 234</td>
<td>Organic Chemistry I and Organic Chemistry I Laboratory (Major Lower-Division)</td>
<td>5</td>
</tr>
<tr>
<td>CHEM 321</td>
<td>Quantitative Chemical Analysis</td>
<td>3</td>
</tr>
<tr>
<td>Select One Set of Courses (Major Lower-Division)</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>PHYS 111 &amp; PHYS 112</td>
<td>General Physics I and General Physics I Laboratory (B1, B3)</td>
<td></td>
</tr>
</tbody>
</table>
Students must complete at least 15 units of upper-division ENG 114.

SF State Studies or University Elective - Take Two

GE Area UD-D: Upper-Division Social Sciences

Major Electives (15 Units Total) - Take One

GE Area D

GE Area UD-B: Upper-Division Physical and/or Life Sciences

GE Area UD-C: Upper-Division Arts and/or Humanities

Eighth Semester

Major Electives (15 Units Total) - Take One

GE Area UD-D: Upper-Division Social Sciences

U.S. and California Government (http://bulletin.sfsu.edu/undergraduate-education/american-institutions/#usg)

SF State Studies or University Elective - Take Two

| Units | 15 |

Total Units 120-121

1 ENG 114 can only be taken if you complete Directed Self-Placement (DSP) and select ENG 114; if you choose ENG 104/ENG 105 through DSP you will satisfy A2 upon successful completion of ENG 105 in the second semester; multilingual students may be advised into alternative English courses.

2 To determine the best B4 course option, students should complete the online advising activity at mathadvising.sfsu.edu (https://mathadvising.sfsu.edu/). Questions? Contact Gator Smart Start. (https://gatorsmartstart.sfsu.edu/)

3 To avoid taking additional units, it is recommended that you meet the SF State Studies (AERM, GR, ES, SJ) requirements within your GE or major.

4 PHYS 111 and PHYS 112 are prerequisites for PHYS 121 and PHYS 122. PHYS 220 and PHYS 222 are prerequisites for PHYS 230/PHYS 232 and PHYS 240/PHYS 242.

5 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.

6 Upper-Division Electives (15 units)

   • Students must complete at least 15 units of upper-division Chemistry and Biology electives selected from the lists below. Courses from community colleges cannot be substituted for the courses on the list below.
   
   • Electives must include at least:
      i. one course with a CHEM prefix
      ii. one GWAR (GW) course (See Footnote 7), and
      iii. three laboratory courses.

   • Note that many Biology electives have a BIOL 240 prerequisite.

   • Students wishing to enroll in BIOL 350, BIOL 355, and BIOL 612 without completing the BIOL 240 prerequisite should contact the instructor of record before registration.

   • Students should consult an advisor regarding the selection of elective courses and check course co- and pre-requisites before enrolling.

   • Graduate-level courses in chemistry or appropriate courses in biology, physics, geosciences, and computer science may be substituted upon prior approval of an advisor.

Upper-Division Electives in Chemistry

Students should keep in mind that non-Biochemistry courses may require additional prerequisites that are not met in the Biochemistry degree or permission of the instructor.

CHEM 322 Quantitative Chemical Analysis Laboratory (2 units)*
CHEM 325 Inorganic Chemistry (3 units)
CHEM 336 Organic Chemistry II Laboratory (2 units)*
CHEM 370 Computer Applications in Chemistry and Biochemistry (3 units)*
CHEM 390GW Contemporary Chemistry and Biochemistry Research - GWAR (3 units)
CHEM 420 Environmental Analysis (3 units)*
CHEM 422 Instrumental Analysis (4 units)*
CHEM 426 Advanced Inorganic Chemistry Laboratory (2 units)*
CHEM 433 Advanced Organic Chemistry (3 units)
CHEM 443 Biophysical Chemistry Laboratory (4 units)*
CHEM 451 Experimental Physical Chemistry Laboratory (2 units)*
CHEM 645GW Research Trends in Chemistry and Biochemistry - GWAR (3 units)
CHEM 667/BIOL 667 Optical Engineering for the Biological Sciences (3 units)
CHEM 680 Chemical Oceanography (3 units)
CHEM 699 Independent Study (1-6 units)*

Upper-Division Electives in Biology and Computer Science

BIOL 350 Cell Biology (3 units)
BIOL 351 GW Experiments in Cell and Molecular Biology - GWAR (4 units)*
BIOL 355 Genetics (3 units)
BIOL 357 Molecular Genetics (3 units)
BIOL 358 Forensic Genetics: Math Matters (4 units)*
BIOL 401 General Microbiology (3 units)
BIOL 402GW General Microbiology Laboratory - GWAR (3 units)*
BIOL 420 General Virology (3 units)
BIOL 435 Immunology (3 units)
BIOL 436 Immunology Laboratory (2 units)*
BIOL 612 Human Physiology (3 units)
BIOL 613GW Human Physiology Laboratory - GWAR (3 units)*
BIOL 638 Bioinformatics and Genome Annotation (4 units)*
BIOL 640 Cellular Neurosciences (3 units)

Select a maximum of one:
CSC 306 An Interdisciplinary Approach to Computer Programming (3 units)
CSC 508 Machine Learning and Data Science for Personalized Medicine (3 units)
CSC 509 Data Science and Machine Learning for Medical Image Analysis (3 units)

GWAR Elective (3-4 units of the 15 total Elective units)

BIOL 351 GW Experiments in Cell and Molecular Biology - GWAR (4 units)
BIOL 402GW General Microbiology Laboratory - GWAR (3 units)
BIOL 613GW Human Physiology Laboratory - GWAR (3 units)
CHEM 390GW Contemporary Chemistry and Biochemistry Research - GWAR (3 units)
CHEM 645GW Research Trends in Chemistry and Biochemistry - GWAR (3 units)

* Can be used to fulfill the laboratory requirement.

By petition only. To be used as an upper-division elective in Chemistry, a minimum of 3-units must be taken in a single semester.

Given catalog rights, fall 2023 transfer students do not need to complete an Area F course.