

# BACHELOR OF SCIENCE IN BIOCHEMISTRY ROADMAP

120 Total Units Required

Minimum Number of Units in the Major: 70

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
<b>First Semester</b>		
CHEM 115	General Chemistry I (Major Lower-Division)	4
ENG 114	Writing the First Year: Finding Your Voice (A2) <sup>1</sup>	3
MATH 226	Calculus I (Major Lower-Division, B4) <sup>2</sup>	4
GE Area A <sup>3</sup>		3
<b>Units</b>		<b>14</b>
<b>Second Semester</b>		
CHEM 215	General Chemistry II (Major Lower-Division)	4
MATH 227	Calculus II (Major Lower-Division)	4
Select One Set of Courses (Major Lower-Division, B1, B3): <sup>4</sup>		4
PHYS 111 & PHYS 112	General Physics I and General Physics I Laboratory	
PHYS 220 & PHYS 222	General Physics with Calculus I and General Physics with Calculus I Laboratory	
GE Area E		3
<b>Units</b>		<b>15</b>
<b>Third Semester</b>		
CHEM 233 & CHEM 234	Organic Chemistry I and Organic Chemistry I Laboratory (Major Lower-Division)	5
CHEM 321	Quantitative Chemical Analysis	3
Select One Set of Courses (Major Lower-Division): <sup>4</sup>		4
PHYS 121 & PHYS 122	General Physics II and General Physics II Laboratory	

PHYS 230 & PHYS 232	General Physics with Calculus II and General Physics with Calculus II Laboratory	
PHYS 240 & PHYS 242	General Physics with Calculus III and General Physics with Calculus III Laboratory	
GE Area A		3
<b>Units</b>		<b>15</b>
<b>Fourth Semester</b>		
BIOL 230	Introductory Biology I (Major Lower-Division)	5
CHEM 335	Organic Chemistry II (Major Upper-Division)	3
GE Area C - Take Two		6
GE Area D		3
<b>Units</b>		<b>17</b>
<b>Fifth Semester</b>		
CHEM 340	Biochemistry I (Major Upper-Division)	3
CHEM 343	Biochemistry I Laboratory (Major Upper-Division)	3
GWAR Elective <sup>5,6</sup>		3-4
GE Area C		3
GE Area D		3
<b>Units</b>		<b>15-16</b>
<b>Sixth Semester</b>		
Select One (Major Upper-Division):		3
CHEM 300	Physical Chemistry for Life Sciences I	
CHEM 351	Physical Chemistry I: Thermodynamics and Kinetics	
CHEM 341	Biochemistry II (Major Upper-Division)	3
Major Electives (15 Units Total) - Take One <sup>6</sup>		3
GE Area F <sup>±</sup>		3
U.S. and California Government ( <a href="http://bulletin.sfsu.edu/undergraduate-education/american-institutions/#usg">http://bulletin.sfsu.edu/undergraduate-education/american-institutions/#usg</a> )		3
<b>Units</b>		<b>15</b>
<b>Seventh Semester</b>		
Select One (Major Upper-Division):		3
CHEM 301	Physical Chemistry for Life Sciences II	
CHEM 353	Physical Chemistry II: Quantum Chemistry and Spectroscopy	
Major Electives (15 Units Total) - Take One <sup>6</sup>		3

GE Area UD-B: Upper-Division Physical and/or Life Sciences	3
GE Area UD-C: Upper-Division Arts and/or Humanities	3
SF State Studies or University Elective	2
<b>Units</b>	<b>14</b>
<b>Eighth Semester</b>	
Major Electives (15 Units Total) - Take Two <sup>5</sup>	6
GE Area UD-D: Upper-Division Social Sciences	3
SF State Studies or University Elective - Take Two	6
<b>Units</b>	<b>15</b>
<b>Total Units</b>	<b>120-121</b>

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 685 Projects in the Teaching of Chemistry and Biochemistry (1 unit)
CHEM 686 Experiences in Teaching Chemistry and Biochemistry (1 unit) <sup>7</sup>
CHEM 699 Independent Study (1-6 units)* <sup>8</sup>
<i>Upper-Division Electives in Biology and Computer Science</i>
BIOL 350 Cell Biology (3 units)
BIOL 351GW 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 Sequence Analysis (4 units)*
BIOL 640 Cellular Neurosciences (3 units)

Select a maximum of one:

CSC 306 An Interdisciplinary Approach to Computer Programming (3 units)

CSC 408 Machine Learning and Data Science for Personalized Medicine (3 units)

CSC 509 Data Science and Machine Learning for Medical Image Analysis (3 units)

<sup>7</sup> May be repeated and up to 2 units used towards Elective requirement.

<sup>8</sup> By petition only. Units must be taken in the same semester to be used as an upper-division elective.

\* Can be used to fulfill the laboratory requirement.

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

<sup>1</sup> 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.

<sup>2</sup> 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/>)

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

<sup>4</sup> 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.

<sup>5</sup> **GWAR Elective (3-4 units of the 15 total Elective units)**

BIOL 351GW 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)

<sup>6</sup> **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:

- one course with a CHEM prefix,
- one GWAR (GW) course (See Footnote 5), and
- 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.