

Chemistry

The recommended introductory chemistry sequence for potential chemistry majors:

FALL	SPRING
FIRST YEAR	
CHEM 111/113 General Chemistry I (4 credits) MATH see #3 below (4 credits)	CHEM 121/114 General Chemistry II (4 credits) MATH see #3 below (4 credits) PHYS 121/141 General Physics I (4 credits)—if intending BS degree
SECOND YEAR	
CHEM 221/255 Organic Chemistry (5 credits) MATH see #3 below PHYS 122/142 General Physics II (4 credits) —if intending BS degree	CHEM 231/256 Organic Chemistry (4 or 5 credits)

Additional Information

1. The chemistry program offers Chem 111 (General Chemistry) ONLY in the fall semester. In other words, potential chemistry majors cannot *begin* their study of chemistry in the spring semester. If they don't begin their study of chemistry in the fall of their first year, they'll need to wait until the fall of their second year. It is possible, but challenging, to complete a chemistry major if Chem 111 is taken in the second year.

2. Students receiving scores of 4 or 5 on the Chemistry Advanced Placement exam may enroll in Organic Chemistry in their first year. Some students with scores of 4 or 5 opt to take Chemistry 111/113 and 121/114 or delay Organic Chemistry till their second year while completing the other cognate courses listed above. If students have questions about which course sequence is more appropriate, they should consult Graham Peaslee, (peaslee@hope.edu) chair of the department.

3. Math 131 (Calculus I) and Math 132 (Calculus II) are required of all chemistry majors; chemistry majors should complete their math requirements by the end of their second year or sooner. Additional mathematics courses are strongly recommended for those intending to earn B.S. degrees. Many B.S. chemistry majors complete a math minor. For those students starting with Math 125 (Calculus with Review), there will be at least three math courses required for the chemistry major.

4. One year of physics is required. If students intend a B.S. degree, they should begin Physics 121/141 no later than their second year (to take these classes, students need to have taken or be enrolled concurrently in Calculus, Math 131). For students intending to earn a B.A. degree in chemistry, Physics 105/107 and physics 106/108 (College Physics) may be appropriate; these course are algebra-based (rather than calculus-based). Students with questions should consult Graham Peaslee, (peaslee@hope.edu) chair of the department.

5. Students can earn a Bachelor of Arts or a Bachelor of Science degree in chemistry. Requirements for each differ; requirements for the ACS (American Chemical Society) Certified majors in chemistry are on the following page. The Chemistry Department strongly recommends that students planning a career in chemistry, whether or not they plan to go to graduate school, pursue the Bachelor of Science degree.

COURSE SEQUENCE FOR ACS APPROVED B.S. CHEMISTRY MAJOR

(Consult with chemistry faculty to determine the most appropriate sequence for your studies)

Fall – First Year ¹	credits	Spring – First Year ¹	credits
CHEM 111 General Chemistry I	3	CHEM 121 General Chemistry II	3
CHEM 113 Lab Gen & Analyt Chem	1	CHEM 114 Lab Gen & Analyt Chem	1
MATH 131 Calculus I	4	MATH 132 Calculus II	4
Core and Electives to total 16 credits		PHYS 121 General Physics I ⁵	3
		PHYS 141 General Physics Lab I ⁵	1
		Core and Electives to total 16 credits	
Fall – Second Year		Spring – Second Year	
CHEM 221 Organic Chemistry I	3	CHEM 231 Organic Chemistry II	3
CHEM 255 Organic Chemistry Lab I	2	CHEM 256 Organic Chemistry Lab II **	1 or 2
MATH 231 Multivariable Math I ²	4	MATH 232 Multivariable Math II ²	4
PHYS 122 General Physics II ⁵	3		
PHYS 142 General Physics Lab II ⁵	1		
Core and Electives to total 16 credits		Core and Electives to total 16 credits	
Fall – Third Year ³		Spring – Third Year ³	
CHEM 343 Physical Chemistry I	3	CHEM 344 Physical Chemistry II	3
CHEM 345 Physical Chemistry Lab I	1	CHEM 346 Physical Chemistry Lab II	1
CHEM 311 Biochemistry ⁷	1	CHEM 322 Inorganic Chemistry	3
CHEM 490 Research **	1	CHEM 324 Inorganic Laboratory	1
Core and Electives to total 16 credits		CHEM 348 Advanced Spectroscopy Lab or CHEM 347 Chemical Modeling Lab ⁶	1
		**	
		CHEM 490 Research **	1
		Core and Electives to total 16 credits	
Fall – Fourth Year		Spring – Fourth Year	
Advanced Chemistry Course 4: (CHEM 421 Structure, Dynamics, And Synthesis; or CHEM 311 Biochem I)	3	Advanced Chemistry Course 4: (CHEM 422 Structure, Dynamics, And Synthesis; or CHEM 314 Biochemistry II)	3
CHEM 331 Analytical Chemistry ³	3	CHEM 315 Biochemistry Lab **	1
CHEM 332 Analytical Chemistry Lab	1	CHEM 490 Research **	1
CHEM 490 Research **	1	Core and Electives to total 16 credits	
Core and Electives to total 16 credits			

1. Students who have had strong preparation in science and mathematics should consider taking the General Physics sequence during years 1-2, but it may be taken during years 2-3 ⁷. Students who have not had a pre-calculus course in high school should take MATH 125 and MATH 126, Calculus with Review, and then complete MATH 132, Calc II.
2. MATH 231 and MATH 232 are highly recommended but not required for an ACS approved major.
3. It is highly recommended that students take Physical Chemistry during the third year, since it is a prerequisite for CHEM 421 and 422. Analytical Chemistry and Laboratory and Biochemistry II (if selected as an Advanced Course) may be taken in either the third or fourth year.
4. An appropriate advanced-level molecular biology course, physics course, or mathematics course may be substituted for one of the advanced chemistry courses.
5. PHYS 121 is a co/prerequisite for CHEM 343, PHYS 122 is a co/prerequisite for CHEM 344. Completion as a prerequisite is recommended, but the Physics sequence may be taken in the years 1-2 or 2-3. MATH 131 is a co/pre-requisite for PHYS 121.
6. Chem 347 (even numbered years) and/or Chem 348 (odd numbered years) may be taken in the 3rd or 4th year.
7. CHEM 311 Biochemistry is required and may be taken anytime after completion of Organic chemistry.
8. CHEM 256 (2nd half of semester, 1 credit), CHEM 315, CHEM 347, CHEM 348 and CHEM 490 are electives and may be combined so that the total of all labs taken for the major exceeds 500 lab hours (see College *Catalog*).

COURSE SEQUENCE FOR ACS APPROVED B.S. - BIOCHEMISTRY OPTION

(Consult with chemistry faculty to determine the most appropriate sequence for your studies)

Fall – First Year ¹	credits	Spring – First Year ¹	credits
CHEM 111 General Chemistry I	3	CHEM 121 General Chemistry II	3
CHEM 113 Lab Gen & Analyt Chem	1	CHEM 114 Lab Gen & Analyt Chem	1
MATH 131 Calculus I	4	MATH 132 Calculus II	4
BIO 240 Cells and Genetics ¹	4	PHYS 121 General Physics I ^{2,6}	3
Core and Electives to total 16 credits		PHYS 141 General Physics Lab I	1
		General Education and Electives to total 16 credits	
Fall – Second Year		Spring – Second Year	
CHEM 221 Organic Chemistry I	3	CHEM 231 Organic Chemistry II	3
CHEM 255 Organic Chemistry Lab I	2	CHEM 256 Organic Chemistry Lab II ^{3 **}	1 or 2
PHYS 122 General Physics II ⁶	3	BIO 260 Organismal Biology	4
PHYS 142 General Physics Lab II	1	Core and Electives to total 16 credits	
General Education and Electives to total 16 credits			
Fall – Third Year ⁴		Spring – Third Year ⁴	
CHEM 343 Physical Chemistry I ⁴	3	CHEM 344 Physical Chemistry II ⁴	3
CHEM 345 Physical Chemistry Lab I	1	CHEM 322 Inorganic Chemistry ⁴	1
CHEM 311 Biochemistry I	3	CHEM 314 Biochemistry II	3
BIO 280 Ecology and Evolutionary Biology	4	CHEM 315 Biochemistry Lab	1
General Education and Electives to total 16 credits		BIO/CHEM 490 Biochemistry Research ^{5 **}	1
		General Education and Electives to total 16 credits	
Fall – Fourth Year		Spring – Fourth Year	
Advanced Biology Course ^{5 **}	3	Advanced Biology Course ^{5 **}	3
CHEM 331 Analytical Chemistry ⁴	3	BIO/CHEM 490 Biochemistry Research ^{5 **}	1
CHEM 332 Analytical Chemistry Lab	1	General Education and Electives to total 16 credits	
BIO/CHEM 490 Biochemistry Research ^{5 **}	1		
General Education and Electives to total 16 credits			

- Students who have had strong preparation in science and mathematics should consider taking the General Physics sequence during years 1-2, but it may be taken during years 2-3 ⁶. Students who have not had a pre-calculus course in high school should take MATH 125 and MATH 126, Calculus with Review, and then complete MATH 132, Calc II.
- BIO 240 Cells and Genetics, BIO 260 Organismal Biology, and BIO 280 Ecology and Evolutionary Biology are prerequisite for all upper-level Biology courses. If Physics is not taken until year 2, two of these biology courses should be taken in year 1.
- The first half-semester (1 credit) of CHEM 256 is required, the second half-semester (1 credit) is an elective.
- Analytical Chemistry and Laboratory, Physical Chemistry and Laboratory and the Inorganic Chemistry lecture may be taken during either the third or fourth year.
- Three credits of advanced biology are required. These may be BIO 356 Genetics, BIO 366 Molecular Biology or Biochemistry Research (CHEM/BIO 490). BIO 240, BIO 260 and BIO 280 are prerequisite for upper-level biology courses.
- PHYS 121 is a co/prerequisite for CHEM 343, PHYS 122 is a co/prerequisite for CHEM 344. Completion as a prerequisite is recommended, but the Physics sequence may be taken in the years 1-2 or 2-3. MATH 131 is a co/pre-requisite for PHYS 121.

**CHEM 256 (2nd half of semester, 1 credit), the Advanced Biology Courses (lab component) and CHEM/BIO 490 are electives and may be combined so that the total of all labs taken for the major exceeds 500 lab hours. CHEM 346, CHEM 347 and CHEM 348 may also count toward the 500 lab hours (see College catalog).