

MAJOR IN CHEMISTRY

This Bachelor of Science in Chemistry is certified by the American Chemical Society (ACS). Chemistry, the central science, engages biochemistry, biology, engineering, and environmental and materials sciences. Chemists synthesize compounds ranging from life-enhancing medicines to the materials of modern society, with the understanding that there can be unintended consequences. Chemists collect and analyze data used in policy decisions, including those involving the air, food, soil, and water. Chemists develop materials and processes that are safer, and are more energy and material efficient. Chemists develop processes for the recovery and conversion of waste to raw material.

With these important and diverse roles, chemists need to be skilled at the various arts of chemistry, conversant with other scientists as well as policy decision makers, and cognizant of the diverse impacts that their works have on society. Chemistry majors develop a solid foundation in general chemistry and mathematics, followed by course work in organic chemistry, analytical chemistry, physical chemistry, inorganic chemistry, chemical biology, and physics. The curriculum is rounded out by courses in the liberal and communications arts.

Learning Objectives

Upon earning a bachelor of science degree in chemistry, successful students will be able to:

1. Demonstrate foundational skills and knowledge in all the major sub-disciplines of chemistry (analytical, biological, inorganic, materials, organic, and physical).
2. Demonstrate rigorous in-depth skills and knowledge in at least two of the sub-disciplines.
3. Exhibit valuable laboratory skills in all fundamental areas of chemistry, enabling them to contribute effectively to a professional laboratory as well as engage in original research.
4. Use visualization tools, theory, computation, and simulations to explain experimental results, make predictions, and test hypotheses.
5. Obtain, organize, and critically evaluate chemical information, and effectively present it coherently through oral and written discourse with specialists and non-specialists alike.
6. Ethically and responsibly engage their knowledge of chemistry to address current global and societal challenges.
7. Apply sustainability principles that incorporate complex environmental, economic, and social factors.

Potential Occupations

Chemists are employed in a vast array of professional fields in private industry, government, and education. Chemists work in research and development, analysis and testing, consulting, industrial quality control and assurance, environmental resource management, and forensics. Principal employers are petrochemical firms, biotechnology firms, consumer chemical firms, environmental testing laboratories, pharmaceutical companies, agricultural companies, governmental regulatory agencies, governmental and educational research laboratories, and manufacturing firms. Many chemists are also engaged in startup companies. Chemistry is also an excellent major for those preparing for careers in veterinary medicine and the health professions. Students whose career goals involve teaching at the secondary school level have the opportunity to complete the teacher licensure program through the School of Education (<http://soe.chhs.colostate.edu/>).

Many possible occupations for chemists include, but are not limited to: agricultural chemist, air and water quality analyst, biochemical technician, chemical sales and marketing representative, clinical chemist, consultant, educator, forensic analyst, laboratory technician/bench chemist, materials analyst, patent examiner, pharmaceutical chemist, polymer technician, technical writer, and toxicologist.

Concentrations

- Environmental Chemistry Concentration (<https://catalog.colostate.edu/general-catalog/colleges/natural-sciences/chemistry/chemistry-major/environmental-chemistry-concentration/>)
- Forensic Chemistry Concentration (<https://catalog.colostate.edu/general-catalog/colleges/natural-sciences/chemistry/chemistry-major/forensic-chemistry-concentration/>)
- Health Sciences Concentration (<https://catalog.colostate.edu/general-catalog/colleges/natural-sciences/chemistry/chemistry-major/health-sciences-concentration/>)
- Materials Concentration (<https://catalog.colostate.edu/general-catalog/colleges/natural-sciences/chemistry/chemistry-major/materials-concentration/>)
- Sustainable Chemistry Concentration (<https://catalog.colostate.edu/general-catalog/colleges/natural-sciences/chemistry/chemistry-major/sustainable-chemistry-concentration/>)

Requirements Effective Fall 2026

Chemistry majors must achieve a minimum grade of C (2.000) in all the listed courses required for the major in chemistry.

Freshman

		AUCC	Credits
CHEM 120 ¹	Foundations of Modern Chemistry (GT-SC2)	3A	4
CHEM 121 ¹	Foundations of Modern Chemistry Laboratory (GT-SC1)	3A	1
CHEM 192	Introductory Seminar in Chemistry		2
CHEM 241 ²	Foundations of Organic Chemistry		4
CHEM 242 ²	Foundations of Organic Chemistry Laboratory		1
CHEM 263	Foundations of Inorganic Chemistry		4
CHEM 264	Foundations of Inorganic Chemistry Laboratory		1
CO 150	College Composition (GT-CO2)	1A	3

MATH 155 or 160	Calculus for Biological Scientists I (GT-MA1) Calculus for Physical Scientists I (GT-MA1)	1B	4
1C (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)		1C	3
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	3
Total Credits			30
Sophomore			
CHEM 231	Foundations of Analytical Chemistry		3
CHEM 232	Foundations of Analytical Chemistry Lab		2
CHEM 321 or BC 351	Foundations of Chemical Biology Principles of Biochemistry		4
CHEM 322	Foundations of Chemical Biology Laboratory		1
Select one group from the following:			5
Group A			
CS 150B	Culture and Coding: Python	3B	
Elective			
Group B			
CS 152	Python for STEM		
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)		3B	
MATH 161 or 271	Calculus for Physical Scientists II (GT-MA1) Applied Mathematics for Chemists I	1B	4
PH 121 or 141	General Physics I (GT-SC1) Physics for Scientists and Engineers I (GT-SC1)	3A	5
PH 122 or 142	General Physics II (GT-SC1) Physics for Scientists and Engineers II (GT-SC1)	3A	5
Total Credits			29
Junior			
CHEM 371	Fundamentals of Physical Chemistry		4
CHEM 372	Fundamentals of Physical Chemistry Lab	4A	1
In-depth Chemistry Courses (see list below)			4
Advanced Writing (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing) ³		2	3
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		3D	3
Social and Behavioral Science (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-science)		3C	3
Electives			12
Total Credits			30
Senior			
Select one course from the following:			2
CHEM 493	Senior Seminar	4C	
CHEM 499 ⁴	Senior Thesis	4C	
In-depth Chemistry Courses (see list below)			8
Electives ⁵			21
Total Credits			31
Program Total Credits:			120

In-depth Chemistry Courses

- At least 5 credits must come from AUCC 4B designated courses: CHEM 431, CHEM 432, CHEM 440, CHEM 445, CHEM 461, CHEM 462, CHEM 476, CHEM 477.

- At least 3 credits must come from laboratory course or lab components of lecture/laboratory courses: CHEM 312, CHEM 431, CHEM 432, CHEM 433, CHEM 434, CHEM 440, CHEM 442, CHEM 456, CHEM 462, CHEM 477, or CHEM 498.

Code	Title	AUCC	Credits
CHEM 311	Introduction to Nanoscale Science		3
CHEM 312	Nanochemistry Laboratory		1
CHEM 315	Foundations of Polymer Chemistry		3
CHEM 320	Chemistry of Addictions		3
CHEM 333	Forensic Chemistry		3
CHEM 338	Environmental Chemistry		3
CHEM 355	Foundations of Sustainable Chemistry		3
CHEM 431	Instrumental Analysis	4B	3
CHEM 432	Instrumental Analysis Laboratory	4B	2
CHEM 433	Clinical Chemistry		3
CHEM 434	Forensic Chemistry Laboratory		1
CHEM 440	Advanced Organic Chemistry Laboratory	4B	2
CHEM 442	Chemistry of Hemp and Cannabis		3
CHEM 445	Synthetic Organic Chemistry	4B	3
CHEM 448	Medicinal Chemistry		3
CHEM 451	Foundations of Catalytic Chemistry		3
CHEM 456	Foundations of Sustainable Chemistry Lab		1
CHEM 461	Inorganic Chemistry	4B	3
CHEM 462	Inorganic Chemistry Laboratory	4B	2
CHEM 463	Applications of Spin in Chemistry		3
CHEM 465	Chemistry of Sustainable E-Waste Management		4
CHEM 476	Advanced Physical Chemistry	4B	3
CHEM 477	Advanced Physical Chemistry Laboratory	4B	1
CHEM 498	Research		1-3

¹ Students who complete General Chemistry in Freshman year (CHEM 111 or CHEM 107, CHEM 112 or CHEM 108, and CHEM 113, CHEM 114) do not have to take CHEM 120 and CHEM 121.

² Students may complete the organic requirement by taking CHEM 341, CHEM 343, and CHEM 344. Students who take CHEM 245/CHEM 246 may complete the organic chemistry requirement by taking CHEM 343/CHEM 344. For both sets of these students, CHEM 343/CHEM 344 together count as an in-depth chemistry course.

³ CHEM 301 is recommended.

⁴ CHEM 499 Senior Thesis by department approval. Students fulfilling the AUCC 4C requirement with CHEM 499 must write a thesis and present it to the department.

⁵ Select enough elective credits to bring the program total to a minimum of 120 credits, of which at least 42 must be upper-division (300- to 400-level).

Major Completion Map

Distinctive Requirements for Degree Program:

TO PREPARE FOR FIRST SEMESTER: The curriculum for the new American Chemical Society Certified Chemistry major assumes students enter college prepared to take calculus. Entering students who are not prepared to take calculus will need to fulfill pre-calculus requirements in the first semester. CHEM 111 and CHEM 120 require Algebra II as a prerequisite (this prerequisite is met by having Algebra II by test credit, transfer credit, or placement out of MATH 117 and MATH 118 on Math Placement Exam). Earned grades of C (2.000) or better are required in all listed courses for the major in chemistry.

Freshman

Semester 1		Critical	Recommended	AUCC	Credits
CHEM 120	Foundations of Modern Chemistry (GT-SC2)	X		3A	4
CHEM 121	Foundations of Modern Chemistry Laboratory (GT-SC1)	X		3A	1
CHEM 192	Introductory Seminar in Chemistry	X			2
CO 150	College Composition (GT-CO2)	X		1A	3
1C	(https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#aucc)	X		1C	3
Arts and Humanities (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities)			X	3B	3

Total Credits**16**

Semester 2		Critical	Recommended	AUCC	Credits
CHEM 241	Foundations of Organic Chemistry	X			4
CHEM 242	Foundations of Organic Chemistry Laboratory	X			1
CHEM 263	Foundations of Inorganic Chemistry	X			4
CHEM 264	Foundations of Inorganic Chemistry Laboratory	X			1
MATH 160 or 155	Calculus for Physical Scientists I (GT-MA1) Calculus for Biological Scientists I (GT-MA1)	X		1B	4

Total Credits**14****Sophomore**

Semester 3		Critical	Recommended	AUCC	Credits
CHEM 231	Foundations of Analytical Chemistry				3
CHEM 232	Foundations of Analytical Chemistry Lab				2
MATH 161 or 271	Calculus for Physical Scientists II (GT-MA1) Applied Mathematics for Chemists I			1B	4
PH 121 or 141	General Physics I (GT-SC1) Physics for Scientists and Engineers I (GT-SC1)	X		3A	5

Total Credits**14**

Semester 4		Critical	Recommended	AUCC	Credits
CHEM 321 or BC 351	Foundations of Chemical Biology Principles of Biochemistry	X			4
CHEM 322	Foundations of Chemical Biology Laboratory	X			1
PH 122 or 142	General Physics II (GT-SC1) Physics for Scientists and Engineers II (GT-SC1)	X		3A	5

Select one group from the following:

5

Group A

CS 150B Culture and Coding: Python

Elective

Group B

CS 152 Python for STEM

Arts and Humanities (<https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#arts-humanities>)

3B

Total Credits**15****Junior**

Semester 5		Critical	Recommended	AUCC	Credits
CHEM 371	Fundamentals of Physical Chemistry	X			4
CHEM 372	Fundamentals of Physical Chemistry Lab	X		4A	1
Advanced Writing (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#advanced-writing)				2	3
Social and Behavioral Science (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#social-behavioral-science)			X	3C	3

Elective				3
Total Credits				14
Semester 6	Critical	Recommended	AUCC	Credits
In-depth Chemistry Courses (see list on Program Requirements tab)	X		4B	4
Historical Perspectives (https://catalog.colostate.edu/general-catalog/all-university-core-curriculum/aucc/#historical-perspectives)		X	3D	3
Electives		X		9
Total Credits				16
Senior				
Semester 7	Critical	Recommended	AUCC	Credits
In depth Chemistry Courses (see list on Program Requirements tab)	X			4
Electives		X		11
Total Credits				15
Semester 8	Critical	Recommended	AUCC	Credits
CHEM 493 or 499 Senior Seminar			4C	2
Senior Thesis				
In depth Chemistry Courses (see list on Program Requirements tab)	X			4
Elective		X		10
The benchmark courses for the 8th semester are the remaining courses in the entire program of study.	X			
Total Credits				16
Program Total Credits:				120