CHEMISTRY (BS IN CHEMISTRY)

The Chemistry Program

The Bachelor of Science in Chemistry provides students with a strong foundation in the chemical sciences while offering the flexibility to pursue areas of particular interest. In addition to the Chemistry major, students may choose a concentration in Biochemistry or Chemical Physics, allowing them to tailor the major to their academic interests and career goals. The curriculum is designed to develop a broad understanding of chemical principles while providing opportunities for in-depth study, hands-on laboratory experiences, and faculty-mentored research opportunities. Graduates pursue a wide range of paths, including careers in industry, government, education, healthcare, and research, as well as advanced study in chemistry, biochemistry, medicine, engineering, law, business, and other professional fields.

Students seeking additional professional preparation may complete the requirements for an American Chemical Society (ACS) Certified Degree in Chemistry, Biochemistry, or Chemical Physics. ACS certification includes additional coursework and a significant research experience, providing students with advanced training that is recognized nationally.

Research is a central component of the chemistry program. Many students work closely with faculty on original research projects for academic credit during the school year. The Department of Chemistry also offers a robust summer research program, with funded opportunities available for many students to engage in full-time, faculty-mentored research. Research opportunities allow students to further develop laboratory, analytical, and problem-solving skills as well as other career competencies, while contributing to new discoveries in the chemical sciences.

In addition to the chemistry major, the Department offers a minor in Chemistry and a minor in Biochemistry.

Research in Chemistry-Summer Fellowship Program
A summer program for chemistry majors affords the opportunity to learn research skills and to apply these skills to a current research problem. Each student in the summer program is guided by a faculty mentor. This program provides valuable preparation for either CHEM 495 Honors - CHEM 496 Honors Honors in Chemistry, or CHEM 490 Senior Research, Senior Research. Admission to the fellowship program is competitive. Stipends and the opportunity to apply for complimentary campus housing are provided. Opportunities for summer research are also possible for rising sophomores and juniors.

Course Requirements

Code	Title	Hours
Foundational		
MATH 111	Calculus I	4
MATH 112	Calculus II	4
PHYS 101P	General Physics I	3
or PHYS 101H	General Physics I - Honors	
PHYS 101L	General Physics-Lab	1
PHYS 102P	General Physics II	3
or PHYS 102H	General Physics II - Honors	
PHYS 102L	General Physics-Lab	1
General Chemistry		
CHEM 103	General Chemistry I	3
or CHEM 205	Advanced General Chemistry	
CHEM 208	General Chemistry II and Introduction to Inorganic Chemistry	3
or CHEM 205	Advanced General Chemistry	
CHEM 103L	General Chemistry Lab I	1
CHEM 254	General Chemistry Laboratory II	1
or CHEM 256	Inorganic and Quantitative Laboratory Methods	
Organic Chemistry		
CHEM 206	Organic Chemistry I	3
CHEM 206L	Organic Chemistry Lab I	1
CHEM 207	Organic Chemistry II for Life Sciences	3
or CHEM 209	Organic Chemistry II	
CHEM 253	Organic Chemistry Laboratory II	1
Biochemistry		
CHEM 314	Biochemistry	3
Inorganic Chemistry		
CHEM 312	Inorganic Chemistry	3
Physical and Analytical Chemistry		
CHEM 301	Physical Chemistry: Quantum Mechanics & Spectroscopy	3
CHEM 302	Physical Chemistry: Thermodynamics & Kinetics	3
CHEM 302L	Physical Chemistry Lab	1
CHEM 309	Instrumental Analysis	4
CHEM 309L	Instrumental Analysis Laboratory	0
Remaining Credit Hours		**6**
Select six hours from the following:		
CHEM 401	Advanced Physical Chemistry	
CHEM 402	Advanced Inorganic Chemistry	
CHEM 403	Advanced Organic Chemistry	
CHEM 404	Advanced Analytical Chemistry	
CHEM 408	Computational Chemistry	
CHEM 411	Polymer Science I	
CHEM 415	Advanced Biochemistry	
CHEM 417	Neurochemistry	
CHEM 419	Bioinorganic Chemistry	
CHEM 456	Mass Spectrometry	
CHEM 457	Organic Synthesis	
CHEM 458	Organic Spectroscopy	
Total Hours		**55**

These courses are somewhat hierarchical and offered during a single semester of the academic year with the exception of CHEM 314 Biochemistry, which is offered in both the fall and spring semesters. Core courses may be completed in six semesters following the sequence below to meet prerequisites for courses providing the remaining six credit hours in the fourth year.

Major Computing Requirement

Satisfied by successfully completing required word processing, data and graphical analysis, molecular drawing and modeling, and literature database searching assignments made throughout the core curriculum of the Chemistry major.

Major Writing Requirement

Consists of writing a paper (of at least 2000 words) during the senior year. The paper is written in CHEM 490W or CHEM 496 for seniors enrolled for research credit, or can be written as part of any 400-level Chemistry course with a "W" designation in which the student is concurrently enrolled.

Additional Requirements

CHEM 205 Advanced General Chemistry is recommended for entering students who have earned AP or IB credit for CHEM 103 General Chemistry I and CHEM 103L General Chemistry Lab I. CHEM 205 Advanced General Chemistry replaces CHEM 103 General Chemistry I and CHEM 208 General Chemistry II and Introduction to Inorganic Chemistry. Other well-prepared students lacking AP or IB credit can take CHEM 205 Advanced General Chemistry in place of CHEM 103 General Chemistry I and CHEM 208 General Chemistry II and Introduction to Inorganic Chemistry with instructor permission. These students must take the CHEM 103L General Chemistry Lab I laboratory.

In the second year, CHEM 209 Organic Chemistry II and CHEM 256 Inorganic and Quantitative Laboratory Methods are recommended for students intending to major in chemistry. CHEM 207 Organic Chemistry II for Life Sciences and CHEM 254 General Chemistry Laboratory II are recommended for all other science majors, but they also may be used to satisfy the requirements for a major in chemistry in place of CHEM 209 Organic Chemistry II and CHEM 256 Inorganic and Quantitative Laboratory Methods, respectively.

Credit Limitations for the Major

- CHEM 100 Big Ideas in Chemistry, CHEM 150 First-Year Seminar, CHEM 190 Introductory Research, CHEM 201 Color, Light, & Chemistry, CHEM 217 History of Modern Medicinal Chemistry and Drug Development, CHEM 290 Sophomore Research CHEM 341 Physical and Analytical Chemistry for Life Sciences, CHEM 360 General Topics in Chemistry, CHEM 361 Global Topics in Chemistry, CHEM 390 Junior Research,CHEM 460 Special Topics in Chemistry, CHEM 490 Senior Research or CHEM 495 Honors - CHEM 496 Honors may not be included in the minimum credit hours for the major.
- No more than six semester credits in CHEM 490 Senior Research or CHEM 495 Honors/CHEM 496 Honors may be applied toward a degree.
- Credits obtained for CHEM 190 Introductory Research/CHEM 290 Sophomore Research/CHEM 390 Junior Research cannot be used towards the 120 hour graduation credit minimum.
- Students may not obtain credit for both CHEM 205 Advanced General Chemistry and CHEM 208 General Chemistry II and Introduction to Inorganic Chemistry.
- Credits from required pre-requisite courses in Mathematics and Physics are not applicable toward the minimum requirements for a major in Chemistry.

Additional Information

- In a typical program, majors will have completed CHEM 103 General Chemistry I, CHEM 206 Organic Chemistry I, CHEM 209 Organic Chemistry II or CHEM 207 Organic Chemistry II for Life Sciences, and CHEM 208 General Chemistry II and Introduction to Inorganic Chemistry, plus MATH 111 Calculus I, MATH 112 Calculus II, and MATH 212 Introduction to Multivariable Calculus or MATH 213 Multivariable Calculus for Science and Mathematics, and PHYS 101 General Physics-Lecture or PHYS 101H General Physics I - Honors / PHYS 101L General Physics-Lab - PHYS 102 Gen Physics-Lecture or PHYS 102H General Physics II - Honors / PHYS 102L General Physics-Lab before enrolling in CHEM 301 Physical Chemistry: Quantum Mechanics & Spectroscopy or CHEM 302 Physical Chemistry: Thermodynamics & Kinetics in their junior year. (MATH 212 Introduction to Multivariable Calculus or MATH 213 Multivariable Calculus for Science and Mathematics is strongly recommended and can be taken concurrently with CHEM 301 Physical Chemistry: Quantum Mechanics & Spectroscopy if necessary).
- The laboratory courses should be taken concurrently with the appropriate lecture courses.
- CHEM 314 Biochemistry#andCHEM 103 General Chemistry I are valuable courses and recommended in the general education of a chemist.
- MATH 212 Introduction to Multivariable Calculus or MATH 213 Multivariable Calculus for Science and Mathematics are strongly recommended, but not required, for Chemistry majors.

College (COLL) Courses

CHEM 100, CHEM 150, and CHEM 201 have been designed for non-science majors. CHEM 100 fulfills COLL 100 requirements, CHEM 150 fulfills COLL 150 requirements, and CHEM 201, CHEM 205 and CHEM 314 paired with 314C fulfill COLL 200 requirements in the NQR knowledge domain. CHEM 416, 417, 490, or 496 meet COLL 400 requirements. In the case of CHEM 490 a total of 3 or more total credits is required. These credits can be taken in a single semester or spread out over two semesters, and must be paired with CHEM 490W.

Students majoring in science and/or intending a career in health sciences should take CHEM 103 or CHEM 205 as their introductory chemistry course. Usually, the CHEM 103L laboratory course is taken along with CHEM 103.

Biochemistry Concentration Requirements:

The optional Biochemistry Concentration enhances the standard Chemistry major with biological perspectives on the subdiscipline of Biochemistry. This concentration is designed for students interested in research careers at the interface of chemistry with biology or medicine. In addition to the 58 semester credits of core chemistry courses above, the Biochemistry Concentration requires 10-11 additional credits. Prerequisite credits for the required biology elective course do not count towards the major.

Students must take the following courses:

Code	Title	Hours
CHEM 415	Advanced Biochemistry	3
CHEM 420	Biochemistry Lab	1
One additional 400 level CHEM course from the list of Chemistry courses that count towards the credit major requirement.		
One upper-level biology course selected from:		3-4
BIOL 306	Microbiology	
BIOL 310	Molecular Cell Biology	
BIOL 442	Molecular Genetics	

Chemical Physics Concentration Requirements:

The optional Chemical Physics Concentration expands upon the physical subdiscipline from the perspective of physics. This concentration is designed for students interested in highly mathematical research careers at the interface of chemistry and physics. In addition to the credits of core chemistry courses above, the Chemical Physics Concentration

requires 9 semester credits. Prerequisite credits for the required Physics elective course do not count towards the major.

Students must take the following courses:

Code	Title	Hours
CHEM 401	Advanced Physical Chemistry	3
One additional 400 level CHEM course from the list of Chemistry courses that count towards the credit major requirement.		3
One upper-level physics course selected from:		3
PHYS 303	Classical Mechanics of Particles and Waves II	
PHYS 313	Quantum Mechanics I	
PHYS 401	Electricity & Magnetism I	

American Chemical Society Approval and Certified Degrees

The department curriculum is approved by the American Chemical Society (ACS). An ACS approved degree in chemistry from William & Mary is awarded if a student's academic program meets additional course criteria within the minimum credit hours of course work previously described plus a minimum of 3 credits of independent research through CHEM 490 (https://catalog.wm.edu/preview_program.php?catoid=34&poid=7028&returnto=5205#tt9337) or 6 credits in CHEM 495 (https://catalog.wm.edu/preview_program.php?catoid=34&poid=7028&returnto=5205#tt1546)/CHEM 496 (https://catalog.wm.edu/preview_program.php?catoid=34&poid=7028&returnto=5205#tt7633) . The department currently offers three concentrations leading to ACS certified degrees: chemistry, biochemistry, and chemical physics. The specific course requirements for each ACS concentration are summarized below.

NOTE: ACS certified degrees require two semesters of calculus-based Physics and associated labs (PHYS 101/101H with 101L; 102/102H with 102L).

Chemistry

Completed with the major requirements.

Biochemistry

Code	Title	Hours
CHEM 415	Advanced Biochemistry	3
CHEM 420	Biochemistry Lab	1
One additional 400 CHEM level course from the list of Chemistry courses that count towards the 36 - 39 credit major requirement.		3
Select one of the following:		3-4
BIOL 306	Microbiology	
BIOL 310	Molecular Cell Biology	
BIOL 442	Molecular Genetics	

Chemical Physics

Code	Title	Hours
CHEM 401	Advanced Physical Chemistry	3
One additional 400 level CHEM course from the list of Chemistry courses that count towards the 36-39 credit major requirement.		3
Select one of the following:		3
PHYS 303	Classical Mechanics of Particles and Waves II	
PHYS 313	Quantum Mechanics I	
PHYS 401	Electricity & Magnetism I	