CHEMISTRY (BS)

CIP: 40.0501

Program Description

Chemistry is the study of the world of molecules: how they are created from atoms, how their structures affect their chemical and physical properties, and how they unite or assemble to form the matter that makes up the physical world. Knowledge of chemistry is fundamental to an in-depth understanding of the structural properties and biochemical reactions that define all living systems. Chemistry is therefore the central science that bridges physics and the life sciences, and is a foundation to many other fields, such as materials science, earth science, and forensic science. The challenges that society faces in the twenty-first century, such as managing climate change, sourcing clean energy, and ensuring food security, are at their root chemical problems. With a global perspective and a broad science curriculum at its core, our chemistry major program gives students a comprehensive outlook necessary to tackle these challenges.

A key characteristic of the chemistry major at NYU Shanghai is a good balance between depth and breadth of study: following the foundational science courses in chemistry and physics, students take the essential "canon" of organic chemistry and physical chemistry lectures and labs. Students then have flexibility in choosing three or more chemistry electives in areas of specialization that interest them, including Analytical Chemistry, Computational Chemistry, and Biochemistry courses. A distinguishing feature of chemistry is the importance of creativity, whether it be in synthesizing new molecules, discovering novel reactions and materials, or developing new theories of matter. All chemistry students undertake a research or literature review project during their senior year in an Integrated Science Capstone course. Students who are pursuing careers in academic or industrial research are encouraged to undertake two or more semesters of research with faculty, potentially culminating in an undergraduate thesis and chemistry honors.

Majoring in chemistry provides good preparation for graduate study in chemistry and related fields, such as biochemistry, biomedicine, and materials science. Chemistry major students are also well prepared for professional school, including medical, pharmacy, dental, optometry, veterinary, forensic, and law school. Students who, instead, decide to enter industry after graduation are well-served by the combination of creative and quantitative skills developed in the chemistry major that transfer to diverse sectors from data science to biotechnology to finance.

Chemistry Honors

Students who meet GPA eligibility requirements laid out elsewhere in the bulletin may pursue Chemistry Honors. Honors-track students conduct two semesters of research with a faculty member for a total of 4 credits of Independent Study and culminating in a 4-credit Undergraduate Thesis course in the year of graduation. Honors-track students are not required to take the Integrated Science Capstone course, although they are strongly encouraged to audit it. Students who switch to the Honors track after taking the Integrated Science Capstone may have 4 credits of Independent Study waived with prior approval, but will need to complete the 4-credit Undergraduate Thesis course.

Admissions

New York University's Office of Undergraduate Admissions supports the application process for all undergraduate programs at NYU. For additional information about undergraduate admissions, including application requirements, see How to Apply (https://www.nyu.edu/admissions/undergraduate-admissions/how-to-apply.html).

Program Requirements

Course	Title	Credits
Core Courses		
Social and Cultural Foundations		
CCSF-SHU 101L	Global Perspectives on Society	4
Interdisciplinary Perspectives on China (Two Courses)		8
Writing		
WRIT-SHU 102	Writing as Inquiry	4
WRIT-SHU 201	Perspectives on the Humanities	4
Language		
Language Courses		8-16
Mathematics		
MATH-SHU 131	Calculus	4
Algorithmic Thinking		
Algorithmic Thinking Course		4
Science		
Experimental Discovery in the Natural World Requirement Fulfilled by Major Coursework		
Science, Technology, and Society Requirement Fulfilled by Major Coursework		
Courses for the Chemistry Major		
Foundational Courses		
CHEM-SHU 125	Foundations of Chemistry I	3
CHEM-SHU 126	Foundations of Chemistry II	3
CHEM-SHU 127	Foundations of Chemistry I Lab	2
CHEM-SHU 128	Foundations of Chemistry II Lab	2
PHYS-SHU 11	General Physics I	3
or PHYS-SHU 91	Foundations of Physics I Honors	
PHYS-SHU 12	General Physics II	3
or PHYS-SHU 93	Foundations of Physics II Honors	
PHYS-SHU 71	Foundations of Physics Lab I	2
PHYS-SHU 94	Foundations of Physics Lab II	2
Required Courses		
CHEM-SHU 225	Organic Chemistry I	3
CHEM-SHU 225L	Organic Chemistry I Lab	2
CHEM-SHU 226	Organic Chemistry II	3
CHEM-SHU 226L	Organic Chemistry II Lab	2
CHEM-SHU 651	Physical Chemistry: Quantum Mechanics and Spectroscopy (taken in Shanghai)	4
CHEM-SHU 652	Physical Chemistry: Thermodynamics and Kinetics (taken in Shanghai)	4
CHEM-UA 661	Physical Chemistry Laboratory	4
CHEM-SHU 998	Integrated Science Capstone	4
MATH-SHU 151	Multivariable Calculus	4
Chemistry Electives		
Select three of the following:		12
CHEM-GA 9627	Computational Chemistry	

CHEM-GA 9666	Quantum Chemistry and Advanced Statistical Mechanics	
CHEM-GA 9668	Chemical Dynamics	
CHEM-SHU 312	Analytical Chemistry	
CHEM-SHU 881	Biochemistry I	
CHEM-SHU 882	Biochemistry II	
CHEM-SHU 997	Independent Study – Chemistry	
Electives		
Other Elective Credits		22-30
Total Credits		**128**

General Electives

Recommended General Electives

Students may take any courses in NYU's global network to satisfy the general elective requirements, but are strongly encouraged to take one or more of the following mathematics and computer science courses.

Course	Title	Credits
Recommended Mathematics General Electives		
MATH-SHU 140	Linear Algebra	4
MATH-SHU 235	Probability and Statistics	4
MATH-SHU 262	Ordinary Differential Equations	4
Recommended Computer Science General Electives		
CSCI-SHU 11	Introduction to Computer Programming	4
CSCI-SHU 101	Introduction to Computer and Data Science	4

Research Opportunities

NYU Shanghai boasts a world-class research environment across multiple fields of Chemistry. Students are strongly encouraged to begin research with faculty members as early as freshman or sophomore year, and research opportunities are available during the semesters and over the winter and summer breaks. Students particularly interested in conducting research in Shanghai over the summer are encouraged to apply for DURF grants awarded by the university.

Sample Plan of Study

Starting Major in First Year

Course	Title	Credits
1st Semester/Term		
CCSF-SHU 101L	Global Perspectives on Society	4
MATH-SHU 131	Calculus	4
CHEM-SHU 125	Foundations of Chemistry I	3
CHEM-SHU 127	Foundations of Chemistry I Lab	2
PHYS-SHU 11 General Physics I or Core Language Course		3 or 4
	Credits	**16-17**
2nd Semester/Term		
WRIT-SHU 102	Writing as Inquiry	4
MATH-SHU 151	Multivariable Calculus	4
CHEM-SHU 126	Foundations of Chemistry II	3
CHEM-SHU 128	Foundations of Chemistry II Lab	2
PHYS-SHU 12 General Physics II or Core Language Course		3 or 4
	Credits	**16-17**
3rd Semester/Term		
WRIT-SHU 201	Perspectives on the Humanities	4
CHEM-SHU 225	Organic Chemistry I	3
CHEM-SHU 225L	Organic Chemistry I Lab	2
Chemistry Elective		4
PHYS-SHU 11 General Physics I or Core Language Course		3 or 4
	Credits	**16-17**
4th Semester/Term		
Core Course		4
CHEM-SHU 226	Organic Chemistry II	3
CHEM-SHU 226L	Organic Chemistry II Lab	2
PHYS-SHU 12 or PHYS-SHU 93	General Physics II or Foundations of Physics II Honors	3
PHYS-SHU 94	Foundations of Physics Lab II	2
Chinese or EAP or Core Course		4
	Credits	**18**
5th Semester/Term		
CHEM-SHU 651	Physical Chemistry: Quantum Mechanics and Spectroscopy	4
Chemistry Elective		4
General Elective		4
General Elective		4
	Credits	**16**
6th Semester/Term		
CHEM-UA 661	Physical Chemistry Laboratory	4
Chemistry Elective		4
General Elective		4
General Elective		4
	Credits	**16**
7th Semester/Term		
CHEM-SHU 652	Physical Chemistry: Thermodynamics and Kinetics	4
CHEM-SHU 998	Integrated Science Capstone	4
Core Course or General Elective		4
General Elective		2
	Credits	**14**
8th Semester/Term		
Chemistry Elective		4
General Elective		4
General Elective		4
General Elective		4
	Credits	**16**
	Total Credits	**128-131**

Starting Major in Second Year

Course	Title	Credits
1st Semester/Term		
CCSF-SHU 101L	Global Perspectives on Society	4
Chinese or EAP		4
Core Course		4
Core or General Elective		4
	Credits	**16**
2nd Semester/Term		
WRIT-SHU 102	Writing as Inquiry	4
MATH-SHU 131	Calculus	4
Core or General Elective		4
Chinese or EAP		4
	Credits	**16**
3rd Semester/Term		
WRIT-SHU 201	Perspectives on the Humanities	4
CHEM-SHU 125	Foundations of Chemistry I	3
CHEM-SHU 127	Foundations of Chemistry I Lab	2

PHYS-SHU 11 or PHYS-SHU 91	General Physics I or Foundations of Physics I Honors	3
PHYS-SHU 94	Foundations of Physics Lab II	2
Chinese or General Elective		4
	Credits	**18**
4th Semester/Term		
MATH-SHU 151	Multivariable Calculus	4
CHEM-SHU 126	Foundations of Chemistry II	3
CHEM-SHU 128	Foundations of Chemistry II Lab	2
PHYS-SHU 12 or PHYS-SHU 93	General Physics II or Foundations of Physics II Honors	3
PHYS-SHU 94	Foundations of Physics Lab II	2
Chinese or General Elective		4
	Credits	**18**
5th Semester/Term		
CHEM-SHU 225	Organic Chemistry I	3
CHEM-SHU 225L	Organic Chemistry I Lab	2
CHEM-SHU 651	Physical Chemistry: Quantum Mechanics and Spectroscopy	4
General Elective		4
General Elective		4
	Credits	**17**
6th Semester/Term		
CHEM-SHU 226	Organic Chemistry II	3
CHEM-SHU 226L	Organic Chemistry II Lab	2
CHEM-UA 661	Physical Chemistry Laboratory	4
Chemistry Elective		4
General Elective		4
	Credits	**17**
7th Semester/Term		
CHEM-SHU 652	Physical Chemistry: Thermodynamics and Kinetics	4
CHEM-SHU 998	Integrated Science Capstone	4
Chemistry Elective		4
General Elective		2
	Credits	**14**
8th Semester/Term		
Chemistry Elective		4
General Elective		4
General Elective		4
	Credits	**12**
	Total Credits	**128**

Learning Outcomes

Upon successful completion of this program, students will:

1. Demonstrate an understanding of core knowledge in chemistry, particularly the concepts and theories underlying molecular structure and interactions, organic reactivity, chemical equilibria and kinetics, and spectroscopy.
2. Use and apply these concepts and knowledge to new situations or datasets to solve problems.
3. Demonstrate facility at experimental design and analysis using the scientific method by generating ways of testing predictions from hypotheses and critically determining what would remain untested.
4. Synthesize data (e.g. from experiments or observations) to construct models that describe how chemical and physical transformations occur.
5. Demonstrate literacy in statistics and an ability to conduct relevant statistical tests and error analysis.
6. Display routine practice of laboratory safety, including performing risk assessments, following established safety protocols, using appropriate personal protective equipment, and maintaining detailed laboratory notebooks.
7. Effectively communicate their problem-solving rationale or research work in spoken, visual, and written form.
8. Critically evaluate their own works, as well as those of their peers and works from the current literature in chemical sciences, and effectively communicate these evaluations in spoken and written form.
9. Demonstrate a basic spectrum of technical skills commonly used in modern chemistry, such as titrating, performing organic reactions, purification, determining redox potentials, and using analytical and spectroscopic methods for chemical identification.

Policies

Program Policies

1. Students who did not attend a Chinese-medium high school fulfill the Core language requirement by demonstrating proficiency of the Chinese language through the Intermediate level. Chinese speakers who did not attend an English-medium high school fulfill the Core language requirement through completion of EAP-SHU 100 English for Academic Purposes I and EAP-SHU 101 English for Academic Purposes II . Additional information can be found on the NYU Shanghai Core Curriculum page (https://bulletins.nyu.edu/undergraduate/shanghai/core-curriculum/#text).
2. Chemistry majors are strongly encouraged to complete the Foundational Courses in their first two years.
3. Relationship between General Physics and Foundations of Physics Honors: General Physics I & II are calculus-based courses for science majors, pre-meds, engineers and others who want a broad introduction and survey of basic physics including classical mechanics, electricity and magnetism, optics and waves, and thermal and statistical physics. Foundations of Physics I-IV Honors cover a similar set of topics in considerably greater depth, plus special relativity and an introduction to quantum mechanics, over four semesters, and these courses are recommended for students with a strong high-school background in physics and mathematics. While Foundations of Physics I & II Honors meet the requirements for a Chemistry major, taken alone, these courses do not include some important topics, such as optics, thermal and statistical physics, mechanics, and condensed matter physics. Therefore, students electing to take the Honors Physics track are recommended to also take Foundations of Physics III & IV Honors.
4. CHEM-SHU 998 Integrated Science Capstone must be taken in the year of graduation.
5. Additional advanced chemistry courses in NYU's global network can also meet the Chemistry Electives requirement. Students should consult with their Academic Advisor for further details.

Prerequisite Course for Declaring a Major

Final grade of C/ current semester midterm grade of B or higher in Foundations of Chemistry I.

Major Policies

Graduate courses in chemistry may be taken for undergraduate credit and can satisfy a Chemistry Elective requirement, with prior approval. Graduate courses offered in Shanghai include CHEM-GA 9627 (https://bulletins.nyu.eduabout:blank) Computational Chemistry, CHEM-GA 9666 (https://bulletins.nyu.eduabout:blank) Quantum Chemistry and Advanced Statistical Mechanics, and CHEM-GA 9668 (https://bulletins.nyu.eduabout:blank) Chemical Dynamics.

NYU Policies

University-wide policies can be found on the New York University Policy pages (https://bulletins.nyu.edu/nyu/policies/).

NYU Shanghai Policies

Additional academic policies can be found on the NYU Shanghai Academic Policies page (https://bulletins.nyu.edu/undergraduate/shanghai/academic-policies/).