Chemistry, BS

Department of Chemistry, College of Arts and Sciences
Degree Awarded: Bachelor of Science in Chemistry

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Minors of particular interest to students majoring in Chemistry: Biology (BIO), Environmental Studies (ENS), Marine Sciences (MAR)

The Bachelor of Science program in Chemistry is designed to prepare the student for graduate study in chemistry or for industrial or other employment. It includes options in biological chemistry, chemical physics, and environmental chemistry, in addition to the traditional chemical science option. The B.S. program of the Department of Chemistry is approved by the Committee on Professional Training of the American Chemical Society.

The Bachelor of Arts program allows more flexibility in the choice of electives, accommodating the needs of pre-medical students and others whose career objectives may call for a substantial introduction to chemistry. It can also accommodate students who wish to obtain a strong undergraduate background in another science or mathematics while earning a degree in chemistry.

Students interested in combining the study of chemistry with the study of materials science should see also the Interdisciplinary Program in Engineering Chemistry.

Requirements for the Majors in Chemistry (CHE)

The department of Chemistry offers both a Bachelor of Arts and a Bachelor of Science degree in Chemistry.

Requirements for the Major (Bachelor of Science Degree)

All of the courses used to fulfill the requirements of the major (CHE, MAT, PHY, BIO, etc.) must be passed with a letter grade of C or higher, with the exception of three courses, for which the grade may be C-. G/P/NC grades are not acceptable in courses taken for the major. No transferred course with a grade lower than C may be used to fulfill any major requirement.

Completion of the major requires a minimum of 66 credits.

Core Requirements

- CHE 131 - General Chemistry IB **4 credits**
  OR
- CHE 129 - General Chemistry IA **4 credits AND**
- CHE 130 - Problem Solving in General Chemistry **1 credit,**
- CHE 132 - General Chemistry II **4 credits**
  OR
- CHE 152 - Molecular Science I **4 credits**

- CHE 133 - General Chemistry Laboratory I **1 credit**
- CHE 134 - General Chemistry Laboratory II **1 credit**
  OR
- CHE 154 - Molecular Science Laboratory I **2 credits**

- CHE 301 - Physical Chemistry I **4 credits**
- CHE 302 - Physical Chemistry II **4 credits**

- CHE 303 - Solution Chemistry Laboratory **2 credits**

- CHE 321 - Organic Chemistry I **4 credits**
- CHE 322 - Organic Chemistry IIA **4 credits**
  OR
- CHE 331 - Molecular Science II **4 credits**
- CHE 332 - Molecular Science III **4 credits**

- CHE 375 - Inorganic Chemistry I **3 credits**

- CHE 327 - Organic Chemistry Laboratory **2 credits**
  OR
- CHE 383 - Introductory Synthetic and Spectroscopic Laboratory Techniques **2 credits**

- CHE 385 - Tools of Chemistry **1 credit,**

- MAT 131 - Calculus I **4 credits**
- MAT 132 - Calculus II **4 credits AND**
- MAT 203 - Calculus III with Applications **4 credits** (See note 1 for possible substitutions). If students do not place into MAT 125 or MAT 131 on the basis of the math placement examination, MAT 123 (or MAT 119/MAT 123) is a required course for the major.

- PHY 131 - Classical Physics I **3 credits**
- PHY 133 - Classical Physics Laboratory I **1 credit**
- PHY 132 - Classical Physics II **3 credits**
- PHY 134 - Classical Physics Laboratory II **1 credit** (See note 2 for possible substitutions)

Area Requirements

One of the following options:

Chemical Science Option

- CHE 304 - Chemical Instrumentation Laboratory **2 credits**

- CHE 357 - Molecular Structure and Spectroscopy Laboratory **2 credits** or
- CHE 377 - Inorganic Chemistry Laboratory **3 credits**

- CHE 328 - Synthetic and Spectroscopic Laboratory Techniques **3 credits**
  OR
- CHE 384 - Intermediate Synthetic and Spectroscopic Laboratory Techniques **3 credits**

- CHE 487 - Research in Chemistry **0-6 credits**
  OR
- CHE 495 - Senior Research **3 credits**
- CHE 496 - Senior Research **3 credits** (see note 3)

Two electives chosen from:

- CHE 345 - Structure and Reactivity in Organic Chemistry **3 credits**
- CHE 461 - Selected Topics in Chemistry **1-3 credits**

- CHE 346 - Biomolecular Structure and Reactivity **3 credits**
- CHE 461 - Selected Topics in Chemistry **Credits: 1-3 credits**

- CHE 348 - Reaction Mechanisms in Organic Chemistry **3 credits**
- CHE 461 - Selected Topics in Chemistry **Credits: 1-3 credits**

- CHE 351 - Quantum Chemistry **3 credits**
- CHE 353 - Chemical Thermodynamics **3 credits**
- CHE 358 - Computing in Chemistry **3 credits**
- CHE 376 - Inorganic Chemistry II **3 credits**
- CHE 377 - Inorganic Chemistry Laboratory **3 credits** (see note 3)
- CHE 378 - Materials Chemistry **3 credits**
- PHY 251 - Modern Physics **3 credits**
- ESG 281 - Engineering Introduction to the Solid State **3 credits**

Biological Chemistry Option

(See note 4)

- CHE 328 - Synthetic and Spectroscopic Laboratory Techniques **3 credits**
  OR
- CHE 384 - Intermediate Synthetic and Spectroscopic Laboratory Techniques **3 credits**

- BIO 202 - Fundamentals of Biology: Molecular and Cellular Biology **3 credits**

- CHE 346 - Biomolecular Structure and Reactivity **3 credits**
- CHE 461 - Selected Topics in Chemistry **1-3 credits** (recommended)
  OR
- BIO 361 - Biochemistry I **3 credits**

- BIO 310 - Cell Biology **3 credits**
  OR
- BIO 362 - Biochemistry II **3 credits**

One organic or inorganic chemistry elective chosen from:

- CHE 345 - Structure and Reactivity in Organic Chemistry **3 credits**
- CHE 461 - Selected Topics in Chemistry **1-3 credits**

- CHE 346 - Biomolecular Structure and Reactivity **3 credits**
- CHE 461 - Selected Topics in Chemistry **Credits: 1-3 credits** (See note 4)

- CHE 348 - Reaction Mechanisms in Organic Chemistry **3 credits**
- CHE 461 - Selected Topics in Chemistry **Credits: 1-3 credits**

- CHE 376 - Inorganic Chemistry II **3 credits**
- CHE 377 - Inorganic Chemistry Laboratory **3 credits**
- CHE 378 - Materials Chemistry **3 credits**

- CHE 495 - Senior Research **3 credits**
- CHE 496 - Senior Research **3 credits**

Chemical Physics Option

- CHE 304 - Chemical Instrumentation Laboratory **2 credits**

- CHE 351 - Quantum Chemistry **3 credits**
  OR
- CHE 353 - Chemical Thermodynamics **3 credits**

- CHE 357 - Molecular Structure and Spectroscopy Laboratory **2 credits**

- AMS 210 - Applied Linear Algebra **3 credits**
  OR
- MAT 211 - Introduction to Linear Algebra **3 credits**

OR

- AMS 261 - Applied Calculus III **4 credits**
  OR
- MAT 303 - Calculus IV with Applications **4 credits** (See note 6)

- PHY 251 - Modern Physics **3 credits**
- PHY 252 - Modern Physics Laboratory **1 credit**

One elective chosen from:

(the last three courses require other physics prerequisites or permission of the instructor)

- CHE 358 - Computing in Chemistry **3 credits**
- PHY 277 - Computation for Physics and Astronomy **3 credits**
- PHY 300 - Waves and Optics **4 credits**
- PHY 307 - Physical and Mathematical Foundations of Quantum Mechanics **4 credits**
- PHY 301 - Electromagnetic Theory I **3 credits**
- PHY 303 - Mechanics **3 credits**
- PHY 306 - Thermodynamics, Kinetic Theory, and Statistical Mechanics **3 credits**

Environmental Chemistry Option

- CHE 304 - Chemical Instrumentation Laboratory **2 credits**
- CHE 310 - Chemistry in Technology and the Environment **3 credits**

- CHE 357 - Molecular Structure and Spectroscopy Laboratory **2 credits**
  OR
- CHE 377 - Inorganic Chemistry Laboratory **3 credits OR**
- CHE 311 - Environmental Chemistry Lab **2 credits**

- CHE 328 - Synthetic and Spectroscopic Laboratory Techniques **3 credits**
  OR
- CHE 384 - Intermediate Synthetic and Spectroscopic Laboratory Techniques **3 credits**

- BIO 201 - Fundamentals of Biology: Organisms to Ecosystems **3 credits**
  OR
- BIO 113 - General Ecology **3 credits**

- ATM 397 - Air Pollution and Global Warming **3 credits** (See note 6 for possible substitutions)

Marine and Atmospheric Chemistry Option

- ATM 205 - Introduction to Atmospheric Sciences **3 credits**
- MAR 308 - Environmental Instrumental Analysis **3 credits**
- MAR 333 - Coastal Oceanography **3 credits**
- MAR 351 - Introduction to Ocean Chemistry **3 credits**

Two electives chosen from:

- MAR 301 - Environmental Microbiology **4 credits**
- MAR 302 - Marine Microbiology and Microbial Ecology **3 credits**
- MAR 334 - Remote Sensing of the Environment **3 credits**
- MAR 336 - Marine Pollution **3 credits**
- MAR 394 - Environmental Toxicology and Public Health **3 credits**
- ATM 305 - Global Atmospheric Change **3 credits**
- ATM 345 - Atmospheric Thermodynamics and Dynamics **3 credits**
- ATM 397 - Air Pollution and Global Warming **3 credits**

Upper-Division Writing Requirement

Each student majoring in Chemistry must use CHE 303, CHE 304, or CHE 384 to satisfy the writing requirement for the Chemistry major (a satisfactory grade is required). These courses require several papers which are evaluated for cogency, clarity, and mechanics, and satisfy the university Stony Brook Curriculum WRTD learning objective.

Notes:

1. Alternate Mathematics Sequences
   The following alternate sequences may be substituted for major requirements or prerequisites: MAT 125 (or MAT 130/MAT 125), MAT 126, MAT 127 or MAT 141, MAT 142 or MAT 171 or AMS 151, AMS 161 for MAT 131, MAT 132; AMS 210 or MAT 211 or AMS 261 for MAT 203. Equivalency for MAT courses as indicated by earning the appropriate score on a placement examination will be accepted as fulfillment of the requirement without the necessity of substituting other credits.
2. Alternate Physics Sequences
   The following alternate sequences may be substituted for physics requirements or prerequisites: PHY 141/PHY 133, PHY 142/PHY 134 or PHY 125, PHY 126/PHY 133, PHY 127/PHY 134 for PHY 131/PHY 133, PHY 132/PHY 134.
3. Students may complete both CHE 357 and CHE 377 in lieu of the research requirement. However, CHE 377 can only fulfill one of the requirements of the alternative to CHE 357, the alternative to research, or one of the electives.
4. It is recommended that students selecting the biological option take a minimum of one BIO lab (e.g., BIO 204).
5. CHE 346/CHE 461 may not be used as both an elective and as a substitute for BIO 361.
6. The Chemical Physics option requires two math courses in addition to Calculus I and II.
7. The following substitutions for ATM 397 need additional prerequisites: ENV 315/GEO 315 Groundwater Hydrology, MAR 336 - Marine Pollution, MAR 351 - Introduction to Ocean Chemistry.
8. Transfer Credit
   At least 12 credits of upper-division work in chemistry must be taken at Stony Brook; these must be taken in at least two of the major subdisciplines (inorganic, physical, and organic chemistry).
9. The American Chemical Society's Committee on Professional Training has set nationally recognized standards for professional preparation in chemistry. The Chemistry faculty recommends that students intending to pursue careers in the chemical sciences secure ACS certification along with their Bachelor of Science degree.

To obtain ACS certification, students who elect the *chemical science* option must complete CHE 346/CHE 461 or BIO 361.

Students who elect the *biological chemistry* option must complete one additional elective in chemistry or a related field, CHE 304, and one of the following: 1. CHE 487 (6 or more credits), 2. CHE 495-CHE 496, 3. CHE 357 and CHE 377, 4. CHE 357 and CHE 487 (3 or more credits), 5. CHE 377 or CHE 487 (3 or more credits) or 6. a research experience in the chemical sciences at another college, university, or government laboratory of at least 180 hours (see note 10).

Students who elect the *chemical physics* option must complete CHE 346/CHE 461 and one of the following: 1. 6 additional credits chosen from CHE 328 or CHE 384, CHE 377, CHE 487 or CHE 495-CHE 496, or 2. a research experience in the chemical sciences of at least 180 hours at another college, university, or government laboratory (see note 10).

Students who elect the *marine and atmospheric chemistry* option must complete CHE 346/CHE 461, CHE 328 or CHE 384, and one of the following: 1. CHE 487 (6 or more credits), 2. CHE 495-CHE 496, 3. CHE 357 and CHE 377 , 4 CHE 357 and CHE 487 (3 or more credits), 5. CHE 377 and CHE 487 (3 or more credits) or 6. a research experience in the chemical sciences at another college, university, or government laboratory of at least 180 hours (see note 10).

Students who elect the *environmental chemistry* option must complete CHE 346/CHE 461 and either CHE 377 (in addition to CHE 357 or CHE 311) CHE 487 (3 credits), CHE 495-CHE 496, or a research experience in the chemical sciences at another college, university, or government laboratory of at least 180 hours (see note 10).

10. Additional Areas of Study
    Because knowledge of computer programming is of great value to all chemists, CHE 358 or other course in computer programming is recommended.
11. Students who fulfill ACS requirements with an off-campus research experience must register for CHE 487 (0 credits). All students using CHE 487 to fulfill ACS requirements must prepare a written research report that will be evaluated by a Stony Brook Chemistry faculty member.

Chemistry Honors Program

Students who have maintained a minimum cumulative grade point average of 3.00 in science and mathematics through the junior year are eligible for departmental honors in chemistry. An additional requirement for honors is the submission of a senior thesis based on research performed during the senior year. The student will be given an oral examination in May by his or her research supervisor and the undergraduate research committee. The awarding of honors requires the recommendation of this committee and constitutes recognition of superior performance in research and scholarly endeavors. If the student has also achieved a 3.40 cumulative grade point average in chemistry courses taken in the senior year, honors will be conferred.

Chemistry Secondary Teacher Education Program

See the Education and Teacher Certification entry in the alphabetical listings of Approved Majors, Minors, and Programs.

Bachelor of Science Degree/Master of Science Degree Program

A student interested in this research-intensive graduate program, intended to prepare students for professional employment in the chemical or pharmaceutical industries, may apply for admission at the end of the junior year. The program leads to a Bachelor of Science degree in Chemistry at the end of the fourth year and a Master of Science in Chemistry at the end of the fifth year. During the senior year, the student is expected to take two 500-level CHE courses, GRD 500 Responsible Conduct of Research and Scholarship, and begin research in the senior research sequence. In the fifth year, the student works full-time on research, earning 24 credits in CHE 599.

SBC Courses

This table illustrates major courses that can also be used to fulfill SBC requirements. (See Note 1 & Note 2)

SBC Category	Required Major Courses	Optional Major Courses (see Note 3)
ARTS		
GLO		
HUM		
LANG (see Note 4)		
QPS	MAT 131, MAT 132	
SBS		
SNW	PHY 131, PHY 132	BIO 113, BIO 201, CHE 131, CHE 132, CHE 152
TECH		CHE 304, CHE 328, CHE 384, MAR 308, MAR 334, PHY 277
USA		
WRT		
STAS		CHE 310, MAR 394
EXP+		CHE 487, CHE 495, CHE 496
HFA+		
SBS+		AMS 316, AMS 335, AMS 341, AMS 342
STEM+	CHE 301, MAT 203	AMS 210, AMS 261, ATM 205, ATM 305, BIO 202, CHE 321, CHE 331, MAR 308, MAR 333, MAR 334, MAR 351, MAT 203, MAT 211, PHY 251, PHY 300
CER	CHE 385	ATM 397
DIV (see Note 5)		
ESI	CHE 303	CHE 383, CHE 496. MAR 394
SPK	CHE 385	CHE 496
WRTD	CHE 303	CHE 304, CHE 384

Note 1: Some course information may be subject to change. Please contact your major advisor for additional consultation.

Note 2: For majors that require study in a related area or completion of a minor, visit the respective program's "Major SBC Courses" page to view expanded SBC options.

Note 3: Denotes any course in which students can choose from more than one option. These may include, but are not limited to, major electives, concentration/track/specialization courses, or calculus/physics/chemistry sequences.

Note 4: CEAS majors, the Athletic Training major, the Respiratory Care major, and the Clinical Laboratory Sciences major are exempt from the LANG learning objective. Students enrolled in the major in Social Work are exempt from the LANG learning objective, but are required to enroll in and pass with a letter grade of C or higher the first semester of an elementary foreign language course numbered 111, or satisfy through alternate methods.

Note 5: Students are responsible for completing the general education requirements published in the Bulletin that was current as of the first semester of matriculation (or rematriculation). The following student groups must satisfy the DIV learning objective as part of their degree requirements:

- Freshmen who matriculate in the Fall of 2019 or later
- Transfer students who matriculate in the Spring of 2020 or later
- Students who rematriculate in the Fall of 2019 or later

Sample Course Sequence

Sample Course Sequence for the Major in Chemistry (Chemical Science Option, B.S. Degree)