

State University of New York at Stony Brook

Environmental Chemistry

**Bachelor of Science
in Chemistry Option**

Department of Chemistry

Department of Chemistry
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Stony Brook, New York 11794-3400

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Environmental Chemistry

The Environmental Chemistry Option of the Bachelor of Science Degree in Chemistry is designed to enable students to explore the application of their laboratory based understanding of the principles of chemistry to a wide variety of chemical phenomena that have an impact on the human environment.

The program provides a solid grounding in fundamental chemistry broadened by an introduction to the science of ecology and to several important areas of environmental science which make use of this chemical and ecological knowledge. Students completing this program are prepared for work, or advanced study, in specialized area of environmental chemistry, chemical ecology or environmental technology or, with the addition of some suitable electives, for entry into the study of such fields as environmental medicine, occupational health or environmental law.

What is Environmental Chemistry? As with other subdivisions of the field of chemistry, it is perhaps most useful to define environmental chemistry operationally in terms of the activities of scientists who refer to themselves as environmental chemists. A major endeavor of such scientists is the study of the chemical phenomena associated with the causes and effects of various local, regional and global air, water and land pollution problems such as ground water contamination, acid rain and ozone depletion. Problems associated with the disposal of both domestic and industrial waste require research by chemically trained scientists, as do efforts to understand the mechanisms by which potentially toxic or hazardous chemicals are transported and distributed within and around ecosystems. Most aspects of environmental chemistry require a detailed understanding of the methods required to obtain representative samples and to perform reliable analyses of complex environmental materials for trace chemical contaminants.

Declaring the Major. The Environmental Chemistry Option of the Chemistry Major is open to all Stony Brook undergraduates. Perhaps the ideal time to declare the major is at the beginning of a student's sophomore year. It is usually unwise to postpone the declaration past the beginning of the student's junior year. Students who wish to elect this major should speak to the Director of Undergraduate Studies.

Plan of Study. Freshman students usually begin their studies toward the major by completing their introductory studies in chemistry and mathematics. In the sophomore year studies in biology and organic chemistry are combined with mathematics and

physics courses. In the junior and senior years, physical and inorganic chemistry lecture courses are completed as well as a series of advanced laboratory courses.

Research. Environmental Chemistry is based upon research. This is why students in the major have so many laboratory courses required for their degree. However structured instructional laboratories can not truly introduce students to independent research. For this experience the student must seek out independent research opportunities. The faculty of the Department of Chemistry welcome qualified undergraduate students into their research laboratories. Research opportunities may also exist in other parts of the University such as Marine Sciences. These opportunities are especially suitable for students in their junior and senior years of study. Interested students should review the research interests of the various faculty members and then discuss the possibilities for independent study or research with the individual faculty members who have the research programs of greatest interest. Each summer there are numerous special research programs available at Stony Brook, at nearby Brookhaven Laboratory and at universities across the country, open to qualified students. Interested students should talk to the Director of Undergraduate Studies several months in advance.

Careers. Students who complete the Environmental Chemistry Option will be well prepared for entry level positions in a rapidly expanding list of career opportunities in both the private and the public sector. Increased awareness and concern about environmental contamination and new governmental regulations have resulted in the need for chemically trained scientists to apply their expertise to such problems as the chemical analysis of diverse environmental samples, the design of technologies for the remediation of environmental pollution and the modification of production processes to reduce or eliminate the production of hazardous chemical wastes. Avoidance or remediation of environmental problems often requires a multidisciplinary approach. Students who supplement the requirements for the Environmental Chemistry Option with carefully selected courses in applied economics and other social sciences will increase their employment prospects. Since a recognized chemistry program with ample laboratory experience (including research) may provide an edge with many employers, it is suggested that students consider completing the requirements for a degree certified by the American Chemical Society. The Environmental Chemistry Option is also an excellent preparation for students who plan to pursue graduate study in order to prepare to do research in some area of Environmental Chemistry. In addition to chemistry departments, such graduate programs may be found in departments of geology, atmospheric sciences, marine sciences and earth sciences. Masters degrees are usually obtainable after one and a half to two years additional study. Ph.D. degrees usually

require four-five years study beyond the Bachelor of Science Degree. Graduate students usually receive substantial stipends throughout their period of graduate study. The Environmental Chemistry Option (supplemented by appropriate electives) is also an excellent undergraduate major for students considering preparation for professional degree programs in related fields, such as environmental toxicology or environmental law.

Internships. Special internships are available for qualified undergraduate students majoring in the chemical sciences. These programs allow students to combine work in an industrial setting with their academic studies. Students in the program work in an industrial laboratory one or two days a week. In return they receive a salary from the company and academic credit from Stony Brook. Interested students should talk to the Student Affairs Coordinator several months in advance.

Double Majors. Highly motivated students often choose to complete the requirements for two majors. Students choosing to major in chemistry may wish to consider a second major in such fields as engineering chemistry, physics, mathematics or biology. Students completing a double major will have an extra credential when looking for a job or when applying for graduate study. However a double major is certainly not a good idea for everyone. Often a better approach is to choose particular advanced courses as electives, matching one's own interests and abilities. And in all cases students should consider the importance of research and additional laboratory courses.

American Chemical Society Certification. The American Chemical Society is the national organization for chemists in the United States. The Society publishes the most prestigious journals, hosts the major national chemistry conferences, and influences chemical education in the country. The Society sets standards for the undergraduate chemistry programs at American universities. As part of this program the American Chemical Society's Committee on Professional Training has defined a minimum set of courses that they consider necessary for a student to achieve the skills needed for entry into the chemistry profession. Students who complete these requirements have their degrees certified by the Society. Students receiving certified degrees are eligible for immediate entry into the Society upon graduation. Certification requires the completion of a small number of courses in addition to those required for the major.

Environmental Chemistry Option

Major Requirements for the Bachelor of Science Degree:

Candidates for the Bachelors of Science Degree in Chemistry who elect the Environmental Chemistry option must complete the Chemistry Core Requirements of basic chemistry, mathematics and physics courses, plus a series of area requirements unique to the Environmental Chemistry Option. In addition all students must fulfill the Upper-Division Writing Requirement.

All required courses must be taken for a letter grade; P/NC grades are not acceptable. All chemistry courses must be passed with a grade of C or higher with the exception of three courses for which the grade may be C-. No transferred course with a grade lower than C may be used to fulfill any major requirement.

Completion of the major requirements entails approximately 65 to 67 credits.

A. Core Requirements

- _____ CHE 129/ 130 or 131, 132 or 141, 142 General or Honors Chemistry
- _____ CHE 133, 134 or 143, 144 General or Honors Chemistry Laboratory
- _____ CHE 301, 302 Physical Chemistry I, II
- _____ CHE 303 Solution Chemistry Laboratory
- _____ CHE 321, 326 Organic Chemistry I, IIB
- _____ CHE 375 Inorganic Chemistry
- _____ CHE 383 Introductory Synthetic and Spectroscopic Laboratory Techniques
- _____ CHE 385 Tools of Chemistry
- _____ MAT 131, 132 Calculus I, II (Substitutions are possible, see note 1)
- _____ MAT 211 or AMS 210 Linear Algebra
- _____ PHY 131, 132 Classical Physics I, II (Substitutions are possible, see note 2)

B. Area Requirements for Environmental Chemistry Option

- _____ CHE 304 Chemical Instrumentation Laboratory
- _____ CHE 310 Environmental Chemistry Option
- _____ CHE 384 Intermediate Synthetic and Spectroscopic Laboratory Techniques
- _____ CHE 357 Molecular Structure and Spectroscopy Laboratory
- _____ BIO 201 Fundamentals of Biology: Organisms to Ecosystems or
BIO 113 Applied Ecology
- _____ ATM/MEC 397 Air Pollution and Its Control

C. Upper-Division Writing Requirement

Successful completion of CHE 385.

Notes:

1. Alternate Mathematics Sequences

The following alternate sequences may be substituted for mathematics requirements or prerequisites: MAT 125, 126, 127 or 141, 142 for 131, 132; MAT 203 or MAT 205 for AMS 210 or MAT 211. Equivalency for MAT courses as indicated by earning the appropriate score on the Mathematics 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 121/123, 122/124 or PHY 141, 142 or PHY 125, 126, 127 for PHY 131, 132

3. Transfer Credit

At least twelve 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).

4. American Chemical Society Certification

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 in Chemistry degree.

For ACS certification, students electing the Environmental Chemistry Option need to complete the following courses:

_____ CHE 346 Biomolecular Structure and Reactivity

_____ CHE 487 or 496 Senior Laboratory Projects in Chemistry or Senior Research

5. Additional Areas of Study. A knowledge of computer programming is of great value to all chemists and a course in computer programming is recommended. For those students who plan to pursue post-college studies in chemistry, it is recommended that they attain a reading knowledge of German and of French or Russian.

**Sample Course Sequence for Students
Electing Environmental Chemistry Option
With ACS Certification**

Required Courses:

(major)	Required for CHE Major: Environmental Chemistry Option
(DEC)	Diversified Education Curriculum
(ACS)	Required for American Chemical Society Certified Degree (These courses are not required for the CHE degree, but are required for ACS certification.)

Only the minimum number of required credits are listed. Good students will elect to take additional courses in both the major and other areas. Suggested electives include research and additional specialized courses.

Fall - Freshman year

MAT 131	4	(major)
CHE 141 or 131 or 129/130	4	(major)
CHE 143 or 133	1	(major)
WRT 102	3	(DEC)
DEC course	3	(DEC)

Total 15 credits

Spring - Freshman year

CHE 142 or 132	4	(major)
CHE 144 or 134	1	(major)
MAT 132	4	(major)
DEC courses	6	(DEC)

Total 15 credits

Fall - Sophomore year

CHE 321	4	(major)
CHE 383	2	(major)
MAT 211	3	(major)
PHY 131 or 141	4	(major)
BIO 201	4	(major)

Total 17 credits

Spring - Sophomore year

CHE 326	4	(major)
CHE 384	3	(major)
CHE 385	1	(major)
PHY 132 or 142	4	(major)
Elective	3	(elective)

Total 15 credits

Fall - Junior year

CHE 301	4	(major)
CHE 303	2	(major)
DEC course	3	(DEC)
DEC course	3	(DEC)
Open Elective	3	

Total 15 credits

Spring - Junior year

CHE 302	4	(major)
CHE 304	2	(major)
CHE 310	3	(major)
DEC course	3	(DEC)
DEC Elective	3	(DEC)

Total 15 credits

Fall - Senior year

CHE 346	3	(ACS)
CHE 375	3	(major)
CHE 357	2	(major)
CHE 495	3	
DEC courses	6	(DEC)

Total 17 credits

Spring - Senior year

CHE 496	2	(ACS)
ATM/MEC 397	3	(major)
DEC course	3	(DEC)
Open Electives	9	

Total 17 credits

Grand Total 126 credits

Chemistry at Stony Brook

The Department of Chemistry offers a variety of degree opportunities for undergraduates.

The Bachelor of Science in Chemistry Degree

Students who wish to complete the B.S. degree in Chemistry must elect one of the following options. All the options feature a common core of basic introductory chemistry, physics and mathematics courses combined with additional courses unique to each option. A separate brochure is available describing the features of each option.

Chemical Science

This option is the most traditional path with a greatest emphasis given to courses in the Chemistry Department. Students electing this option will acquire a considerable amount of laboratory experience. This option is an excellent one for students who wish to seek employment as a chemist or who wish to go to graduate school in chemistry.

Biological Chemistry

Students choosing this option take a variety of courses in the biological sciences in addition to advanced courses in chemistry. The program prepares students for work or further study in such fields as chemistry, biochemistry, biotechnology, pharmacology, medicinal chemistry, medicine or other health sciences.

Chemical Physics

The Chemical Physics option is for students who wish to combine their studies in chemistry with additional courses in Physics and Mathematics. The program is strongly recommended for students who have an interest in the more physical aspects of chemistry. Students who complete the program are well trained for employment in chemistry and well prepared for graduate studies in chemical physics or physical chemistry.

Environmental Chemistry

This option is a unique one that combines traditional studies in chemistry with additional work in biology and environmental science. Student completing the program are well prepared for employment as chemists and for graduate studies in chemistry as well as various environmental specialties.

The Bachelor of Arts in Chemistry Degree

Students who wish to complete the B.A. degree in Chemistry must complete a set of requirements somewhat less lengthy than those required for the B.S. degree. The B.A. degree may be a good choice for students seeking further professional training or those who wish to combine their major in chemistry with a second major in some other department.

The Bachelor of Science in Engineering Chemistry Degree

The Engineering Chemistry Program is an interdisciplinary program sponsored by the Department of Chemistry and the Department of Materials Science and Engineering. The program is designed to provide students with a basic understanding of the chemical principles and materials technology underlying modern materials technology. Students take a core of courses in chemistry, physics and mathematics combined with a set of courses offered by the Materials Science and Engineering Department. Students completing the program are well trained for employment in the materials field or for graduate study in solid state chemistry or materials science.