Chemistry (CHE)

Majors in Chemistry

Department of Chemistry, College of Arts and Sciences

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

Faculty

Mohammad J. Akhtar, Lecturer and Director of General Chemistry Laboratories, Ph.D., University of the Pacific: Kinetics and mechanisms of inorganic reactions.

John M. Alexander, Professor, Ph.D., Massachusetts Institute of Technology: Reactions between complex nuclei.

Jacob Bigeleisen, Distinguished Professor Emeritus, Ph.D., University of California, Berkeley: Chemistry of isotopes.

Rong Chen, Lecturer and Director of Undergraduate Organic Chemistry Laboratories, Ph.D., University of Southern California: Organic and polymer chemistry; undergraduate laboratory curriculum development.

Benjamin Chu, Distinguished Professor, Ph.D., Cornell University: Light-scattering spectroscopy; X-ray scattering; polymer physics; colloid science; DNA electrophoresis; biomedical applications.

Dale G. Drueckhammer, Professor, Ph.D., Texas A and M University: Organic chemistry; molecular recognition; computer-aided molecular design; enzyme inhibitors and mechanistic probes.

Frank W. Fowler, Professor, Ph.D., University of Colorado: Synthetic chemistry. Recipient of the State University Chancellor’s Award for Excellence in Teaching, 1995, and the President’s Award for Excellence in Teaching, 1995.

Joanna S. Fowler, Adjunct Professor, Ph.D., University of California, Los Angeles: Organic chemistry with short-lived positron-emitting isotopes; PET imaging; neurosciences; drug mechanisms.

Nancy Garoff, Assistant Professor, Ph.D., University of California: Non-natural organic compounds and their properties; organic materials.

Clare Grey, Professor, D.Phil., University of Oxford: Materials chemistry; solid-state NMR spectroscopy; environmental chemistry.

Albert Haim, Professor Emeritus, Ph.D., University of Southern California: Kinetics and mechanisms of inorganic reactions. Recipient of the State University Chancellor’s Award for Excellence in Teaching, 1981. Recipient of the Stony Brook Alumni Association’s Outstanding Professor Award, 1994.

David M. Hanson, Professor, Ph.D., California Institute of Technology: Physical chemistry; learning theory and practice.

Benjamin S. Hsiao, Professor, Ph.D., University of Connecticut: Fundamentals of structure, morphology, property and processing relationships in polymers; nanocomposites and biomaterials.

Takanobu Ishida, Professor Emeritus, Ph.D., Massachusetts Institute of Technology: Chemistry of stable isotopes; isotope separation; electrochemistry.

Philip M. Johnson, Professor, Ph.D., Cornell University: Optical molecular spectroscopy.

Robert C. Kerber, Distinguished Teaching Professor, Ph.D., Purdue University: Chemical education. Recipient of the State University Chancellor’s Award for Excellence in Teaching, 1986, and the President’s Award for Excellence in Teaching, 1986.

Aleksi Khokhlov, Adjunct Professor, Ph.D., Moscow State University: Physical chemistry of polyelectrolytes and ionomers; polymer physics.

Stephen A. Koch, Professor, Ph.D., Massachusetts Institute of Technology: Synthetic chemistry, inorganic, bioinorganic, and solid-state chemistry.

Roy Lacey, Professor, Ph.D., Stony Brook University: Nuclear chemistry. Recipient of the State University Chancellor’s Award for Excellence in Teaching, 1998, and the President’s Award for Excellence in Teaching, 1998.

Joseph W. Lauher, Professor, Ph.D., Northwestern University: Structural chemistry; crystallography. Recipient of the State University Chancellor’s Award for Excellence in Teaching, 1990, and the President’s Award for Excellence in Teaching, 1990.

William J. Le Noble, Professor Emeritus, Ph.D., University of Chicago: Chemistry of highly compressed solutions; stereochemistry.

James F. Marecek, Adjunct Professor, Ph.D., Case Western Reserve University: Chemical synthesis.

Andreas Mayr, Professor, Ph.D., University of Munich: Synthesis of nanostructures for molecular electronics; metal-carbon multiple bonds; molecular materials.

Michelle M. Millar, Associate Professor, Ph.D., Massachusetts Institute of Technology: Transition metal chemistry; bioinorganic chemistry.

Marshall D. Newton, Adjunct Professor, Ph.D., Harvard University: Theoretical chemistry; prediction and analysis of molecular structure and energetics; analysis of charge transfer kinetics.

Iwao Ojima, Distinguished Professor, Ph.D., University of Tokyo: Synthetic Organic Chemistry at the Biomedical Interface.

Kathryn Parker, Professor, Ph.D., Stanford University: Organic synthesis; synthetic methods; natural products, non-natural nucleosides; designed enzyme inhibitors; molecular tools for biochemistry.

Fernando O. Raineri, Adjunct Assistant Professor, Ph.D., University of Buenos Aires, Argentina: Solvent effects on electron transfer reactions; equilibrium and nonequilibrium solutions; thermodynamics, structure and dynamics of liquids and solutions.

Daniel P. Raleigh, Professor, Ph.D., Massachusetts Institute of Technology: Biological chemistry; protein folding and the role of protein misfolding in disease.

Nicole S. Sampson, Professor, Ph.D., University of California, Berkeley: Bioorganic chemistry; mechanistic enzymology and chemical biology.

Robert F. Schneider, Associate Professor, Ph.D., Columbia University: Chemical education. Recipient of the State University of New York Chancellor’s Award for Excellence in Teaching, 2002, and the President’s Award for Excellence in Teaching, 2002.

Trevor J. Sears, Adjunct Professor, Ph.D., Southampton University, U.K.: Molecular spectroscopy and dynamics of chemically reactive species.

Carlos Simmerling, Assistant Professor, Ph.D., University of Illinois at Chicago: Development of new algorithms and programs for simulation of large biomolecular systems; development of tools for the visualization and analysis of the data generated by such calculations.

Richard Soclof, Adjunct Associate Professor, Ph.D., University of California, Berkeley: Gas phase kinetics.

Charles S. Springer, Professor Emeritus, Ph.D., Ohio State University: Nuclear magnetic resonance, with emphasis on living systems.

George Stell, Distinguished Professor Emeritus, Ph.D., New York University: Molecular theory of fluids; transport and thermodynamic properties of fluids.

Peter Tonge, Associate Professor, Ph.D., University of Birmingham, England: Biological chemistry; tuberculosis drug discovery; spectroscopic insights into enzyme mechanisms; structure and function of fluorescent proteins.
Courses in Chemistry

See the Course Descriptions listing in this Bulletin for complete information.

CHE 123-E, 124-E Introductory Chemistry I, II
CHE 130 Problem Solving in General Chemistry
CHE 131-E, 132-E General Chemistry Laboratory I, II
CHE 133, 134 General Chemistry Laboratory I, II
CHE 141-E, 142-E Honors Chemistry I, II
CHE 143, 144 Honors Chemistry Laboratory I, II
CHE 198-E Chemistry for Engineers
CHE 199 General Chemistry Laboratory for Engineers
CHE 221 Introduction to Chemistry of Solids
CHE 301, 302 Physical Chemistry I, II
CHE 303 Solution Chemistry Laboratory
CHE 304 Chemical Instrumentation Laboratory
CHE 310-H Chemistry in Technology and the Environment
CHE 312 Physical Chemistry (Short Course)
CHE 321 Organic Chemistry I
CHE 322 Organic Chemistry IIA
CHE 326 Organic Chemistry IIIB
CHE 327 Organic Chemistry Laboratory
CHE 341, 342 Organic Chemistry Honors Seminar I, II
CHE 344 Spectroscopy of Organic Compounds
CHE 345 Structure and Reactivity in Organic Chemistry
CHE 346 Biomolecular Structure and Reactivity
CHE 351 Quantum Chemistry
CHE 353 Chemical Thermodynamics
CHE 357 Molecular Structure and Spectroscopy Laboratory
CHE 361 Nuclear Chemistry
CHE 362 Nuclear Chemistry Laboratory
CHE 375, 376 Inorganic Chemistry I, II
CHE 383 Introductory Synthetic and Spectroscopic Laboratory Techniques
CHE 384 Intermediate Synthetic and Spectroscopic Laboratory Techniques
CHE 385 Tools of Chemistry
CHE 461 Selected Topics in Chemistry
CHE 475, 476 Undergraduate Teaching Practica I, II
CHE 482 Senior Laboratory Projects in Chemistry
CHE 487 Research in Chemistry
CHE 488 Internship
CHE 490 Current Trends in Biological Chemistry
CHE 495, 496 Senior Research

Requirements for the Major in Chemistry (CHE) (Bachelor of Science Degree)

Up to three chemistry courses passed with a C– may be applied to the major; all other courses offered for the major must be passed with a letter grade of C or higher. No transferred course with a grade lower than C may be used to fulfill any major requirement.

Completion of the major requires approximately 64-67 credits.

A. Core Requirements

1. CHE 131, 132 General Chemistry I, II
   or CHE 141, 142 Honors Chemistry
2. CHE 133, 134 General Chemistry Lab I, II
   or CHE 143, 144 Honors Chemistry Laboratory I, II
3. CHE 301, 302 Physical Chemistry I, II
4. CHE 303 Solution Chemistry Laboratory
5. CHE 321, 326 Organic Chemistry I, IIIB
6. CHE 375 Inorganic Chemistry I
7. CHE 383 Introductory Synthetic and Spectroscopic Laboratory Techniques
8. CHE 385 Tools of Chemistry
9. MAT 131, 132 Calculus I, II (See Note 1 for possible substitutions)
10. AMS 210 Applied Linear Algebra
    or MAT 211 Linear Algebra (See Note 1 for possible substitutions)
11. PHY 131/133, 132/134 Classical Physics I, II (See Note 2 for possible substitutions)
Accurate as of Fall 2005

B. Area Requirements

One of the following options:

1. Chemical Science Option
   CHE 304 Chemical Instrumentation Laboratory
   CHE 357 Molecular Structure and Spectroscopy Laboratory
   CHE 384 Intermediate Synthetic and Spectroscopic Laboratory Techniques
   CHE 482 Senior Laboratory Projects in Chemistry
   or CHE 496 Senior Research
   Two electives chosen from CHE 221, 344, 345, 346, 376, PHY 251, or ESG 281

2. Biological Chemistry Option
   CHE 384 Intermediate Synthetic and Spectroscopic Laboratory Techniques
   One organic or inorganic chemistry elective chosen from CHE 344, 345, 346, 348, or 496
   BIO 202 Fundamentals of Biology: Cell and Molecular Biology
   BIO 201 Biochemistry I
   BIO 310 Cell Biology
   or BIO 362 Biochemistry II

3. Chemical Physics Option
   CHE 304 Chemical Instrumentation Laboratory
   CHE 351 Quantum Chemistry
   or CHE 353 Chemical Thermodynamics
   CHE 357 Molecular Structure and Spectroscopy Laboratory
   MAT 205 Calculus III (See Note 1 for possible substitutions)
   PHY 251/252 Modern Physics and Laboratory
   One elective chosen from PHY 262, 301, 303, or 306

4. Environmental Chemistry Option
   CHE 304 Chemical Instrumentation Laboratory
   CHE 310 Chemistry in Technology and the Environment
   CHE 357 Molecular Structure and Spectroscopy Laboratory
   CHE 384 Intermediate Synthetic and Spectroscopic Laboratory Techniques
   BIO 201 Fundamentals of Biology: Organisms to Ecosystems
   or BIO 113 Applied Ecology

   ATM 397 Air Pollution and Its Control
5. Marine and Atmospheric Chemistry Option
   ATM 205 Introduction to Atmospheric Sciences
   MAR 308 Principles of Instrumental Analysis
   MAR 333 Coastal Oceanography
   MAR 351 Introduction to Ocean Chemistry
   ATM 305 Global Atmospheric Change and ATM 397 Air Pollution and Its Control

C. Upper-Division Writing Requirement

Each student majoring in chemistry must take CHE 385, Tools of Chemistry, until a satisfactory grade is achieved. The course requires several papers which are evaluated for cogency, clarity, and mechanics.

Notes:

1. Alternate Mathematics Sequences
   The following alternate sequences may be substituted for major requirements or prerequisites: MAT 125, 126, 127 or 141, 142 or AMS 151, 161 for MAT 131, 132; MAT 203 or 205 for PHY 210 or MAT 211. 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 121/123, 122/124 or PHY 141, 142 or PHY 125, 126, 127 for PHY 131/133, 132/134.
Sample Course Sequence for the Major in Chemistry (B.A. Degree)

### Freshman
- **Fall Credits**
  - MAT 131 4
  - CHE 131 or 141 4
  - CHE 133 or 143 4
  - D.E.C. 3
  - D.E.C. 3
  - Total 15

### Spring Credits
- D.E.C. A 3
- CHE 132 4
- CHE 134 or 144 4
- MAT 132 4
- D.E.C. 3
- Total 15

### Sophomore
- **Fall Credits**
  - CHE 321 3
  - CHE 383 2
  - AMS 210 or MAT 211 3
  - PHY 131 4
  - D.E.C. 3
  - Total 15

### Spring Credits
- CHE 326 3
- CHE 384* 3
- CHE 385 4
- PHY 132 4
- D.E.C. 3
- Elective 3
- Total 17

### Junior
- **Fall Credits**
  - CHE 301 4
  - CHE 303 2
  - AMS 210 or MAT 211 3
  - PHY 131 4
  - D.E.C. 3
  - Total 15

### Spring Credits
- CHE 302 4
- CHE 304* 2
- D.E.C. 3
- Elective 3
- Total 15

### Senior
- **Fall Credits**
  - CHE 375 3
  - D.E.C. 3
  - Upper-Division electives 3
  - Elective 3
  - Total 15

### Spring Credits
- Upper-Division electives 6
- Electives 9
- Total 15

*Only one of these two laboratory courses is required.

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

### Requirements for the Major in Chemistry (CHE) (Bachelor of Arts Degree)
Up to three chemistry courses passed with a C- may be applied to the major; all other courses offered for the major must be passed with a letter grade of C or higher. No transferred course with a grade lower than C may be used to fulfill any major requirement.

Completion of the major requires approximately 53-54 credits.

A. Study Within the Area of Chemistry
1. CHE 131, 132 General Chemistry I, II
   - or CHE 141, 142 Honors Chemistry I, II
2. CHE 133, 134 General Chemistry Lab I, II
   - or CHE 143, 144 Honors Chemistry Laboratory I, II
3. CHE 301, 302 Physical Chemistry I, II
4. CHE 383 Solution Chemistry Laboratory and one additional laboratory course (304 or 384)
5. CHE 321, 326 Organic Chemistry I, II
6. CHE 327 Organic Chemistry Laboratory
   - or CHE 383 Introductory Synthetic and Spectroscopic Laboratory Techniques
7. CHE 375 Inorganic Chemistry I
8. CHE 385 Tools of Chemistry

B. Courses in Related Fields
1. MAT 131, 132 Calculus I, II and AMS 210 Applied Linear Algebra
   - or MAT 211 Linear Algebra
   (See Note 1)
2. PHY 131/133, 132/134 Classical Physics I, II and labs (See Note 2)
C. Upper-Division Writing Requirement
Each student majoring in chemistry must take CHE 385, Tools of Chemistry, until a satisfactory grade is achieved. The course requires several papers which are evaluated for cogency, clarity, and mechanics.

Notes:
1. Alternate Mathematics Sequences
The following alternate sequences may be substituted for major requirements or prerequisites: MAT 125, 126, 127 or 141, 142 or AMS 151, 161 for MAT 131, 132; MAT 203 or 205 for AMS 210 or MAT 211. 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 121/123, 122/124 or 125, 126, 127, or 141, 142 for PHY 131/133, 132/134.

3. Transfer Credit
At least 12 credits of chemistry courses must be taken at Stony Brook; these must be taken in at least two of the major subdisciplines (inorganic, physical, and organic chemistry).

Honors Program in Chemistry
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 is a 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 and begin research. In the fifth year, the student works full-time on research, earning 24 credits in CHE 599.