Recognizing the wide range of studies encompassed by chemistry, the department encourages undergraduates to explore offerings in other departments such as mathematics, computational and applied mathematics, biochemistry, and physics as well as upper-level courses in chemistry. An interdepartmental major is offered in chemical physics. Taking advantage of the department’s extensive array of modern instrumentation, each chemistry major carries out a program of individual research under the supervision of a faculty member.

Graduate studies emphasize individual research, together with a fundamental understanding of chemistry beyond the students’ specific interests. Faculty research interests include the synthesis and biosynthesis of organic natural products, the synthesis of small cycloalkanes, molecular recognition and biological catalysis, bioinorganic and organometallic chemistry, the chemistry of group 13 (III) elements, high-pressure and high-temperature chemistry, fluorine chemistry, chemical vapor deposition, the design of nanophase solids, molecular photochemistry and photophysics, infrared kinetic spectroscopy, laser and NMR spectroscopy, the study of oriented molecular beams, theoretical and computational chemistry, and the study of giant fullerene molecules and fullerene nanowires.
Degree Requirements for B.A. in Chemistry

For general university requirements, see Graduation Requirements (pages 17–19). Students majoring in chemistry must have a total of at least 127 semester hours at graduation, including the following courses required of all majors:

**Core Courses**

**Chemistry**
- CHEM 121–122 General Chemistry with Laboratory
  (or CHEM 151–152 Honors Chemistry with Laboratory)
- CHEM 211–212 Organic Chemistry
- CHEM 213–214 Organic Chemistry Lab
- CHEM 311–312 Physical Chemistry
- CHEM 351 Introductory Module in Experimental Chemistry I
- CHEM 352 Introductory Module in Experimental Chemistry II
- CHEM 360 Inorganic Chemistry
- CHEM 491 Research for Undergraduates

**Mathematics**
- MATH 101 and 102 Single Variable Calculus I and II
  (or MATH 121 and 122)
- MATH 211 Ordinary Differential Equations and Linear Algebra
- MATH 212 Multivariable Calculus
  (or MATH 221 and 222 Honors Calculus III and IV)

**Physics**
- PHYS 101 or 111 Mechanics
- PHYS 102 or 112 Electricity and Magnetism
  (PHYS 201 Waves and Optics and PHYS 202 Modern Physics recommended)

**Other**
- NSCI 230 Computation in the Natural Sciences (or equivalent)

**Additional Courses**

At least 2 courses from the following:
- CHEM 401 Advanced Organic Chemistry
- CHEM 430 Quantum Chemistry
- CHEM 495 Transition Metal Chemistry
- CHEM 382 Advanced Module in Physical Chemistry, B
- CHEM 383 Advanced Module in Instrumental Analysis, A
- CHEM 384 Advanced Module in Instrumental Analysis, B

6 hours in upper-level courses (from chemistry, physics, mathematics, computational and applied mathematics, biochemistry, or other subjects with adviser approval)

To ensure that students receive suitable breadth in their laboratory experience, these selections must be approved by the student’s major committee. Other advanced laboratory courses from chemically related disciplines (biochemistry, materials science, environmental engineering, etc.) may be substituted for these advanced modules, with approval of the committee. Chemistry majors may also substitute 2 advanced organic laboratory module credit hours for CHEM 213 and CHEM 214, with approval of the committee. Since this advanced modular laboratory program is being offered for the first time this year, it will be necessary to phase in the curriculum over the next couple of years. It is anticipated that additional modules other than those specifically listed above will be developed during this time period. During the interim, the department will accept CHEM 313 and CHEM 314 (which were offered in previous years, but will not be offered in 1999–2000) as substitutes for two advanced modules each. For special situations, please consult your departmental adviser.

At least 4 advanced laboratory module credit hours from the following list.
- CHEM 373 Advanced Module in Fullerence Chemistry
- CHEM 374 Advanced Module in Synthetic Chemistry
- CHEM 375 Advanced Module in Inorganic Chemistry
- CHEM 376 Advanced Module in Materials Chemistry
- CHEM 377 Advanced Module in Catalysis
- CHEM 381 Advanced Module in Physical Chemistry, A

- CHEM 382 Advanced Module in Physical Chemistry, B
- CHEM 383 Advanced Module in Instrumental Analysis, A
- CHEM 384 Advanced Module in Instrumental Analysis, B

6 hours in upper-level courses (from chemistry, physics, mathematics, computational and applied mathematics, biochemistry, or other subjects with adviser approval)
Students must take at least 3 hours of research (CHEM 491) in no less than 2-hour segments. With department approval, students may satisfy this requirement with HONS 470–471, which requires participation in CHEM 491 meetings. Students may also satisfy 3 of the 6 required hours in upper-level courses with additional research.

**American Chemical Society Certification.** The Rice Department of Chemistry is on the approved list of the Committee on Professional Training of the American Chemical Society and so can certify that graduates have met the appropriate standards. For certification, students must complete:

- All core courses (see above)
- CHEM 495 *Transition Metal Chemistry*
- Either CHEM 401 *Advanced Organic Chemistry* or CHEM 430 *Quantum Chemistry*
- 9 hours in upper-level courses from chemistry, physics, mathematics, computational and applied mathematics, biochemistry, or other approved subjects

A foreign language, preferably German, is recommended.

**Chemical Physics Major.** The chemical physics major is offered in conjunction with the Department of Physics; faculty advisers are Professor Hutchinson in chemistry and Professor Stevenson in physics. Students take upper-level courses in both chemistry and physics, focusing on the applications of physics to chemical systems. Students majoring in chemical physics must complete the following courses:

### Core Courses
**Chemistry**
- CHEM 121–122 *General Chemistry with Laboratory* (or CHEM 151–152 *Honors Chemistry with Laboratory*)
- CHEM 211 *Organic Chemistry*
- CHEM 311–312 *Physical Chemistry*

**Physics**
- PHYS 101 or 111 *Mechanics*
- PHYS 102 or 112 *Electricity and Magnetism*
- PHYS 201 *Waves and Optics*
- PHYS 202 *Modern Physics*
- PHYS 231 *Elementary Physics Lab II*
- PHYS 301 *Intermediate Mechanics*
- PHYS 302 *Intermediate Electrodynamics*

**Mathematics**
- MATH 101 and 102 *Single Variable Calculus I and II*
- (or MATH 121 and 122)
- MATH 211 *Ordinary Differential Equations and Linear Algebra*
- MATH 212 *Multivariable Calculus* (or MATH 221 and 222 *Honors Calculus III and IV*)

**Additional Courses**
- 1 course from CHEM 212 or CHEM 360
- 2 courses from PHYS 311, PHYS 312, CHEM 430, CHEM 415
- 6 hours from CHEM 213, CHEM 214, CHEM 351, CHEM 352, CHEM 373–384, PHYS 331, or PHYS 332
- 2 courses from NSCI 230, CAAM 211, CAAM 212, or mathematics or computational and applied mathematics at the 300 level or above

**Admission Requirements for Accelerated B.A./Ph.D. Program in Chemistry**

The high level of training provided in the Rice B.A. program enables certain especially qualified undergraduates to enter an accelerated program that allows them to complete a Ph.D. degree within two or three years after receiving their B.A. degree. Students electing this option must begin their research during the summer following their junior year and continue the research by taking CHEM 491 during their senior year. Students specializing in organic chemistry should also start taking cumulative examinations during the senior year.
Degree Requirements for M.A. and Ph.D. in Chemistry

For general university requirements, see Graduate Degrees (pages 72–73). Students who have completed course work equivalent to that required for a B.A. in chemistry may apply for admission to the Ph.D. program. For more information, see Admission to Graduate Study (page 77).

M.A. Program. Students are NOT normally admitted to study for an M.A. degree. However, this degree is sometimes awarded to students who do not wish to complete the entire Ph.D. program. Candidates for the M.A. degree must:

- Complete 6 one-semester courses
- Produce a thesis that presents the results of a program of research approved by the department
- Pass a final oral examination

Ph.D. Program. The Ph.D. is primarily a research degree. Graduate education is aimed at developing each student’s ability to conduct independent, creative research and to develop habits of inquiry that will ensure continuing intellectual development throughout their careers. The completion of the Ph.D. program is expected to take no more than five years of full-time study. Ph.D. students must:

- Complete 6 one-semester courses
- Pass 2 oral examinations, the first involving a presentation of the student’s research progress to date and the second a presentation of an original research proposal
- If specializing in organic chemistry, pass 5 cumulative examinations (which are given periodically)
- Submit and defend a publishable thesis that represents an original and significant contribution to the field of chemistry

See CHEM (pages 283–286) in the Courses of Instruction section.