

# Curriculum and Requirements

Natural Sciences Division

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Chemistry is often called the central science, overlapping significantly with biology, physics, psychology, mathematics, geology, and engineering. All studies of matter at the molecular level (for example, biochemistry, molecular biology, pharmacology, neuroscience, nanoscience, computational chemistry, solid-state physics, geochemistry, the environmental sciences, and material science and engineering) depend on the theories and methods of chemistry.

## **New Students**

The first semester of introductory chemistry is offered at two levels. CHEM 121 is a lecture-and-discussion course intended for students needing a thorough introduction to the fundamental concepts, theories, and methods of chemistry; enrollment priority is given to first- and second-year students. CHEM 122 is a lecture-and-discussion course designed for a select group of students who would like to build upon a strong secondary-school preparation in chemistry and math. These two courses meet at the same time. CHEM 123 is the accompanying lab course, highly recommended for students in CHEM 121 and required for students in CHEM 122. First-year students enrolling in any introductory chemistry course must complete the chemistry readiness test and survey during orientation.

Students who have successfully completed CHEM 121 can then choose a second-semester lecture-and-discussion course based on their particular interests. CHEM 124 continues the investigation of chemical principles as they apply to issues in modern chemistry, such as sustainability, neurochemistry, biochemistry, and molecular medicine. Students who complete CHEM 122 may enroll directly into CHEM 243 in the spring, and get an early start on the upper-level curriculum. These two courses meet at the same time. CHEM 126 is the accompanying lab course, highly recommended for students in CHEM 124 and a co- or prerequisite for students in CHEM 243.

Completion of a full-year sequence of introductory chemistry lecture and lab courses (1.5 units) is a prerequisite for enrolling in organic chemistry or any other advanced chemistry courses and will satisfy medical-school requirements for a course in general chemistry. Transfer students and those with Advanced Placement credit or exceptionally strong secondary-school preparation in chemistry may be invited by the department, after completing the chemistry readiness test and survey, to begin their studies in organic chemistry.

The department also offers several courses designed for students who are not planning to continue beyond one or two semesters of study. These "non-majors" courses, which are numbered below 120 and have no prerequisites, serve various purposes. CHEM 109 is a required core course for the concentration in neuroscience, and CHEM 108 or CHEM 110 is a required core course for the concentration in environmental studies. Students wanting to complete the College requirements for 1 unit in the natural sciences can take any two of these, and CHEM 108 satisfies the College quantitative reasoning (QR) requirement. Non-majors courses do not serve as a prerequisite for any higher-numbered courses in the department.

### **The Chemistry Curriculum**

The chemistry curriculum begins with a series of courses covering introductory chemistry and organic chemistry in the first two years, then branches out to advanced topics in physical, inorganic, and analytical chemistry and biochemistry. Because of this vertical structure, we advise students to begin their study of chemistry as soon as possible in order to build upon their secondary-school preparation in math and science, the roots of college chemistry. Students who are considering a chemistry, biochemistry, or molecular biology major or who are planning to complete premedicine requirements should plan to take a full year of introductory lecture and lab courses (see below) in their first year.

The chemistry major is rounded out with an offering of courses and labs on the major subdisciplines of the field, along with seminar-style special topics courses. A capstone Chemistry Research Seminar for seniors in the fall semester guides students through a self-study of an individual research topic, and the Senior Exercise in the spring semester involves preparing and presenting a thirty-minute talk on two research papers on the senior research topic. Opportunities to work on independent research projects are available at all levels of the curriculum.

Chemistry majors are well prepared for professional employment or graduate study in chemistry, biochemistry, and related fields; the health sciences such as medicine, dentistry, and nursing; the veterinary sciences; secondary-school teaching; engineering; the environmental sciences; business and law; and public service. The major emphasizes the development of independent, critical thinking as well as problem-solving and communication skills. Our department is accredited by the American Chemical Society (ACS), and students may elect to receive a degree certified by the ACS (see below).

Numerous opportunities exist for students to participate in the life of the department through (1) undertaking research with faculty members, (2) participating in social and outreach activities, (3) advising the department in the hiring and evaluation of faculty members and other matters, and (4) working as stockroom assistants, laboratory proctors, paper graders, and tutors.

### **Requirements for the Major**

The minimum requirement for a chemistry major is 6 units of credit in the department, including the following:

One year of introductory chemistry lecture with lab:

CHEM 122  
CHEM 123 and CHEM 126

*or*

CHEM 121 and CHEM 124  
CHEM 123 and CHEM 126

One semester of organic chemistry with lab (0.75 unit):

CHEM 231 with Chem 233

Three advanced courses (1.5 units):

CHEM 243  
CHEM 335  
CHEM 341

Two elective advanced courses (1.0 unit) from CHEM 232, 336, or 401

Four advanced labs (1.0 unit) from CHEM 234, 370, 371, 372, 373 and 374

0.5 unit of CHEM 375 may replace one advanced lab (.25 units)

CHEM 475 Chemistry Research Seminar (.25 units) and the Senior Exercise

In addition, a year of introductory physics lecture (PHYS 130, 135 or 140, 145) with lab (PHYS 141, 146), and Calculus B (MATH 112) are highly recommended. Those students planning to do graduate work in chemistry or related areas should take additional advanced courses in chemistry and the natural sciences division and partake in research opportunities during the school year and summer. For a degree to be certified by the American Chemical Society, a student must complete 1.5 units of introductory physics, the minimum chemistry major plus CHEM 256 and 1.0 unit of research in CHEM 375.

The chemistry and biology departments offer interdisciplinary majors in biochemistry and molecular biology. Refer to the biochemistry and molecular biology section in this catalog for descriptions and course requirements. We encourage students to take upper-level courses in departments affiliated with chemistry (biology, physics, mathematics, or psychology). With department approval, one of the required advanced labs can be replaced with 1.0 unit of selected 200- or 300-level coursework in another department.

### **Senior Exercise**

The Senior Exercise in chemistry has two components, one written and one oral. At the end of the fall semester, students submit a review paper on an assigned topic. During the spring semester, senior chemistry majors must prepare and present a thirty-minute talk on two research

papers relating to their senior research topic. See the department chair and Web site for more information.

### **Honors**

Departmental honors in chemistry involve demonstrating excellence in both depth and breadth of the discipline, through accomplishments on a specific research project and achievement in studying the principal areas of chemistry knowledge. Students wishing to pursue senior honors research in chemistry should apply to the chemistry department chair no later than April 15 of their junior year. See the department chair and Web site for more information.

### **Requirements for the Chemistry Minor**

The minor in chemistry requires a minimum of 2.50 units of credit earned in the chemistry curriculum; these include completion of introductory chemistry (CHEM 122 or CHEM 124), the introductory laboratories (CHEM 123 and CHEM 126), an advanced seminar (CHEM 401), and two upper-level lectures from: CHEM 231, 232, 243, 256, 335, 336, 341, or additional sections of 401.