Chemistry, B.S.

The major in Chemistry is elected by students planning careers in the chemical sciences and frequently also by those whose interests lie in other disciplines such as biology, medicine, public health, earth sciences, ecology, secondary education, business, and law. New freshman and transfer Chemistry students are strongly encouraged to take an orientation seminar, CHEM 11, where they learn about the Chemistry major requirements, the Chemistry Department, and the career options available to students after graduation.

The curriculum of the Department is designed to satisfy the diverse needs of these students and others who may have occasion to study chemistry. The year-long lecture course sequence of CHEM M2A-CHEM M2B-CHEM M2C and laboratory course sequence of CHEM M2LA-CHEM M2LB-CHEM M3LC (or the Honors sequence of CHEM H2A-CHEM H2B-CHEM H2C and CHEM H2LA-CHEM H2LB-CHEM H3LC) cover the fundamentals of general and analytical chemistry, and serve as prerequisites to all study in the Department at more advanced levels. The subject matter of these courses also serve as a thorough introduction to the varied aspects of modern chemistry for students who do not wish to pursue their studies beyond the introductory level.

Completion of a one-year sequence in organic chemistry lectures, CHEM 51A-CHEM 51B-CHEM 51C, along with organic chemistry laboratory courses, is required for Chemistry majors and for students of the life sciences. These core organic chemistry courses are typically taken by students in their second year at UCI. All Chemistry students then take inorganic chemistry lecture and laboratory courses, CHEM 107 and CHEM 107L, an advanced instrumental analysis course, CHEM 152, and a three-quarter sequence of physical chemistry, CHEM 132A – CHEM 132B – CHEM 132C. Students will also take a mathematical and computing skill course, CHEM 5, in parallel with CHEM 132A, to help them improve their learning experience in the physical chemistry sequence.

To complete the Chemistry major requirements, the students take a minimum of five upper-division elective courses chosen from a broad menu, which includes graduate level courses. Certain advanced courses required of Chemistry majors may also be of interest to other majors. Many students elect to take a pre-defined set of elective courses in order to fulfill requirements for one of the concentrations and specializations, such as Chemical Biology, Chemistry Education, Environmental Chemistry, Medicinal Chemistry, Nuclear and Radiochemistry, Synthetic Chemistry, or Theoretical and Computational Chemistry and Quantum Science. For example, Chemistry majors who are interested in teaching chemistry at the secondary level often complete the optional concentration in Chemistry Education.

The undergraduate program of the Chemistry Department emphasizes close contact with research, and all Chemistry majors are encouraged to engage in research or independent study under the direction of a faculty member. Research is an integral requirement of the ACS certified degree, and it greatly increases chances for admission into graduate and professional schools. Students have an opportunity to write their research thesis as part of an upper-division writing course CHEM 180W (CHEM H181W in the Honors sequences). Information describing the procedures for arranging an undergraduate research opportunity is available on the Chemistry Department website (http://www.chem.uci.edu/undergrad/).

Chemistry majors who plan subsequent study in medical, dental, or other professional schools should request information concerning admission requirements directly from the schools which they seek to enter. Excellent counseling about preparation for a career in the health sciences is provided by the health science advisors in the School of Biological Sciences. Those intending to pursue graduate studies in chemistry should discuss their plans with a research area advisor no later than the fall quarter of their senior year. The current advisors for each research area are listed on the Chemistry Department website (http://www.chem.uci.edu/undergrad/).

Students may be admitted to the Chemistry major upon entering the University as freshmen, via change of major, or as transfer students from other colleges and universities. Information about change of major policies is available in the Physical Sciences Student Affairs Office and at the UCI Change of Major Criteria website (http://www.changeofmajor.uci.edu/). For transfer student admission, preference will be given to junior-level applicants with the highest grades overall and who have satisfactorily completed the following required courses: one year of general chemistry with laboratory and one year of approved calculus. Completion of one year of organic chemistry is strongly recommended.

All students must meet the University Requirements (http://catalogue.uci.edu/informationforadmittedstudents/requirementsforabachelorsdegree/).

School Requirements: None.

Departmental Requirements

<table>
<thead>
<tr>
<th>Basic Requirements</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2A- 2B- 2D</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>PHYSICS 7C- 7D- 7E</td>
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<tr>
<td></td>
</tr>
<tr>
<td>PHYSICS 7LC- 7LD</td>
</tr>
<tr>
<td></td>
</tr>
</tbody>
</table>

Select one of the following sequences and accompanying labs:
CHEM M2A- M2B- M2C

Majors General Chemistry Lecture
and Majors General Chemistry Lecture
and Majors General Chemistry Lecture

CHEM M2LA- M2LB

Majors General Chemistry Laboratory
and Majors General Chemistry Laboratory

or

CHEM H2A- H2B- H2C

Honors General Chemistry
and Honors General Chemistry
and Honors General Chemistry

CHEM H2LA- H2LB

Honors General Chemistry Laboratory
and Honors General Chemistry Laboratory

Complete the analytical chemistry laboratory

CHEM M3LC

Majors Quantitative Analytical Chemistry Laboratory

Select one of the following organic chemistry sequences and accompanying labs:

CHEM 51A- 51B- 51C

Organic Chemistry
and Organic Chemistry
and Organic Chemistry

CHEM M52LA- M52LB- M52LC

Majors Organic Chemistry Laboratory
and Majors Organic Chemistry Laboratory
and Majors Organic Chemistry Laboratory

or

CHEM H52LA- H52LB- H52LC

Honors Organic Chemistry Laboratory
and Honors Organic Chemistry Laboratory
and Honors Organic Chemistry Laboratory

Complete:

CHEM 5

Scientific Mathematical and Computing Skills

CHEM 107- 107L

Inorganic Chemistry
and Inorganic Chemistry Laboratory

CHEM 152

Advanced Analytical Chemistry

CHEM 132A- 132B- 132C

Chemical Thermodynamics, Kinetics, and Dynamics
and Quantum Principles, Spectroscopy, and Bonding
and Molecular Structure and Elementary Statistical Mechanics

Elective Requirements

Select at least five electives from the following lists, including at least two courses selected from the lecture list and at least two courses selected from the laboratory list:

 Lectures:

BIO SCI 98

Biochemistry

BIO SCI 99

Molecular Biology

BIO SCI M114

Advanced Biochemistry

BIO SCI M116

Advanced Molecular Biology

BIO SCI M123

Introduction to Computational Biology (same as BME 132)

CBE 110

Reaction Kinetics and Reactor Design

CBE 130

Separation Processes

CBE 145

Chemical Process Control

CBE 161

Introduction to Biochemical Engineering

CBE 181

Polymer Science and Engineering

CBE 183

Surface and Adhesion Science

CHEM 100

Special Topics in Chemistry

CHEM 125

Advanced Organic Chemistry

CHEM 127

Inorganic Chemistry II

CHEM 128

Introduction to Chemical Biology

CHEM 133

Nuclear and Radiochemistry

CHEM 138

Introduction to Computational Organic Chemistry
CHEM 141 Environmental Chemistry
CHEM 145A Gas-Phase Atmospheric Chemistry
CHEM 145B Multi-Phase Atmospheric Chemistry
CHEM 150 Computational Chemistry
CHEM 177 Medicinal Chemistry

Any level 200 four-unit course numbered between 201-205, 210-269

EARTHSS 142 Atmospheric Chemistry
EARTHSS 144 Marine Geochemistry and Biogeochemistry
EARTHSS 171 Microbial Biogeochemistry
ENGRCEE 162 Introduction to Environmental Chemistry
ENGRMAE 114 Fuel Cell Fundamentals and Technology
ENGRMAE 164 Air Pollution and Control
MSE 141 Nano-Scale Materials and Applications
MSE 164 X-ray Diffraction, Electron Microscopy, and Microanalysis
PHRMSCI 170A Molecular Pharmacology I
PHRMSCI 170B Molecular Pharmacology II
PHRMSCI 171 Physical Biochemistry
PHYSICS 111A-111B Classical Mechanics and Classical Mechanics
PHYSICS 112A-112B Electromagnetic Theory and Electromagnetic Theory
PUBHLTH 171 Human Exposure to Environmental Contaminants

Laboratories:

<table>
<thead>
<tr>
<th>Course</th>
<th>Laboratory</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO SCI M114L</td>
<td>Biochemistry Laboratory</td>
</tr>
<tr>
<td>BIO SCI M116L</td>
<td>Molecular Biology Laboratory</td>
</tr>
<tr>
<td>BIO SCI M118L</td>
<td>Experimental Microbiology Laboratory</td>
</tr>
<tr>
<td>CBE 140A</td>
<td>Chemical Engineering Laboratory I</td>
</tr>
<tr>
<td>CBE 140B</td>
<td>Chemical Engineering Laboratory II</td>
</tr>
<tr>
<td>CHEM 128L</td>
<td>Introduction to Chemical Biology Laboratory Techniques</td>
</tr>
<tr>
<td>CHEM 133L</td>
<td>Nuclear and Radiochemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 150L</td>
<td>Computational Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 153</td>
<td>Physical Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 156</td>
<td>Advanced Laboratory in Chemistry and Synthesis of Materials</td>
</tr>
<tr>
<td>CHEM 160</td>
<td>Organic Synthesis Laboratory</td>
</tr>
<tr>
<td>CHEM 177L</td>
<td>Medicinal Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 180</td>
<td>Undergraduate Research ³</td>
</tr>
<tr>
<td>CHEM 197</td>
<td>Professional Internship ⁴</td>
</tr>
<tr>
<td>EARTHSS 114</td>
<td>Earth System Science Laboratory and Field Methods</td>
</tr>
</tbody>
</table>

1 Courses must be taken for a letter grade.
2 At least three of the courses used to satisfy the Elective Requirement must be courses offered by the Chemistry Department, including at least one lecture course and one laboratory course.
3 CHEM 180 and CHEM H180 can be counted toward this requirement no more than once.
4 CHEM 197 must be taken for 4 units and can be counted toward this requirement no more than once.

Sample Program — Chemistry Majors ¹

Items in parentheses are recommended choices or alternatives.

<table>
<thead>
<tr>
<th>Freshman</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall</td>
<td>Winter</td>
<td>Spring</td>
</tr>
<tr>
<td>MATH 2A</td>
<td>MATH 2B</td>
<td>MATH 2D</td>
</tr>
<tr>
<td>Lower-division Writing</td>
<td>Lower-division Writing</td>
<td>CHEM M3LC</td>
</tr>
</tbody>
</table>

¹ UCI General Catalogue 2023-24
Optional American Chemical Society Certification

For ACS Certification, the program must include:

A. The Chemical Biology lecture and lab courses:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 128</td>
<td>Introduction to Chemical Biology</td>
</tr>
<tr>
<td>CHEM 128L</td>
<td>Introduction to Chemical Biology Laboratory Techniques</td>
</tr>
</tbody>
</table>

B. One course selected from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 153</td>
<td>Physical Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 156</td>
<td>Advanced Laboratory in Chemistry and Synthesis of Materials</td>
</tr>
<tr>
<td>CHEM 160</td>
<td>Organic Synthesis Laboratory</td>
</tr>
<tr>
<td>CHEM 180</td>
<td>Undergraduate Research</td>
</tr>
<tr>
<td>CHEM H180A</td>
<td>Honors Research in Chemistry</td>
</tr>
<tr>
<td>CHEM H180B</td>
<td>Honors Research in Chemistry</td>
</tr>
<tr>
<td>CHEM H180C</td>
<td>Honors Research in Chemistry</td>
</tr>
</tbody>
</table>

C. One course or the lecture/lab pair selected from:

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 125</td>
<td>Advanced Organic Chemistry</td>
</tr>
<tr>
<td>CHEM 127</td>
<td>Inorganic Chemistry II</td>
</tr>
<tr>
<td>CHEM 133</td>
<td>Nuclear and Radiochemistry</td>
</tr>
<tr>
<td>CHEM 133L</td>
<td>Nuclear and Radiochemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 138</td>
<td>Introduction to Computational Organic Chemistry</td>
</tr>
<tr>
<td>CHEM 141</td>
<td>Environmental Chemistry</td>
</tr>
<tr>
<td>CHEM 150</td>
<td>Computational Chemistry</td>
</tr>
<tr>
<td>CHEM 150L</td>
<td>Computational Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 177</td>
<td>Medicinal Chemistry</td>
</tr>
<tr>
<td>CHEM 177L</td>
<td>Medicinal Chemistry Laboratory</td>
</tr>
</tbody>
</table>

or

<table>
<thead>
<tr>
<th>Course</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 201-205</td>
<td></td>
</tr>
<tr>
<td>213-249</td>
<td></td>
</tr>
</tbody>
</table>

D. One course or the lecture/lab pair selected from list B or C.

E. Independent research with a written thesis submitted as part of CHEM 180W or CHEM H181W.

Optional Concentrations and Specializations in Chemistry

The core chemistry curriculum provides the students with the foundational knowledge of the traditional areas of chemistry. In addition, the students have an option to focus their education on one of the following areas of chemistry by completing the chemistry core requirements and strategically choosing their elective requirements as shown below. At least two quarters of undergraduate research (CHEM 180, CHEM H180A, CHEM H180B, CHEM H180C) with a research group chosen in consultation with the faculty advisors are strongly recommended but not required for all the concentrations and specializations listed below. The names of the faculty advisors for each concentration and specialization can be found on the Department of Chemistry website.
Only one specialization or concentration may appear on the transcript. If students simultaneously satisfy requirements for more than one specialization or concentration, they should choose which one will be appearing on their transcript.

### Optional Concentration in Chemical Biology

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>BIO SCI 97</td>
<td>Genetics</td>
</tr>
<tr>
<td>BIO SCI 98</td>
<td>Biochemistry</td>
</tr>
<tr>
<td>BIO SCI 99</td>
<td>Molecular Biology</td>
</tr>
<tr>
<td>CHEM 128</td>
<td>Introduction to Chemical Biology</td>
</tr>
<tr>
<td>CHEM 128L</td>
<td>Introduction to Chemical Biology Laboratory Techniques</td>
</tr>
</tbody>
</table>

### Optional Specialization in Environmental Chemistry

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 145A</td>
<td>Gas-Phase Atmospheric Chemistry</td>
</tr>
<tr>
<td>or EARTHSS 142</td>
<td>Atmospheric Chemistry</td>
</tr>
<tr>
<td>EARTHSS 144</td>
<td>Marine Geochemistry and Biogeochemistry</td>
</tr>
<tr>
<td>CHEM 141</td>
<td>Environmental Chemistry</td>
</tr>
<tr>
<td>CHEM 153</td>
<td>Physical Chemistry Laboratory</td>
</tr>
</tbody>
</table>

### Optional Specialization in Medicinal Chemistry

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 128</td>
<td>Introduction to Chemical Biology</td>
</tr>
<tr>
<td>CHEM 128L</td>
<td>Introduction to Chemical Biology Laboratory Techniques</td>
</tr>
<tr>
<td>CHEM 160</td>
<td>Organic Synthesis Laboratory</td>
</tr>
<tr>
<td>CHEM 177</td>
<td>Medicinal Chemistry</td>
</tr>
<tr>
<td>CHEM 177L</td>
<td>Medicinal Chemistry Laboratory</td>
</tr>
</tbody>
</table>

### Optional Specialization in Nuclear and Radiochemistry

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 133</td>
<td>Nuclear and Radiochemistry</td>
</tr>
<tr>
<td>CHEM 133L</td>
<td>Nuclear and Radiochemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 153</td>
<td>Physical Chemistry Laboratory</td>
</tr>
</tbody>
</table>

### Optional approved elective

### Optional Specialization in Synthetic Chemistry

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 125</td>
<td>Advanced Organic Chemistry</td>
</tr>
<tr>
<td>CHEM 127</td>
<td>Inorganic Chemistry II</td>
</tr>
<tr>
<td>CHEM 156</td>
<td>Advanced Laboratory in Chemistry and Synthesis of Materials</td>
</tr>
<tr>
<td>CHEM 160</td>
<td>Organic Synthesis Laboratory</td>
</tr>
</tbody>
</table>

### Optional Concentration in Chemistry Education

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 193</td>
<td>Research Methods</td>
</tr>
<tr>
<td>EDUC 55</td>
<td>Knowing and Learning in Mathematics and Science</td>
</tr>
<tr>
<td>PHY SCI 5</td>
<td>California Teach 1: Introduction to Science and Mathematics Teaching</td>
</tr>
<tr>
<td>PHY SCI 105</td>
<td>California Teach 2: Middle School Science and Mathematics Teaching</td>
</tr>
</tbody>
</table>

### Optional Concentration in Theoretical and Computational Chemistry and Quantum Science

The concentration in Theoretical and Computational Chemistry and Quantum Science aims to provide a rigorous education for Chemistry majors with special interests in theory and computation and quantum science. Compared to the regular Chemistry major, additional courses in mathematics, physics, and computer science are required, while upper-division laboratory courses are optional. Enrolling in this concentration requires approval by a faculty advisor. The advisors will be members of the Theoretical and Computational Chemistry faculty group, and will assist the students in choosing elective courses tailored to the students’ interests.

### A. Complete the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 3A</td>
<td>Introduction to Linear Algebra</td>
</tr>
<tr>
<td>MATH 3D</td>
<td>Elementary Differential Equations</td>
</tr>
<tr>
<td>PHYSICS 50</td>
<td>Introductory Mathematical Physics</td>
</tr>
<tr>
<td>CHEM 150</td>
<td>Computational Chemistry</td>
</tr>
</tbody>
</table>
Select at least nine courses from the following or the Chemistry major electives:

B. Select at least one from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>PHYSICS 111A</td>
<td>Classical Mechanics</td>
</tr>
<tr>
<td>PHYSICS 112A</td>
<td>Electromagnetic Theory</td>
</tr>
<tr>
<td>PHYSICS 111B</td>
<td>Classical Mechanics</td>
</tr>
<tr>
<td>PHYSICS 112B</td>
<td>Electromagnetic Theory</td>
</tr>
<tr>
<td>PHYSICS 113A</td>
<td>Quantum Mechanics</td>
</tr>
<tr>
<td>PHYSICS 113B</td>
<td>Quantum Mechanics</td>
</tr>
<tr>
<td>PHYSICS 113C</td>
<td>Quantum Mechanics</td>
</tr>
<tr>
<td>PHYSICS 115A</td>
<td>Statistical Physics</td>
</tr>
<tr>
<td>PHYSICS 125A</td>
<td>Mathematical Physics</td>
</tr>
<tr>
<td>PHYSICS 125B</td>
<td>Mathematical Physics</td>
</tr>
</tbody>
</table>

C. Select at least one from the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 105A-105LA</td>
<td>Numerical Analysis I and Numerical Analysis Laboratory</td>
</tr>
<tr>
<td>MATH 105B-105LB</td>
<td>Numerical Analysis II and Numerical Analysis Laboratory</td>
</tr>
<tr>
<td>STATS 7</td>
<td>Basic Statistics</td>
</tr>
<tr>
<td>STATS 110</td>
<td>Statistical Methods for Data Analysis I</td>
</tr>
<tr>
<td>STATS 111</td>
<td>Statistical Methods for Data Analysis II</td>
</tr>
<tr>
<td>STATS 112</td>
<td>Statistical Methods for Data Analysis III</td>
</tr>
</tbody>
</table>

D. Select at least one of the following:

<table>
<thead>
<tr>
<th>Course</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>EECS 12</td>
<td>Introduction to Programming</td>
</tr>
<tr>
<td>EECS 20</td>
<td>Computer Systems and C Programming</td>
</tr>
<tr>
<td>EECS 22</td>
<td>Advanced C Programming</td>
</tr>
<tr>
<td>EECS 22L</td>
<td>Software Engineering Project in C Language</td>
</tr>
</tbody>
</table>

Optional Courses - The following courses are required for the regular Chemistry major, but optional for the Concentration in Theoretical and Computational Chemistry:

<table>
<thead>
<tr>
<th>Course</th>
<th>Topic</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 5</td>
<td>Scientific Mathematical and Computing Skills</td>
</tr>
<tr>
<td>CHEM 107L</td>
<td>Inorganic Chemistry Laboratory</td>
</tr>
<tr>
<td>CHEM 152</td>
<td>Advanced Analytical Chemistry</td>
</tr>
</tbody>
</table>

All electives listed under the Chemistry major.

Sample Program - Concentration in Theoretical and Computational Chemistry

Items in parentheses are recommended choices or alternatives.

<table>
<thead>
<tr>
<th>Freshman</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2A</td>
<td>math 2B</td>
<td>Lower-Division Writing</td>
<td>MATH 2D</td>
</tr>
<tr>
<td>Lower-Division Writing</td>
<td>Lower-Division Writing</td>
<td></td>
<td>General Education</td>
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</table>

<table>
<thead>
<tr>
<th>Sophomore</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 51A- M52LA (CHEM H52A, CHEM H52LA)</td>
<td>CHEM 51B- M52LB (CHEM H52B, CHEM H52LB)</td>
<td>CHEM 51C- M52LC (CHEM H52C, CHEM H52LC)</td>
<td></td>
</tr>
<tr>
<td>PHYSICS 7C- 7LC</td>
<td>PHYSICS 7D- 7LD</td>
<td>PHYSICS 7E</td>
<td></td>
</tr>
<tr>
<td>MATH 3A</td>
<td>MATH 3D</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Junior</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 132A</td>
<td></td>
<td>CHEM 132B</td>
<td>CHEM 132C</td>
</tr>
<tr>
<td>CHEM 107</td>
<td>PHYSICS 112A</td>
<td>General Education</td>
<td>PHYSICS 113A</td>
</tr>
<tr>
<td>PHYSICS 111A</td>
<td>General Education</td>
<td></td>
<td>EECS 20</td>
</tr>
<tr>
<td>EECS 12</td>
<td>General Education</td>
<td></td>
<td>General Education</td>
</tr>
<tr>
<td>PHYSICS 50</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Sample program for transfer students entering at the Junior level**

<table>
<thead>
<tr>
<th>Junior</th>
<th>Fall</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 132A</td>
<td>CHEM 132B</td>
<td>CHEM 132C</td>
<td></td>
</tr>
<tr>
<td>CHEM 107</td>
<td>STATS 7</td>
<td>PHYSICS 50</td>
<td></td>
</tr>
<tr>
<td>MATH 105A-105LA</td>
<td>General Education</td>
<td>EECS 20</td>
<td></td>
</tr>
<tr>
<td>EECS 12</td>
<td>General Education</td>
<td>General Education</td>
<td></td>
</tr>
</tbody>
</table>

**Secondary Teaching Certification Option**

With additional course work and field experience offered through the UCI Cal Teach program, students who complete the concentration in Chemistry Education can also earn a California Preliminary Single Subject Teaching Credential. Completing the bachelor’s degree, concentration, and teacher certification in four years is possible with careful, early planning. Additional courses required for teacher certification are:

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 109</td>
<td>Reading and Writing in Mathematics and Science</td>
</tr>
<tr>
<td>EDUC 143AW-143BW</td>
<td>Classroom Interactions I and Classroom Interactions II</td>
</tr>
<tr>
<td>EDUC 148</td>
<td>Complex Pedagogical Design</td>
</tr>
<tr>
<td>EDUC 158</td>
<td>Student Teaching Mathematics and Science in Middle/High School (two quarters)</td>
</tr>
<tr>
<td>LPS 60</td>
<td>The Making of Modern Science</td>
</tr>
</tbody>
</table>

Successful completion of EDUC 143AW-EDUC 143BW and EDUC 148 will be accepted in lieu of three electives (from the above Elective Requirements list) for students pursuing the concentration in Chemistry Education. To complete the remaining electives, students may choose any combination from the approved list of lectures or laboratories, e.g. two laboratories, or two lectures, or one laboratory and one lecture. For additional information about teacher certification requirements and enrollment procedures, see Preparation for Teaching Science and Mathematics (http://catalogue.uci.edu/schoolofphysicalsciences/#undergraduateprogramstext). Interested students are strongly encouraged to contact the Cal Teach Resource and Advising Center or the Physical Sciences Student Affairs Office.

**Sample Program — Concentration in Chemistry Education (with Secondary Teaching Certification Option)**

Items in parentheses are recommended choices or alternatives.
The departmental requirements leave the student a great deal of latitude in choice of courses; the student can choose to pursue interests ranging from biochemistry on the one hand to chemical physics on the other. Many of the basic requirements above coincide with those of the School of Biological Sciences. For this reason a double major in Chemistry and Biological Sciences is popular. The Department is approved by the American Chemical Society to offer an undergraduate degree certified by the Society as suitable background for a career in chemistry or for graduate study in chemistry. While it is not mandatory, it is desirable for students to pursue a course of study that the Department judges to merit a certified degree. Specifically, the following courses must be included in the program of study and must be taken for a letter grade:

| CHEM 128 | Introduction to Chemical Biology |
| or BIO SCI 98 | Biochemistry |

and two laboratory courses from the list of upper-division laboratory courses that are not already required for the major from the following:

- CHEM 128L: Introduction to Chemical Biology Laboratory Techniques
- CHEM 152: Advanced Analytical Chemistry
- CHEM 153: Physical Chemistry Laboratory
- CHEM 156: Advanced Laboratory in Chemistry and Synthesis of Materials
- CHEM 160: Organic Synthesis Laboratory
- CHEM 180: Undergraduate Research (or CHEM H180)

Sample Program — Chemistry-Biological Sciences Double Majors

Items in parentheses are recommended choices or alternatives.

<table>
<thead>
<tr>
<th>Freshman</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 2A</td>
<td>MATH 2B</td>
<td>General Education</td>
</tr>
<tr>
<td>BIO SCI 93</td>
<td>BIO SCI 94</td>
<td>General Education</td>
</tr>
<tr>
<td>CHEM 11</td>
<td></td>
<td></td>
</tr>
<tr>
<td>BIO SCI 2A</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sophomore</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 51A- M52LA (CHEM H52A, CHEM H52LA)</td>
<td>CHEM 51B- M52LB (CHEM H52B, CHEM H52LB)</td>
<td>CHEM 51C- M52LC (CHEM H52C, CHEM H52LC)</td>
</tr>
<tr>
<td>CHEM 5</td>
<td>PHYSICS 7C- 7LC</td>
<td>PHYSICS 7D- 7LD</td>
</tr>
<tr>
<td>(Physics 2)</td>
<td>BIO SCI 98</td>
<td>BIO SCI 99</td>
</tr>
<tr>
<td>BIO SCI 97</td>
<td>General Education/Elective</td>
<td>BIO SCI 194S</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Junior</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 132A</td>
<td>CHEM 132B</td>
<td>CHEM 132C</td>
</tr>
<tr>
<td>PHYSICS 7E</td>
<td>CHEM 107L</td>
<td>Bio. Sci. major course</td>
</tr>
<tr>
<td>CHEM 107</td>
<td>General Education/Elective</td>
<td></td>
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<tr>
<td>BIO SCI 100</td>
<td></td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Senior</th>
<th>Winter</th>
<th>Spring</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bio. Sci. major course</td>
<td>Chemistry Elective</td>
<td>Chemistry Elective</td>
</tr>
<tr>
<td>General Education/Elective</td>
<td>General Education/Elective</td>
<td>General Education/Elective</td>
</tr>
</tbody>
</table>

The Honors Program in Chemistry is a research-based program offered to selected Chemistry majors during their final year. Applicants to the program must have completed their junior year with a grade point average of at least 3.3 overall and in their Chemistry courses. They must also have demonstrated the potential of carrying out research of honors quality, as judged by the Chemistry faculty member who will supervise their research. Students in this program enroll in Honors Research in Chemistry (CHEM H180A-CHEM H180B-CHEM H180C) throughout their senior year and submit a formal thesis late in the spring quarter. They also enroll in the Honors Seminar in Chemistry (CHEM H181W), in which they receive instruction in scientific writing and present a formal research seminar. Successful completion of CHEM H181W satisfies the UCI upper-division writing requirement. NOTE: Students enrolled in the Honors Research in Chemistry (CHEM H180A-CHEM H180B-CHEM H180C) do not enroll in CHEM 180 (Undergraduate Research).
Students who complete these requirements, whose grade point average remains above the 3.3 standard, and whose research is judged to be of honors quality will graduate with Departmental Honors in Chemistry.

The Department also offers an Honors General Chemistry sequence, CHEM H2A-CHEM H2B-CHEM H2C. This course in general chemistry is designed for members of the Campuswide Honors Collegium (CHC) and other highly qualified students. It covers the same material as CHEM 1A-CHEM 1B-CHEM M3C, but in greater depth.

Additional information is available from the Chemistry Undergraduate Program Office.

- Chemistry, Ph.D.