CHEMISTRY MAJOR, B.A.

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Chemistry is the scientific study of the composition and properties of matter and the investigation of the laws that govern them. All chemists have a common core of knowledge, learned through a highly structured sequence of undergraduate courses in which the content is divided into the classical subdisciplines. Toward the end of students' progress through their four years of undergraduate study, they may choose to concentrate in one or more areas of chemistry through the courses selected to fulfill the chemistry elective requirements and through undergraduate research.

Department Programs

Majors

• Chemistry Major, B.A. (p. 1)
• Chemistry Major, B.S. (http://catalog.unc.edu/undergraduate/programs-study/chemistry-major-bs)
• Chemistry Major, B.S.—Biochemistry Track (http://catalog.unc.edu/undergraduate/programs-study/chemistry-major-bs-biochemistry-track)
• Chemistry Major, B.S.—Polymer Track (http://catalog.unc.edu/undergraduate/programs-study/chemistry-major-bs-polymer-track)

Minor

• Chemistry Minor (http://catalog.unc.edu/undergraduate/programs-study/chemistry-minor)

Graduate Programs

• M.A. in Chemistry (http://catalog.unc.edu/graduate/schools-departments/chemistry)
• M.S. in Chemistry (http://catalog.unc.edu/graduate/schools-departments/chemistry)
• Ph.D. in Chemistry (http://catalog.unc.edu/graduate/schools-departments/chemistry)

Student Learning Outcomes

Upon completion of the chemistry (B.A.) program, students should be able to:

• Demonstrate a solid understanding of basic chemical principles (knowledge base in chemistry)
• Demonstrate the ability to solve chemical problems (analytical skills)
• Demonstrate the use of critical and creative thinking skills in conducting research with mentoring from a faculty member (critical thinking skills in chemistry)

Requirements

In addition to the program requirements listed below, students must

• attain a final cumulative GPA of at least 2.0
• complete a minimum of 45 academic credit hours earned from UNC–Chapel Hill courses
• take at least half of their major course requirements (courses and credit hours) at UNC–Chapel Hill
• earn a minimum of 18 hours of C or better in the major core requirements (some majors require 21 hours).

For more information, please consult the degree requirements section of the catalog (http://catalog.unc.edu/undergraduate/general-education-curriculum-degree-requirements/#degreerequirementstext).

Gateway Course
CHEM 101 & 101L General Descriptive Chemistry I and Quantitative Chemistry Laboratory I

Core Requirements
CHEM 102 General Descriptive Chemistry II H
or CHEM 102H General Descriptive Chemistry II
CHEM 102L Quantitative Chemistry Laboratory II
CHEM 241 Modern Analytical Methods for Separation and Characterization
CHEM 241L Laboratory in Separations and Analytical Characterization of Organic and Biological Compounds
or CHEM 245L Honors Laboratory in Separations and Analytical Characterization of Organic and Biological Compound
CHEM 251 Introduction to Inorganic Chemistry
CHEM 430 Introduction to Biological Chemistry H
CHEM 480 Introduction to Biophysical Chemistry
or CHEM 481 Physical Chemistry I
CHEM 550L Synthetic Chemistry Laboratory I
CHEM 261 Introduction to Organic Chemistry I H
CHEM 262 Introduction to Organic Chemistry II H
CHEM 262L Laboratory in Organic Chemistry
or CHEM 263L Honors Laboratory in Organic Chemistry
One course from the following list (three hours):
CHEM 395 Research in Chemistry for Undergraduates H
CHEM 420 Introduction to Polymer Chemistry
CHEM 421 Synthesis of Polymers
CHEM 431 Macromolecular Structure and Metabolism
CHEM 432 Metabolic Chemistry and Cellular Regulatory Networks
CHEM 441 Intermediate Analytical Chemistry
CHEM 444 Separations
CHEM 446 Analytical Spectroscopy
CHEM 448 Mass Spectrometry
CHEM 450 Intermediate Inorganic Chemistry
CHEM 460 Intermediate Organic Chemistry H
CHEM 530L Laboratory Techniques for Biochemistry
Sample Plan of Study

Sample plans can be used as a guide to identify the courses required to complete the major and other requirements needed for degree completion within the expected eight semesters. The actual degree plan may differ depending on the course of study selected (second major, minor, etc.). Students should meet with their academic advisor to create a degree plan that is specific and unique to their interests. The sample plans represented in this catalog are intended for first-year students entering UNC-Chapel Hill in the fall term. Some courses may not be offered every term.

The recommended course sequence for the bachelor of arts degree is listed below. At least 18 semester hours of credit in chemistry courses above CHEM 101/101L with individual grades of C or better are required. Grades of C- do not satisfy this requirement. Courses in chemistry and other courses specifically required (and designated by number) may not be declared Pass/Fail.

First Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>MATH 231</td>
<td>Calculus of Functions of One Variable I (QR)</td>
<td>4</td>
</tr>
<tr>
<td>MATH 232</td>
<td>Calculus of Functions of One Variable II (Qi)</td>
<td>4</td>
</tr>
<tr>
<td>ENGL 105</td>
<td>English Composition and Rhetoric</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 101</td>
<td>General Descriptive Chemistry I</td>
<td>4</td>
</tr>
<tr>
<td>&amp; 101L</td>
<td>General Descriptive Chemistry Laboratory I (PX)</td>
<td></td>
</tr>
<tr>
<td>or CHEM 102H</td>
<td>General Descriptive Chemistry II</td>
<td>3</td>
</tr>
<tr>
<td>or CHEM 102L</td>
<td>Quantitative Chemistry Laboratory II</td>
<td>1</td>
</tr>
</tbody>
</table>

One course from:

- CHEM 395 Research in Chemistry for Undergraduates (H) 3
- CHEM 420 Introduction to Polymer Chemistry
- CHEM 447 Introduction to Biophysical Chemistry
- CHEM 481 Physical Chemistry I

Total Hours 18

Sophomore Year

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>CHEM 241</td>
<td>Modern Analytical Methods for Separation and Characterization</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 241L</td>
<td>Laboratory in Separations and Analytical Characterization of Organic and Biological Compounds</td>
<td>1</td>
</tr>
<tr>
<td>or CHEM 245L</td>
<td>Honors Laboratory in Separations and Analytical Characterization of Organic and Biological Compound</td>
<td></td>
</tr>
<tr>
<td>CHEM 251</td>
<td>Introduction to Inorganic Chemistry</td>
<td>2</td>
</tr>
<tr>
<td>CHEM 261</td>
<td>Introduction to Organic Chemistry I (H)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 262</td>
<td>Introduction to Organic Chemistry II (H)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 262L</td>
<td>Laboratory in Organic Chemistry</td>
<td>1</td>
</tr>
<tr>
<td>or CHEM 263L</td>
<td>Honors Laboratory in Organic Chemistry</td>
<td></td>
</tr>
</tbody>
</table>

One of the following:

- PHYS 104 General Physics I
- PHYS 114 General Physics I: For Students of the Life Sciences
- PHYS 116 Mechanics (H)
- PHYS 118 Introductory Calculus-based Mechanics and Relativity

Total Hours 18

Junior and Senior Years

<table>
<thead>
<tr>
<th>Course Code</th>
<th>Course Name</th>
<th>Hours</th>
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</thead>
<tbody>
<tr>
<td>CHEM 430</td>
<td>Introduction to Biological Chemistry (H)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 480</td>
<td>Introduction to Biophysical Chemistry</td>
<td>3</td>
</tr>
<tr>
<td>or CHEM 481</td>
<td>Physical Chemistry I</td>
<td></td>
</tr>
<tr>
<td>One course from:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 401</td>
<td>Research in Chemistry for Undergraduates (H)</td>
<td>3</td>
</tr>
<tr>
<td>CHEM 420</td>
<td>Introduction to Polymer Chemistry</td>
<td></td>
</tr>
<tr>
<td>CHEM 421</td>
<td>Synthesis of Polymers</td>
<td></td>
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<tr>
<td>CHEM 431</td>
<td>Macromolecular Structure and Metabolism</td>
<td></td>
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<tr>
<td>CHEM 432</td>
<td>Metabolic Chemistry and Cellular Regulatory</td>
<td></td>
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<tr>
<td>Networks</td>
<td></td>
<td></td>
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<tr>
<td>CHEM 447</td>
<td>Intermediate Analytical Chemistry</td>
<td></td>
</tr>
<tr>
<td>CHEM 448</td>
<td>Separations</td>
<td></td>
</tr>
<tr>
<td>CHEM 449</td>
<td>Analytical Spectroscopy</td>
<td></td>
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<tr>
<td>CHEM 450</td>
<td>Mass Spectrometry</td>
<td></td>
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<tr>
<td>CHEM 460</td>
<td>Intermediate Inorganic Chemistry</td>
<td></td>
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<tr>
<td>CHEM 530L</td>
<td>Laboratory Techniques for Biochemistry</td>
<td></td>
</tr>
<tr>
<td>Other courses numbered above 420 may be substituted with permission of the instructor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>CHEM 550L</td>
<td>Synthetic Chemistry Laboratory I</td>
<td>2</td>
</tr>
</tbody>
</table>

Approaches (http://catalog.unc.edu/undergraduate/general-education-curriculum-degree-requirements) (three courses)

H Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

1 Other courses numbered above 420 may be substituted with the permission of the instructor.
Honors version available. An honors course fulfills the same requirements as the nonhonors version of that course. Enrollment and GPA restrictions may apply.

1 Placement (PL) credits (zero hours) for MATH 232, MATH 233, or MATH 383 do not satisfy chemistry major requirements.

2 PHYS 118 and PHYS 119 are encouraged for those students considering careers as professional chemists or those students who want the option to switch from the B.A. program to the B.S. program.

3 With the permission of the course instructor, CHEM 420 or other chemistry courses numbered above 420 may be substituted for the listed courses.

Special Opportunities in Chemistry

Honors in Chemistry

Upon the recommendation of the Department of Chemistry, the B.A. or B.S. degree with a major in chemistry may be awarded with honors in chemistry or highest honors in chemistry.

Highest honors in chemistry is a distinction bestowed on a truly exceptional student who has excelled in coursework and who has completed a research project of considerable depth and significance. To attain this distinction the candidate must have nominally satisfied the following guidelines:

- B.A. candidates must have achieved a chemistry major grade point average of 3.85 or higher; B.S. candidates, a chemistry major grade point average of 3.75 or higher.
- Have completed at least five courses in chemistry numbered CHEM 420 or above. For B.A. candidates one of these may be a laboratory course; for B.S. candidates they must all be lecture courses.
- Have completed or be about to complete a research project certified to be of publishable quality by the research advisor and two faculty members appointed by the director of undergraduate studies.

Honors in chemistry is a distinction bestowed on an outstanding student who has demonstrated marked competence in the coursework and who has completed a research project of considerable merit. To attain this distinction the candidate must have nominally satisfied the following guidelines:

- Have achieved a chemistry major grade point average of 3.40 or higher
- Have received no grade below B- in junior- or senior-level chemistry courses
- Have completed at least three lecture courses in chemistry numbered CHEM 420 or above
- Have completed or be about to complete a research project certified to be of honors quality by the research advisor and two faculty members appointed by the vice chair for undergraduate studies

Students who wish to qualify for either of these awards should begin planning their course programs and research activities in the junior year so that ample time and effort may be devoted to succeeding in upper-level courses and research.

Departmental Involvement

Majors are encouraged to participate in AXE (chemistry fraternity) and the undergraduate advisory board.

Laboratory Teaching Internships and Assistantships

Undergraduates have the opportunity to serve as laboratory teaching assistants for entry-level undergraduate laboratory courses.

Special Topics

Special topics not offered through the normal course sequence may be pursued through directed reading and registration in CHEM 396 with the approval of the supervising faculty member, advisor, and vice chair for undergraduate studies. An approved learning contract is required, and students must be registered no later than the end of the first week of classes.

Undergraduate Awards

Excellent performances by undergraduates in chemistry are recognized by the department through the following awards:

- Francis P. Venable Medal: A medallion and cash award are presented to the two most outstanding graduating seniors majoring in chemistry in honor of Dr. Francis P. Venable, who was chair of the department, president of the University from 1900 to 1914, and president of the American Chemical Society.
- Emmett Gladstone Rand Premedical Scholarship: A scholarship is presented to an exceptionally talented graduating senior intending to pursue a career in medicine.
- Jason D. Altom Memorial Award for Undergraduate Research: This cash award recognizes research potential of an undergraduate chemistry major.
- J. Thurman Freeze Scholarship: This scholarship serves to fund summer research between a student’s junior and senior years.
- E.C. Markham Summer Research Fund: The department chair selects the recipient of this award, who will use the salary to perform research between the junior and senior years.
- Carrie Largent Award for Research Excellence: This award is given annually to a graduating senior who has excelled in research.
- David L. Stern Scholar: Top students from upper-division laboratory courses are chosen for this cash award.
- AXE Sophomore Chemist Award: A cash award and certificate are presented to an outstanding sophomore chemistry major.
- James H. Maguire Memorial Award: This award goes to an outstanding and academically gifted junior honors student majoring in chemistry.
- Tanya R. Ellison Scholarship: A female, junior or senior B.S. chemistry major is selected for this cash award on the basis of character and academic commitment.
- Hypercube Scholar Award: An outstanding senior majoring in chemistry is given this chemical software package.

Undergraduate Research

Almost every undergraduate chemistry major who has undertaken a research project has found it to be an exciting and rewarding experience. The reasons are many. One certainly is that it affords an opportunity to make pioneering discoveries at the forefront of science, using
instrumentation and techniques far more sophisticated than those usually encountered in standard laboratory courses.

More than 80 students are involved in undergraduate research projects in chemistry each year. Although successful completion of an undergraduate research project is a requirement for graduation with honors or highest honors (see above), it is not necessary to be a participant in Honors Carolina to undertake a research project.

The usual mechanism for becoming involved in a research project is to register for CHEM 395. This process begins well in advance of a preregistration or registration period with a visit to the Chemistry Student Services office, where a student may obtain a list of undergraduate research opportunities and a form titled Request for Registration in CHEM 395.

Most students begin research during the spring semester of their junior year and continue throughout their senior year. CHEM 395 and CHEM 396 together may be taken for credit as many times as desired but may be counted for no more than nine hours total credit toward graduation in either the B.A. or B.S. traditional and polymer tracks and for no more than six hours in the B.S. biochemistry track. In the B.S. curriculum CHEM 395 may be counted no more than once as an advanced chemistry elective.

**UNC–BEST**

The UNC Baccalaureate Education in Science and Teaching (UNC–BEST) Program is a collaboration between the School of Education and the College of Arts and Sciences and is designed to allow undergraduate science majors interested in teaching high school science the opportunity to earn their science degree and obtain licensure as a North Carolina high school science teacher in four years. UNC–BEST students meet all the degree requirements for their chemistry degree using CHEM 410 as one of their upper-level chemistry courses. UNC–BEST students also fulfill teaching licensure coursework requirements as well as many General Education and elective requirements as they complete courses in teaching and learning.

<table>
<thead>
<tr>
<th>Code</th>
<th>Title</th>
<th>Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>EDUC 516</td>
<td>Introduction to the Education of Exceptional Learners</td>
<td>3</td>
</tr>
<tr>
<td>or EDUC 689</td>
<td>Foundations of Special Education</td>
<td></td>
</tr>
<tr>
<td>EDUC 532</td>
<td>Introduction to Development and Learning</td>
<td>3</td>
</tr>
<tr>
<td>EDUC 615</td>
<td>Schools and Community Collaboration</td>
<td>3</td>
</tr>
<tr>
<td>or EDUC 533</td>
<td>Social Justice in Education</td>
<td></td>
</tr>
<tr>
<td>EDUC 593</td>
<td>Internship/Student Teaching (final semester)</td>
<td>12</td>
</tr>
<tr>
<td>EDUC 601</td>
<td>Education Workshops (final semester)</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Total Hours</td>
<td>22</td>
</tr>
</tbody>
</table>

For more details on admission requirements, application deadlines, and instructions for submitting an online application, visit the School of Education Web site (http://soe.unc.edu/academics/uncbest).