

# CHEMISTRY

## Description

Chemistry deals with the analysis, structure, properties, and synthesis of matter ranging in size from single atoms to biologically active small molecules to DNA and proteins. A major in chemistry prepares students for many career options: industry (research, analysis, production), teaching, graduate studies, or professional schools.

The bachelor of science (BS) program offers two options: Professional, which is recommended for students planning graduate studies or professional careers in chemistry, and Chemical Biology, which is an excellent choice for students interested in a health-related professional school or employment in the industry. The bachelor of arts (BA) program is a broad chemistry major that pairs well with a minor or even second major in other disciplines.

## Options in the Major (BS Only)

### Professional Option

The Professional Option coursework reflects standards set by the American Chemical Society and is excellent preparation for students interested in research and the possibility of pursuing advanced education in Chemistry.

### Chemical Biology Option

The Chemical Biology Option combines a solid background in life science, chemistry, math, and physics with advanced coursework about the chemical principles that support biological function. The advanced courses are chemical biology, computational chemistry, natural product biosynthesis, and biochemical thermodynamics and kinetics.

### Laboratory Fees

Students who enroll in chemistry laboratory courses pay a special fee to defray the cost of materials and equipment. The special fee is applied to tuition in the amounts given in the Office of the University Registrar's website at [registrar.unl.edu](http://registrar.unl.edu) (<http://registrar.unl.edu>). In addition, glassware and equipment that are lost or damaged by the student are charged to the student's N-card for 200-level, 300-level, and 400-level classes.

**Program Assessment.** In order to assist the department in evaluating the effectiveness of its programs, majors will be required in their senior year:

1. To take a standardized chemistry exam during their final year in the program. It will be administered toward the end of their final semester at a time that all graduating students can attend.
2. To participate in an exit interview with a designated faculty member.
3. To submit a copy of the report written for CHEM 398 Undergraduate Research in Chemistry to the departmental office for evaluation.

The vice-chair will inform students of the scheduling and format of assessment activities. The results of participation in these assessment activities will in no way affect a student's GPA or graduation.

## College Admission

The entrance requirements for the College of Arts and Sciences (CAS), including any of the majors or minors offered through the college, are the same as the University of Nebraska–Lincoln General Admission Requirements. In addition to these requirements, the College of Arts and Sciences strongly recommends a third and fourth year of one foreign language in high school. Four years of high school coursework in the

same language will fulfill the College of Arts and Sciences' language requirement. It will also allow students to continue language study at a more advanced level at the University of Nebraska–Lincoln and provide more opportunity to study abroad.

## Academic and Career Advising

### Academic and Career Advising Center

Not sure where to go or who to ask? The Advising Center team in 107 Oldfather Hall can help. The Academic and Career Advising Center is the undergraduate hub for CAS students in all majors. Centrally located and easily accessed, students encounter friendly, knowledgeable people who are eager to help or connect students to partner resources. Students also visit the Advising Center in 107 Oldfather Hall to:

- Choose or change their major, minor, or degree program.
- Check on policies, procedures, and deadlines.
- Get a college approval signature from the Dean's representatives.

CAS Career Coaches are available by appointment (in-person or zoom) and located in the CAS Academic and Career Advising Center, 107 Oldfather Hall. They help students explore majors and minors, gain experience, and develop a plan for life after graduation.

### Assigned Academic Advisors

Academic advisors are critical resources dedicated to students' academic, personal, and professional success. Every CAS student is assigned an academic advisor based on their primary major. Since most CAS students have more than just a single major, it is important to get to know the advisor for any minors or additional majors. Academic advisors work closely with the faculty to provide the best overall support and the discipline specific expertise. They are available for appointments (in-person or zoom) and through weekly virtual drop-ins. Assigned advisors are listed in MyRED (<https://its.unl.edu/myunl/>) and their offices may be located in or near the department of the major for which they advise.

Students who have declared a pre-health or pre-law area of interest will also work with advisors in the Exploratory and Pre-Professional Advising Center (Explore Center) in 127 Love South, who are specially trained to guide students preparing to enter a professional school.

For complete and current information on advisors for majors, minors, or pre-professional areas, visit <https://cas.unl.edu/major-advisors> (<https://cas.unl.edu/major-advisors/>), or connect with the Arts and Sciences Academic and Career Advising Center, 107 Oldfather Hall, 402-472-4190, [casadvising@unl.edu](mailto:casadvising@unl.edu).

### Career Coaching

The College believes that **Academics + Experience = Opportunities** and encourages students to complement their academic preparation with real-world experience, including internships, research, education abroad, service, and leadership. Arts and sciences students have access to a powerful network of faculty, staff, and advisors dedicated to providing information and support for their goals of meaningful employment or advanced education. Arts and sciences graduates have unlimited career possibilities and carry with them important career competencies—communication, critical thinking, creativity, context, and collaboration. They have the skills and adaptability that employers universally value. Graduates are prepared to effectively contribute professionally and personally with a solid foundation to excel in an increasingly global, technological, and interdisciplinary world.

Students should contact the career coaches in the Arts and Sciences Academic and Career Advising Center in 107 Oldfather Hall, or their assigned advisor, for more information. The CAS career coaches help students explore career options, identify ways to build experience and prepare to apply for internships, jobs, or graduate school, including help with resumes, applications, and interviewing.

## ACE Requirements

Students must complete one course for each of the ACE Student Learning Outcomes below. Certified course choices are published in the degree audit, or visit the ACE website (<http://ace.unl.edu>) for the most current list of certified courses.

### ACE Student Learning Outcomes

ACE 1: Write texts, in various forms, with an identified purpose, that respond to specific audience needs, integrate research or existing knowledge, and use applicable documentation and appropriate conventions of format and structure.

ACE 2: Demonstrate competence in communication skills.

ACE 3: Use mathematical, computational, statistical, logical, or other formal reasoning to solve problems, draw inferences, justify conclusions, and determine reasonableness.

ACE 4: Use scientific methods and knowledge to pose questions, frame hypotheses, interpret data, and evaluate whether conclusions about the natural and physical world are reasonable.

ACE 5: Use knowledge, historical perspectives, analysis, interpretation, critical evaluation, and the standards of evidence appropriate to the humanities to address problems and issues.

ACE 6: Use knowledge, theories, and research perspectives such as statistical methods or observational accounts appropriate to the social sciences to understand and evaluate social systems or human behaviors.

ACE 7: Use knowledge, theories, or methods appropriate to the arts to understand their context and significance.

ACE 8: Use knowledge, theories, and analysis to explain ethical principles and their importance in society.

ACE 9: Exhibit global awareness or knowledge of human diversity through analysis of an issue.

ACE 10: Generate a creative or scholarly product that requires broad knowledge, appropriate technical proficiency, information collection, synthesis, interpretation, presentation, and reflection.

- A student may not use a single course to satisfy more than one College Distribution Requirement, with the exception of CDR Diversity. Courses used to meet CDR Diversity may also meet CDR Writing, CDR Humanities, or CDR Social Science.
- Independent study or reading courses and internships cannot be used to satisfy distribution requirements.
- Courses from interdisciplinary programs will be applied in the same area as courses from the home/cross-listed department.

### College Distribution Requirements

*CDR: Written Communication* 3

Select from courses approved for ACE outcome 1.

*CDR: Natural, Physical, and Mathematical Sciences with Lab* 4

Select from biochemistry, biological sciences, chemistry, computer science, geology, meteorology, mathematics, and physics. Must include one lab in the natural or physical sciences. Lab courses may be selected from biochemistry, biological sciences, chemistry, geology, meteorology, and physics.

Some courses from geography and anthropology may also be used to satisfy the lab requirement above.<sup>1</sup>

*CDR: Humanities* 3

Select from classics, English, film studies, history, modern languages and literatures, philosophy, and religious studies.<sup>2</sup>

*CDR: Social Science* 3

Select from anthropology, communication studies, geography, national security studies, political science, psychology, or sociology.<sup>3</sup>

*CDR: Human Diversity in U.S. Communities* 0-3

Select from a set of approved courses as listed in the degree audit.

*CDR: Language* 0-16

Fulfilled by the completion of the 6-credit-hour second-year sequence in a single foreign language in one of the following departments: Classics and religious studies or modern languages and literatures. Instruction is currently available in Arabic, Chinese, Czech, French, German, Greek, Japanese, Latin, Russian, and Spanish.

A student who has completed the fourth-year level of one foreign language in high school is exempt from the languages requirement, but encouraged to continue on in their language study.

Credit Hours Subtotal: 13-32

<sup>1</sup> See Degree Audit or a College of Arts and Sciences advisor for approved geography and anthropology courses that apply as natural science.

<sup>2</sup> Language courses numbered 220 and below do not fulfill the CDR Humanities.

<sup>3</sup> See Degree Audit or College of Arts and Sciences advisor for list of natural/physical science courses in anthropology, geography, and psychology that do not apply as social science.

## College Degree Requirements

### College Distribution Requirements – BA and BS

The College of Arts and Sciences distribution requirements are common to both the bachelor of arts and bachelor of science degrees and are designed to ensure a range of courses. By engaging in study in several different areas within the College, students develop the ability to learn in a variety of ways and apply their knowledge from a variety of perspectives. All requirements are in addition to University ACE requirements, and no course can be used to fulfill both an ACE outcome and a College Distribution Requirement.

### Language Requirement

The University of Nebraska–Lincoln and the College of Arts and Sciences place great value on academic exposure and proficiency in a second language. The University of Nebraska–Lincoln entrance requirement of two years of the same foreign language or the College's language distribution requirement (CDR: Language) will rarely be waived and only

with relevant documentation. See the main College of Arts and Sciences page for more details.

## Experiential Learning Requirement

All undergraduates in the College of Arts and Sciences must complete an Experiential Learning (EL) designated course. This may include 0-credit courses designed to document co-curricular activities recognized as Experiential Learning.

## Scientific Base - BS Only

The bachelor of science degree requires students to complete 60 hours in mathematical, physical, and natural sciences. Approved courses for scientific-based credit come from the following College of Arts and Sciences disciplines: actuarial science, anthropology (selected courses), astronomy, biochemistry (excluding BIOC 101), biological sciences (excluding BIOS 100 or BIOS 203), chemistry (excluding CHEM 101), geography (selected courses), geology, life sciences, mathematics (excluding courses below MATH 104), meteorology, microbiology (excluding MBIO 101), and physics (excluding PHYS 201.)

See your Degree Audit or your assigned academic advisor for a complete list, including individual classes that fall outside of the disciplines listed above. Up to 12 hours of scientific and technical courses offered by other colleges may be accepted toward this requirement with approval of the College of Arts and Sciences. See your assigned academic advisor to start the approval process.

## Minimum Hours Required for Graduation

A minimum of 120 semester hours of credit is required for graduation from the College of Arts and Sciences. A cumulative grade point average of at least 2.0 is required.

## Grade Rules

### Restrictions on C- and D Grades

The College will accept no more than 15 semester hours of C- and D grades from other domestic institutions except for UNO and UNK. All courses taken at UNO and UNK impact the UNL transcript. No transfer of C- and D grades can be applied toward requirements in a major or a minor. No University of Nebraska–Lincoln C- and D grades can be applied toward requirements in a major or a minor. International coursework (including education abroad) with a final grade equivalent to a C- or lower will not be validated by the College of Arts and Sciences departments to be degree applicable.

### Pass/No Pass Privilege

**The College of Arts and Sciences adheres to the University regulations for the Pass/No Pass (P/N) privilege with the following additional regulations:**

- Pass/No Pass hours can count toward fulfillment of University ACE requirements and college distribution requirements up to the 24-hour maximum.
- Most arts and sciences departments and programs do not allow courses graded Pass/No Pass to apply to the major or minor. Students should refer to the department's or program's section of the catalog for clarification. By college rule, departments can allow up to 6 hours of Pass/No Pass in the major or minor.
- Departments may specify that certain courses of theirs can be taken only on a P/N basis.
- The college will permit no more than a total of 24 semester hours of P/N grades to be applied toward degree requirements. This total includes all Pass grades earned at the University of Nebraska–

Lincoln and other U.S. schools. **NOTE:** This 24-hour limit is more restrictive than the University regulation.

## Grading Appeals

A student who feels that he/she has been unfairly graded must ordinarily take the following sequential steps in a timely manner, usually by initiating the appeal in the semester following the awarding of the grade:

1. Talk with the instructor concerned. Most problems are resolved at this point.
2. Talk to the instructor's department chairperson.
3. Take the case to the Grading Appeal Committee of the department concerned. The Committee should be contacted through the department chairperson.
4. Take the case to the College Grading Appeals Committee by contacting the Dean's Office, 1223 Oldfather Hall.

## Course Level Requirements

### Courses Numbered at the 300 or 400 Level

Thirty (30) of the 120 semester hours of credit must be in courses numbered at the 300 or 400 level. Of those 30 hours, 15 hours (1/2) must be completed in residence at the University of Nebraska–Lincoln.

## Residency Requirement

Students must complete at least 30 of the 120 total hours for their degree at the University of Nebraska–Lincoln. Students must complete at least 1/2 of their major coursework, including 6 hours at the 300 or 400 level in their major and 15 of the 30 hours required at the 300 or 400 level, in residence. Credit earned during education abroad may be used toward the residency requirement only if students register through the University of Nebraska–Lincoln.

## Catalog to Use

Students must fulfill the requirements stated in the catalog for the academic year in which they are first admitted to and enrolled as a degree-seeking student at the University of Nebraska–Lincoln. In consultation with advisors, a student may choose to follow a subsequent catalog for any academic year in which they are admitted to and enrolled as a degree-seeking student at the University of Nebraska–Lincoln in the College of Arts and Sciences. Students must complete all degree requirements from a single catalog year. Beginning in 1990-1991, the catalog which a student follows for degree requirements may not be more than 10 years old at the time of graduation.

**Transfer Students:** Students who have transferred from a community college may be eligible to fulfill the requirements as stated in the catalog for an academic year in which they were enrolled at the community college prior to attending the University of Nebraska–Lincoln. This decision should be made in consultation with academic advisors, provided the student a) was enrolled in a community college during the catalog year they are utilizing, b) maintained continuous enrollment at the previous institution for 1 academic year or more, and c) continued enrollment at the University of Nebraska–Lincoln within 1 calendar year from their last term at the previous institution. Students must complete all degree requirements from a single catalog year and within the time frame allowable for that catalog year.

## Learning Outcomes

Graduates with a major in chemistry will be able to:

1. Fundamental Concepts.
  - a. Explain basic chemical principles.
  - b. Solve chemical problems.
2. Experimental Skills.
  - a. Design experiments to study chemical systems.
  - b. Collect data using instruments and computer-based tools.
  - c. Analyze and interpret data.
  - d. Compare experimental results with the literature.
3. Responsible Conduct of Research.
  - a. Apply the principles of chemical hygiene.
  - b. Explain the principles of Green Chemistry and sustainability.
4. Career.
  - a. Describe the importance of diversity, equity, inclusion, & respect.
  - b. Demonstrate effective oral and written skills.
  - c. Develop effective teamwork skills.
  - d. Identify career pathways for using the skills of the major.

## Major Requirements

### Bachelor of Science

The bachelor of science (BS) program offers two options: Professional, which is recommended for students planning graduate studies or professional careers in chemistry, and Chemical Biology, which is an excellent choice for students interested in a health-related professional school or employment in the industry.

#### Core Requirements

##### Career and Academic Planning

CHEM 101	Career Opportunities in Chemistry	1
Credit Hours Subtotal:		1

##### Fundamental Chemistry & Quantitative Analysis

CHEM 113A	Fundamental Chemistry I (Recommended)	3
or CHEM 109A General Chemistry I		
CHEM 113L	Fundamental Chemistry I Laboratory (Recommended)	1
or CHEM 109L General Chemistry I Laboratory		
CHEM 114	Fundamental Chemistry II (Recommended)	3
or CHEM 110A General Chemistry II		
CHEM 221A & CHEM 221L	Elementary Quantitative Analysis and Elementary Quantitative Analysis Laboratory	5
Credit Hours Subtotal:		12

##### Option Courses

Select either the Professional Option or the Chemical Biology Option	50-56
Credit Hours Subtotal:	50-56

**Total Credit Hours** **63-69**

#### Professional Option

##### Organic Chemistry

CHEM 261 & CHEM 263	Organic Chemistry and Mechanistic Organic Chemistry I Laboratory	5
CHEM 262 & CHEM 264	Organic Chemistry and Mechanistic Organic Chemistry II Laboratory	5
Credit Hours Subtotal:		10

#### Biochemistry or Chemical Biology

CHEM 431 or CHEM 435	Biochemistry I: Structure and Metabolism Chemical Biology	3
CHEM 433 or CHEM 437	Biochemistry Laboratory Chemical Biology Laboratory	2
Credit Hours Subtotal:		5

##### Advanced Chemistry (ACE 10)

CHEM 421 or CHEM 441	Analytical Chemistry Inorganic Chemistry	3
CHEM 423 or CHEM 443	Analytical Chemistry Laboratory Inorganic Chemistry Laboratory	2
Credit Hours Subtotal:		5

##### Physical Chemistry

CHEM 481	Physical Chemistry I	4
CHEM 482	Physical Chemistry II	4
CHEM 484	Physical Chemical Measurements	3
Credit Hours Subtotal:		11

##### Research

CHEM 398	Undergraduate Research in Chemistry	2
Credit Hours Subtotal:		2

##### Ancillary Courses

MATH 106	Calculus I	5
MATH 107	Calculus II	4
MATH 208	Calculus III <sup>1</sup>	4
PHYS 211 & PHYS 212	General Physics I and General Physics II	8
Credit Hours Subtotal:		21

**Total Credit Hours** **54**

<sup>1</sup> It is recommended that Professional Option students take MATH 221 in addition to MATH 208.

#### Chemical Biology Option

##### Life Science

LIFE 120 & LIFE 120L	Fundamentals of Biology I and Fundamentals of Biology I laboratory	4
LIFE 121 & LIFE 121L	Fundamentals of Biology II and Fundamentals of Biology II Laboratory	4
Credit Hours Subtotal:		8

##### Organic Chemistry

CHEM 251 & CHEM 253	Organic Chemistry I and Organic Chemistry I Laboratory	4
CHEM 252 & CHEM 254	Organic Chemistry II and Organic Chemistry II Laboratory	4
Credit Hours Subtotal:		8

##### Chemical Biology

CHEM 435 & CHEM 437	Chemical Biology and Chemical Biology Laboratory	5
CHEM 438 or CHEM 453	Computational Chemical Biology Biosynthetic Pathways	3
Credit Hours Subtotal:		8

##### Advanced Chemistry (ACE 10)

CHEM 421	Analytical Chemistry	3
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or CHEM 441	Inorganic Chemistry	
CHEM 423	Analytical Chemistry Laboratory	2
or CHEM 443	Inorganic Chemistry Laboratory	
Credit Hours Subtotal:		5
<b>Physical Chemistry</b>		
CHEM 471	Physical Chemistry	4
Credit Hours Subtotal:		4
<b>Experiential Learning <sup>1</sup></b>		
Select one of the following options:		0-2
CASC 95	Internship in Arts and Sciences	
or CHEM 95	Chemistry Internship	
CASC 98	Undergraduate Research Experience	
or CHEM 398	Undergraduate Research in Chemistry	
Credit Hours Subtotal:		0-2
<b>Ancillary Courses</b>		
MATH 106	Calculus I	5
MATH 107	Calculus II	4
PHYS 141	Elementary General Physics I	4-5
or PHYS 211	General Physics I	
PHYS 142	Elementary General Physics II	4-5
or PHYS 212	General Physics II	
Credit Hours Subtotal:		17-19
<b>Total Credit Hours</b>		<b>50-54</b>

<sup>1</sup> Experience must be related to Chemical Biology and approved by the advisor to meet the requirement.

## Bachelor of Arts

The bachelor of arts (BA) program is designed for students interested in broad undergraduate training in chemistry and pairs well with a minor or additional major.

### Career and Academic Planning

CHEM 101	Career Opportunities in Chemistry	1
Credit Hours Subtotal:		1

### General Chemistry & Quantitative Analysis

CHEM 109A	General Chemistry I (Recommended)	3
or CHEM 113A	Fundamental Chemistry I	
CHEM 109L	General Chemistry I Laboratory (Recommended)	1
or CHEM 113L	Fundamental Chemistry I Laboratory	
CHEM 110A	General Chemistry II (Recommended)	3
or CHEM 114	Fundamental Chemistry II	
CHEM 221L	Elementary Quantitative Analysis Laboratory	2
Credit Hours Subtotal:		9

### Organic Chemistry

CHEM 251	Organic Chemistry I	4
& CHEM 253	and Organic Chemistry I Laboratory	
CHEM 252	Organic Chemistry II	4
& CHEM 254	and Organic Chemistry II Laboratory	
Credit Hours Subtotal:		8

### Physical Chemistry

CHEM 471	Physical Chemistry	4
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Credit Hours Subtotal:	4
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### Advanced Chemistry

Select two sequences of the following:	10
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CHEM 421	Analytical Chemistry	
& CHEM 423	and Analytical Chemistry Laboratory (ACE 10)	
CHEM 431 /	Biochemistry I: Structure and Metabolism	
BIOC 431 /	and Biochemistry Laboratory	
BIOS 431		
& CHEM 433 /		
BIOC 433 /		
BIOS 433		
or CHEM 433	Chemical Biology	
& CHEM 437	and Chemical Biology Laboratory	
CHEM 441	Inorganic Chemistry	
& CHEM 443	and Inorganic Chemistry Laboratory (ACE 10)	

Credit Hours Subtotal:	10
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### Ancillary Requirements

MATH 106	Calculus I	5
MATH 107	Calculus II	4
PHYS 141	Elementary General Physics I	4-5
or PHYS 211	General Physics I	
PHYS 142	Elementary General Physics II	4-5
or PHYS 212	General Physics II	

Credit Hours Subtotal:	17-19
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<b>Total Credit Hours</b>	<b>49-51</b>
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## Additional Major Requirements

### Grade Rules

#### C- and D Grades

A grade of C or above is required for all courses in the major, including ancillary courses.

#### Pass/No Pass

No course taken Pass/No Pass will be counted toward the major with the exceptions of CHEM 101, Internship or Research.

## Requirements for Minor Offered by Department

### Plan A Minor (24-25 hours)

Completion of a chemistry sequence plus an additional twelve (12) hours of chemistry.

Select one sequence from the following:	12-13
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CHEM 109A	General Chemistry I	
& CHEM 109L	and General Chemistry I Laboratory	
& CHEM 110A	and General Chemistry II	
& CHEM 110L	and General Chemistry II Laboratory	
& CHEM 221A	and Elementary Quantitative Analysis	
& CHEM 221L	and Elementary Quantitative Analysis Laboratory	

CHEM 113A Fundamental Chemistry I  
& CHEM 113L and Fundamental Chemistry I Laboratory  
& CHEM 114 and Fundamental Chemistry II  
& CHEM 221A and Elementary Quantitative Analysis  
& CHEM 221L and Elementary Quantitative Analysis Laboratory

Select an additional 12 hours of chemistry <sup>1</sup> 12

**Total Credit Hours** 24-25

<sup>1</sup> Excluding CHEM 101, CHEM 105A, CHEM 105L, CHEM 106A, CHEM 106L, CHEM 131, CHEM 396, CHEM 398, CHEM 499, or CHEM 499H.

## Plan B Minor (20-21 hours)

Completion of a chemistry sequence plus an additional eight (8) hours of chemistry.

Select one sequence from the following: 12-13

CHEM 109A General Chemistry I  
& CHEM 109L and General Chemistry I Laboratory  
& CHEM 110A and General Chemistry II  
& CHEM 110L and General Chemistry II Laboratory  
& CHEM 221A and Elementary Quantitative Analysis  
& CHEM 221L and Elementary Quantitative Analysis Laboratory

Or

CHEM 113A Fundamental Chemistry I  
& CHEM 113L and Fundamental Chemistry I Laboratory  
& CHEM 114 and Fundamental Chemistry II  
& CHEM 221A and Elementary Quantitative Analysis  
& CHEM 221L and Elementary Quantitative Analysis Laboratory

Select an additional 8 hours of chemistry <sup>1</sup> 8

**Total Credit Hours** 20-21

<sup>1</sup> Excluding CHEM 101, CHEM 105A, CHEM 105L, CHEM 106A, CHEM 106L, CHEM 131, CHEM 396, CHEM 398, CHEM 499, or CHEM 499H.

## Grade Rules

### C- and D Grades

A grade of C or above is required for all courses in the minor.

### Pass/No Pass

No course taken Pass/No Pass will be counted toward the minor.

### CHEM 101 Career Opportunities in Chemistry

**Description:** Introduction to chemistry careers and faculty research interests in the Department of Chemistry. This course is required for all chemistry majors (B.S. and B.A.) but is open to all students interested in learning about the chemistry program and its relationship to careers.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Pass No Pass

### CHEM 105A Chemistry in Context I

**Prerequisites:** MATH 101, MATH 103, or Math Placement Exam score for MATH 102, MATH 104, or MATH 106.

**Notes:** Ideally, CHEM 105A and CHEM 105L should be taken together.

**Description:** The extraordinary chemistry of ordinary things. The chemical model of solids, liquids, gases, molecules, and salts. How these models are used to explore chemical aspects of biological, social, or economic situation.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** ASCI 240; CHEM 105L; CHEM 106A; NRES 319; PLAS 327

**ACE:** ACE 4 Science

### CHEM 105L Chemistry in Context I Laboratory

**Prerequisites:** CHEM 105A or parallel.

**Notes:** Ideally, CHEM 105A and CHEM 105L should be taken together.

Credit may be earned in only one of CHEM 105 or CHEM 105L.

**Description:** Accompanying lab to CHEM 105A.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded with Option

**Prerequisite for:** CHEM 106L; NRES 319; PLAS 327

**Course and Laboratory Fee:** \$50

### CHEM 106A Chemistry in Context II

**Prerequisites:** CHEM 105A or CHEM 109A. CHEM 106L recommended parallel.

**Notes:** Ideally, CHEM 106A and CHEM 106L should be taken together.

Credit toward the degree may be earned in only one of CHEM 106, 106A, 110, 110A, or 114.

**Description:** How organic chemistry and biochemistry complement one another. Chemical aspects of biological, social, or economic situations.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Offered:** SPRING

**Prerequisite for:** ASCI 320; ASCI 321; BIOS 459, BIOS 859, NRES 459, NRES 859, WATS 459; CHEM 106L

### CHEM 106L Chemistry in Context II Laboratory

**Prerequisites:** CHEM 105L or 109L; CHEM 106A or parallel.

**Notes:** Ideally, CHEM 106A and CHEM 106L should be taken together.

Credit may be earned in only one of CHEM 106 or CHEM 106L.

**Description:** Accompanying lab for CHEM 106A.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded with Option

**Course and Laboratory Fee:** \$45

**CHEM 109A General Chemistry I**

**Prerequisites:** MATH 102, 103, or a Math Placement Exam score for MATH 106; CHEM 109L recommended parallel.

**Notes:** Ideally, CHEM 109A and CHEM 109L should be taken together. Credit toward the degree may be earned in only one of: 109, 109A, 111, 113 or 113A.

**Description:** Lecture serving as an introduction to chemical reactions, the mole concept, properties of the states of matter, atomic structure, periodic properties, chemical bonding, and molecular structure.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** ASCI 240; BIOC 205; BSEN 321, CIVE 321; BSEN 321H, CIVE 321H; CHEM 106A; CHEM 109L; CHEM 110A; CHME 114; ENVE 210; FDST 205; FORS 300; FORS 411; GEOL 200; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; MATL 260; MATL 360; NRES 319; PLAS 327; PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455

**ACE:** ACE 4 Science

**CHEM 109L General Chemistry I Laboratory**

**Prerequisites:** CHEM 109A or parallel.

**Notes:** Ideally, CHEM 109A and CHEM 109L should be taken together. Credit may be earned in only one of CHEM 109 or CHEM 109L.

**Description:** Accompanying laboratory for CHEM 109A.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded with Option

**Prerequisite for:** CHEM 106L; CHEM 110L; FORS 411; NRES 319; PLAS 327; PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455

**Course and Laboratory Fee:** \$50

**CHEM 110A General Chemistry II**

**Prerequisites:** A grade of C, P, or better in CHEM 109A; CHEM 110L recommended parallel.

**Notes:** Ideally, CHEM 110A and CHEM 110L should be taken together. Credit toward the degree may be earned in only one of CHEM 106, 106A, 110, 110A, or 114.

**Description:** Lecture serving as an introduction to intermolecular forces, kinetics, chemical equilibrium, thermodynamics, and electrochemistry.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** ASCI 320; ASCI 321; ASCI 340; BIOS 459, BIOS 859, NRES 459, NRES 859, WATS 459; BSEN 244; BSEN 321, CIVE 321; BSEN 321H, CIVE 321H; BSEN 355; CHEM 110L; CHEM 221A; CHEM 221L; CHEM 251; CHEM 261; FDST 205; FORS 300; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418; PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455

**ACE:** ACE 4 Science

**CHEM 110L General Chemistry II Laboratory**

**Prerequisites:** CHEM 109L; CHEM 110A or parallel.

**Notes:** Ideally, CHEM 110A and CHEM 110L should be taken together. Credit may be earned in only one of CHEM 110 or CHEM 110L.

**Description:** Accompanying laboratory for CHEM 110A.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded with Option

**Prerequisite for:** CHEM 251; CHEM 261; PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455

**Course and Laboratory Fee:** \$50

**CHEM 113A Fundamental Chemistry I**

**Prerequisites:** MATH 102, MATH 103 or a Math Placement Exam score for MATH 106; CHEM 113L recommended parallel.

**Notes:** Ideally, CHEM 113A and CHEM 113L should be taken together. Credit toward the degree may be earned in only one of: 109, 109A, 111, 113 or 113A.

**Description:** Fundamentals of chemistry for students in physical sciences or chemical engineering. Includes atomic and molecular structure, chemical bonding, states of matter, solutions, and acid-base reactions. Intended for students who plan to take upper-level courses in chemistry.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** BIOC 205; BSEN 321, CIVE 321; BSEN 321H, CIVE 321H; CHEM 110A; CHEM 113L; CHEM 114; CHME 114; ENVE 210; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418

**ACE:** ACE 4 Science

**CHEM 113L Fundamental Chemistry I Laboratory**

**Prerequisites:** CHEM 113A or parallel.

**Notes:** Ideally, CHEM 113A and CHEM 113L should be taken together. Credit may be earned in only one of CHEM 113 or CHEM 113L.

**Description:** Accompanying lab for CHEM 113A.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded with Option

**Course and Laboratory Fee:** \$50

**CHEM 114 Fundamental Chemistry II**

**Prerequisites:** A grade of C, P, or better in CHEM 113A. CHEM 113L recommended.

**Notes:** CHEM 221L is the associated laboratory course and is recommended parallel. Credit toward the degree may be earned in only one of CHEM 110, 110A, or 114.

**Description:** Chemical kinetics, oxidation-reduction reactions and electrochemistry, ionic solution equilibria, thermodynamic concepts, and chemistry of selected elements.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** BSEN 244; BSEN 355; CHEM 221A; CHEM 221L; CHEM 251; CHEM 261; GEOL 418, GEOL 818, NRES 419, NRES 819, WATS 418

**CHEM 131 The Science of Food****Crosslisted with:** FDST 131, NUTR 131**Description:** Covers general and food chemistry, nutrition, food microbiology, food safety and quality, standards that are enforced by regulatory agencies, and food processes applied to improve food quality, shelf life and safety.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** FDST 205**ACE:** ACE 4 Science**CHEM 131H The Science of Food****Crosslisted with:** FDST 131H, NUTR 131H**Description:** Covers general and food chemistry, nutrition, food microbiology, food safety and quality, standards that are enforced by regulatory agencies, and food processes applied to improve food quality, shelf life and safety.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**ACE:** ACE 4 Science**CHEM 191 Special Topics in Chemistry****Description:** Topics vary.**Credit Hours:** 1-6**Min credits per semester:** 1**Max credits per semester:** 6**Max credits per degree:** 6**Grading Option:** Graded with Option**CHEM 221A Elementary Quantitative Analysis****Prerequisites:** CHEM 110A or CHEM 114; or CHEM 114 parallel.**Description:** Methods of statistical data evaluation and rigorous treatment of chemical equilibria, including chemical activity and coupled equilibria, will provide a foundation for understanding classical chemical quantitation techniques.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455**CHEM 221L Elementary Quantitative Analysis Laboratory****Prerequisites:** CHEM 110A or CHEM 114; or CHEM 114 parallel.**Description:** Methods of statistical data evaluation and rigorous treatment of chemical equilibria, including chemical activity and coupled equilibria, will provide a foundation for understanding classical chemical quantitation techniques. Emphasis on laboratory techniques, including gravimetric and volumetric methods.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Offered:** FALL/SPR**CHEM 251 Organic Chemistry I****Prerequisites:** CHEM 110A and CHEM 110L, or CHEM 114.**Notes:** It is suggested that CHEM 253 be taken parallel with CHEM 251.

Credit toward the degree may be earned in only one of CHEM 251 or 261.

**Description:** Chemistry of carbon compounds including basic principles of bonding and structure; properties and reactions of alkanes, alkenes, alkynes, alkyl halides; stereochemistry, and spectroscopy.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** BIOS 302; BIOS 312; BIOS 314; BIOS 326; BIOS 443, BIOS 843, VBMS 843, MBIO 443, VBMS 443; CHEM 252; CHEM 253; CHEM 254; PLAS 455, AGRO 855, NRES 455, NRES 855, SOIL 455; VBMS 403**CHEM 252 Organic Chemistry II****Prerequisites:** CHEM 251 and 253.**Description:** Properties, synthesis, and reactivity of alcohols, ethers, conjugated systems, aromatic systems, heterocycles, carbonyl and nitrogen compounds, with some emphasis on the organic compounds found in nature.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** CHEM 254**CHEM 253 Organic Chemistry I Laboratory****Prerequisites:** CHEM 251 or parallel.**Notes:** CHEM 221 or CHEM 221A & CHEM 221L recommended. Shares a quiz section with CHEM 251 and normally accompanies it.**Description:** Basic techniques of organic chemistry. Structure, identification, physical properties of compounds, molecular modeling, and introduction to the spectroscopic characteristics of organic compounds.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded with Option**Prerequisite for:** CHEM 252; CHEM 254**Course and Laboratory Fee:** \$65**CHEM 254 Organic Chemistry II Laboratory****Prerequisites:** CHEM 251, 253; CHEM 252 or parallel.**Notes:** Shares a quiz section with CHEM 252 and normally accompanies it.**Description:** Synthesis of representative organic compounds. Qualitative analysis of organic compounds. Naturally occurring compounds.**Credit Hours:** 1**Max credits per semester:** 1**Max credits per degree:** 1**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$65



**CHEM 261 Organic Chemistry**

**Prerequisites:** A grade of C, P, or better in CHEM 110A and CHEM 110L, or CHEM 114.

**Notes:** It is suggested that CHEM 263 be taken parallel with CHEM 261. Credit toward the degree may be earned in only one of CHEM 251 or 261.

**Description:** CHEM 261 and 262, together with lab courses 263 and 264, form a continuous basic course covering the important compounds of carbon.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** BIOS 302; BIOS 312; BIOS 314; BIOS 326; BIOS 443, BIOS 843, VBMS 843, MBIO 443, VBMS 443; CHEM 252; CHEM 254; CHEM 262; CHEM 263; CHEM 263A

**CHEM 262 Organic Chemistry**

**Prerequisites:** CHEM 261

**Notes:** It is suggested that CHEM 264 be taken parallel with CHEM 262.

**Description:** Continuation of CHEM 261.

**Credit Hours:** 3

**Max credits per semester:** 3

**Max credits per degree:** 3

**Grading Option:** Graded with Option

**Prerequisite for:** CHEM 254; CHEM 264; CHEM 264A

**CHEM 263 Mechanistic Organic Chemistry I Laboratory**

**Prerequisites:** CHEM 261 or parallel.

**Notes:** It is suggested that CHEM 263 be taken parallel with CHEM 261. Not for Engineering students.

**Description:** Lab work in qualitative organic analysis from a mechanistic perspective.

**Credit Hours:** 2

**Max credits per semester:** 2

**Max credits per degree:** 2

**Grading Option:** Graded with Option

**Offered:** FALL

**Prerequisite for:** CHEM 252; CHEM 254; CHEM 264; CHEM 264A

**Course and Laboratory Fee:** \$65

**CHEM 263A Mechanistic Organic Chemistry I Laboratory**

**Prerequisites:** CHEM 261 or parallel.

**Notes:** Lab accompanying CHEM 261 for Engineering students. It is ideal for CHEM 263A be taken parallel with CHEM 261.

**Description:** Lab work in qualitative organic analysis from a mechanistic perspective.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded with Option

**Offered:** FALL

**Prerequisite for:** CHEM 252; CHEM 254; CHEM 264A

**Course and Laboratory Fee:** \$65

**CHEM 264 Mechanistic Organic Chemistry II Laboratory**

**Prerequisites:** CHEM 262 or parallel; CHEM 263.

**Notes:** It is suggested that CHEM 264 be taken parallel with CHEM 262. Not for Engineering Students.

**Description:** Continuation of CHEM 263. Lab work in qualitative organic analysis from a mechanistic perspective.

**Credit Hours:** 2

**Max credits per semester:** 2

**Max credits per degree:** 2

**Grading Option:** Graded with Option

**Offered:** SPRING

**Course and Laboratory Fee:** \$65

**CHEM 264A Mechanistic Organic Chemistry II Laboratory**

**Prerequisites:** CHEM 262 or parallel; CHEM 263 or CHEM 263A.

**Notes:** Lab accompanying CHEM 262 for Engineering students. It is ideal for CHEM 264A to be taken parallel with CHEM 262.

**Description:** Continuation of CHEM 263A. Lab work in qualitative organic analysis from a mechanistic perspective.

**Credit Hours:** 1

**Max credits per semester:** 1

**Max credits per degree:** 1

**Grading Option:** Graded with Option

**Offered:** SPRING

**Course and Laboratory Fee:** \$65

**CHEM 391 Special Topics in Chemistry**

**Description:** Topics vary.

**Credit Hours:** 1-6

**Min credits per semester:** 1

**Max credits per semester:** 6

**Max credits per degree:** 6

**Grading Option:** Graded with Option

**CHEM 396 Independent Study in Chemistry**

**Prerequisites:** Permission.

**Description:** Independent reading or research under direction of a faculty member.

**Credit Hours:** 1-3

**Min credits per semester:** 1

**Max credits per semester:** 3

**Max credits per degree:** 6

**Grading Option:** Graded with Option

**CHEM 398 Undergraduate Research in Chemistry**

**Prerequisites:** Permission.

**Description:** Special research project under the direction of a member of the departmental faculty. The grade will be awarded following the submission of a written progress and/or final report.

**Credit Hours:** 1-6

**Min credits per semester:** 1

**Max credits per semester:** 6

**Max credits per degree:** 12

**Grading Option:** Graded with Option

**Experiential Learning:** Research

**CHEM 421 Analytical Chemistry****Crosslisted with:** CHEM 821**Prerequisites:** CHEM 221 or CHEM 221A & CHEM 221L and MATH 106; parallel CHEM 423/823**Description:** Chemical and physical properties applied to quantitative chemical analysis. Solution equilibria, stoichiometry, and instrumental theory and techniques.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** SPRING**Prerequisite for:** CHEM 423, CHEM 823; CHEM 824; CHEM 825A; CHEM 825B; CHEM 825D; CHEM 825G; CHEM 825J; CHEM 991A**ACE:** ACE 10 Integrated Product**CHEM 423 Analytical Chemistry Laboratory****Crosslisted with:** CHEM 823**Prerequisites:** CHEM 421/821 or parallel.**Notes:** It is suggested that CHEM 423 be taken parallel with CHEM 421.**Description:** Lab designed to accompany CHEM 421/821. Applications of analytical chemical principles to laboratory problems.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$65**CHEM 431 Biochemistry I: Structure and Metabolism****Crosslisted with:** BIOC 431, BIOC 831, BIOS 431, BIOS 831, CHEM 831**Prerequisites:** LIFE 120 with a grade of C or better; CHEM 252 or CHEM 262 with a grade of C or better.**Notes:** BIOS 206 or PLAS 215 is recommended. First course of a two-semester, comprehensive biochemistry course sequence.**Description:** Structure and function of proteins, nucleic acids, carbohydrates and lipids; nature of enzymes; major metabolic pathways of catabolism; and biochemical energy production.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** AGRO 810, BIOC 810, HORT 810; ASCI 820; ASCI 917; ASCI 925, NUTR 925; ASCI 926, NUTR 926; ASCI 927, NUTR 927; BIOC 305; BIOC 390; BIOC 432, BIOC 832, BIOS 432, CHEM 432, CHEM 832, BIOS 832; BIOC 433, BIOC 833, BIOS 433, BIOS 833, CHEM 433, CHEM 833; BIOC 440; FDST 470, FDST 870; NUTR 450; NUTR 455; NUTR 820, NUTR 420; NUTR 821; PLAS 434, BIOC 434, BIOS 434, CHEM 434, AGRO 834, BIOC 834, BIOS 834, CHEM 834; VBMS 410; VBMS 805; VBMS 950**CHEM 432 Biochemistry II: Metabolism and Biological Information****Crosslisted with:** BIOC 432, BIOC 832, BIOS 432, CHEM 832, BIOS 832**Prerequisites:** BIOC 431/831 with a grade of C or better; BIOS 206 or PLAS 215 with a grade of C or better.**Notes:** Continuation of BIOC 431/831.**Description:** Major metabolic pathways of anabolism, structural and biochemical aspects of biological information flow and use in biotechnology.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** ASCI 949, BIOC 949, NUTR 949; BIOC 435; BIOC 932, BIOS 932, CHEM 932; BIOC 933, BIOS 933, CHEM 933; BIOC 934, BIOS 934, CHEM 934; BIOC 935, BIOS 935, CHEM 935; BIOC 998; VBMS 919; VBMS 950; VBMS 951**CHEM 433 Biochemistry Laboratory****Crosslisted with:** BIOC 433, BIOC 833, BIOS 433, BIOS 833, CHEM 833**Prerequisites:** BIOC 431/831 or parallel; or CHEM 435/835.**Description:** Introduction to techniques used in biochemical and biotechnology research, including measurement of pH, spectroscopy, analysis of enzymes, chromatography, fractionation of macromolecules, electrophoresis, and centrifugation.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Offered:** FALL/SPR**Prerequisite for:** BIOC 437, BIOC 837, BIOS 437, BIOS 837; BIOC 898**Course and Laboratory Fee:** \$50**CHEM 434 Plant Biochemistry****Crosslisted with:** PLAS 434, BIOC 434, BIOS 434, AGRO 834, BIOC 834, BIOS 834, CHEM 834**Prerequisites:** BIOC/BIOS/CHEM 431/831.**Description:** Biochemical metabolism unique to plants. Relationships of topics previously acquired in general biochemistry to biochemical processes unique to plants. Biochemical mechanisms behind physiological processes discussed in plant or crop physiology.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CHEM 435 Chemical Biology****Crosslisted with:** CHEM 835**Prerequisites:** CHEM 252 or 262, and CHEM 221A/CHEM 221L**Description:** Fundamentals of chemical biology with an emphasis on the underlying principles of biomolecular structures, macromolecular-small molecule interactions, including mechanistic aspects of enzymes and cofactors, use of modified enzymes to alter biochemical pathways, and the use of chemical tools for understanding biological processes.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Offered:** FALL**Prerequisite for:** BIOC 433, BIOC 833, BIOS 433, BIOS 833, CHEM 433, CHEM 833; CHEM 437, CHEM 837

**CHEM 437 Chemical Biology Laboratory****Crosslisted with:** CHEM 837**Prerequisites:** BIOC/BIOS/CHEM 431/831 or CHEM 435/835 or parallel**Description:** Introduction to techniques of chemical biology including the study of biological macromolecules and their interaction with small molecule ligands and effectors. Explore modern methods for macromolecular isolation, characterization, and for kinetic analysis and modeling.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded**Offered:** SPRING**Course and Laboratory Fee:** \$65**CHEM 438 Computational Chemical Biology****Crosslisted with:** CHEM 838**Description:** Introduction to computational chemistry applications including molecular dynamics simulations, density functional theory optimizations, and computational docking of small molecules to protein targets.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** SPRING**CHEM 441 Inorganic Chemistry****Crosslisted with:** CHEM 841**Prerequisites:** CHEM 221 or CHEM 221A & CHEM 221L with a minimum grade of C; CHEM 252 or 262.**Notes:** CHEM 443 is recommended to be taken parallel.**Description:** CHEM 441/841 and the accompanying lab course, CHEM 443/843, constitute a basic course in inorganic chemistry. Structure, bonding, properties, and reactions of inorganic compounds with emphasis on the relationships and trends that are embodied in the periodic table of the elements.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Prerequisite for:** CHEM 845**ACE:** ACE 10 Integrated Product**CHEM 443 Inorganic Chemistry Laboratory****Crosslisted with:** CHEM 843**Prerequisites:** CHEM 441 or parallel.**Notes:** It is suggested that CHEM 443 be taken in parallel with CHEM 441.**Description:** Introduction to typical inorganic chemistry laboratory techniques through the preparation and characterization of inorganic compounds.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Prerequisite for:** CHEM 845**Course and Laboratory Fee:** \$65**CHEM 453 Biosynthetic Pathways****Crosslisted with:** CHEM 853**Prerequisites:** CHEM 251 or CHEM 261**Description:** Biosynthetic pathways for bioactive natural products and pathway engineering with an emphasis on those that are medicinally significant, including the biosynthesis of fatty acids, polyketides, phenylpropanoids, terpenoids, steroids, alkaloids, non-ribosomal peptides, and carbohydrates.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded**Offered:** SPRING**CHEM 463 Advanced Organic Preparations****Crosslisted with:** CHEM 863**Prerequisites:** CHEM 252 and CHEM 254.**Notes:** For students who wish additional laboratory work in organic chemistry.**Credit Hours:** 1-5**Min credits per semester:** 1**Max credits per semester:** 5**Max credits per degree:** 5**Grading Option:** Graded with Option**CHEM 471 Physical Chemistry****Crosslisted with:** CHEM 871**Prerequisites:** CHEM 221 or CHEM 221A & CHEM 221L; MATH 107; and PHYS 142 or 212.**Notes:** Credit may not be earned in both CHEM 471/871 and CHEM 481/881.**Description:** Conceptual and mathematical foundations of classical and statistical thermodynamics. Applications of thermodynamics to phase and chemical equilibria. Thermodynamics of solutions of small molecules and of polymers. Biological applications of thermodynamics. Introduction to chemical and biochemical spectroscopy.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Prerequisite for:** BIOC 486, BIOC 886, CHEM 486, CHEM 886**CHEM 481 Physical Chemistry I****Crosslisted with:** CHEM 881**Prerequisites:** CHEM 221 or CHEM 221A & CHEM 221L with grade of at least C; MATH 208; PHYS 212.**Notes:** Credit may not be earned in both CHEM 471/871 and CHEM 481/881.**Description:** CHEM 481/881 and 482/882 with accompanying lab 484/884 form a continuous basic course in physical chemistry for students interested in chemistry as a profession. Introduction to quantum mechanics and statistical mechanics; application to problems in atomic and molecular structure and to spectroscopy.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Prerequisite for:** BIOC 486, BIOC 886, CHEM 486, CHEM 886; CHEM 482, CHEM 882; CHEM 484, CHEM 884; CHEM 484A, CHEM 884A; CHEM 991J; PHYS 422, PHYS 822, ECEN 422, ECEN 822

**CHEM 482 Physical Chemistry II****Crosslisted with:** CHEM 882**Prerequisites:** CHEM 481/881**Notes:** This course should parallel CHEM 484/884. Continuation of CHEM 481/881.**Description:** Thermodynamics and statistical mechanics and their application to the study of solids, liquids, gases, solutions, phase equilibria, and chemical equilibria. Chemical kinetics and reaction dynamics.**Credit Hours:** 4**Max credits per semester:** 4**Max credits per degree:** 4**Grading Option:** Graded with Option**Prerequisite for:** CHEM 484, CHEM 884; CHEM 484A, CHEM 884A; CHEM 845; CHEM 987A; CHEM 987B; CHEM 991J; CHME 925; MATL 962; MATL 972**CHEM 484 Physical Chemical Measurements****Crosslisted with:** CHEM 884**Prerequisites:** CHEM 481/881; CHEM 482/882 or parallel.**Notes:** It is suggested that CHEM 484/884 be taken in parallel with CHEM 482/882.**Description:** Applications of physical measurements and principles to study chemical systems and processes.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$65**CHEM 484A Physical Chemical Measurements****Crosslisted with:** CHEM 884A**Prerequisites:** CHEM 481/881; CHEM 482/882 or parallel.**Notes:** It is suggested that CHEM 484A/884A be taken in parallel with CHEM 482/882.**Credit Hours:** 2**Max credits per semester:** 2**Max credits per degree:** 2**Grading Option:** Graded with Option**Course and Laboratory Fee:** \$65**CHEM 486 Advanced Topics in Biophysical Chemistry****Crosslisted with:** BIOC 486, BIOC 886, CHEM 886**Prerequisites:** CHEM 471/871 or CHEM 481/881.**Description:** Applications of thermodynamics to biochemical phenomena, optical properties of proteins and polynucleotides, and kinetics of rapid reactions.**Credit Hours:** 3**Max credits per semester:** 3**Max credits per degree:** 3**Grading Option:** Graded with Option**CHEM 499 Undergraduate Thesis****Prerequisites:** Permission**Description:** Independent research leading to a thesis.**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 6**Grading Option:** Graded with Option**CHEM 499H Honors Undergraduate Thesis****Prerequisites:** Permission.**Description:** Independent research leading to a thesis.**Credit Hours:** 1-3**Min credits per semester:** 1**Max credits per semester:** 3**Max credits per degree:** 6**Grading Option:** Graded with Option**PLEASE NOTE**

This document represents a sample 4-year plan for degree completion with this major. Actual course selection and sequence may vary and should be discussed individually with your college or department academic advisor. Advisors also can help you plan other experiences to enrich your undergraduate education such as internships, education abroad, undergraduate research, learning communities, and service learning and community-based learning.

## Chemistry - Professional

## Chemistry - Chemical Biology Career Information

*The following represents a sample of the internships, jobs and graduate school programs that current students and recent graduates have reported.*

### Transferable Skills

- Design and implement research experiments
- Understand and practice proper laboratory safety procedures
- Read, understand, and critically review scientific information
- Define problems and identifying causes
- Comprehend and critically evaluate complex information
- Compose convincing arguments and present logical information
- Confidently navigate complex, ambiguous projects and environments
- Demonstrate ethical conduct in research activities
- Document and replicate processes and procedures

### Jobs of Recent Graduates

- Scientist, Streck – Omaha, NE
- Bio-Analytical Analyst, Celerion – Lincoln, NE
- Military Pay Technician, United States Coast Guard – Topeka, KS
- Chemical Contractor, Zoetis – Lincoln, NE
- Laboratory Technician, Enthone – Bridgeview, IL
- Principle Scientist, Novartis – Lincoln, NE
- Pharmacy Technician, CVS – Lincoln, NE
- Quality Management Chemist, Cargil – Blair, NE
- Chemical Analyst, Purac America – Lincolnshire, IL
- Civilian Scientist, United States Navy – China Lake, CA

### Internships

- Intern, Colorado Bureau of Investigation - Denver CO
- Research and Development Intern, Gelita - Sergeant Bluff IA
- Distinguished Life Sciences Scholar, Beckman/Distinguished Life Sciences Scholars - Lincoln NE

## Graduate & Professional Schools

- Master's Degree, Recreational Management, Oklahoma State University – Stillwater, OK
- Master's Degree, Science Teaching, University of Nebraska-Lincoln – Lincoln, NE
- Master's Degree, Synthetic Chemistry, University College Dublin – Dublin, Ireland
- Master's Degree, Biostatistics, University of Nebraska Medical Center – Omaha, NE
- Master's Degree, Geology, University of Nebraska-Lincoln – Lincoln, NE
- Master's Degree, Public Health Administration and Epidemiology, University of Pittsburg – Pittsburg, PA
- Doctoral Degree, Analytical Chemistry, Ohio State University – Columbus, OH
- Doctoral Degree, Chemistry, Massachusetts Institute of Technology – Cambridge, MA
- Doctor of Medicine, University of Nebraska Medical Center – Omaha, NE
- Doctor of Pharmacy, University of Nebraska Medical Center – Omaha, NE