

# Bachelor of Science in Chemistry (ACS Certified Program)

Required 120 credits (36 of which must be numbered 300 or above and 30 of which must be from UND) including:

I. Essential Studies Requirements (see University ES guidelines and course listings.) The following courses must be taken as part of the Essential Studies requirement:

Code	Title	Credits
ENGL 110	College Composition I	3
ENGL 130	Composition II: Writing for Public Audiences	3
COMM 110	Fundamentals of Public Speaking	3

II. The Following Curriculum: Students may choose one the the ACS tracks listed below. The student must complete the requirements for:

- Introductory Courses:** Orientation to Chemistry (CHEM 101) and either Fundamentals of Chemistry Concepts and Lab (CHEM 221 and CHEM 221L) OR the combination of General Chemistry I and II with Labs (CHEM 121, CHEM 121L, CHEM 122, and CHEM 122L)
- Foundational Courses:** 5 one-semester courses at least three credits each. One class in each area of Chemistry: Analytical, Biochemistry, Inorganic, Organic, Physical
- In-Depth Courses:** Four courses that add up to at least 12 credits. For a course to be considered in-depth, it must have a Foundational Course pre-requisite.
- Research and Capstone:** Students must complete Senior Research (CHEM 494) and a capstone, typically Chemistry Capstone (CHEM 495). A capstone from another department may be considered.

## ACS Tracks

Each of the ACS track options listed below requires the following Introductory Courses:

### Introductory Courses

Code	Title	Credits
CHEM 101	Orientation to Chemistry <sup>1</sup>	1
CHEM 221 & 221L	Fundamentals of Chemistry - Concepts and Fundamentals of Chemistry Laboratory <sup>2,3</sup>	4
or CHEM 121 & 121L & CHEM 122 & CHEM 122L	General Chemistry I and General Chemistry I Laboratory and General Chemistry II and General Chemistry II Laboratory	

<sup>1</sup> CHEM 101 may be waived for transfer students or students who add or change their major to Chemistry beyond their first year.

<sup>2</sup> The combination of Chem 121, Chem 121L, Chem 122 and Chem 122L OR Chem 221 and Chem 221L are pre-requisites for Chem 254 and Chem 254L.

<sup>3</sup> Chem 121 is 3 credits, Chem 121L is 1 credit. Chem 122 is 3 credits, Chem 122L is 1 credit.

## Biochemistry Track

Code	Title	Credits
<b>Foundational Courses</b>		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 341 & 341L & CHEM 361	Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I	5
CHEM 466	Fundamentals of Physical and Biophysical Chemistry	3
CHEM 466L	Fundamentals of Physical and Biophysical Chemistry Laboratory	1
BIMD 301	Biochemistry	3
<b>In-Depth Courses</b>		
CHEM 342 & 342L & CHEM 362	Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II	5
CHEM 441	Instrumental Analysis I - Spectroscopy	2
CHEM 442 or CHEM 443	Instrumental Analysis II - Electrochemistry or Instrumental Analysis III - Chromatography/Mass Spectrometry	2
BIOL 341 & 341L	Cell Biology and Cell Biol Lab	4
BIMD 401	Advanced Biochemistry	3
<b>Required Research and Capstone</b>		
CHEM 494	Senior Research	1-3
CHEM 495	Chemistry Capstone	3
<b>Suggested Electives:</b>		
CHEM 370	Drug Chemistry and Toxicology	3
CHEM 294	Introduction to Undergraduate Research	1-3
CHEM 455	Spectroscopy and Structure	3
CHEM 475	Materials Chemistry	3
BIOL 315	Genetics	3
BIOL 369 & 369L	Histology and Histology Lab	4
BIOL 364 & 364L	Parasitology and Parasitology Laboratory	4
N&D 441	Nutritional Biochemistry	4
<b>Math, Physics, and Biology Requirements</b>		
MATH 146 or MATH 165	Applied Calculus I or Calculus I	3
SOC 326 or MATH 166	Sociological Statistics or Calculus II	3
PHYS 211 or PHYS 251	College Physics I or University Physics I	4
PHYS 212 or PHYS 252	College Physics II or University Physics II	4
BIOL 150 & 150L	General Biology I and General Biology I Laboratory	4
BIOL 151 & 151L	General Biology II and General Biology II Laboratory	4

## Biological Track

Code	Title	Credits
<b>Foundational Courses:</b>		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 466	Fundamentals of Physical and Biophysical Chemistry	3

CHEM 466L Fundamentals of Physical and Biophysical Chemistry Laboratory 1

BIMD 301 Biochemistry 3

**Organic Chemistry Options (Choose 1 option below)**

CHEM 340 & 340L Survey of Organic Chemistry and Survey of Organic Chemistry Laboratory 5

OR

CHEM 341 & 341L & CHEM 361 Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I 5

AND

CHEM 342 & 342L & CHEM 362 Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II <sup>2</sup> 5

**In-Depth Courses**

BIOL 341 & 341L Cell Biology and Cell Biol Lab 4

CHEM 366 Polymers and the Environment 3

CHEM 370 Drug Chemistry and Toxicology 3

CHEM 401 Nanotechnology Nanomaterials 3

CHEM 455 Spectroscopy and Structure 3

**Required Research and Capstone**

CHEM 494 Senior Research 2-3

CHEM 495 Chemistry Capstone 3

**Choose at least 4 credits from the following courses:**

CHEM 294 Introduction to Undergraduate Research 1-3

CHEM 441 Instrumental Analysis I - Spectroscopy 2

CHEM 442 Instrumental Analysis II - Electrochemistry 2

CHEM 443 Instrumental Analysis III - Chromatography/Mass Spectrometry 2

**Math, Physics, and Biology Requirements:**

MATH 146 Applied Calculus I 3  
or MATH 165 Calculus I

SOC 326 Sociological Statistics 3  
or MATH 166 Calculus II

PHYS 211 College Physics I 4  
or PHYS 251 University Physics I

PHYS 212 College Physics II 4  
or PHYS 252 University Physics II

BIOL 150 & 150L General Biology I and General Biology I Laboratory 4

BIOL 151 & 151L General Biology II and General Biology II Laboratory 4

**Suggested Electives:**

BIOL 315 Genetics 3

BIOL 369 & 369L Histology and Histology Lab 4

BIOL 364 & 364L Parasitology and Parasitology Laboratory 4

## Computational Track

Code	Title	Credits
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**Foundational Courses**

CHEM 254 & 254L Inorganic Chemistry I and Inorganic Chemistry I Laboratory 4

CHEM 333 & 333L Analytical Chemistry and Analytical Chemistry Laboratory 4

CHEM 470 & 470R Thermodynamics Kinetics and Thermodynamics Kinetics Recitation 4

BIMD 301 Biochemistry 3

**Organic Chemistry Options (Choose 1 option below)**

CHEM 340 & 340L Survey of Organic Chemistry and Survey of Organic Chemistry Laboratory 5

OR

CHEM 341 & 341L & CHEM 361 Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I 5

AND

CHEM 342 & 342L & CHEM 362 Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II 5

**In-Depth Courses**

CHEM 401 Nanotechnology Nanomaterials 3

CHEM 441 Instrumental Analysis I - Spectroscopy 2

CHEM 442 Instrumental Analysis II - Electrochemistry 2

CHEM 454 & 454L Inorganic Chemistry II and Inorganic Chemistry II Laboratory 4

CHEM 455 Spectroscopy and Structure 3

CHEM 470L Physical Chemistry Laboratory 1

CHEM 471 & 471R Quantum Mechanics Spectroscopy and Quantum Mechanics Spectroscopy Recitation 4

**Required Research and Capstone**

CHEM 494 Senior Research 2-3

CHEM 495 Chemistry Capstone 3

**Math and Physics Requirements:**

MATH 165 Calculus I 4

MATH 166 Calculus II 4

PHYS 251 University Physics I 4

PHYS 252 University Physics II 4

**Suggested Electives:**

CSCI 242 Algorithms and Data Structures 3

CSCI 270 Programming for Data Science 3

## Environmental Track

Code	Title	Credits
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**Foundational Courses**

CHEM 254 & 254L Inorganic Chemistry I and Inorganic Chemistry I Laboratory 4

CHEM 333 & 333L Analytical Chemistry and Analytical Chemistry Laboratory 4

CHEM 466 Fundamentals of Physical and Biophysical Chemistry 3

CHEM 466L Fundamentals of Physical and Biophysical Chemistry Laboratory 1

BIMD 301 Biochemistry 3

**Organic Chemistry Options (Choose 1 option below)**

CHEM 340 & 340L Survey of Organic Chemistry and Survey of Organic Chemistry Laboratory 5

OR

CHEM 341 & 341L & CHEM 361 Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I 5

AND

CHEM 342 & 342L & CHEM 362 Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II 5

**In Depth Courses: Choice of 12 credits from the following courses.**

**Must include 44x series, up to 2 credits of 44x can be replaced by (1-2) research credits completed in CHEM 294.**

CHEM 366 Polymers and the Environment 3

CHEM 370 Drug Chemistry and Toxicology 3

CHEM 294 Introduction to Undergraduate Research 1-3

CHEM 402 Trends in Forensic and Environmental Analytical Chemistry 3

CHEM 441 Instrumental Analysis I - Spectroscopy 2

CHEM 442 Instrumental Analysis II - Electrochemistry 2

CHEM 443	Instrumental Analysis III - Chromatography/Mass Spectrometry	2
<b>Required Research and Capstone</b>		
CHEM 494	Senior Research (lab research credits from other department can be considered)	3
CHEM 495	Chemistry Capstone	3
<b>Math and Physics Requirements:</b>		
MATH 146	Applied Calculus I	3
or MATH 165	Calculus I	
SOC 326	Sociological Statistics	3
or MATH 166	Calculus II	
PHYS 211	College Physics I	4
or PHYS 251	University Physics I	
PHYS 212	College Physics II	4
or PHYS 252	University Physics II	
<b>Choose at least 9 credits from the following courses as electives</b>		
COMM 360	Communicating Science	3
ENRV 100	Environmental Studies Seminar	1
ENRV 122	Foundations of Environmental Science	3
ESSP 200	Sustainability Science	3
GEOG 274	Introduction to Geospatial Technologies	3
GEOG 454	Conservation and Sustainable Use of Natural Resources	3
GEOE 419	Groundwater Monitoring and Remediation	3
GEOL 101	Introduction to Geology	3
GEOL 103	Introduction to Environmental Issues	3

## Physical Science Track

Code	Title	Credits
<b>Foundational Courses</b>		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 341 & 341L & CHEM 361	Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I	5
CHEM 470 & 470R	Thermodynamics Kinetics and Thermodynamics Kinetics Recitation	4
BIMD 301	Biochemistry	3
<b>In-Depth Courses</b>		
CHEM 342 & 342L & CHEM 362	Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II	5
CHEM 454 & 454L	Inorganic Chemistry II and Inorganic Chemistry II Laboratory	4
CHEM 470L	Physical Chemistry Laboratory	1
CHEM 471 & 471R	Quantum Mechanics Spectroscopy and Quantum Mechanics Spectroscopy Recitation	4
<b>Required Research and Capstone</b>		
CHEM 494	Senior Research	1-3
CHEM 495	Chemistry Capstone	3
<b>Choose two courses (four total credits) of the following in the 44x series:</b>		
CHEM 441	Instrumental Analysis I - Spectroscopy	2
CHEM 442	Instrumental Analysis II - Electrochemistry	2
CHEM 443	Instrumental Analysis III - Chromatography/Mass Spectrometry	2
<b>Suggested Electives</b>		
CHEM 401	Nanotechnology Nanomaterials	3
CHEM 475	Materials Chemistry	3
<b>Math and Physics Requirements:</b>		

MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 251	University Physics I	4
PHYS 252	University Physics II	4
<b>Suggested Electives:</b>		
PHYS 253	University Physics III	4
GEOL 316	Earth Materials	3
GEOL 318 & 318L	Mineralogy and Mineralogy Lab	3

## Materials Science Track

Code	Title	Credits
<b>Foundational Courses</b>		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4
CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 341 & 341L & CHEM 361	Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I	5
CHEM 466	Fundamentals of Physical and Biophysical Chemistry	3
CHEM 466L	Fundamentals of Physical and Biophysical Chemistry Laboratory	1
BIMD 301	Biochemistry	3
<b>In-Depth Courses</b>		
CHEM 342 & 342L & CHEM 362	Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II	5
CHEM 366	Polymers and the Environment	3
CHEM 370	Drug Chemistry and Toxicology	3
CHEM 401	Nanotechnology Nanomaterials	3
CHEM 454 & 454L	Inorganic Chemistry II and Inorganic Chemistry II Laboratory	4
CHEM 455	Spectroscopy and Structure	3
CHEM 475	Materials Chemistry	3
<b>Required Research and Capstone</b>		
CHEM 494	Senior Research	2-3
CHEM 495	Chemistry Capstone	3
<b>Suggested Electives: Choose at least one from below</b>		
CHEM 441	Instrumental Analysis I - Spectroscopy	2
CHEM 442	Instrumental Analysis II - Electrochemistry	2
CHEM 294	Introduction to Undergraduate Research	1-3
<b>Math and Physics Requirements:</b>		
MATH 146	Applied Calculus I	3
or MATH 165	Calculus I	
SOC 326	Sociological Statistics	3
or MATH 166	Calculus II	
PHYS 211	College Physics I	4
or PHYS 251	University Physics I	
PHYS 212	College Physics II	4
or PHYS 252	University Physics II	

## Research-Focused Track

This track is intended to prepare students for all foundational areas in chemistry and is highly recommended for those who consider graduate school in chemistry.

Code	Title	Credits
<b>Foundational Courses</b>		
CHEM 254 & 254L	Inorganic Chemistry I and Inorganic Chemistry I Laboratory	4

CHEM 333 & 333L	Analytical Chemistry and Analytical Chemistry Laboratory	4
CHEM 341 & 341L & CHEM 361	Organic Chemistry I and Organic Chemistry I Laboratory and Problem Solving in Organic Chemistry I	5
CHEM 470 & 470R	Thermodynamics Kinetics and Thermodynamics Kinetics Recitation	4
BIMD 301	Biochemistry	3
<b>In-Depth Courses</b>		
CHEM 342 & 342L & CHEM 362	Organic Chemistry II and Organic Chemistry II Laboratory and Problem Solving in Organic Chemistry II	5
CHEM 441	Instrumental Analysis I - Spectroscopy	2
CHEM 442	Instrumental Analysis II - Electrochemistry	2
CHEM 443	Instrumental Analysis III - Chromatography/Mass Spectrometry	2
CHEM 454 & 454L	Inorganic Chemistry II and Inorganic Chemistry II Laboratory	4
CHEM 470L	Physical Chemistry Laboratory	1
CHEM 471 & 471R	Quantum Mechanics Spectroscopy and Quantum Mechanics Spectroscopy Recitation	4
<b>Required Research and Capstone</b>		
CHEM 494	Senior Research	1-3
CHEM 495	Chemistry Capstone	3
<b>Suggested Electives:</b>		
CHEM 475	Materials Chemistry	3
CHEM 455	Spectroscopy and Structure	3
CHEM 401	Nanotechnology Nanomaterials	3
BIMD 401	Advanced Biochemistry	3
<b>Math and Physics Requirements</b>		
MATH 165	Calculus I	4
MATH 166	Calculus II	4
PHYS 251	University Physics I	4
PHYS 252	University Physics II	4

## Teacher Licensure

Through a partnership with the College of Education and Human Development, the Department of Teaching, Leadership & Professional Practice, students may seek secondary licensure in Chemistry. The following program of study must be completed:

### I. Chemistry Coursework

1. Chemistry Courses required for a Chemistry degree (B.S. Chemistry or B.S. Chemistry-ACS), including level-II proficiency (two semesters) in a world language.
2. Essential studies coursework.

II. Admission to the Secondary Program i.e., completion of preadmission courses. See College of Education and Human Development for admission and licensing requirements (<https://catalog.und.edu/undergraduateacademicinformation/departmentalcoursesprograms/chemistry/chem-bs/public.courseleaf.com/undergraduateacademicinformation/departmentalcoursesprograms/teachingandlearning/tl-bsed-se/>). Including courses: T&L 250 Introduction to Education T&L 251 Understanding Individuals with Different Abilities III. The program in Secondary Education (see Department of Teaching, Leadership & Professional Practice (<https://und-public.courseleaf.com/undergraduateacademicinformation/departmentalcoursesprograms/teachingandlearning/tl-bsed-se/>)) Chemistry majors seeking secondary licensure must have an advisor in both the Chemistry Department and the Department of Teaching, Leadership & Professional Practice.