

# CHEMISTRY, MS

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## Introduction

Please click here (<http://catalog.ucdenver.edu/cu-denver/graduate/schools-colleges-departments/college-liberal-arts-sciences/chemistry/>) to see Chemistry department information.

The MS program in chemistry focuses on providing students with the skills and knowledge necessary to conduct specialized research in preparation for careers in chemistry and related disciplines. Completing an MS in Chemistry at CU Denver can provide valuable experience that can help students land a job in the pharmaceutical, biotechnological, or other industry or can serve as a stepping stone for admission to a competitive PhD or health sciences program. Our faculty serve as mentors and advisors and assist students on the path to a more satisfying career in science. Prospective students are encouraged to contact the Graduate Program Director. Visit the Department of Chemistry website (<https://clas.ucdenver.edu/chemistry/>) for additional details concerning the chemistry program, admission procedures, financial assistance and faculty research interests.

These program requirements are subject to periodic revision by the academic department and the College of Liberal Arts and Sciences reserves the right to make exceptions and substitutions as judged necessary in individual cases. Therefore, the College strongly urges students to consult regularly with their program advisor to confirm the best plans of study before finalizing them.

**Graduate Education Policies and Procedures apply to this program.**

## Program Requirements

All Chemistry MS students must meet the following requirements for graduation:

1. Students must complete a minimum of 30 credit hours.
2. Out of the 30 credit hours students must complete a minimum of 24 graduate (5000 and above) level credit hours. Up to 6 4000-level credits may be counted as electives with prior approval, provided that they have not been earned as part of an awarded undergraduate degree. Among these 6 credit hours 3 may be taken as Chemistry lectures and another 3 may be taken outside Chemistry.
3. Students must earn a minimum of 20 semester hours in formal lecture or lab courses in the Department of Chemistry. Additional credits can be acquired through research, internships, thesis work, independent study, transfer credits, etc. within the department and in other departments. Course selections outside of the department must be approved by the Graduate Program Director.
4. Students must earn a minimum grade of B- (2.7) in all courses that apply to the degree and must achieve a minimum cumulative GPA of 3.0. Courses taken using P+/P/F or S/U grading cannot apply to program requirements.

## Program Restrictions, Allowances and Recommendations

1. Compliance with all Graduate Education Policies and Procedures
2. Every student must select a thesis or non-thesis plan. As most of the requirements overlap, a student may switch between these plans with permission from the Graduate Program Director.
3. In addition to choosing a plan, every student must select a content emphasis track. Each track has separate placement examinations, therefore switching between tracks requires approval from the Graduate Program Director.
4. Although degrees can be completed in as little as one year, all work must be completed within five years after enrolling in the first graduate class in the department unless an exception is granted by the program director.
5. Students are eligible to apply for a research assistantship or a teaching assistantship positions. Students who are interested in improving teaching skills can enroll in CHEM 5655 Teaching Assistant Bootcamp. This course is required for all students who are interested in working as a teaching assistant in the department.

## Plan I-Thesis

**Plan I (Thesis) is a research oriented program involving a minimum of 30 semester hours with the following requirements:**

- Successful completion of a content emphasis track.
- 3 semester hours of CHEM 6950 Master's Thesis.
- An acceptable formal thesis consistent with the Graduate Education Policies and Procedures.
- Successful oral defense of the master's thesis before a committee of at least three Regular Graduate Faculty, two of whom must be tenure track faculty members and have a Graduate Education appointment through the Department of Chemistry.
- All thesis students must complete 1 credit of CHEM 5610 Understanding & Presenting Chemical Research no later than the semester before they defend their thesis.
- Completion of a high quality research project suitable for publication in a peer-reviewed journal.

## Plan II- Coursework

**Plan II (Course Work) is a coursework oriented program involving a minimum of 30 semester hours with the following requirements:**

- All Plan II students are required to take a final written examination about primary research articles in their discipline. This exam may be taken any semester after 20 semester hours of graduate coursework have been completed. Students may attempt the exam once per semester a maximum of three times and must be registered during the semester that they attempt the final examination.
- All non-thesis students are encouraged to take 1 credit of CHEM 5610 Understanding & Presenting Chemical Research
- Plan II students may arrange for an internship at a local company that employs Chemists and take up to 6 credits of CHEM 5939 Internship must be in good academic standing and have completed 6 graduate semester hours at CU Denver before starting an internship. Approval of the graduate program director is required prior to selecting an internship and enrolling for credit.

Code	Title	Hours
<i>Complete a minimum of 20 semester hours from graduate level formal lecture courses in the Department of Chemistry, including the coursework from at least one of the following content emphasis tracks:</i>		20
Biochemistry (p. 2)		
Molecular Modeling (p. 2)		
Synthesis and Measurement (p. 2)		
Traditional Chemistry (p. 3)		
<i>Complete additional graduate level CHEM credits through research, internships, thesis work, independent study, etc. within the department.</i>		10
<i>Students who choose to complete Plan I must complete the following:</i>		
CHEM 5610	Understanding & Presenting Chemical Research <sup>1</sup>	
<i>Students who complete Plan I must complete a minimum of three credit hours of the following:</i>		
CHEM 6950	Master's Thesis	
<b>Total Hours</b>		<b>30</b>

<sup>1</sup> CHEM 5610 Understanding & Presenting Chemical Research must be completed no later than the semester before students defend their thesis.

### Biochemistry Emphasis Track

Understanding of biochemical principles governing metabolic diseases, cancer and neurodegenerative diseases.

Code	Title	Hours
<i>Complete the following required courses:</i>		7
CHEM 5810	Graduate Biochemistry I	
CHEM 5310	Advanced Organic Chemistry or CHEM 5530 Advanced Physical Chemistry	
<i>Complete two of the following elective courses: <sup>1</sup></i>		6
CHEM 5310	Advanced Organic Chemistry	
CHEM 5388	Nucleic Acid Technologies I	
CHEM 5411	Bioconjugate Techniques and Theranostic Nanomedicine	
CHEM 5530	Advanced Physical Chemistry	
CHEM 5548	Physical Biochemistry Laboratory	
CHEM 5600	Graduate Topics in Chemistry <sup>2</sup>	
CHEM 5815	Structural Biology of Neurodegenerative Diseases	
CHEM 5825	Biochemistry of Metabolic Disease	
CHEM 5830	Graduate Biochemistry II	
CHEM 5835	Biochemistry of Gene Regulation and Cancer	
CHEM 5845	Molecular Modeling and Drug Design	
CHEM 5860	Bioinorganic Chemistry: Bioinorganic compounds in medicine	
<b>Total Hours</b>		<b>13</b>

<sup>1</sup> CHEM 5310 Advanced Organic Chemistry or CHEM 5530 Advanced Physical Chemistry may be taken as an elective, if not used as a required course.

<sup>2</sup> Course topic must match to the topic area of the track and be pre-approved by the Graduate Program Director.

### Molecular Modeling Emphasis Track

Students in this track will learn fundamental principles and modern techniques in computer modeling and apply the acquired knowledge to solve practical problems in chemistry, biochemistry, biophysics, and material sciences.

Code	Title	Hours
<i>Complete the following required courses:</i>		6
CHEM 5530	Advanced Physical Chemistry or CHEM 5510 Computational Chemistry	
CHEM 5845	Molecular Modeling and Drug Design	
<i>Complete two of the following elective courses:</i>		6
CHEM 5010	Advanced Inorganic Chemistry	
CHEM 5310	Advanced Organic Chemistry	
CHEM 5510	Computational Chemistry	
CHEM 5580	Molecular Informatics	
CHEM 5600	Graduate Topics in Chemistry <sup>1</sup>	
CHEM 5630	Programming for Data Analysis in the Physical Sciences	
CHEM 5640	Artificial Intelligence in Chemistry and Biochemistry	
CHEM 5810	Graduate Biochemistry I	
CHEM 5815	Structural Biology of Neurodegenerative Diseases	
<b>Total Hours</b>		<b>12</b>

<sup>1</sup> Course topic must match to the topic area of the track and be pre-approved by the Graduate Program Director.

### Synthesis and Measurement Emphasis Track

Students in this track will learn how to prepare and characterize molecules and materials and how to measure their properties.

Code	Title	Hours
<i>Complete the following required courses:</i>		6
CHEM 5010	Advanced Inorganic Chemistry or CHEM 5310 Advanced Organic Chemistry	
CHEM 5110	Advanced Analytical Chemistry or CHEM 5220 Practical Applications of Spectroscopy	
<i>Complete two of the following elective courses: <sup>1</sup></i>		6
CHEM 5388	Nucleic Acid Technologies I	
CHEM 5411	Bioconjugate Techniques and Theranostic Nanomedicine	
CHEM 5421	Cannabis Chemistry	
CHEM 5510	Computational Chemistry	
CHEM 5530	Advanced Physical Chemistry	
CHEM 5548	Physical Biochemistry Laboratory	
CHEM 5600	Graduate Topics in Chemistry <sup>2</sup>	
CHEM 5700	Environmental Chemistry	
CHEM 5810	Graduate Biochemistry I	
CHEM 5815	Structural Biology of Neurodegenerative Diseases	
CHEM 5845	Molecular Modeling and Drug Design	
CHEM 5860	Bioinorganic Chemistry: Bioinorganic compounds in medicine	

BIOE 5420 Special Topics in Bioengineering<sup>3</sup>

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**Total Hours** **12**

<sup>1</sup> CHEM 5010 Advanced Inorganic Chemistry, CHEM 5110 Advanced Analytical Chemistry, CHEM 5221 Practical Applications of Spectroscopy or CHEM 5310 Advanced Organic Chemistry may be taken as electives if not used as a required course.

<sup>2</sup> Course topic must match to the topic area of the track and be pre-approved by the Graduate Program Director.

<sup>3</sup> must be pre-approved by the Graduate Director

### Traditional Chemistry Emphasis Track

Students that are interested in gaining experience in a broad range of chemistry including the critical sub-disciplines of organic, inorganic, analytical, and physical chemistry are encouraged to consider the traditional track.

Code	Title	Hours
<i>Complete the following required courses:</i>		<i>12</i>
CHEM 5010	Advanced Inorganic Chemistry	
CHEM 5110	Advanced Analytical Chemistry	
CHEM 5310	Advanced Organic Chemistry	
CHEM 5530	Advanced Physical Chemistry	
<b>Total Hours</b>		<b>12</b>

To learn more about the Student Learning Outcomes for this program, please visit our website (<https://clas.ucdenver.edu/chemistry/graduate-students/program-learning-goals/>).