

# Chemistry, PHD

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**Chairperson: Adam T. Fiedler, Ph.D.**

Chemistry website (<https://www.marquette.edu/grad/programs-chemistry.php>)

## Degree Offered

Doctor of Philosophy

## Program Description

The Department of Chemistry offers outstanding research and educational opportunities in its graduate programs, leading to the master of science or doctoral degrees. The heart of the graduate degree is research, conducted in concert with a faculty mentor. The program requires 24 hours of course work, and students are advanced to Ph.D. candidacy after successfully completing a literature seminar (4th term) and research meeting (5th term). The program emphasizes development of the whole scientist.

Subspecialty areas of research within the Department of Chemistry include: photochemistry; molecular spectroscopy; biochemistry, inorganic chemistry, materials chemistry and nanotechnology; organometallic catalysis, physical organic chemistry, bioorganic, theoretical chemistry, and chemical dynamics.

## General Information

For more detailed and comprehensive information about the master of science and doctoral programs in chemistry, students should consult the most recent edition of the Chemistry Department's Graduate Student Handbook. This publication defines the current rules and guidelines that govern department and program requirements.

## Second Language Requirements

Normally, no reading knowledge of a second language is required in either the master's or doctoral programs. However, at the discretion of the student's thesis or dissertation committee, proficiency in a second language may be required if it is necessary in the student's research.

## Proficiency Examinations

Incoming chemistry students must pass three proficiency examinations, which may be selected from among the four traditional areas of chemistry (analytical, inorganic, organic and physical chemistry). Incoming chemical physics students must pass proficiency examinations in physics, physical chemistry, and one other area of chemistry. These examinations can be repeated up to two times each, and the student must pass three by the end of his/her second term of full-time study or the equivalent.

## CAREER SKILLS REQUIREMENT FOR PH.D. STUDENTS

Marquette University is committed to preparing our students to become exemplary leaders in their chosen academic and professional fields by preparing them for careers in which they find purpose and value by engaging in Ignatian pedagogical reflection and practice. The purpose of the career skills requirement is to ensure all doctoral students have the opportunity to reflect on their desired career and to acquire essential career-related skills needed for them to pursue their chosen path.

Students enrolled in Ph.D. programs in Fall 2024 and beyond at Marquette must complete three career skills requirements. Requirements are satisfied by one or more of approved courses, workshops, or practical experiences in each category, as approved by the Graduate School. Completion of each skill will be noted on the student's transcript.

## CAREER DISCERNMENT

Students will be able to identify and prepare for career pathways that are consistent with their values.

*Objectives:*

1. Understand realities of academic job market for your discipline, creating space for career imagination and understand potential career paths.
2. Exploration of, and defining student's own identity/experiences/values/strengths/gifts and how the career pathway fits with those values.
3. Students will learn to identify and attain the skills and experiences necessary to obtain the career pathway they desire.

Code	Title	Hours
Choose 1:		
GRAD 8097	Career Discernment/Career Diversity Skills (Career Development Bootcamp)	0
GRAD 8097	Career Discernment/Career Diversity Skills (Seminar Series)	0
GRAD 8097	Career Discernment/Career Diversity Skills (Ph.D. Pathways)	0

## COMMUNICATION

Students will be able to communicate their ideas and scholarship effectively to audiences beyond those in their discipline.

*Objectives:*

1. Demonstrate the ability to communicate (e.g., research, expertise, experiences) effectively and ethically with disciplinary, cross-disciplinary, and nonacademic audiences.
2. Demonstrate the ability to communicate effectively and ethically within various contexts, formats, and media.
3. Demonstrate the ability to effectively deliver a presentation and facilitate discussion.

Code	Title	Hours
Choose 1:		
GRAD 8098	Communication Skills (Seminar Series)	0
GRAD 8098	Communication Skills (Three Minute Thesis)	0
GRAD 8961	Science Storytelling	1

## UNDERSTANDING DIVERSITY, EQUITY AND INCLUSION

Students will understand the importance of diversity, equity and inclusion and how issues of DEI are relevant to their career pathways.

*Objectives:*

1. Be aware of and able to identify how explicit and implicit bias impacts work life and understand possible strategies to address this bias.
2. Be able to articulate the value of universal design principles and ethical application to area of study.
3. Be able to work and interact effectively with persons from diverse backgrounds with varied values, ideas, and opinions.

Code	Title	Hours
GRAD 8099	Diversity, Equity and Inclusion Skills	0

## Chemistry Doctorate

**Specializations:** Analytical Chemistry, Bioanalytical Chemistry, Biophysical Chemistry, Chemical Physics, Inorganic Chemistry, Organic Chemistry, Physical Chemistry

A program for the doctoral degree is determined by the student's research adviser in consultation with the student's dissertation committee.

A doctoral student must complete a program of study defined on an approved Doctoral Program Planning Form. Normally, the student will be required to complete 24 credit hours of course work and 12 credit hours of CHEM 8999 Doctoral Dissertation for a total of 36 post-bachelor's degree credit hours. An intense program of laboratory instruction and research to begin no later than the second term of study is also required. Six credit hours of course work may be CHEM 6995 Independent Study in Chemistry. In addition, seminar course work (CHEM 6960 Departmental Seminar, CHEM 6953 Literature Seminar, CHEM 8953 Research Seminar) is required for the program but earns no credit. A third year research meeting consisting of a written report and oral presentation constitutes a qualifying examination; in addition, advancement to doctoral candidacy is contingent upon maintaining a 3.000 grade point average at the end of the fourth term of study in at least 15 credit hours of formal (non-CHEM 6995) course work. The student must submit a dissertation describing a significant body of independent research carried out in concert with a faculty mentor. The dissertation must be of a caliber that would be publishable in the leading scientific journals. A public defense of the dissertation is required.

Code	Title	Hours
24 credit hours of course work		24
CHEM 5130	Characterization of Organic Compounds	
CHEM 5330	Inorganic Chemistry	
CHEM 5430	Introduction to Quantum Chemistry	
CHEM 5433	Physical Chemistry 1	
CHEM 5530	Biochemistry 1: Macromolecular Structure and Function	
CHEM 5630	Introduction to Polymer Science	
CHEM 5932	Advanced Topics in Chemistry	
CHEM 6101	Modern Concepts of Organic Chemistry	
CHEM 6102	Organic Reactions	
CHEM 6103	Mechanisms of Organic Reactions	
CHEM 6201	Physical Methods of Analysis	
CHEM 6202	Spectrochemical Methods of Analysis	

CHEM 6203	Electroanalytical Methods	
CHEM 6204	Analytical Separations	
CHEM 6301	Advanced Inorganic Chemistry 1	
CHEM 6302	Advanced Inorganic Chemistry 2	
CHEM 6401	Computational Chemistry	
CHEM 6402	Introduction to Spectroscopy	
CHEM 6403	Statistical Thermodynamics	
CHEM 6404	Chemical Kinetics	
CHEM 6405	Advanced Physical Chemistry	
CHEM 6406	Infrared and Raman Spectroscopy	
CHEM 6407	Advanced Quantum Chemistry	
CHEM 6931	Topics in Chemistry	
CHEM 6995	Independent Study in Chemistry (Up to 6 hours can be counted towards the degree.)	
12 credit hours of Doctoral Dissertation		12
CHEM 8999	Doctoral Dissertation	
Seminar course work is required every term		0
CHEM 6960	Departmental Seminar	
Seminar course work presented at Departmental Seminar		0
CHEM 6953	Literature Seminar	
CHEM 8953	Research Seminar	

**Total Credit Hours:**

**36**

## University Policies

- Academic Censure - Graduate School (<https://bulletin.marquette.edu/policies/academic-censure/graduate/>)
- Academic Integrity (<https://bulletin.marquette.edu/policies/academic-integrity/>)
- Academic Misconduct (<https://bulletin.marquette.edu/policies/academic-misconduct-policy/>)
- Academic Program Definitions (<https://bulletin.marquette.edu/policies/academic-programs-defined/>)
- Accelerated Degree Programs (<https://bulletin.marquette.edu/policies/accelerated-degree-programs/>)
- Attendance - Graduate School (<https://bulletin.marquette.edu/policies/attendance/graduate/>)
- Awarding Diplomas and Certificates (<https://bulletin.marquette.edu/policies/awarding-diplomas-certificates/>)
- Background Checks, Drug Testing (<https://bulletin.marquette.edu/policies/background-checks-drug-testing/>)
- Class Rank (<https://bulletin.marquette.edu/policies/class-rank/>)
- Commencement (<https://bulletin.marquette.edu/policies/commencement/>)
- Course Levels (<https://bulletin.marquette.edu/policies/course-levels/>)
- Credit Hour (<https://bulletin.marquette.edu/policies/credit/>)
- Credit Load - Graduate School (<https://bulletin.marquette.edu/policies/credit-load/graduate/>)
- Faculty Grading (<https://bulletin.marquette.edu/policies/faculty-grading/>)
- Family Education Rights and Privacy Act-FERPA (<https://bulletin.marquette.edu/policies/ferpa/>)
- Grade Appeals (<https://bulletin.marquette.edu/policies/grade-appeals/>)
- Grading System - Graduate School and Graduate School of Management (<https://bulletin.marquette.edu/policies/grading-system/graduate-management/>)
- Graduation - Graduate School (<https://bulletin.marquette.edu/policies/graduation/graduate/>)
- Immunization and Tuberculosis Screening Requirements (<https://bulletin.marquette.edu/policies/immunization-and-tuberculosis-screening/>)
- Last Date of Attendance/Activity (<https://bulletin.marquette.edu/policies/last-dateof-attendance-activity/>)
- Military Call to Active Duty or Training (<https://bulletin.marquette.edu/policies/militarycall-active-duty-training/>)
- Registration - Graduate School (<https://bulletin.marquette.edu/policies/registration/graduate/>)
- Repeated Courses - Graduate School (<https://bulletin.marquette.edu/policies/repeated-courses/graduate/>)
- Student Data Use and Privacy (<https://bulletin.marquette.edu/policies/student-data-use-privacy/>)
- Transcripts-Official (<https://bulletin.marquette.edu/policies/transcripts-official/>)
- Transfer Course Credit - Graduate School (<https://bulletin.marquette.edu/policies/transfer-course-credit-policy/graduate/>)
- Withdrawal - Graduate School (<https://bulletin.marquette.edu/policies/withdrawals/graduate/>)

## Graduate School Policies

- Academic Performance (<https://bulletin.marquette.edu/graduate/policies/academic-performance/>)
- Advising (<https://bulletin.marquette.edu/graduate/policies/advising/>)
- Certificate Concurrent Enrollment (<https://bulletin.marquette.edu/graduate/policies/certificate-concurrent-enrollment/>)
- Conduct (<https://bulletin.marquette.edu/graduate/policies/conduct/>)
- Confidentiality of Proprietary Information (<https://bulletin.marquette.edu/graduate/policies/confidentiality-proprietary-information/>)
- Continuous Enrollment (<https://bulletin.marquette.edu/graduate/policies/continuous-enrollment/>)
- Courses and Prerequisites (<https://bulletin.marquette.edu/graduate/policies/courses-prerequisites/>)
- Cross-listed Courses (<https://bulletin.marquette.edu/graduate/policies/cross-listed-courses/>)
- Deadlines (<https://bulletin.marquette.edu/graduate/policies/deadlines/>)
- Doctoral Degree Academic Program Overview (<https://bulletin.marquette.edu/graduate/policies/doctoral-program-overview/>)
- Graduate Credit (<https://bulletin.marquette.edu/graduate/policies/graduate-credit/>)
- Graduate School Policies (<https://bulletin.marquette.edu/graduate/policies/>)
- Independent Study (<https://bulletin.marquette.edu/graduate/policies/independent-study/>)
- Intellectual Property (<https://bulletin.marquette.edu/graduate/policies/intellectual-property/>)
- Master's Degree Academic Program Overview (<https://bulletin.marquette.edu/graduate/policies/masters-program-overview/>)
- Merit-Based Aid Registration Requirements (<https://bulletin.marquette.edu/graduate/policies/merit-based-aid-registration-requirements/>)
- Research Involving Humans, Animals, Radioisotopes or Recombinant DNA/Transgenic Organisms (<https://bulletin.marquette.edu/graduate/policies/research-involving-humans-animals-radioisotopes-recombinant-dnatransgenic-organisms/>)
- Temporary Withdrawal from Graduate Program (<https://bulletin.marquette.edu/graduate/policies/temporary-withdrawal-graduate-program/>)
- Time Limitations (<https://bulletin.marquette.edu/graduate/policies/time-limitations/>)
- Working with Minors (<https://bulletin.marquette.edu/graduate/policies/working-minors/>)

## Chemistry Graduate Programs

- Chemistry, MS (<https://bulletin.marquette.edu/graduate/chemistry-ms/>)
- Chemistry, PHD (p. 1)

### CHEM 5130 Characterization of Organic Compounds (3 credits)

Fundamental theory of spectral methods used to identify organic compounds. Structure elucidation through application of nuclear magnetic resonance, ultraviolet, infrared, and mass spectroscopy. 3 hr. lecture.

*Level of Study:* Graduate

*Last four terms offered:* 2023 Spring Term, 2021 Spring Term, 2019 Spring Term, 2017 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%205130>)

### CHEM 5230 Forensic Chemistry (3 credits)

Examines the chemistry of forensics. Topics include: the science behind forensic analysis, methods for data analysis and applications of analytical methods in forensic science.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Spring Term, 2020 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%205230>)

### CHEM 5330 Inorganic Chemistry (3 credits)

Structure and bonding as related to physical and chemical properties; concepts relating to mechanisms; metal complexes; organometallic chemistry; molecular symmetry; catalysis; and descriptive chemistry to demonstrate applications of principles.

*Level of Study:* Graduate

*Last four terms offered:* 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%205330>)

### CHEM 5430 Introduction to Quantum Chemistry (3 credits)

Elementary quantum theory and applications to atoms, molecules, and chemical bonding.

*Level of Study:* Graduate

*Last four terms offered:* 2014 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%205430>)

**CHEM 5431 Physical Chemistry: Fundamentals with Applications in Biological Sciences (3 credits)**

Focuses on basic principles, using examples drawn from applications to biological systems. Covers macroscopic, statistical, and microscopic descriptions of matter. Emphasis on thermodynamics, chemical and physical equilibria, transport properties, and kinetics.

*Level of Study:* Graduate

*Last four terms offered:* 2015 Fall Term, 2014 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%205431>)

**CHEM 5433 Physical Chemistry 1 (3 credits)**

Foundations of quantum mechanics, applications to chemical systems, atomic and molecular structure and spectroscopy, foundations of statistical mechanics, states of matter, laws of thermodynamics, phase and chemical equilibrium, electrochemistry, transport properties and chemical kinetics. 3 hrs. lec.

*Level of Study:* Graduate

*Last four terms offered:* 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%205433>)

**CHEM 5434 Physical Chemistry 2 (3 credits)**

Continuation of CHEM 5433. Three hrs. lec.

*Level of Study:* Graduate

*Last four terms offered:* 2016 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%205434>)

**CHEM 5530 Biochemistry 1: Macromolecular Structure and Function (3 credits)**

Chemistry and biology of the component molecules of living cells, with an emphasis on the structure and function of proteins, nucleic acids and biochemical cofactors. Underlying principles include bonding, kinetics, thermodynamics, biochemical transformations, molecular recognition, protein folding, enzyme catalysis, protein-nucleic acid structure and function and evolution at the biochemical level.

*Level of Study:* Graduate

*Last four terms offered:* 2023 Fall Term, 2022 Fall Term, 2021 Fall Term, 2020 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%205530>)

**CHEM 5630 Introduction to Polymer Science (3 credits)**

Theory and practice of molecular weight determination for macromolecules. Characterization of polymers, including spectroscopic, chemical and mechanical procedures. Synthesis of polymers, including kinetics of reaction. Polymer additives and technology.

*Level of Study:* Graduate

*Last four terms offered:* 2018 Fall Term, 2015 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%205630>)

**CHEM 5932 Advanced Topics in Chemistry (1-3 credits)**

Advanced topics of current interest in inorganic, organic, analytical, physical or biochemistry.

*Level of Study:* Graduate

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%205932>)

**CHEM 6101 Modern Concepts of Organic Chemistry (3 credits)**

Stereochemistry, structure-reactivity, and linear free energy relationships. Chemistry of reaction intermediates and mechanistic approaches to problems. Offered fall term.

*Level of Study:* Graduate

*Last four terms offered:* 2023 Fall Term, 2021 Fall Term, 2020 Fall Term, 2019 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206101>)

**CHEM 6102 Organic Reactions (3 credits)**

Scope and limitations of modern techniques of synthesis utilizing addition, elimination, oxidation, reduction, substitution, rearrangement, and concerted reactions. Attention to mechanisms and stereochemistry.

*Prerequisite:* CHEM 6101.

*Level of Study:* Graduate

*Last four terms offered:* 2022 Spring Term, 2018 Spring Term, 2016 Spring Term, 2014 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206102>)

**CHEM 6103 Mechanisms of Organic Reactions (3 credits)**

Fundamental principles of physical organic chemistry. Mechanisms of common organic reactions with emphasis on polar mechanisms. Introduction to Huckel and extended Huckel molecular orbital calculations.

*Prerequisite:* CHEM 6101.

*Level of Study:* Graduate

*Last four terms offered:* 2016 Fall Term, 2015 Spring Term, 2013 Spring Term, 2010 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206103>)

**CHEM 6201 Physical Methods of Analysis (3 credits)**

Review of equilibria, principles and practice of spectrophotometry, electroanalysis and separation methods.

*Level of Study:* Graduate

*Last four terms offered:* 2015 Spring Term, 2014 Spring Term, 2011 Fall Term, 2010 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206201>)

**CHEM 6202 Spectrochemical Methods of Analysis (3 credits)**

Discussion of modern instrumentation for spectrochemical analysis including conventional sources, lasers, monochromators and detection systems.

Review and comparison of methods and applications of various spectrochemical techniques for the analysis of atomic and molecular species.

*Level of Study:* Graduate

*Last four terms offered:* 2019 Fall Term, 2016 Fall Term, 2014 Fall Term, 2013 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206202>)

**CHEM 6203 Electroanalytical Methods (3 credits)**

Electroanalytical methods for analysis and as a probe of homogeneous and heterogeneous redox processes with major emphasis on voltammetric, coulometric, potentiostatic and potentiometric methods. Also the redox chemistry of important organic, inorganic and organometallic compounds.

*Level of Study:* Graduate

*Last four terms offered:* 2018 Fall Term, 2017 Fall Term, 2016 Spring Term, 2015 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206203>)

**CHEM 6204 Analytical Separations (3 credits)**

Emphasis on gas chromatography and high performance liquid chromatography. Also included: other forms of chromatography, electrophoresis and related techniques, distillation, extraction, dialysis.

*Level of Study:* Graduate

*Last four terms offered:* 1997 Fall Term, 1994 Spring Term, 1992 Spring Term, 1990 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206204>)

**CHEM 6301 Advanced Inorganic Chemistry 1 (3 credits)**

Atomic and molecular structure, chemistry of the compounds of metals, transition metals and nonmetals, introduction to symmetry, ligand field theory, mechanisms, acids and bases, non-aqueous solvents, organometallic compounds, and applications of spectroscopy.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Spring Term, 2022 Spring Term, 2020 Spring Term, 2018 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206301>)

**CHEM 6302 Advanced Inorganic Chemistry 2 (3 credits)**

Special emphasis on such topics as non-aqueous solvents, mechanisms of inorganic reactions, inorganic polymers, descriptive chemistry, coordination chemistry, organometallic chemistry, point group classification, spectroscopy as applied to inorganic compounds, inorganic biochemistry, and current inorganic literature.

*Level of Study:* Graduate

*Last four terms offered:* 2015 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206302>)

**CHEM 6401 Computational Chemistry (3 credits)**

Survey of the theories, models, and methods of modern computational chemistry. Topics include: molecular mechanics, semiempirical and ab initio molecular orbital theory, and Density Functional theory. Emphasizes applications in vibrational and electronic spectroscopy, thermodynamics, reaction dynamics, and condensed phase phenomena.

*Prerequisite:* CHEM 5434.

*Level of Study:* Graduate

*Last four terms offered:* 2023 Fall Term, 2022 Spring Term, 2020 Spring Term, 2018 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206401>)

**CHEM 6402 Introduction to Spectroscopy (3 credits)**

Basic theory of chemical spectroscopy. Time-dependent Schrodinger wave equation, and the emission and absorption of radiation. Group theory and selection rules. Electronic spectra and structure of atoms and molecules. Rotations and vibrations of molecules. Spin resonance spectroscopy.

*Prerequisite:* CHEM 6405.

*Level of Study:* Graduate

*Last four terms offered:* 2021 Fall Term, 2019 Spring Term, 2016 Fall Term, 2015 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206402>)

**CHEM 6403 Statistical Thermodynamics (3 credits)**

Applications of statistical methods to chemical systems at equilibrium, including the calculations of thermodynamic functions, the properties of gases, and the theories of the liquid state. Introduction to non-equilibrium statistics and quantum statistics.

*Level of Study:* Graduate

*Last four terms offered:* 2002 Spring Term, 1999 Fall Term, 1997 Fall Term, 1996 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206403>)



**CHEM 6404 Chemical Kinetics (3 credits)**

Mathematical and phenomenological description of chemical rate processes and application to the solution of chemical problems.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Spring Term, 2023 Spring Term, 2016 Spring Term, 2006 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206404>)

**CHEM 6405 Advanced Physical Chemistry (3 credits)**

Atomic and molecular structure and chemical bonding from the point of view of quantum mechanics; illustrations from spectroscopy.

*Level of Study:* Graduate

*Last four terms offered:* 2003 Spring Term, 1998 Fall Term, 1997 Spring Term, 1995 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206405>)

**CHEM 6406 Infrared and Raman Spectroscopy (3 credits)**

General theories of molecular vibrations and applications of infrared and Raman spectroscopy to chemical problems.

*Level of Study:* Graduate

*Last four terms offered:* 1990 Fall Term, 1988 Fall Term, 1987 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206406>)

**CHEM 6407 Advanced Quantum Chemistry (3 credits)**

The application of advanced topics and methods of quantum mechanics to chemistry.

*Prerequisite:* CHEM 6405.

*Level of Study:* Graduate

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206407>)

**CHEM 6931 Topics in Chemistry (1-3 credits)**

Topics of current interest in biochemistry.

*Level of Study:* Graduate

*Last four terms offered:* 2023 Fall Term, 2023 Spring Term, 2022 Fall Term, 2022 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206931>)

**CHEM 6953 Literature Seminar (0 credits)**

Scholarly presentation on a current topic in chemistry. Mandatory for all CHEM graduate students. SNC/UNC grade assessment.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206953>)

**CHEM 6960 Departmental Seminar (0 credits)**

Papers and discussions as a means of interpreting present trends in chemical research. Required of all full-time graduate students in chemistry. SNC/UNC grade assessment.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206960>)

**CHEM 6995 Independent Study in Chemistry (1-4 credits)**

Faculty-supervised, independent study/research of a specific area or topic in Chemistry.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206995>)

**CHEM 6998 Essay Project (1-6 credits)**

An essay project developed in consultation with the adviser. S/U grade assessment.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206998>)

**CHEM 6999 Master's Thesis (1-6 credits)**

S/U grade assessment.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%206999>)

**CHEM 8953 Research Seminar (0 credits)**

Scholarly presentation of student's dissertation research topic in chemistry. Mandatory for all CHEM doctoral students. SNC/UNC grade assessment.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%208953>)

**CHEM 8999 Doctoral Dissertation (1-9 credits)**

S/U grade assessment.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%208999>)

**CHEM 9503 Competency Exam Prep: Less Than Half-Time (0 credits)**

A less than half-time equivalent course, used for those Marquette graduate students who are participating in undergraduate courses in preparation for graduate competency examinations.

*Prerequisite:* Cons. of the Graduate School.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Spring Term, 2023 Fall Term, 2023 Spring Term, 2022 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209503>)

**CHEM 9603 Competency Exam Prep: Less Than Half-Time (0 credits)**

A less than half-time equivalent course, used for those Marquette graduate students who are studying, whether in a classroom or independently, in preparation for graduate competency examinations.

*Prerequisite:* Cons. of the Graduate School.

*Level of Study:* Graduate

*Last four terms offered:* 2021 Spring Term, 2020 Spring Term, 2019 Spring Term, 2018 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209603>)

**CHEM 9970 Graduate Standing Continuation: Less than Half-Time (0 credits)**

Fee. SNC/UNC grade assessment. Designated as less than half-time status only, cannot be used in conjunction with other courses, and does not qualify students for financial aid or loan deferment.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2008 Spring Term, 2007 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209970>)

**CHEM 9974 Graduate Fellowship: Full-Time (0 credits)**

Fee. SNC/UNC grade assessment. Designated as full-time status. If a student is already registered in other courses full time, this continuation course is not needed.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2011 Summer Term, 2009 Fall Term, 2009 Summer Term, 2009 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209974>)

**CHEM 9975 Graduate Assistant Teaching: Full-Time (0 credits)**

Fee. SNC/UNC grade assessment. Designated as full-time status. If a student is already registered in other courses full time, this continuation course is not needed.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2012 Spring Term, 2011 Spring Term, 2009 Fall Term, 2009 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209975>)

**CHEM 9976 Graduate Assistant Research: Full-Time (0 credits)**

Fee. SNC/UNC grade assessment. Designated as full-time status. If a student is already registered in other courses full time, this continuation course is not needed.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2022 Spring Term, 2021 Fall Term, 2018 Summer Term, 2016 Summer Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209976>)

**CHEM 9994 Master's Thesis Continuation: Less than Half-Time (0 credits)**

Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of less than half-time status. Requires that the student is working less than 12 hours per week on their master's thesis. All six thesis credits required for the degree should be completed before registering for non-credit Master's Thesis Continuation.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2015 Spring Term, 2014 Spring Term, 2012 Spring Term, 2011 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209994>)



**CHEM 9995 Master's Thesis Continuation: Half-Time (0 credits)**

Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of half-time status. Requires that the student is working more than 12 to less than 20 hours per week on their master's thesis. All six thesis credits required for the degree should be completed before registering for non-credit Master's Thesis Continuation.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2023 Fall Term, 2009 Fall Term, 2009 Spring Term, 2008 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209995>)

**CHEM 9996 Master's Thesis Continuation: Full-Time (0 credits)**

Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of full-time status. Requires that the student is working 20 hours or more per week on their master's thesis. All six thesis credits required for the degree should be completed before registering for non-credit Master's Thesis Continuation.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Summer Term, 2024 Spring Term, 2022 Spring Term, 2021 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209996>)

**CHEM 9997 Doctoral Dissertation Continuation: Less than Half-Time (0 credits)**

Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of less than half-time status. Requires that the student is working less than 12 hours per week on their doctoral dissertation. All 12 dissertation credits required for the degree should be completed before registering for non-credit Doctoral Dissertation Continuation.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2010 Fall Term, 2009 Fall Term, 2008 Spring Term, 2007 Fall Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209997>)

**CHEM 9998 Doctoral Dissertation Continuation: Half-Time (0 credits)**

Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of half-time status. Requires that the student is working more than 12 to less than 20 hours per week on their doctoral dissertation. All 12 dissertation credits required for the degree should be completed before registering for non-credit Doctoral Dissertation Continuation.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2023 Fall Term, 2021 Spring Term, 2020 Fall Term, 2020 Spring Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209998>)

**CHEM 9999 Doctoral Dissertation Continuation: Full-Time (0 credits)**

Fee. SNC/UNC grade assessment. Allows a student to be considered the equivalent of full-time status. Requires that the student is working 20 hours or more per week on their doctoral dissertation. All 12 dissertation credits required for the degree should be completed before registering for non-credit Doctoral Dissertation Continuation.

*Prerequisite:* Cons. of dept. ch.

*Level of Study:* Graduate

*Last four terms offered:* 2024 Summer Term, 2024 Spring Term, 2023 Fall Term, 2023 Summer Term

Schedule of Classes (<https://bulletin.marquette.edu/class-search/?details&code=CHEM%209999>)