

Chemistry, Ph.D.

COLLEGE OF SCIENCE AND TECHNOLOGY (<http://cst.temple.edu>)

About the Program

The Chemistry graduate program is designed to provide a solid background in the chosen area of specialization. It emphasizes the acquisition of skills that enable students to gain further knowledge in their research and professional careers. For this reason, the Chemistry graduate degree program is research oriented, and seminar attendance and familiarization with the chemical literature are considered integral. The course requirements are comparatively light, although a wide variety of intermediate and advanced courses in related areas are offered. Students are encouraged to take courses in related areas, such as Biology, Computer Science, and Physics, according to their research interests.

Time Limit for Degree Completion: 7 years

Campus Location: Main

Full-Time/Part-Time Status: The degree program can be completed on a full- or part-time basis.

Interdisciplinary Study: A Chemical Physics program is offered jointly with the Department of Physics.

Areas of Specialization: The Department of Chemistry offers programs leading to the M.A. and Ph.D. degrees in Analytical Chemistry, Biochemistry, Inorganic Chemistry, Organic Chemistry, and Physical Chemistry. Areas of specialization include environmental chemistry, materials and polymers, medicinal, nanoscience, photonics, and surface science.

Job Prospects: The majority of students find employment in the chemical industry. Some go on to academic positions or positions in government laboratories.

Non-Matriculated Student Policy: Non-matriculated students are allowed to take up to 9 credits before admission into a degree program must be sought.

Financing Opportunities: The duties of a Teaching Assistant typically involve leading recitation sections and/or overseeing laboratories, as well as grading lab assignments, tests, and quizzes, when applicable. After their first year, most students are supported by a research assistantship.

Admission Requirements and Deadlines

Application Deadline:

Fall: December 15; January 1 international

Spring: September 15; August 1 international

For Fall admissions, priority will be given to applications submitted by December 15. Applications submitted after December 15 will be considered on a case-by-case basis for admissions and financial assistance.

Applications for Spring admission should be received by September 15. Note, however, that Spring admission is rare as coursework is designed to start in the Fall.

APPLY ONLINE to this graduate program.

Letters of Reference:

Number Required: 3

From Whom: Letters of recommendation should be obtained from faculty or people in industry who are familiar with the academic and/or research aptitude of the candidate.

Master's Degree in Discipline/Related Discipline: A master's degree is not required for admission into the Ph.D. program.

Bachelor's Degree in Discipline/Related Discipline: A baccalaureate degree is required. Typically, the undergraduate degree has been earned in Chemistry, Biochemistry, or a related field.

Statement of Goals: Include your specific interest in Temple's program; your research goals; your future career goals; and your academic and research achievements.

Standardized Test Scores:

GRE: Required. If the applicant's GPA is below 3.25, s/he can be considered for appointment as a Teaching Assistant if her/his percentile scores on the verbal and quantitative portions of the GRE sum to at least 100%.

TOEFL: 88 iBT or 575 PBT minimum. Regardless of score, all international students are required to take a SPEAK test upon arrival at Temple.

Resume: Current resume required.

Other: Submission of research papers with the applicant as a co-author or any other material associated with the applicant's research aptitude is recommended.

Program Requirements

General Program Requirements:

Number of Credits Required Beyond the Master's: 12

Number of Credits Required Beyond the Baccalaureate: 42

Required Courses:

Six formal lecture courses		18
Literature seminar		2
Research courses ¹		21
CHEM 8985	Teaching in Higher Ed:Phys Sci	1
Total Credit Hours		42

¹ Coursework includes a combination of CHEM 9994 Preliminary Examination Preparation, CHEM 9998 Pre-Dissertation Research / Elevation to Candidacy, and CHEM 9999 Dissertation Research, with a minimum of 2 credits of CHEM 9999 required.

Culminating Events:

Literature Seminar:

The Ph.D. student makes the presentation of one departmental seminar on a current literature topic or her/his research, as approved by the seminar professor. The seminar is 30 minutes in length and should include any background material needed to allow the audience to appreciate the topic(s) discussed.

Cumulative Examinations:

Cumulative examinations are a major part of the preliminary examinations. Written by the Graduate Faculty, cumulative examinations are offered seven times a year. Each cumulative examination is evaluated by at least two Graduate Faculty members. Students entering the program in Fall 2012 or later must pass a total of five "cumes" within the first two years of matriculation. Note that students who began their program of study prior to Fall 2012 must pass six cumes in three years.

Original Research Proposal:

To obtain Ph.D. candidacy, the student is required to write, present, and defend an Original Research Proposal (ORP). The topic of the ORP can be related to the student's research, but must still be original. The proposal is an opportunity for the student to use her/his scientific knowledge to demonstrate her/his ability to formulate experiments, calculations, theory, etc. to address an important scientific problem. The ORP should also contain a description of the actual research that the student will pursue for her/his Ph.D.

The student must consult with her/his research advisor for guidance prior to writing the ORP. It is understood by writing this document that a general experience in research will help evolve new chemistry through observations made during the course of an ongoing research problem. The ORP needs to be defended within 30 months of matriculation for students entering the program in Fall 2012 or later. Note that students who started prior to this date must defend the document within 42 months of matriculation.

Dissertation:

The doctoral dissertation is an original study that makes a significant contribution to the field of Chemistry. It should expand the existing knowledge and demonstrate the student's knowledge of research methods and a mastery of her/his primary area of interest. The dissertation should be rigorously investigated; uphold the ethics and standard of the field of Chemistry; demonstrate an understanding of the relationship between the primary area of interest and the broader field of Chemistry; and be prepared for publication in a professional journal.

The Doctoral Advisory Committee is formed to oversee the student's doctoral research and is comprised of at least three Graduate Faculty members. Two members, including the Chair, must be from the Chemistry Department. Committee compositions must be approved by the Graduate Committee. The Chair is responsible for overseeing and guiding the student's progress, coordinating the responses of the Committee members, and informing the student of her/his academic progress.

The Dissertation Examining Committee evaluates the student's dissertation and oral defense. This committee is comprised of the Doctoral Advisory Committee and at least one additional Graduate Faculty member from outside the Chemistry Department. The Outside Examiner should be identified no later than the beginning of the academic term in which the student will defend the dissertation. The Dissertation Examining Committee evaluates the student's ability to express verbally her/his research question, methodological approach, primary findings, and implications. The Committee votes to pass or fail the dissertation and the defense.

If a student needs to change a member of a Committee, the new member must be approved by the department's Graduate Committee and registered with the Graduate Secretary and the Graduate School.

Students who are preparing to defend their dissertation should confirm a time and date with their Dissertation Examining Committee and register with the Graduate Secretary at least 15 days before the defense is to be scheduled. The Graduate Secretary arranges the time, date, and room within two working days, and forwards to the student the appropriate forms. After the time, date, and room have been arranged for the defense, the student is required to send the Graduate School a completed "Announcement of Dissertation Defense" form, found at <http://www.temple.edu/grad/forms/>, at least 10 days before the defense. The student posts flyers announcing the defense.

Contacts

Program Web Address:

<https://chem.cst.temple.edu/graduate/>

Department Information:

Dept. of Chemistry
130 Beury Hall
1901 N. 13th Street
Philadelphia, PA 19122
chemgrad@temple.edu
215-204-7118

Mailing Address for Application Materials:

Dept. of Chemistry
400 Carnell Hall (041-03)
1803 N. Broad Street
Philadelphia, PA 19122-6095

Department Contacts:

Admissions:

Graduate Secretary
chemgrad@temple.edu
215-204-1980

Program Coordinator:

Dr. Frank Spano
Graduate Chairperson
spano@temple.edu
215-204-5203

Chairperson:

Dr. Daniel R. Strongin
dstrongi@temple.edu
215-204-7119

Courses

CHEM 5001. Advanced Inorganic Chemistry I. 3 Credit Hours.

Group theory and its applications to chemical systems. Molecular orbital theory and spectroscopy. Descriptive chemistry of transition metal and organometallic compounds.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5102. Data Analysis and Evidence. 2 Credit Hours.

Forensic chemistry involves the forensic application of analytical chemistry theories, techniques and instrumentation to the analysis of controlled substances, fire debris evidence, explosives, and other trace evidence/chemical unknown materials. This course will cover those concepts relevant to the field of forensic chemistry including chain of custody, the theory and practical applications of the uncertainty of measurement and propagation of error. Students will also learn the classifications and unique physical and chemical characteristics of forensic chemistry evidence and investigate the physical and chemical characteristics of this evidence through the use of chemical, microscopic and instrumental techniques. The chemical characteristics of explosive materials as well as the analytical techniques used to analyze these samples will also be covered.

Department Restrictions: Must be enrolled in one of the following Departments: CST:Chemistry.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5103. Advanced Instrumental Methods. 3 Credit Hours.

Recent developments in electrochemical and electroanalytical techniques, including voltammetric and potentiostatic procedures and the basics of instrumental design. Applications to organic chemistry, trace analysis, chromatographic detectors, and electrokinetics discussed.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5107. Drug Analysis. 4 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5108. Investigative Chemistry. 4 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5201. Physical Methods in Organic Chemistry. 3 Credit Hours.

Principles and applications of important physical and spectroscopic methods; IR, UV, NMR, MS, ESR, ORD, and CD in structure determination.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5202. Organic Reaction Mechanisms. 3 Credit Hours.

This course is an introductory overview of organic structure and most common organic reaction mechanisms.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5205. Organic Syntheses. 3 Credit Hours.

Scope and limitations of modern synthetic methods, including silicon reagents, organometallic and radical chemistry.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5301. Quantum Chemistry. 3 Credit Hours.

Introduction to quantum mechanics and its application to chemical systems.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5302. Statistical Thermodynamics. 3 Credit Hours.

The basic concept of statistical mechanical ensembles and their application.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5304. Nanomaterials Chemistry and Physics. 3 Credit Hours.

This course will cover the key chemical/physical properties of nanomaterials as well as nanomaterials characterization and synthesis for graduate students. The goal of this class is to help students get familiar to the important concepts associated with the confined dimensionality in nanomaterials and apply these concepts to understand unique electronic/optical properties of nanomaterials and the thermodynamics/kinetics of forming nanomaterials. The course is organized with four modules: 1) Introduction to Nanoscience - Physical and Chemical Concepts, 2) Characterization of Materials at Nanoscale, 3) Fabrication of Nanostructures and Nanomaterials, and 4) Case Study of Specific Nanomaterials.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5305. Chemical Kinetics. 3 Credit Hours.

A study of the dynamics of chemical reactions.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5358. Cellular/Molecular Neuroscience. 3 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5401. Biochemistry I. 3 Credit Hours.

A survey of the biological macromolecules (proteins, nucleic acids, carbohydrates, and lipids) correlating their structures with their chemical properties and biological functions.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5412. Structural Bioinformatics II. 3 Credit Hours.

This course provides an introduction to structural bioinformatics, with focus on understanding three dimensional structures of biological macromolecules. Topics covered include: an overview of macromolecular structure determination, introduction to molecular modeling theory and the application of computational modelling in structure based drug design. The course also offers practical training on the application of molecular modelling methods for understanding structural biology and in rational drug discovery.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

BIOL 5411|Minimum Grade of B-|May not be taken concurrently.

CHEM 5505. Advanced Polymer Structure and Properties. 3 Credit Hours.

Polymers are ubiquitous in many new (scaffolds for tissue engineering, hip replacements) and old (textiles, engineering resins, flocculants) applications, and are often used in composites with inorganic materials. In order to better understand the use and novel developments of polymers, this course will provide the fundamentals of synthesis, polymer structure/property relationships, and characterization methods.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 5701. Teaching of Chemistry. 0 to 3 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 8000. Special Topics in Inorganic Chemistry. 3 Credit Hours.

A survey of a topic chosen by the instructor. Topics could include bioinorganic chemistry, organometallic chemistry, solid state and materials chemistry, and catalysis.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 8001. Leadership, Law and Ethics in Forensic Science. 3 Credit Hours.

This course will provide the students with an introduction to the American criminal justice system, explain the role of the forensic scientist in the criminal justice system, and discuss theoretical and practical applications of forensic science laboratory management. Students will learn successful leadership styles and discuss topics relating to ethical behavior, quality measures including quality control and quality assurance, communication and privacy issues relating to forensic science as well as resource management. Through discussion and analysis of the U.S. Constitution, the Pennsylvania Constitution, Federal (and State) Rules of Criminal Procedure, and Federal (and State) Rules of Evidence with particular emphasis on case law, students will develop a practical understanding of modern criminal jurisprudence. Special emphasis and consideration will be given to the ethical obligations of criminal justice practitioners, including judges, prosecutors, defense attorneys, law enforcement officers and expert witnesses.

Department Restrictions: Must be enrolled in one of the following Departments: CST:Chemistry.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 8107. Advanced Forensic Chemistry. 3 Credit Hours.

Forensic chemistry involves the forensic application of analytical chemistry theories, techniques and instrumentation to the analysis of controlled substances, fire debris evidence, explosives, and other trace evidence/chemical unknown materials. This course will cover those concepts relevant to the field of forensic chemistry including chain of custody, the theory and practical applications of the uncertainty of measurement and propagation of error. Students will also learn the classifications and unique physical and chemical characteristics of forensic chemistry evidence and investigate the physical and chemical characteristics of this evidence through the use of chemical, microscopic and instrumental techniques. The chemical characteristics of explosive materials as well as the analytical techniques used to analyze these samples will also be covered.

Department Restrictions: Must be enrolled in one of the following Departments: CST:Chemistry.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

Pre-requisites:

CHEM 5102|Minimum Grade of B+|May not be taken concurrently.

CHEM 8200. Special Topics in Organic Chemistry. 3 Credit Hours.

Advanced lecture course; subject matter varies from semester to semester.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 8201. The Chemistry of Natural Products. 3 Credit Hours.

Biogenetic classification, classical and modern synthetic approaches to polyketides, steroids, terpenes, and alkaloids.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 8202. Organometallic Chemistry. 3 Credit Hours.

A survey of the chemistry of organic compounds of the main and transition elements, with emphasis on their reactions and applications.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 8205. Heterocyclic Chemistry. 3 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 8210. Special Topics in Organic Chemistry. 3 Credit Hours.

Advanced lecture course; subject matter varies from semester to semester.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 8300. Special Topics in Physical Chemistry. 3 Credit Hours.

Advanced lecture course, subject matter varies from semester to semester.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 8301. Molecular Spectroscopy. 3 Credit Hours.

Absorption, emission and scattering of light by molecular system. Discussion of basic principles and experimental techniques.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 8302. Computational Chemistry. 3 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 8303. Modern Meth in Exp Chem. 3 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 8310. Special Topics in Analytical Chemistry. 3 Credit Hours.

Advanced lecture course, subject matter varies from semester to semester.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 8400. Special Topics in Biochemistry. 3 Credit Hours.

Advanced lecture course; subject matter varies from semester to semester.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 8401. Bioinorganic Chemistry. 3 Credit Hours.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 8501. High Polymer Chemistry. 3 Credit Hours.

Introduction to the important theoretical and practical aspects of high polymer chemistry.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 8601. Analytical Separations. 3 Credit Hours.

Theory and practice of modern separation methods with emphasis on chromatographic and electrophoretic techniques.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may not be repeated for additional credits.

CHEM 8985. Teaching in Higher Ed: Phys Sci. 1 to 3 Credit Hour.

Teaching in Higher Education: Physical Sciences. This course focuses on learning theory and the best teaching practices, with the aim of preparing students for effective higher education teaching.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 9300. Seminar in Physical Chemistry. 1 Credit Hour.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 9800. Seminar in Forensic Chemistry. 1 Credit Hour.

Wide-ranging introduction to key areas and "hot topics" in forensic science, as presented by a series of guest lectures by leading practitioners in the field.

Department Restrictions: Must be enrolled in one of the following Departments: CST:Chemistry.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 9900. Seminar. 2 Credit Hours.

Formal presentation of research topics by graduate students. Regular attendance required of all graduate students.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 9991. Master's Research Projects. 1 to 6 Credit Hour.

Short-term, limited research project or laboratory project in the field. This course is not the capstone project course, nor can it be used for thesis based research. The course is for master's students only, including PSM, MA or MS. This class will not confer full-time program status unless nine credits are taken.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 9994. Preliminary Examination Preparation. 1 to 6 Credit Hour.

This course is required for students who are preparing for the preliminary or candidacy examination. Students should enroll after coursework is completed or when preparing for the candidacy exam until the time that the preliminary or candidacy examination is completed. This course will confer full-time status at the minimum credit hour registration limit of one credit. All students must complete a minimum of one credit of this course. Students must complete a total of 6 credit hours of 9994, 9998 and 9999.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 9995. Capstone Project. 1 to 6 Credit Hour.

Capstone project for master's students including students in PSM, MA or MS. This class will provide full-time status. Students in PSM programs need to register for at least one credit of this course to fulfill program requirements. Additional credits may be required for specific programs. This course will confer full-time status at the minimum credit hour registration limit of one credit.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Degree Restrictions: Must be enrolled in one of the following Degrees: Master of Arts, Master of Science, Prof Science Masters.

Repeatability: This course may be repeated for additional credit.

CHEM 9996. Master's Thesis Research. 1 to 6 Credit Hour.

Course for master's thesis research. Only intended for students in thesis bearing master's programs. A minimum of one credit is required. This course will confer full-time status at the minimum credit hour registration limit of one credit.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Repeatability: This course may be repeated for additional credit.

CHEM 9998. Pre-Dissertation Research / Elevation to Candidacy. 1 to 6 Credit Hour.

This course is intended for students who are performing research prior to candidacy. Students can register for this course after required courses are completed. This course will confer full-time status at the minimum credit hour registration limit of one credit. Students must be registered for this course during the semester that they are to be elevated to candidacy examination. Students must complete a total of 6 credit hours of 9994, 9998 and 9999.

Department Restrictions: Must be enrolled in one of the following Departments: CST:Chemistry.

Field of Study Restrictions: Must be enrolled in one of the following Fields of study: Chemistry.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

College Restrictions: Must be enrolled in one of the following Colleges: Science & Technology.

Repeatability: This course may be repeated for additional credit.

CHEM 9999. Dissertation Research. 1 to 6 Credit Hour.

The course is for Ph.D. students who have been elevated to candidacy. During the course of their candidacy students must complete a minimum of two credits of dissertation research. This course will confer full-time status at the minimum credit hour registration limit of one credit. Students must complete a total of 6 credit hours of 9994, 9998 and 9999.

Level Registration Restrictions: Must be enrolled in one of the following Levels: Graduate.

Student Attribute Restrictions: Must be enrolled in one of the following Student Attributes: Dissertation Writing Student.

Repeatability: This course may be repeated for additional credit.