

# Princeton CHEMISTRY

chemistry.princeton.edu

## Information for Prospective Chemistry Majors

### Prerequisite Courses – Must be taken before Junior Year

#### One Year of General Chemistry

CHM 201 & 202, OR CHM 207 & 202, OR CHM 215 & 1 credit of advanced placement,  
OR 2 credits of advanced placement

#### One Year of College Physics

PHY 101 & 102, OR PHY 103 & 104, OR PHY 105 & 106,  
OR 2 credits of advanced placement

#### Differential and Integral Calculus

MAT 103 & 104, OR 2 credits of advanced placement

#### One Year of Organic Chemistry – Must be taken at Princeton University, Transfer credit not accepted

CHM 301 & CHM 302, OR CHM 301 & CHM 304

\*Note: CHM 337 does not satisfy the organic chemistry requirement for the Chemistry Major

\*\*All prerequisite courses must be taken for a grade – P/D/F not accepted

### Department Requirements

#### Core Courses

**One Semester Undergraduate Organic Chemistry** (CHM 301 OR CHM 302 OR CHM 304)

**One Semester Undergraduate Inorganic Chemistry** (CHM 411 OR CHM 412)

**One Semester Undergraduate Physical Chemistry** (CHM 305 OR CHM 306 OR CHM 406)

**One Semester Core Laboratory** (CHM 371 OR MSE 302 OR PHY 312 OR CBE 346)

#### Cognate Courses

**Four additional departmental courses** or courses in cognate departments. Courses must be advanced courses (with prerequisites) and have a strong chemistry component. Consult the DUS for confirmation of course eligibility.

### Annual Introductory Chemistry Course Offerings

#### Fall

CHM 201: General Chemistry I

CHM 207: Advanced General Chemistry - Materials  
Chemistry

CHM 301: Organic Chemistry I: Biological Emphasis

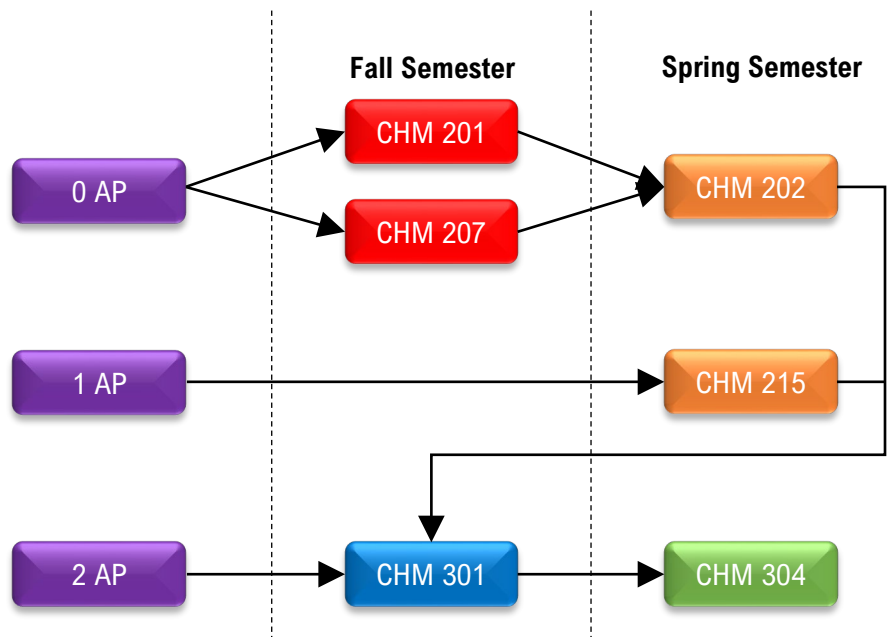
#### Spring

CHM 202: General Chemistry II

CHM 215: Advanced General Chemistry – Honors

CHM 304: Organic Chemistry II: Foundations of  
Chemical Reactivity and Synthesis

## AP Credit and Placement



## Sample Schedules for Prospective Majors

### No Placement Credit in CHM or MAT

Year	Fall	Spring
1st Year	CHM 201/207 MAT 103	CHM 202 MAT 104
2nd Year	CHM 301 PHY 101/103	CHM 304 PHY 102/104

### 1 unit Placement Credit in CHM and 1 unit Placement in MAT

Year	Fall	Spring
1st Year	MAT 104 PHY 101/103	CHM 215 PHY 102/104
2nd Year	CHM 301	CHM 304 CHM 373

### 2 units Placement Credit in CHM and 2 units Placement in MAT

Year	Fall	Spring
1st Year	CHM 301	CHM 304
2nd Year	CHM 411 PHY 101/103	CHM 373 PHY 102/104

## Departmental Courses

Eight departmental courses are required: **4 Core** courses and **4 Cognate** courses

Core Courses	Cognate Courses**
<ul style="list-style-type: none"><li>➤ Organic Chemistry - 1 semester<ul style="list-style-type: none"><li>○ CHM 301 (F) or 304 (S)</li></ul></li><li>➤ Core Lab - 1 semester<ul style="list-style-type: none"><li>○ CHM 371 or MSE 302</li></ul></li><li>➤ Physical Chemistry - 1 semester<ul style="list-style-type: none"><li>○ CHM 305 (F), CHM 306 (S), or CHM 406 (S)</li></ul></li><li>➤ Inorganic Chemistry - 1 semester<ul style="list-style-type: none"><li>○ CHM 411 (F) or CHM 412 (S)</li></ul></li></ul>	<ul style="list-style-type: none"><li>➤ Non-introductory course</li><li>➤ Courses must have prerequisites</li><li>➤ Courses may include:<ul style="list-style-type: none"><li>○ 200 level and higher: MAT and PHY</li><li>○ 300 level and higher: CHM, MSE, QCB, and some MOL, GEO, EEB, and Engineering courses.</li></ul></li><li>➤ Courses are evaluated on an individual basis, and the course must have strong chemistry component. Policy courses do not meet the requirement.</li></ul>

## Experimental Chemistry

The Department of Chemistry recently revamped our Experimental Chemistry undergraduate course offerings. Experimental Chemistry now consists of two courses, CHM 371 and CHM 373. **Concurrent enrollment or prior completion of CHM 373 is required for CHM 371.** The overarching goal of these courses is to learn the art of designing experiments for independent inquiry. *Prerequisite: CHM 202/215*

**CHM 371: Experimental Chemistry (Fall)**, This course consists of laboratory exercises that explore a breadth of topics in chemistry. The laboratory topics include inorganic synthesis, physical characterization, spectroscopy, and computational chemistry. Incorporated into these experiments are analytical methods, quantitative methods, and instrumental methods. Proper lab technique and data management are also part of the learning experience.

**CHM 373: Analytical Methods and Experimental Design (Fall and Spring)**, This course introduces fundamental principles of modern analytical methods such as spectroscopy, chromatography, and electrochemistry. Students learn about instrumental methods that employ these concepts and how to interpret data collected using these techniques. Discussion includes statistical treatment of data using standard methods for proper reporting of information with precision, accuracy, and uncertainty.

## Physical Chemistry

The study of the physical properties of atoms and molecules and the measurement of their reaction dynamics is known as Physical Chemistry. The topics of quantum chemistry, thermodynamics, kinetics, and statistical mechanics are covered in the physical chemistry course sequence. One physical chemistry course is required for graduation, but both courses may be taken to gain a full exposure to the theoretical constructs. *Prerequisites: CHM 202/215, MAT 104, and PHY 102/104.*

**CHM 305: The Quantum World (fall)**, This course covers the introduction to quantum mechanics and highlights the difference between classical mechanical systems and quantum systems. Examples are drawn from nano- and mesoscale materials such as solar energy, quantum biology, and nanoscience.

**CHM 306: Chemical Thermodynamics and Kinetics (spring)**, This is an introduction to chemical thermodynamics, statistical mechanics, and kinetics. Special emphasis is placed on biological problems, including nerve conduction, muscle contraction, ion transport, enzyme mechanisms, and macromolecular properties in solutions.

## Inorganic Chemistry

Inorganic Chemistry highlights how structure informs function for materials not classified as “organic.” The first eight weeks of both CHM 411 and 412 will cover the same foundational topics in Group Theory, Molecular Orbital Theory, and Ligand Field Theory. The two courses will diverge during the last four-week period. Thus, students will select whether to take 411 or 412 based on scheduling (i.e., they are offered in different terms) and topical interest. *Prerequisites: CHM 301 and CHM 304. (CHM 337 does not provide adequate preparation for these courses.)*

**CHM 411: Inorganic Chemistry: Structure and Reactivity (Fall)**, will consider topics of molecular reactivity and reaction mechanism after developing key concepts in bonding and coordination chemistry structure.

**CHM 412: Inorganic Chemistry: Structure and Materials (Spring)**, will consider topics in the areas of solid-state chemistry, inorganic materials chemistry, and nanoscience after completing the initial 6-week development of coordination chemistry bonding and structure.

Either CHM 411 or 412 will prepare the student for advanced Inorganic Chemistry coursework at the 500-level.

## Cognate Courses

All cognate courses must be approved by the Director of Undergraduate Studies in Chemistry. Due to the variable nature of courses from other departments each semester, the approved course list is dynamic. Any questions about cognate course approval can be discussed during course advising meetings.

## Independent Work

	Fall	Spring
<b>Junior Year</b>	CHM 981 – Fall (1 credit)	CHM 981 – Spring (1 credit)
	<p><b>Colloquium:</b> Monday, 7:30 – 9:00</p> <p>Faculty research talks and required departmental trainings. Attendance is mandatory.</p> <p><b>Reading Groups:</b> 90-minutes each week, times TBD.</p> <p>Faculty-led discussions about the scientific literature, focusing on the structure, content, and critical analysis. Short assignments due each week, longer critical writing projects due 3x per semester.</p>	<p><b>Laboratory Work:</b> 10 – 15 hours each week.</p> <p>Each student joins a research laboratory and begins an original research project. The final project is a research proposal summarizing your results, and outlining future work.</p>
<b>Senior Year</b>	CHM 984 (2 credits)	
	<b>Laboratory Work:</b> 10 – 15 hours each week.	
	Students spend the senior year completing laboratory work related to their thesis project. All thesis projects are experimental in nature. No “library theses” are accepted. Thesis due date is typically mid-April.	

\*Independent Work Credits count toward overall GPA but not toward the “31” credits for graduation.

## Comprehensive Exams (CHM 983)

The comprehensive exam is an oral thesis presentation, given by each senior student to a group of three members of the faculty, including their thesis adviser, during the first part of the final exam period.

## Minors or Certificates

Chemistry does not offer a Minor or Certificate in the field.

Some of the more common certificates that chemistry majors have earned through Princeton University are: Environmental Studies, Material Science and Engineering, Neuroscience, Quantitative and Computational Biology, and Sustainable Energy.

## Professional Certification and Graduate School Preparation

Students also have the opportunity to attain a chemistry degree that is certified by the American Chemical Society (ACS). The ACS guidelines list courses that are strongly recommended to be completed as thorough preparation for entering Graduate School.

Requirements for ACS Certification:

- Two semesters organic chemistry (CHM 301 and CHM 302/304)
- Two semesters physical chemistry (CHM 305 and CHM 306/406)
- One semester inorganic chemistry (CHM 411 or CHM 412)
- One semester biochemistry (MOL 345 or CHM 403)
- One semester analytical chemistry (CHM 373)
- One semester of core laboratory (CHM 371)  
*Note: MSE 302 does not meet the 6-hour/week requirement.*
- Two semesters Junior Independent Work (CHM 981)
- Two semesters Senior Independent Work (CHM 984)
- Two semesters of Calculus (MAT 103 & 104) or equivalent
- Two semesters of Physics (PHY 101/102 or PHY 103/104) or equivalent