

## DEPARTMENT OF CHEMISTRY

### Graduate Study

#### **Doctor of Philosophy**

The Department of Chemistry (<https://chemistry.mit.edu>) offers the Doctor of Philosophy degree. The subjects offered aim to develop a foundational knowledge of fundamentals and a familiarity with current progress in the most active and important areas of chemistry. In addition to formal coursework, each student undertakes a research project that forms the core of graduate work. Through the experience of conducting an investigation leading to the doctoral thesis, a student learns general methods of scientific approach and acquires training in some of the specialized techniques of research.

The major areas of research in the department include chemical biology, inorganic chemistry, organic chemistry, and physical chemistry. Chemical research frequently involves more than one of the traditional subfields. Some research activities of the department are carried out in association with interdisciplinary laboratories and centers (<https://catalog-dev.mit.edu/mit/research>) as described in Research and Study. These interdisciplinary research laboratories provide stimulating interaction among the research programs of several MIT departments and give students opportunities to become familiar with research work in disciplines other than chemistry. The department also participates in the interdisciplinary graduate Program in Polymers and Soft Matter, the Biotechnology Training Program, the Microbiology Program, and the Biophysics Certificate Program.

The Doctor of Philosophy in Chemistry (<http://catalog.mit.edu/degree-charts/phd-chemistry>) does not have any formal subject requirements. Each student, with the advice of a research supervisor, pursues an individual program of study that is pertinent to the student's long-range research interests. In general, candidates for the PhD degree in chemistry are expected to have completed at least 48 units of subjects approved for this purpose by the department with a grade of B- or better. The MIT English Evaluation Test (EET) is required for international students whose native language is not English. If English language subjects are recommended based on the EET results, students are required to complete the subjects for a letter grade. English language subjects do not count towards the 48 units of general coursework.

All students are required to teach for two terms, usually during the first year. While teaching, students enroll in 18 units of 5.91 Teaching Experience in the Chemical Sciences. During their first two academic semesters, students also enroll in at least 1 unit of 5.90 Problems in Chemistry.

Students typically confirm their research area during their first year in the PhD program. During the first term of residence, all graduate students are encouraged to select research supervisors who serve as

their advisors for the duration of their graduate careers. The overall program of graduate subjects is established by each student in consultation with the research supervisor. In planning this program and in establishing the thesis problem, careful consideration is given to the candidate's academic record, interests, and professional experience.

After the first year, students must register for thesis units every term they are in the program as they complete appropriate milestones (forming a thesis committee, passing both the written and oral components of the general exam, writing and successfully defending the thesis, and submitting a final, approved thesis document).

A comprehensive oral examination in the candidate's area of study is held generally in the fourth term of residence. Progress in the student's research is also examined at that time. The written examination occurs in conjunction with the oral examination and involves the preparation and submission of a formal document summarizing the dissertation project and progress to date. A final oral presentation on the subject of the doctoral research is scheduled after the thesis has been submitted and evaluated by a committee of examiners.

All students are expected to register for the appropriate 5.9xx series departmental seminars each fall and spring term.

Training and practice in developing original research ideas and expressing them in a formal written proposal is an important part of the PhD degree. Additionally, the development of good oral communication skills is an integral part of becoming an effective scientist. To this end, several exercises have been established to ensure that every student interested in obtaining training and experience in presenting written research proposals and seminars to the department on their thesis research will have an opportunity to do so. These exercises generally occur in the third or fourth year. A brief summary of requirements for each research area is given below.

- **Chemical Biology**
  - Students prepare and present an independent research proposal in the third year.
  - Students present a public seminar as part of their thesis defense.
- **Inorganic Chemistry**
  - Students prepare and present an independent research proposal in the third year.
  - Students present a public seminar in their fourth or fifth year as part of the regular Inorganic Seminar Series.
- **Organic Chemistry**
  - Students prepare an independent research proposal in the fourth year.
  - Students present a public seminar as part of their thesis defense.
- **Physical Chemistry**

- Students present a public seminar as part of their thesis defense.

### ***Interdisciplinary Programs***

#### **Polymers and Soft Matter**

The Program in Polymers and Soft Matter (PPSM) (<http://polymerscience.mit.edu>) offers students from participating departments an interdisciplinary core curriculum in polymer science and engineering, exposure to the broader polymer community through seminars, contact with visitors from industry and academia, and interdepartmental collaboration while working towards a PhD or ScD degree.

Research opportunities include functional polymers, controlled drug delivery, nanostructured polymers, polymers at interfaces, biomaterials, molecular modeling, polymer synthesis, biomimetic materials, polymer mechanics and rheology, self-assembly, and polymers in energy. The program is described in more detail (<http://catalog.mit.edu/interdisciplinary/graduate-programs/polymers-soft-matter>) under Interdisciplinary Graduate Programs.

#### ***Admission Requirements***

Students intending to do graduate work in the Chemistry Department should have excellent undergraduate preparation in chemistry. The department is flexible with respect to specific course preparation; the essential requirement is demonstration of ability to progress with advanced study and research in some area of special interest. However, mathematics and physics are important prerequisites for graduate work in physical chemistry or chemical physics, whereas less preparation in these areas is required for work in organic chemistry.

#### ***Financial Support***

First-year graduate students are usually supported by a combination of departmental fellowships and research assistantships while they complete the academic teaching requirement. Most students receive appointments to research assistantships after their first year, and departmental fellowships are also available. Financial support after the first academic year is subject to the availability of funds and provided for students who maintain a satisfactory record.

#### ***Inquiries***

Correspondence about the graduate program or appointments should be addressed to the Chemistry Education Office, Room 6-205, 617-253-1851.