

**Michigan Technological University
Department of Chemistry
PhD Requirements**

I. Introduction

This document describes the requirements and responsibilities for PhD students in the Chemistry Department at Michigan Technological University and supplements the information available at the Graduate School website, (<http://www.gradschool.mtu.edu/>), where there is a link to the Graduate Bulletin which then has links for various items such as degree requirements, thesis formats, etc. PhD candidates should familiarize themselves with both this document and the information available at the Graduate School website.

The steps in the program include courses, qualifying exams, presentation of an original research proposal, presentation of a research plan, and the writing and defense of a dissertation. Each of these steps is detailed below. The final outcome expected for a PhD degree is published original research. Students are advised throughout the program by a primary research advisor, an advisory committee, and the departmental Graduate Programs Committee (GPC).

A timeline to degree for all MTU graduate students and copies of the forms used to document your progress are available on-line from the MTU Graduate School website. The timeline including specific Chemistry Department requirements is:

| Activity | Time | Form |
|--------------------------------|--|---------------|
| Orientation | Two weeks before first semester | |
| Advisor selection | Before 10th week of first semester | Departmental |
| Begin research work | Week 11 of first semester | |
| Recommended Advisor | By end of second semester | D2 |
| Recommended Advisory Committee | By end of second semester* *Held in office until completion of D4 | D4-A |
| Preliminary Program of Study | By end of second semester | D3 |
| Start taking qualifying exams | September, second year | D4- (Written) |
| Presentation of research plan | By end of second year (in CH5900) | D6 |
| Original research proposal | By end of spring semester, third year | D4- (Oral) |
| Advisory committee meetings | as needed | |
| Degree Schedule | Term prior to defense term | D5 |
| Scheduling of final oral exam | Two weeks before defense | D7 |
| Dissertation Defense | | D8 |

II. Plan for first semester graduate students

A. Orientation

Students entering the PhD program must arrive on campus at least two weeks before classes begin. Incoming students will participate in the department orientation program including: introduction to the faculty, an explanation of student responsibilities, laboratory safety training, and teaching assistant (TA) training. During this period placement exams and English proficiency exams (for non-native speakers) will also be administered.

B. Placement Examinations

All entering graduate students (PhD and MS) will take placement examinations in four subject areas. All students will take exams in organic, inorganic, and physical chemistry, and will select one additional exam in analytical, polymer, or biological chemistry. Results from these exams will be used by the Graduate Programs Committee to assign course requirements and appropriate levels (3000, 4000 or 5000 level courses). In cases where serious deficiencies are revealed by the exams, the committee or research advisor will require a student to earn a grade of B or better in the appropriate undergraduate course or to retake one or more placement exams at a later date. A serious deficiency is defined as a score less than 50 percentile in the student's major area or 25 percentile in cognate subjects.

C. Advising of Entering Graduate Students

The Chair of the Graduate Programs Committee acts as advisor for entering students until they have chosen a research advisor. This temporary advisor will guide initial course selection and assist in selection of a research advisor. Before the second semester of enrollment students will have a research advisor who will approve subsequent coursework.

III. Course Requirements

A. Advising for Course Selection

When selecting courses, all students must consult their advisors for approval. To assist in this process advisors and the GPC review copies of student transcripts at the end of each semester.

Performance on the placement examinations and review of the student's undergraduate and graduate transcript will be used by the Graduate Programs Committee to guide course selection during the first year of graduate study using guidelines established by the chemistry faculty. Grades and research needs will guide later course selections.

B. Coursework Requirements

In their first year of full-time study, all PhD students are required to complete a minimum of 5 courses or 15 semester credits. Two of these courses must be in the student's major area of research, and one course must be completed in each of two other areas of chemistry. Students may petition to the Graduate programs Committee to replace one of the secondary areas of concentration by an area outside of chemistry. CH5990, CH6990, and CH5900 (seminar and research credits) do not count towards these course requirements. Additional courses may be required by the GPC and the student's advisor based on the student's background and performance on the placement exams and departmental courses.

For the spring semester of the second year, each student must register in CH5900 (Chemistry Seminar) and present their research plan as part of the CH5900 course requirement.

All graduate students are required to attend the weekly departmental seminars as well as graduate defense seminars.

C. Credit Requirements

All graduate students must register for exactly 9 credits each semester of the academic year and one credit for the summers. Students engaged in research may register for up to 9 credits of CH6990 per semester. A minimum of 60 credits, including at least 24 credits of CH6990 (research credits), is required for graduation.

D. Transfer Credits

Previously earned credits may not be transferred to the Chemistry degree program except in very limited situations. Specifically, credits may not be transferred from any program in which a degree was awarded. Transfer of credits from uncompleted programs may be considered only if appropriately related to the student's current program of study. Any such request must be made to the Graduate Programs Committee within one term of the student's arrival on campus.

If a student has completed an MS degree or equivalent in chemistry or a related field he/she may petition the Graduate Programs Committee to be exempted from some of the required coursework described above. However, the student may still be required by his/her advisor or Advisory Committee to complete further coursework related to his/her dissertation work.

IV. **Research**

A. Selection of Research Advisor

Graduate students must select a Research Advisor within 10 weeks of beginning their first semester of full-time study. During this period students are encouraged to speak with all faculty members about available research topics, and to visit their labs and research group meetings. To assist in the process, the Graduate Programs Committee will provide all incoming students with a list of specific faculty members whom they must interview. A student can submit a Chemistry Department Research Advisor Declaration Form only after signatures are obtained from all professors on his or her interview list.

B. Advisory Committee and Thesis Examining Committee

In addition to a research advisor, each student also has an Advisory Committee which helps monitor his/her progress, assists in evaluating progress, and acts as the final examining committee for the dissertation. Members of this committee may also be consulted for help with research or academic issues. The Research Advisor, in consultation with the student, forms the Advisory Committee by the end of the student's second semester on campus. The Advisory Committee is made up of three members of the MTU graduate faculty. The student is responsible for submitting the D4-A form (Recommended Advisory Committee) to the department chair for approval. For the final Examining Committee, another member of the graduate faculty from a cognate department must be added to the committee. All four members must sign the D7 form for scheduling the dissertation defense; the completed and signed D7 form must be submitted to the Graduate School at least two weeks before the oral defense.

C. Review of Graduate Student Progress

First year graduate students will be evaluated by the Graduate Programs Committee after their first semester of enrollment. Performance in course work and as a teaching assistant will be evaluated, and those students who show unsatisfactory progress or performance will be placed on departmental probation.

Each semester student progress will be documented by the Research Advisor, or the Advisory Committee, in a memo addressed to the Graduate Programs Committee. A copy of

the progress report must be sent to the student and the Department Chair. Students who show unsatisfactory progress may be placed on departmental probation. Continued financial support will depend on these evaluations.

V. Research Plan

During the spring semester of the second year each student orally presents a research plan describing the objective of his/her thesis research, the results of a literature search, and descriptions of intended experiments or procedures. Preliminary results may also be included. Presentations are 20-30 minutes in length.

This presentation takes place within the context of the seminar course (CH5900). The instructor distributes to faculty and graduate students a schedule of dates and topics of presentations for students enrolled in the class. All presentations take place during the regularly scheduled class hour. Students who are scheduled to present a Research Plan distribute to their Advisory Committee members a few days before their talk a 1 page abstract of the presentation (or a hardcopy of the PowerPoint slides). If a committee member is unable to attend the presentation, these provide information for the absent advisory committee member(s) to determine if they will sign the D6 form. The advisory committee may also ask for a repeat presentation at a time when the entire committee is available.

When the Advisory Committee approves the plan, the D6 form (Approval of Dissertation Proposal) is submitted. In terms of the timing of events, this talk takes place before (and is not a substitute for) presentation and defense of an original research proposal, which is part of the D4 form (see section 7).

VI. Qualifying Examinations

All doctoral students will commence taking cumulative examinations (cumes) beginning with the first date they are offered in the second year of their enrollment (typically the last Saturday of September). Students may start sitting for exams at any time during their first year if they wish, with the consent of their graduate research advisor.

A. Examination Requirements

For each exam, 2 points will be awarded for a pass, 1 point for a near pass, or 0. Students must obtain a total of 5 points (with a score of 2 on at least one exam) in a maximum of 4 total sittings within the second academic year of enrollment.

On exams where students score 0 or 1, an exam author may request an oral exam follow up to a student's written responses. Depending on student performance in the oral review, a student's score may be increased by one point. The oral component usually will be completed within three weeks of a sitting and will be conducted by the exam author and the advisor (or a member of the student's advisory committee if the advisor is the exam author).

B. Schedule and Exam Format

Each academic year four exam sessions will be held from 9:00AM to noon during the last Saturday in the months of September, January, and March and the first Saturday of December. At the start of the academic year the GPC will distribute to faculty a list of the students taking exams that year and their respective exam subject area(s) as determined by the students and their advisors. Examinations will only be prepared in these areas. Usually a student will take only exams in their research area. In some cases (when the research area is cross-disciplinary and with advisor approval), students may be allowed to select an exam from one of two subject areas in the current offerings (i.e., analytical, biological, inorganic, organic, physical, and polymer chemistry). With prior agreement among faculty in any

subject area, exams may have multiple authors (including authors from other departments). During a sitting, students may work only the exam in their subject areas(s). Exams must be graded within two weeks. Students are allowed to photocopy their graded exams and are encouraged to seek clarification with faculty. Chosen exams will be returned to the department office.

C. Source of Test Material

Exams will focus on material in the recent literature, departmental seminars and/or material covered in advanced graduate courses. Upcoming exam author(s) will distribute at least three weeks before an exam a listing of topics to be covered, reading material from textbooks (maximum of 100 pages), journal articles (10 maximum), or other material relevant to the exam. Additionally, material in departmental seminars in any subject area presented within the month prior to an exam may be covered.

Successful completion of these exams constitutes part 1 of the D4 form (Report on the Comprehensive Examination).

D. Appeals Process

The graduate programs committee (GPC), acting in consultation with the student and the student's advisor, will evaluate each student who fails to obtain 5 points within the allowed 4 sittings. The GPC may allow an extension for an additional sitting with the student being placed under departmental probation or immediately transfer the student to the MS program.

VII. Original Research Proposal

A research proposal must be presented in both an oral and written format to the student's Advisory Committee by the end of their third year. The preparation and presentation of an original research proposal is intended to give students experience in developing an original idea and presenting it to the scientific community. All successful research scientists must be able to present and defend their ideas to sponsors, including government agencies, industrial sponsors, or employers.

The topic should not be closely related to the student's current and previous research projects, but represent new ideas and techniques developed by the student from his/her reading, research, and coursework. The student should discuss these proposal ideas with their advisor before beginning to write. The topic of the original research proposal and the written summary must be approved by the advisor prior to scheduling of the oral presentation. Students are encouraged to follow *The ACS Style Guide, 2nd Ed.*, which is available in the departmental office. The written proposal is to be submitted to the advisory committee at least two weeks prior to the presentation. If the student wishes to use a pre-formatted original research proposal style, a template similar to those used within the ACS's Paragon manuscript submission system is available on the departmental graduate guidelines web page.

The proposal should be a maximum of 15 pages (double-spaced, 12 pt type) of text (including figures). The title page, abstract, and reference section (bibliography) are not included in the page count.

The proposal must include the following elements:

- Title page: a descriptive title and authors name
- Abstract: a one-paragraph summary of the objectives, approach, expected results, and significance of the proposed work.
- Introduction: background on the topic and its significance in a broad context.
- Specific objectives or goals: what particular question(s) will you answer?

- Research plan: What is your experimental design?
- Literature Cited: a bibliography in a standard format.

In addition, the proposal should discuss the expected results, their interpretation and possible problems along with strategies on how to resolve them. Some projects may include a discussion of novel techniques to be employed, sources and use of unusual equipment or materials, timelines for long or time-sensitive work, sampling details for field studies, alternate methods of approaching problems and a budget page. Figures and diagrams are often very helpful in conveying ideas; properly cited figures from literature sources may be used.

The oral presentation (about 45 min in length) should describe the original research concept with clear objectives, documentation from the literature, a defined procedure and anticipated results as far as can reasonably be expected. Faculty and graduate students of the department may attend the oral presentation. After the presentation, the advisory committee will ask questions based on both the oral and written portions. If the committee determines that the minimum requirements were not met, they may require further work. If the committee is still not satisfied that the requirements have been met, they may recommend that the student should not continue in the PhD program or that the student transfer to the MS program.

The proposal should be presented with the clear understanding that the material is confidential and remains the intellectual property of the student. A file of selected summaries produced by earlier students will be maintained in the Chemistry Office for reference purposes.

This step constitutes part 2 of the D4 form (Report on the Comprehensive Examination).

VIII. Dissertation

A. Dissertation Defense

The dissertation must be publicly presented as a seminar as part of the final oral examination. The advisory committee attends the seminar and, following open questions, conducts a private examination of the student. At the option of the advisory committee, the private exam may occur up to a week after the initial oral presentation. After the defense, any corrections to the thesis that were requested by the Examining Committee must be made and new signatures obtained on the final new version. As described below, there are several optional formats for presenting and submitting the thesis

B. Formats for the thesis

1. Standard Dissertation Format

This dissertation format is described on the Graduate School website (<http://www.gradschool.mtu.edu/>). Copies of earlier dissertations are kept in the Chemistry Office and in the library for reference. Students for whom English is a second language are strongly encouraged to get assistance proofreading the dissertation draft. The MTU Reading and Writing Center serves as a good source. The dissertation describes the results of the student's research. It contains a review of the literature on the student's research topic leading to a statement of the objective of the research. This is often followed by a description of the procedures used during the research, the results found using those procedures, and a discussion of the implications of those results leading to a statement of the conclusions from the research. A section on suggested areas for further research is often included. Many alternate formats are possible and the student should work closely with his/her advisor during all stages of the preparation of the dissertation.

As fully described on the Graduate School website, the thesis must be submitted to the Graduate School Office, (GSO), on a CD as a plain pdf file or a fully linked and bookmarked pdf file. Alternatively, the student may submit the thesis in an ETD (electronic thesis/dissertation) format in order to have it available via the web, but there are additional formatting requirements. See the link on ETD instructions available on the Graduate School website. In spite of the format chosen, the student will always be required to submit a printed version of his/her thesis to the departmental office.

2. Alternate Dissertation Format: Presentation of Publications

An alternate dissertation structure, based on accumulated literature publications, may be appropriate to some individual student cases. The student must have the approval of his/her advisor, who may seek advice from the Advisory Committee, before deciding on taking this approach to written presentation of his/her work.

A dissertation presented as an accumulation of papers published by the student must contain the following elements:

- The papers must have been processed into a form consistent with the library requirements for acceptance and binding.
- The papers must be preceded by a description of the basis for the entire work including a complete literature review for the research subject (if not included in any of the publications), a statement of overall objectives and conclusions.
- Each paper, if co-authored, should be accompanied by a statement of the contribution made by the student and approved by the co-author(s).
- A separate section describing uncompleted and unpublished work, if appropriate, should be included.

Papers suitable for inclusion in a dissertation prepared in this way include all papers published or accepted for publication by peer-reviewed journals of a standard acceptable to the student's advisor and committee. While it is not possible to define an adequate standard or number of publications, it would be expected that a PhD candidate would have sufficient material for three or more publications. A single, outstanding paper representing a major contribution to knowledge may be sufficient while a multitude of repetitious publications describing similar work with minor variations may be ruled inadequate. It is recommended that the student work closely in collaboration with his/her advisor and Advisory Committee in the preparation of a dissertation in this form.

Papers prepared as contributions to conference proceedings or for other reasons may be included if necessary for completeness of the description of the work. Publications prepared but not yet accepted for publication may also be included as unfinished work.

IX. Financial Support and Continuous Enrollment

A. Departmental Support

Students should not expect to have GTA support for an indefinite period. Normally, GTA support for a PhD student should not extend for more than five years (a total of six years for a student obtaining both MS and PhD degrees from our department). GTA support is contingent upon satisfactory performance of the student's instructional and research responsibilities.

The Department will pay tuition for Graduate Teaching Assistants *only* for those courses that are related to their degree program. The department does not pay tuition for students who are not resident at MTU.

B. Continuous Enrollment

Continuous enrollment throughout the academic year (fall and spring semesters) is required through the semester in which students complete all degree requirements. This means students who wish to remain active in the graduate program must be enrolled every academic fall and spring semester from their first enrollment through filing the completed D8 form with the Graduate School in (a) regular courses including independent study, special projects, etc.; (b) research credits; OR (c) in one of three courses (UN5951, UN5952, UN5953).* Students who do not maintain active status enrollment (through one or more of the three course options above) will have to apply for re-admission to regain active status. Students may request a waiver of continuous enrollment. However, waivers of continuous enrollment will be strictly limited to one term except in the most serious situations. For more information, contact the Graduate School.

*Contact the Graduate School regarding these courses. Please note that tuition for these courses may not be waived and these courses may not be paid from departmental or sponsored accounts.

X. **Probation and Dismissal**

A. Departmental Probation

Students placed on departmental probation will be so informed in writing by the department chair. Students who remain on departmental probation for two consecutive semesters may be subject to academic dismissal.

B. Academic Dismissal

The procedures for academic dismissal and the grievance procedures are fully described on the Graduate School website. Decisions on dismissal will be made by the chemistry faculty on the advice of the Graduate Programs Committee in consultation with the Department Chair and the student's Advisory Committee. The student may be required to withdraw or switch to the MS program if he/she is not meeting expected standards. The Advisory Committee, department chair and Dean of the Graduate School are all involved in the process, and the student is given several opportunities to contest the dismissal.

XI. **Where to go for help**

- Forms: Departmental Graduate Aide
- Procedures: Departmental Graduate Aide
- Policy: GPC
- GTA employment: Department Chair
- Petitions for extensions, etc: GPC