

**Introduction:** The PhD program in Chemistry has certain clear, objective, and well-defined quantitative requirements with definite deadlines. These are indicated in this document. There are also several requirements that are necessarily more subjective and that should be accomplished as soon as a student is prepared. For these requirements, this document provides guidelines and recommendations, but specific requirements and deadlines will be determined in consultation with the thesis advisor and advisory committee.

**Annual Review:** A yearly review of each graduate student's progress will be conducted by the GEC. Each student will fill out a GEC progress report form at the end of spring semester. The GEC will review the progress of each student and will determine whether he/she has made satisfactory progress on the requirements as defined below, and will also make recommendations to the student and advisory committee regarding any pending requirements.

**1. Proficiencies.** Within the first week of entering graduate school, the student will take proficiency exams offered in the five different disciplines of chemistry: organic, inorganic, physical, analytical and biochemistry. The purpose of these exams is to determine if the student has the appropriate background to succeed in the chemistry graduate program. Based on the student's performance on the exams, specific coursework or self-study will be recommended by the GEC. However, the responsibility for passing the proficiency exams rests with the student. The student will have two additional opportunities to take the exams within the first year of graduate study. Failure to pass proficiency exams in at least three of the five disciplines within the first year will result in termination from the program.

**2. Coursework.** The coursework that a graduate student takes is dependent upon their research area, the degree they are pursuing, and the need to cover deficiencies as determined from the proficiency exams. In general, at least 60 semester credits are required for the doctorate of which 18 credits must be lecture-based courses (e.g. six courses usually worth 3 credits each at the 500 level; some 400 level courses can be used; special approval must be received from the Graduate School upon recommendation of the advisory committee and department if a student wishes to count more than six (6) credits of 300 UG courses toward their graduate degree.).

Specific requirements:

- Students must successfully complete Chem 501 and Chem 640 in the first Fall Semester registered
- Students must successfully complete Chem 650 in the first two Spring Semesters registered.
- All graduate students will register for Chem 630 (Departmental Seminar) every semester. Attending departmental research seminars is integral to a student's education and allows the student a chance to learn about areas of science outside of their research area. Attendance of these seminars is mandatory unless excused by the faculty member responsible for organizing the seminar. The method of grading this class is the choice of the faculty member organizing the seminar.

- Students must complete 18 credits in letter-grade courses. At least 9 of the 18 credits must be in 500-level letter-grade Chemistry courses. Six of these 9 credits must be in 500-level letter-grade Chemistry courses outside the student's research specialty area, as determined by the advisory committee. The remaining 9 of the 18 credits may be in traditional letter-grade courses within or outside the Department of Chemistry when approved by the student's committee.

The student should consult with his or her thesis advisor and advisory committee for recommendations regarding coursework.

Students must maintain a B average in courses taken for graduate credit at The University of Montana; no grade below C will be accepted toward any degree requirement. The graduate school automatically places a student on academic probation if the cumulative grade point average falls below 3.0. Satisfactory progress in seminars and graduate level research is also expected. The department will take the following actions for a student who fails to maintain this average:

End of Semester 1: Receive a notice from the chair of his/her advisory committee and/or from the Graduate Education Committee warning of academic probation.

End of Semester 2: Be retained or placed on probation by the department for a deficiency of six or more grade points. Grade point deficiency is defined in terms of the number of hours of A which would be needed to make the average 3.0. For example, either 3 hours of D or six hours of C would require six hours of A to bring the average to 3.0 and a six grade point deficiency would exist.

End of Semester 3: Be recommended automatically to the Graduate School to be dropped from the graduate program of the department during the second year if the deficiency exceeds nine grade points, or at the end of the second academic year or thereafter if the deficiency exceeds six grade points. Reinstatement can be made on the basis of a petition approved by the department and the Graduate Dean. Such a petition can only be considered during the regular academic year.

Graduate School regulations allow the repeat of up to six semester credits to raise the grades obtained, upon approval of department chair. Students should be aware that the repetition of "F" grades counts within this limit and that the approval of the department chair can be expected only in the case of compelling extenuating circumstances. The continuation of the student in a given program is subject to periodic review by the departmental faculty.

There are no options on grading procedures in courses taken for graduate credit. Traditional letter grades must be obtained in all courses except research (graded N, Continuation), thesis (graded N, Continuation) and seminar (graded Pass/Fail) courses. Continuation grades are converted to letter grades at the end of a student's program.

Transfer of Graduate Credit: Graduate School policy allows for the transfer of graduate credits taken elsewhere only with the Department's recommendation and after satisfactory work at UM has been demonstrated. Credits with grades other than A or B, thesis or correspondence credits, extension credits outside the Montana university system, or credits earned at institutions not offering graduate degrees in the discipline of the course are not transferable. In the Department of Chemistry, the student's advisory committee must initiate the recommendation for transfer of credits. The advisory committee should be organized as soon as possible if credit transfer is desired. The advisory committee will take in consideration the student's background and professional goals along with the performance on the incoming proficiency exams in making the recommendation.

**3. Graduate Student Committees.** Not later than the second semester of graduate study, students should select a thesis advisor and become active in research (doing research and attending group meetings). In consultation with their thesis advisor, the student should select an advisory committee that reflects their area of study. The advisory committee is comprised of five members that include the thesis advisor, two internal and one external members chosen by the student in consultation with the thesis advisor, and one member selected by the department chairperson. Students should have their first committee meeting early in the third semester, and each year thereafter.

**4. Seminar.** All graduate students will enroll in and successfully complete Chem 650 during the first two Spring Semesters registered. In the second Spring Semester registered, all students will give a seminar as part of Chem 650 on a topic that is not directly related to their dissertation research. The topic will be decided in consultation with the faculty member of record for Chem 650 that semester and the thesis advisor. The faculty member of record for the course will define other requirements of Chem 650 in a given semester.

**5. Dissertation Proposal.** The dissertation for the Ph.D. program is a thesis that is based on original research. The student selects the thesis topic after consultation with his/her advisor, and prepares a brief written thesis proposal and research schedule for written approval by the committee and the Graduate Dean. There is no Graduate School form for this. The committee and Graduate Dean sign the cover sheet of the combined proposal and schedule. The student should satisfy this requirement as soon as possible after selecting a thesis advisor and no later than two semesters prior to the dissertation defense.

**6. Cumulative Exams.** The Ph.D. candidate is required to pass four out of ten cumulative exams attempted. This requirement is to be completed before the end of the student's fifth semester (excluding summers). Failure to complete this requirement will result in removal of the student from the PhD track but will still allow the student to pursue a Masters degree. With the advise of the thesis advisor and advisory committee, students should begin taking cumulative exams by their third semester or earlier to be able to attempt a wide choice of exams. The following specific points pertain to the cumulative exam policy:

- All cumulative exams are written and two-hours in duration.
- Exams will be offered October, December, February, April, and June, usually on the first Saturday of the month.
- Faculty will make up the cumulative exams on a rotating basis.
- Exam topics will be announced at the beginning of each semester.
- Students must sign up to take a cumulative exam at least two weeks in advance of the exam date.
- Cumulative exams will be offered in organic, physical, analytical and inorganic chemistry on each exam date. Topics may be broadened to include areas such as bioorganic and environmental chemistry.
- Cumulative exams are graded pass/fail (A failing grade will be given if a student signs up for an exam but fails to take it -- except for reasons beyond the student's control).
- The student's advisory committee may require that the student pass one cumulative exam outside their area of research.
- Failure to pass one cumulative exam from the first five attempted indicates insufficient progress. The student's advisory committee will make a recommendation to the Department concerning whether or not to retain the student in the Ph.D. program.

While there is no set requirement, once a student has begun taking cumulative exams he or she is advised to sign up for and complete an exam each time they are offered.

**7. Out-of-Field Proposal.** As soon after completion of the cumulative exams and the dissertation proposal as a student's thesis advisor and advisory committee feels the student is prepared, he/she will write and defend an out-of-field proposal. The format of the proposal is determined by the advisory committee and usually matches that of a major funding institution (NIH, NSF, DOD, DOE etc). The student will present this proposal to their committee and defend the proposal in an oral examination conducted by their research committee.

The oral research proposal examination, with the cumulative examinations, satisfies the comprehensive examination requirement of the Graduate School Ph.D. requirements. Minor area requirements, and the cumulative examinations, must be completed before the research proposal is presented. The dissertation proposal must also have been approved earlier and normally a considerable amount of the dissertation-related research will have been done. The oral research proposal examination precedes Application For Graduation and should be presented before the end of the third year.

The oral research proposal examination tests the readiness of the student for independent research. To provide the best indication of the student's abilities, the research proposal topic should be as remote as practical from his/her dissertation research. The student's advisory committee determines whether a research proposal topic is acceptable in every respect: independence from dissertation topic, novelty and content. It is recommended that the student obtain the advisory committee's approval of his/her topic before much time is invested in the proposal.

Students who have received a Ph.D. in Chemistry from UM usually feel that the experience of writing a serious research proposal is one of the most valuable features of their graduate education. Both proposal-writing skills and the out-of-field experience are highly valued in academia and industry.

The student's committee will approve or assign the format of the written proposal. The committee may require guidelines of a specific funding agency (e.g., NIH, NSF, or PRF). In any event, the proposal will include the following.

- A thorough literature review with an extensive bibliography
- A clear statement of the proposed research
- A justification of the work, making it clear why it is important
- A detailed consideration of possible difficulties in the proposed research, with an indication of alternate approaches, or of how anticipated problems could be overcome

These statements do not suggest an organization of the material and might not apply to all topics. They are not intended to limit the treatment of the research proposal. The candidate can expect advice from his/her advisor on the writing of the proposal and presentation of the material. He/she should not expect significant help on problem selection, designing of the proposed research program, or development of any of the ideas involved.

A copy of the written research proposal and abstract must be delivered to each committee member at least ten days before the date set for the oral examination. At the same time, a one-page abstract of the proposal, including key references, must be distributed to all other chemistry faculty and graduate students.

The oral research proposal examination will have the following format:

- 20-30 minute presentation that will be open to all faculty and students
- 15 minute question/answer period open to the general audience
- 1-2 hour question/answer period conducted by the committee and interested U.M. faculty (the general audience will be asked to leave)
- Candidate excused and committee votes to pass or fail

The oral research proposal examination is open to all interested faculty, who may raise questions on recognition by the examination chair. Students may attend the candidate's formal presentation which opens the examination and may ask questions for a period not to exceed 15 minutes following that presentation, but will then be excused before the questioning by the advisory committee and U.M. faculty begins.

Although the oral research proposal examination is nominally a two-hour exam, the **scheduling must provide for three hours**. The exam will commence with a brief formal presentation of the research proposal. The examination chair (an advisory committee member, but not the thesis advisor) will limit the student to 20-30 minutes for this

presentation. Following the formal presentation the examination chair will supervise the question period, arranging that each committee member and interested U.M. faculty member have adequate opportunity to question the candidate. Although most of the questions in this examination will be concerned with the proposal, questions on cognate and minor areas may, and likely will, be asked.

Only advisory committee members vote on the performance of the candidate in the examination. The candidate and guests are excused before the vote is taken. The student will pass if there are less than two dissenting votes. If the student fails, he/she may be given a second examination; however, the advisory committee may decide against a second examination or may require that a second examination be based on a new research proposal.

After passing the oral research proposal examination, the candidate will furnish a copy of the research proposal to the department for his/her file.

**8. Application for Graduation.** After the Oral Out-of-field Research Proposal Examination has been passed and at least one semester before the Ph.D degree is to be awarded, the student must submit to the Graduate School three copies of the Application For Graduation Form and a graduation fee of \$25.00. The Graduate School will conduct a degree audit and send two copies of this form back to the graduate program (one departmental copy and one student copy) early in the graduating semester. The department and student should note any problems and rectify them at least two weeks prior to the end of the final semester by using a Graduation Amendment Form. If the student fails to meet the original graduation date as requested on the form, the student may request the application be reactivated for the following semester by notifying the Graduate School one semester prior to the revised completion date.

## **9. Dissertation and Dissertation Defense**

Students are required to submit an Electronic Thesis, Dissertation and Professional Paper (ETDP) that describes their empirical or scholarly research and findings. The ETDP will have a front section, including a title page, abstract, acknowledgements, and table of contents, a body section that contains an introduction, literature review, materials and methods, results, discussion and conclusions, and a back section that contains references and appendices. The document is prepared using a word processor, converted to pdf format with relevant multimedia objects embedded. ETDPs may contain supplemental files, hypertext links, audiovisuals and other interactive features. The ETDP will in most cases be available to anyone who can browse the World Wide Web. Wide dissemination of research results and scholarly inquiry are encouraged, but the advisor and advisory committee can request limited access where there are legitimate patent or publishing issues. The student should arrange for submission of the draft and final versions of their ETDP with their thesis advisor.

The style of the ETDP text must follow the formal recommendations in the latest edition of *Form and Style: Theses, Reports, Term Papers* by W.S. Campbell and Stephen

V. Ballou or *A Manual for Writers of Term Papers, Theses and Dissertations* by Kate L. Turabian (copies are available in the UM Bookstore). The following requirements are supplementary to the above-mentioned material:

- Literature references are to be collected in a bibliography at the end of the thesis (not as footnotes and not at the end of chapters).
- Entries in the bibliography may be in alphabetical order or in order of citation in the text.
- The form of each bibliographic entry and the manner of citing the reference in the text of the thesis may follow the style of any major journal in the area of the student's thesis. The principal methods of citing references are listed on pp. 106-107 of the *ACS Style Guide*, James S. Dodd, Editor. A copy is available in the chemistry office.
- The student must consult with his or her advisor concerning preferred bibliographical style, particularly regarding the omission or inclusion of article titles.

In addition, students should refer to the [UM Graduate School Formatting Guidelines](#), which is available on the Graduate School web site. When preparing the Approval Page, Copyright Notice and Abstract for the ETDP, students should use the templates provided by the Graduate School.

The Graduate School and the Chemistry Department have established several deadlines and procedures relative to the dissertation defense. At least five weeks before the dissertation defense and at least nine weeks before the end of the semester in which the student expects to receive the degree, the candidate must submit unbound committee drafts or electronic copies (with prior committee approval) of the dissertation/EDTP to each advisory committee member. Advisory committee members who have concerns about whether the dissertation meets the criteria to proceed to the defense should express those concerns to the thesis advisor at least one week before the scheduled examination. If there are less than two committee members with concerns, the student's adviser and the Graduate Dean may elect to proceed. If there are two or more committee members who feel that the thesis is not ready to be defended, the defense will be indefinitely postponed. One copy of the draft EDTP and the student's e-mail address must be electronically submitted to the Graduate School office one week in advance of the defense. [Instructions](#) for submitting the draft are available from the Graduate School. This submission indicates the document is defensible and all members of the advisory committee have agreed it is ready for defense. The draft may include the comments of the advisory committee members as to corrections and suggested revisions.

The dissertation defense is an oral examination of the student's knowledge and a defense of the thesis. The dissertation committee will conduct a final examination dealing primarily with the dissertation and its relationship to the student's fields of study. This examination is held no later than four weeks before the end of the semester in which the degree is to be granted. It must be preceded by the preliminary approval of the EDTP by

the dissertation committee and the Graduate School, as well as the completion of all other requirements for the degree, including any set by the dissertation committee.

The time and place of the dissertation defense must be announced to the Graduate School and to the Chemistry Department at least two weeks before the examination, and notice must appear in the Faculty and Staff Newsletter at least one week before the defense.

The dissertation defense begins with a seminar (less than one hour) given by the student on the dissertation topic followed by periods for questions. If the seminar is given as a general departmental seminar, it need not immediately precede questioning by the committee. If both seminar and questioning period are scheduled in one session, then three hours must be allowed. The seminar is followed by a question and answer session that is open to the public; guests may ask questions upon recognition by the examination chair. The committee and UM faculty guests are then allowed by the examination chair to closely question the candidate on his or her general chemical knowledge and on the dissertation. Finally the advisory committee members discuss privately the student's performance and vote upon the outcome, which will be one of the following: (1) The student passes, and the dissertation is accepted as presented. (2) The student passes, but minor revisions are required in the dissertation. (3) The student fails and/or major revision is required in the dissertation. The committee result is a pass if no more than one member dissents. If the student fails, and the committee so advises, he/she may make the necessary revisions and defend again. At least thirty days must elapse between examinations. In no case will a student be allowed to defend his/her thesis more than twice.

If the student passes the dissertation defense, the chair and co-chair of the committee sign the Degree Completion document (The "Department" copy of the Graduation Application) under Final Degree Requirements.

At least two weeks before the end of the semester in which the degree is to be conferred, and after any revisions required by the committee or the Graduate School have been made, the EDTP must be submitted electronically to the Graduate School and to UMI/ProQuest through the University of Montana section of the UMI/ProQuest web site. Directions for submitting the document to UMI/ProQuest can be found on the Graduate School [web page](#). The student will also submit the signed Certificate of Approval Form and any other documentation required by the Graduate School. Submission of the electronic document by the thesis advisor will certify that the document has been reviewed and approved as the final document by all members of the committee. The Graduate School will match up the electronic document with the Certificate of Approval Form and the document submitted to UMI/ProQuest and will give final approval for release of the document into circulation.

In addition, one bound thesis copy is given to the Department for its library. A bound copy should also be provided to the research advisor. It is a courtesy to provide bound copies to members of the dissertation committee.

The following summarizes deadlines relating to the dissertation defense and graduation.

- Draft of dissertation to committee – five weeks before dissertation defense.
- Notify Graduate School and Department of Chemistry of time and place of defense – two weeks before dissertation defense.
- Submit approved draft of EDTP to the graduate school – one week before dissertation defense.
- Announcement of time and place of defense appears in Faculty/Staff Newsletter – one week before dissertation defense.
- Dissertation defense – four weeks before the end of semester.
- EDTP submitted to the graduate school along with signed Certificate of Approval Form and any other required documents – two weeks before the end of the semester.

Dissertation *in absentia*: With prior approval of the department and the Graduate Dean, a student admitted to candidacy may register for and receive residence credit for research done *in absentia* for the dissertation. Prior to finishing the dissertation and taking the final examination, a graduate student is responsible for making himself/herself fully available to his/her research advisor and advisory committee to meet published deadlines and to allow the required time for examination procedures.

**10. Time limit.** The graduate school requires that all requirements for the doctorate must be completed within seven years of commencing graduate course work at The University of Montana.

### GENERAL EXPECTATIONS

Students should be actively looking for a research group and join no later than the end of the second semester of their first year. Rotations among research groups are encouraged and the student is advised to work in the lab for a period of time prior to committing to that group. The individual professors must approve these arrangements. To assess their progress and to avoid misunderstandings, new students without a research advisor should arrange monthly meetings with the GEC.

The expectations for a student in a PhD program are advisor-specific. It is important that a student discuss these expectations with their prospective research advisor and have a clear understanding of what is expected of them in terms of daily work hours, work duties, and the necessary milestones expected for a PhD. All absences should be negotiated in advance with the student's advisor or the GEC if the student has not selected an advisor.

Successful completion of a PhD in Chemistry entails more than passing course work and standardized tests. The graduate student must demonstrate the ability to comprehend fundamental scientific problems, read and understand the primary literature

in their area of research, and successfully transmit their knowledge to an experimental or theoretical application. Failure to demonstrate such skills can result in termination of the candidate from the PhD program regardless of his/her success in coursework and standardized tests.

In general, the expectation is that a PhD will not be awarded unless the student has made significant contributions on one or more peer-reviewed papers (published or in press). Students are also encouraged to give presentations of their work at scientific meetings.

If a research advisor determines that a student is making insufficient progress in the PhD program, the student will receive a written warning. Within one month of such a warning, the student must convene their thesis advisory committee to review the situation and to develop suggestions for alternative approaches or remedial work. Within three months of this review, the student must reconvene the committee to assess progress. If progress is insufficient, the committee will proceed with termination of the student from the PhD program. A student may appeal the committee's decision to the Dean of Graduate Studies who, along with the Department Chairperson, will meet with the advisory committee to review the process and determine whether there were sufficient grounds for dismissal.