

Graduate Program Handbook

DEPARTMENT OF CHEMISTRY AND BIOCHEMISTRY,
MONTANA STATE UNIVERSITY

Welcome!

Welcome to the Chemistry and Biochemistry Graduate Program at Montana State University! We are a highly active department, numbering 16 research active, tenure track faculty (and growing!) and ~65 graduate students working toward their Ph.D. degrees. Our research activities are both broad and deep, ranging from chemical synthesis to energy conversion and storage to biochemical catalysis. Furthermore, our research has impact! Discoveries made by researchers in our department are published in some of the most prestigious journals, and findings are presented by students and faculty alike at regional, national, and international meetings.

Our graduate program has been designed with care and is intended to provide students with the training and mentoring they need to develop into independent, critical thinking scientists who will become leaders in their chosen fields. A balanced combination of coursework and independent investigation is mapped out with guidance from faculty advisors. Depending on the nature of a student's research project, courses can be taken in other departments on campus. Collaborative interactions with other research groups within and outside of the department are quite common.

At the conclusion of their graduate education at Montana State University, students should have professional command of the fundamentals of their disciplines and the ability to initiate new lines of insightful research addressing important and timely questions. During their graduate career, students are pushed to think independently and to critically analyze scientific problems that span disciplinary boundaries.

In the pages that follow, you will find the details about program requirements for earning a Ph.D. in Chemistry or Biochemistry. We are delighted that you have chosen Montana State to develop your skills as a scientist and earn your graduate degree. We encourage you to explore fully all of the opportunities available to you.

Welcome aboard!

Graduate Program Committee

(Adopted 1 August, 2017)

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Anticipated Timeline to Graduation

<i>Year 1</i>	<i>Year 2</i>	<i>Years 3-5</i>
Qualifying Exams	Program of Study	Annual Committee Meetings
Coursework Requirements	Completion of Coursework	Present Seminar
TA Labs	Research	Attend Conferences
Lab Rotations	Comprehensive Exam	Prepare Manuscripts
Choose Advisor	Cumulative Exams (organic)	Write/Defend Dissertation
Cumulative Exams (organic)		

Guidelines for Graduate Students at Montana State University Department of Chemistry and Biochemistry

This document describes the program requirements for graduate students pursuing a Ph.D. or M.Sc. degree in Chemistry or Biochemistry at Montana State University. This document serves as a guide for any student in the department navigating a graduate degree, however, emphasis is placed on program requirements for a Ph.D. This document is intended to assist with understanding the requirements (and intended timeline for meeting those requirements) of both the Chemistry and Biochemistry department and The Graduate School. The information contained in this document is not a replacement for any policy or procedure set forth by The Graduate School. All students are expected to be familiar with both departmental and The Graduate School requirements for their degree.

Questions about the Department of Chemistry and Biochemistry graduate program can be addressed to Dr. Doreen Brown Graduate Program Director, Professor Rob Walker, Chair of the Graduate Program Committee and/or Professor Mary Cloninger, Department Head.

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We encourage every student to become familiar with the information contained on The Graduate School website.

Graduate Studies

To accommodate the diverse backgrounds of incoming students, the first two years of the graduate program are structured to cultivate the skills and expertise that students will need to perform the high-quality research that is expected for a dissertation. Program requirements must be fulfilled in order for a student to remain in good standing. However, a student's individual plan of study can be tailored to allow the student to make up deficiencies in their background by taking advantage of relevant courses that might not be offered annually.

Entering students who have already obtained an advanced degree (e.g. M.Sc. in a science or engineering discipline) may petition for a reduction in the coursework required for their PhD program of study. Students with an advanced degree may also request that the qualifying exam requirement also be waived. Each petition/request will be treated on a case by case basis and will be reviewed by the Graduate Program Committee or in consultation with a student's research advisor when the student files his/her program of study.

Note that in instances where Graduate School policy and Department policy appear incongruent, the Department policy takes precedence.

Programmatic requirements for a Ph.D. degree include the following:

1. Graduate School requirements - Statements in quotations are found on the Graduate School's website.

- **60 credits** – The 60 credits required for the Ph.D. degree by the Graduate School includes at least 32 credits of coursework and 28 credits of dissertation research (CHMY/BCH 690). In practical terms, graduate students must take six, 3-credit classes. These classes will be at the 500-level, although two classes at the 400-level can be used to satisfy part of the coursework requirement. Typically, a student will take two classes each semester their first year and then two classes their second year. The student may take more than the 6 required courses with approval from their research advisor. The balance of the coursework credits consists of CHMY/BCH 594 (seminar-6 total credits) and CHMY/BCH 689 (graduate classroom instruction-8 total credits).

Students must maintain a 3.0 GPA average or better to remain in good standing. Failure to remain in good standing academically and/or failure to meet any Department or the Graduate School requirement may result in loss of teaching or research assistantship (and any benefits that go with receiving an assistantship). The Graduate School's policy on good academic standing is found at the following link:

http://www.montana.edu/gradschool/policy/grades_academicstanding.html

The program director of the department will prepare annual progress reports for students. The student and research advisor will review the document together and both sign. The form is sent to human resources. The document is found on the Graduate School's website at <http://www.montana.edu/gradschool/forms.html> under Department Forms, Annual Review of Academic Progress

Choosing a research advisor/graduate committee – Students can choose a research advisor starting in December of their first semester. Students must choose a research advisor before the end of the first year and their graduate committee before the end of their third semester of study.

(Note that the Department policy requires students to choose their research advisor before the start of Spring Break of their first year. For students starting their studies in the Spring semester, they will need to have chosen their research advisor before the end of their 1st semester.)

“The doctoral committee is composed of a minimum of four members. The majority of the committee should be made up of faculty from the degree-granting department, but due to the interdisciplinary nature of many degrees, committee composition is not limited to the degree-granting department. The graduate committee chair and the department head recommend the committee composition to The Graduate School. Final approval of committee composition rests with The Graduate School.”

“Non-tenure track committee members-Committee members not holding tenured or tenure-track faculty status at MSU-must submit documentation of their qualifications, including a vita and a letter of recommendation from the student’s department head to The Graduate School. In some cases, these committee members may act as co-chair of a student’s committee.”

- **Filing a Program of Study (POS)** – A POS must be filed with the Graduate School by the end of a student’s third semester. The POS lists the courses required to earn a PhD (or MS) and officially documents a student’s graduate committee. The POS is signed by each committee member although final approval rests with the Graduate School Dean. The link to the form can be found on the department’s website under Graduate Program’s Advanced Degree requirements, Year 2 at:
<http://chemistry.montana.edu/graduate/advanced-degree-req.html>

Students are strongly encouraged to solicit recommendations from their committee members regarding courses, including those outside of the student’s own program, that are relevant to their field of study and research.

- **Doctoral comprehensive examination** - Statements in quotations are found on the Graduate School’s website. “The comprehensive examination is the major academic examination during the doctoral study that assures that the student has attained sufficient mastery of their discipline. Some departments use the passing of the comprehensive examination as the qualifying examination that admits the doctoral student to candidacy. This examination is valid for five (5) years from the term of successful completion.”
 - **Written and oral** - “The comprehensive examination requirements are department specific. In the case where a department has written and oral examinations, the graduate committee will determine if the student has passed or failed the requirements. A student must have an approved [Graduate Program of Study & Committee](#) form on file with The Graduate School prior to sitting for any portion of the comprehensive examination or dissertation defense. It is the student’s responsibility to ensure that all committee members, including the graduate representative if applicable, are available when scheduling the comprehensive examination.”

Additional information about the comprehensive exam format for the Biochemistry/Chemistry program is contained in Section 3.5.

- **Dissertation and defense** – “All doctoral candidates must defend their dissertation. The defense usually consists of a public presentation and an oral examination of the candidate’s research. The candidate must have an approved Graduate Program of Study & Committee form on file with The

Graduate School prior to the defense of dissertation. The public is invited to the oral presentation of the defense. Following the public portion of the defense, the committee chair will excuse the public from the defense. The graduate committee then will examine the candidate's knowledge of the research in depth."

Additional Information about the Graduate School's PhD requirements and policies can be found at http://www.montana.edu/gradschool/policy/degreq_doctoral.html

2. Department requirements

- **Orientation** – All first year students are required to participate in the Department's orientation activities. Orientation is a three-week-long event in August that takes place three weeks prior to the start of classes. Orientation activities include the following:
 - The first opportunity to take Qualifying Exams is during the first week of orientation in August. Students can sit for as many exams as they like
 - Introduction to department research led by individual faculty
 - Course advising/registering for classes
 - TA training
 - Graduate School informational and orientation sessions
- Students in their first year are required to attend a series of Faculty Research Reviews in August and the first part of September.
- **Qualifying Exams** – The Chemistry and Biochemistry graduate program uses ACS qualifying exams to establish baseline knowledge in the disciplines. Students are required to pass three exams during their first year. Exams are offered in many of the traditional chemistry/biochemistry sub-disciplines (organic, inorganic, biochemistry, physical, analytical). In addition, students can also sit for an internally created molecular biology qualifying exam and or a microbiology exam. Requirements for a passing mark and restrictions concerning how often a given subject exam can be taken are described in more detail in Section 3.1 of this handbook.
- **Rotations** – During the first semester of the first year and the beginning of the second semester, students will participate in (at least) two rotations in research labs. Rotations are intended to provide students with the opportunity for an in-depth introduction to the research being pursued by different groups in the department. The goal of these rotations is to enable students to make more informed decisions about the work they would like to pursue for their dissertation research. The structure of rotations depends on the expectations of individual faculty members. Rotations will typically be ~4-6 weeks and may involve a formal lab-work component or simply attending group meetings for a month. Rotations will start after the Faculty Research Talks have concluded. After the second rotation has finished, students can begin choosing research groups.

- **Teaching** – First year students will typically serve as the Teaching Assistant for 3 sections of a large, undergraduate chemistry class. Responsibilities include but not limited to teaching general chemistry, biochemistry or organic chemistry labs, grading, proctoring, assisting in the student help center and holding office hours.
- **Organic Cumulative exams** – Students in the organic chemistry division are required to pass a total of 4 cumulative exams: 2 by the end of their 4th semester in residence and 2 more by the end of their 6th semester. After students pass two cumulative exams, they will be permitted to schedule their oral comprehensive exam. Additional information about the cumulative exam requirement is found in Section 3.9 of this handbook.
- **Graduate Committee** - The student's research advisor is the committee chair. The committee will meet with the student *twice* during the student's second year – once in the Fall semester to learn about the student's project and make recommendations about topics judged to be relevant for the student's plan of study, and once in the Spring semester for the student's comprehensive examination. The committee will then meet with the student annually following successful completion of the comprehensive exam (see annual committee meetings below for further committee meeting requirements).
- **Comprehensive Exam (see section 3.5)**
- **Annual committee meetings** – Following successful completion of their comprehensive exam, students will meet annually with their committee to discuss progress, accomplishments, and plans for future work (See Section 3.7).
- **Departmental seminar** – During their third year, students are strongly encouraged to present a departmental seminar based primarily on their intended dissertation research. Students should arrange to have at least half of their (departmental) committee present for the seminar. All students must complete this requirement by the end of their 8th semester in the program. A short meeting with the student's committee following the seminar satisfies the requirement for that year's annual committee meeting. During this meeting, students are expected to present a plan of tasks required for dissertation completion and a proposed timeline. The form to be filed to the graduate program director is found under "Advanced Degree Requirements-Year 4" on the department's website at <http://chemistry.montana.edu/graduate/advanced-degree-req.html>
- **Year 5 (and beyond)** - If a student is not prepared to defend their dissertation by the end of the 5th year, they will be expected to have a committee meeting and a detailed plan of the remaining work to be accomplished for the dissertation and defense. Form to be filed to the graduate program director is found under "Advanced Degree Requirements-Year 5" on the department's website at

<http://chemistry.montana.edu/graduate/advanced-degree-req.html>

- **Dissertation and Defense (See Section 3.8)**

3. Program specific requirements in detail

3.1 Qualifying Exams

Students enrolled in the Chemistry and Biochemistry program must demonstrate their preparedness for advanced degree study by passing a qualifying examination. To meet this requirement, a student must pass three examinations during their first year. In most instances, qualifying exams are standard ACS examinations in the traditional sub-disciplines of analytical, biochemistry, inorganic, organic and physical. Qualifying exams in molecular biology and microbiology have also been created by the Department. (Note: biochemistry, organic and physical all assume that a student has taken a 2-semester undergraduate sequence in the respective subject area.)

Exams will be offered at four different times during a student's first year: August, November, February and April. During each of these four months, each exam will be offered once and a student can sit for as many exams as desired during that month. Note that different versions of the same qualifying exam may be offered during the course of one year. (For example, the 2007 Analytical exam might be offered in August and April, the 2016 Analytical exam might be offered in November and February.)

Taking a qualifying exam will result in one of three outcomes: full pass (FP), master's pass (MP) or no pass (NP). The scores required for a FP are set by meeting the 55th percentile of the national average for the appropriate exam. The MP threshold is set to the 50th percentile and on most occasions the difference between an FP and MP score is ~2 questions. Scores below the 50th percentile will be marked as NP. The qualifying exam requirement for Ph.D. track students is fulfilled with three FP marks.

To remain in good standing in the Ph.D. program, students must earn 3 FP marks during their first year. Doing so satisfies the Department's Qualifying Exam requirement. Students who have not earned 3 FP marks *but* have earned 3 marks that qualify as MP can remain in the program but will be moved to the Master's track. These MP students remain eligible for a M.Sc. degree *but not* a Ph.D. degree. Students who do not meet at least the MP requirement will be released from the program after the first year.

Students (and faculty) should be aware of two contingencies:

1. Any student who has earned at least 2 FP marks during their first year can petition to sit for one additional qualifying exam in May at the end of their first year. The petition consists of a letter written by the student outlining the steps that will be taken to prepare for their last exam opportunity *and* a letter of support from the student's faculty advisor.
2. Students who have moved to the Master's track *can* sit for qualifying exams during their 2nd year. Readmission to the Ph.D. track will happen

automatically should a 2nd year M.Sc. student earn 3 FP marks during their 2nd year. Note that FP marks from Year 1 *will not* carry over into Year 2.

Students entering the graduate program having already received an advanced degree from another institution can petition to have the qualifying requirement waived. Typically, waivers will be granted to those students who have satisfied a similar requirement at their former institution and have appropriate documentation.

3.2 Coursework and Research

The Program of Study (POS) approved by the Graduate School requires every student in our Ph.D. graduate programs to complete 32 credits of coursework and 28 credits of research to obtain a Ph.D.

Coursework = 32 total credits include the following:

- 6 foundation courses (3 cr. each) = 18 credits
- Grad Instruction (CHMY/BCH 689 under advisor's name) = 8 credits (2 credits/semester for 4 semesters)
- Seminar (BCH/CHMY 594) = 6 credits (1 cr./semester for 6 semesters)

The Department of Chemistry and Biochemistry requires every student to take 6 foundational courses that are discipline specific. There is flexibility in taking classes outside of the department. Students should consult their research advisor and committee members for help with course selection. A list of courses offered are found under MYINFO tab -schedule of classes.

Research - After coursework is completed, students register for BCH/CHMY 690 dissertation research credit until they write and defend their dissertation. A minimum of 28 (690) credits are required to satisfy the research requirement for a Ph.D.

3.3 Rotations and research advisor selection

The rotation structure is flexible to allow each group/PI the opportunity to define what is expected from a rotating first year student. Students *must* fulfill 2 rotations before joining a group. Students must choose (and be accepted into) a group before spring break of their first year to remain in good standing with the department. Lab experience in the summer prior to the first semester of graduate school will be counted as a rotation.

3.4 Program of study and committee selection

By the end of their third semester in the Ph.D. program (2nd semester if a MS candidate), students are required to submit a program of study (POS) to the Graduate School. The POS is an official document that sets in place the student's committee members and the student's course of study. The form is available at <http://www.montana.edu/gradschool/forms.html>. The document should be completed by the student in consultation with their research advisor. Signatures are required from the student, committee members, and department head and subsequently the dean of the Graduate School.

Note that in 2015, the Graduate School dropped the requirement that all Ph.D. committees include a graduate school representative. Typically, the 'grad rep' is a tenured or tenure track faculty member from a different department at MSU and serves as an impartial observer of events including the Comprehensive Exam and the Ph.D. defense. While a grad rep is no longer required, a number of student and committees alike have benefitted from including a grad rep on the committee. The decision to do so or not will be made cooperatively by the graduate student and her/his advisor.

The Department recognizes that some research projects rely heavily on participation from outside collaborators. In these instances, an outside collaborator *can* become a member of a student's graduate committee (as defined by the POS). Should such a situation arise, the student and advisor should provide the Graduate School with appropriate information about the proposed external appointee (e.g. CV, representative papers showing expertise in the field, etc.), in addition to a required letter of support from the Dept. Head. The student and advisor must ascertain the current Graduate School requirements at the time of the requested appointment.

3.5 Comprehensive Exam.

The Comprehensive Exam is one of the last programmatic requirements for the Ph.D. degree prior to the completion of a doctoral dissertation and defense. The goals of the Comprehensive Exam are two-fold: 1) the candidate must show the examining committee that she/he has a well-defined research project with clearly defined goals, and 2) the candidate must demonstrate that she/he has the ability to execute successfully the proposed research plan. In preparation for the exam, the candidate should be sure to have a firm understanding of the fundamental principles relevant to the proposed field of study and show the ability to apply those principles to new scientific challenges. The Comprehensive Exam requirement should be fulfilled before the start of a student's 5th semester in the program.

The Comprehensive Exam consists of two parts: 1) a written requirement and 2) an oral defense of proposed research. Successful completion of the exam requires that the candidate's committee approves both the written requirement and the oral defense.

3.5.1 Comprehensive Exam – Written Requirement. The written requirement consists of a proposal that is intended to be a scholarly document describing the research a student plans to pursue for a Ph.D. dissertation. Most students will have already begun their dissertation research, but the proposal should focus on what the student intends to accomplish for her/his doctoral thesis. Progress made by the time of the comprehensive exam can be described as preliminary results.

The general format of the candidacy proposal should follow the structure required by the National Science Foundation and is described in the NSF's Grant Proposal Guide (Section II.C.2.d): http://www.nsf.gov/publications/pub_summ.jsp?ods_key=gpg. Specifically, the proposal should...

“...provide a clear statement of the work to be undertaken and must include: motivation and objectives for the proposed work, expected significance, and relation to the present state of knowledge in the field. The proposal should outline the general plan of work, including the broad design of activities to be undertaken, and, where appropriate, provide a clear description of experimental methods and procedures.”

Each candidate (in consultation with her/his advisor) is free to decide how the proposal is organized (i.e. Introduction, Techniques, Methods Development, Prior Results, Plan of Work, etc.) but the proposal is subject to several restrictions:

- The written proposal must not exceed 20 pages, double-spaced with 1” margins, including figures *but not* including references and appendices. Text font size should be either Times/Times New Roman 12 point or Arial/Courier/Palatino/Helvetica 11 point.
- References should include all necessary citation information (journal, volume, year, starting and ending page number) *and* title. Citing a reference indicates that the candidate understands why the cited work is relevant to the material being presented in the proposal.
- Material suitable for appendices can include a) characterization of molecules synthesized prior to the candidacy exam (e.g. NMR, IR, Mass spec data); b) software or other code written for computational analysis; c) technical drawings such as those used for machining instrumentation or designing electrical circuits; d) experimental conditions for previously performed studies (including experiments that led to data being presented in the body of the proposal).

Questions about format, organization, and/or content should be discussed with one’s research advisor and/or one’s committee.

Students are strongly encouraged to schedule their Comprehensive Exam before the end of their fourth semester but must be scheduled before the start of a student’s fifth semester.

The written proposal must be distributed to the examining committee at least two weeks prior to the oral defense. Members of the committee will then review the proposal and, when appropriate, provide feedback and/or request that additional content be included in the proposal. Approval of the written proposal is not required prior to the oral examination, but questions that arise during the oral examination may lead to the student being asked to revise the written proposal to address issues that are deemed relevant to the planned research.

3.5.2 Comprehensive Exam – Oral Defense. The oral defense of a student’s proposed Ph.D. research is the second part of the Comprehensive Exam. For the oral defense, a student should prepare a ~30 min presentation intended to inform the committee about the proposed research. The presentation can include preliminary data and a review of relevant literature. Committee members may ask questions

during or after the presentation with the intent of determining whether or not the student has the skills necessary to execute the proposed research plan.

The oral defense and subsequent period for questions is closed to everyone except the student and her/his committee.

3.5.3. Comprehensive Exam Outcomes. Each element of the Comprehensive Exam is assessed as either a pass, fail, or conditional pass. A 'pass' signifies that a student's proposed research has been evaluated as advancing the field in innovative ways and is likely to lead to an acceptable Ph.D. dissertation. Furthermore, a 'pass' also confirms that the student has the skills and knowledge necessary to carry out the proposed research.

A 'conditional pass' is awarded if a student appears generally well prepared to execute the research described in the proposal but has one or more limitations in either skill or foundational knowledge that might prove difficult to overcome as the student begins her/his research project. These limitations might be in the written proposal (e.g. failure to articulate testable hypotheses or identify knowledge gaps) or in the oral defense if a student should prove unable to answer fundamental questions pertaining to principles relevant for the proposed dissertation research. In the event that a student receives a conditional pass, committee members will identify clearly the source of their concerns *and* the requirements that must be satisfied in order for the conditional pass to be converted into a full pass.

A student will receive a failing mark on the Comprehensive Exam if the proposal fails to meet the criteria described above or if the student fails to show sufficient mastery of the discipline during the oral defense. In the event that the student receives a failing mark, the Department follows Graduate School policy that states:

"The student is allowed two (2) total attempts to pass the Comprehensive Examination. At least six (6) months must elapse before the second (2nd) attempt at the examination. Failure to pass the second (2nd) attempt results in termination of graduate study and dismissal from the academic program. Students who are dismissed from the program due to a second (2nd) failed attempt are ineligible to reapply to the same degree program."

(http://www.montana.edu/gradschool/policy/degreq_doctoral.html)

3.6 Departmental seminar

All students are required to present their research in the format of a department seminar, preferably during their third year of graduate school but no later than at the end of their 8th semester of graduate school. The student is required to convene with their committee members directly after the seminar for a meeting to discuss any research questions/issues and a plan for writing and defending their dissertation. A form, signed by students and committee chair is filed to the program director, found at <http://www.chemistry.montana.edu/graduate/advanced-degree-req.html> (under the Year 4 heading).

3.7 Annual committee meetings

Annual committee meetings are a requirement by the Graduate School for the student to remain in good standing.

The following meetings for a PhD student in the program are required:

- 3rd semester - pre-comprehensive exam meeting. A first meeting where the student becomes acquainted with their committee members and introduces her/his research topic. This meeting is informal with no grade requirement. This meeting may serve as an opportunity for committee members to share their expectations for a successful Ph.D. graduate career and the committee as a whole may assist the student with understanding Graduate School and Department degree requirements.
- 4th semester – Comprehensive Exam, Pass/Fail grades are distributed for both oral and written components. Documentation of the grades are submitted to the Graduate School.
- 6th -8th semesters in the program. After the department seminar meeting – This meeting takes place directly after the student’s department seminar. At this meeting, the student and the committee may discuss research directions and any anticipated challenges. Also, the student and committee should discuss a plan of action for scheduling a defense by the 10th semester.
- 10th semester and beyond. If no dissertation defense is scheduled before the start of the 11th semester, students must meet annually with their committee until the defense is scheduled.

3.8 Dissertation and defense

Writing and defending the dissertation is the last major requirement for receiving a Ph.D. The student is required to submit the dissertation to their committee members two weeks prior to the date of the defense. The first part of the Ph.D. defense is a public seminar (~1 hr) and the second part is a closed oral defense of the dissertation with the student’s PhD committee. The defense and the dissertation are graded with pass/fail.

The written dissertation represents the culmination of a student’s scholarly activities. The dissertation itself can be prepared in one of two forms: 1) standard option or 2) manuscript option. Guidelines can be found on the MSU Graduate School electronic theses and dissertations website:

<http://www.montana.edu/wwwetd/>

The dissertation is a professional scientific document. Research presented in the dissertation should be new, innovative, and advance knowledge in the student’s field of study. The dissertation’s content should meet the standard for publication in the peer reviewed literature. While expectations will differ between research groups, a student should plan to have authored one or more first author manuscripts accepted for publication prior to defending her/his dissertation. Specific expectations regarding authoring manuscripts should be communicated

clearly and consistently by the research advisor to the student during the student's graduate tenure.

Students are responsible to complete (1) a dissertation points document prior to the defense. The document is to be returned to the graduate program director 2 days prior to the defense date. Examples of the dissertation points are found at <http://www.chemistry.montana.edu/graduate/Dissertationpts.html>

Students are also responsible for the completion of (2) a EDT form at http://www.montana.edu/gradschool/documents/forms/etd_certificate_approval_form.pdf and (3) the Survey of Earned Doctorate found at <https://sed-ncses.org/GradDateRouter.aspx>

3.9 Division specific requirements

Students whose research has a strong organic focus may be required to take organic cumulative exams. The cumulative exam requirement is intended as a vehicle for assessing a depth of understanding regarding fundamental and advanced concepts in all areas of organic chemistry (with emphasis on mechanistic, synthetic and physical concepts). Students who are expected to take cumulative exams will have this requirement noted on their program of study.

The decision of whether or not a student will be required to take cumulative exams is at the discretion of their Ph.D. advisor. This requirement will be articulated to the student clearly when the student joins their research group.

Cumulative exams are offered three times during the semester and students can begin taking cumulative exams as soon as they start their first semester. Each cumulative exam is typically a collaborative effort of two organic faculty. Cumulative exams are evaluated with either a full pass, $\frac{1}{2}$ pass, or no pass. A student must earn a total of 4 passing marks. (Two $\frac{1}{2}$ pass marks count for one full pass.) Fulfilling this requirement will result in 2 credits of CHMY591 – 1 credit for passing the first two exams and 1 credit for passing the remaining exams.

A student must pass (at least) 2 cumulative exams before she/he can schedule a comprehensive exam and the cumulative exam requirement must be fulfilled before the student starts their 7th semester.

4.0 Summary: Proposed timeline of expectations for Ph.D. degree completion

Orientation

mid-August

- Meeting with Program Committee Chair – review of PhD requirements.
- Qualifying exams
- Research talks presented by faculty
- Advising/Registering
- TA training

Year 1

First semester

- Two classes
- Teaching assistant responsibilities
- Attend Faculty Research Reviews
- Rotations
- Choosing a research group
- Qualifying exams if necessary

Second semester

- Two classes
- Teaching assistant responsibilities
- Start research
- Qualifying exams if necessary
- Choosing a research group if necessary

Year 2

First semester

- 1-2 classes
- 1st year review with committee - 30 min presentation and discussion of 1st year research. This meeting is informal with no written document required.
- Cumulative Exams for organic students

Second semester

- Finish course requirements
- Cumulative Exams for organic students (must pass 2 by the end of the 4th semester)
- Research
- Comprehensive Exam written proposal & oral defense

Year 3

- Cumulative exams for organic students (must pass 4 by the end of the 6th semester)
- Research
- Departmental seminar (meet with committee after presentation)

Year 4

- Research
- Departmental seminar if necessary (meet with committee after presentation)
- Committee meeting - discuss a time line for finishing up and provide a summary of publication activity. If a student at the end of Year 4 cannot say with confidence that a dissertation will be ready to defend by the end of Year 5, then the student (and advisor) must present a plan outlining what needs to be done for a research project to become dissertation ready.

Year 5

- Research
- Dissertation and Defense
- Committee Meeting- if the student is not ready to write and defend a dissertation by the end of Year 5, the student must have a committee meeting. The meeting will consist of a 30-minute presentation on their progress, a discussion on their time line for finishing up, and a summary of publication activity. If a student at the end of Year 5 cannot say with confidence that a dissertation will be ready to defend by the end of Year 6, then the student (and advisor) must present a plan outlining what needs to be done for a research project to become dissertation ready.