DEPARTMENT OF CHEMISTRY
UNIVERSITY OF COLORADO BOULDER
Departmental Rules for Advanced Degrees

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[1] These rules apply to students entering the department in the fall semester, 2022, or later.

I. General Requirements

The major goals of graduate study in chemistry are to master known principles and techniques, and to produce new fundamental knowledge through research. The rules contained in this document are designed to guide the graduate student to successful achievement of these goals.

The department expects that incoming students have gained a mastery of undergraduate chemistry before entering the graduate program. For chemistry doctoral (Ph.D.) or master's (M.S.) degrees, two semesters of undergraduate organic chemistry, at least one semester of physical chemistry, and at least two semesters (total) from the areas of analytical chemistry, biochemistry and/or inorganic chemistry are required. If incoming students have not fulfilled these requirements upon admission to the graduate program, they are expected to demonstrate proficiency in these areas by completing appropriate coursework within the first two semesters of graduate study, as determined by the divisional graduate advisor.

It should be noted that these graduate programs are a full-time endeavor, and students that are supported on a graduate research assistantship or teaching assistantship are not allowed to work at outside jobs other than tutoring. If a student is interested in tutoring, they should first inform their research advisor.

Progress through our graduate program is monitored by the faculty to assure completion of various requirements that are important indicators of Ph.D. or M.S. degree level performance. Specific formal requirements are presented in Section III for the Ph.D. degree program and in Section IV for the M.S. degree program. These formal requirements for advanced degrees include satisfactory performance both on examinations and in courses, in writing an original research proposal, and in conducting original fundamental research culminating in the candidate's Ph.D. thesis.

In addition, the following general requirements must be fulfilled for a student to remain in good standing:

1) A grade point average of at least 3.0 (B) in all formal coursework, and an overall grade point average of at least 3.0 in all coursework undertaken.
2) A mutual agreement between a research advisor and a student ideally needs to occur by the end of the first semester and no later than the end of the student's second semester. Thereafter, progress in research as specified by the research advisor is required.

Students who do not meet the requirements for admission as regular degree students may be recommended for provisional degree status. With the concurrence of the dean of the graduate school, these students are admitted for a probationary term of either one or two semesters of full-time study or the equivalent for part-time students. At the end of the specified probationary

period, provisional degree students must be either admitted to regular degree status or dismissed from the graduate program to which they were provisionally admitted. Provisional students are subject to the same standards of performance that are required of regular degree students.

The Department of Chemistry assigns each student a temporary advisor from the graduate scholastic committee upon entry, normally the graduate advisor in the student's division (Physical; Organic; Analytical, Environmental & Atmospheric; or Materials & Nanoscience). A student can change their temporary advisor to another member of the graduate scholastic committee by notifying their assigned temporary advisor, the graduate program manager, and their new temporary advisor of this selection.

Students should begin meeting with potential research advisors as soon as possible after entering the Ph.D. or M.S. programs. Each division has its own guidelines for first-year graduate students to officially join research groups. Students should consult with their Divisional Graduate Advisor and follow the corresponding guidelines. Research advisors must be members of the Department of Chemistry tenured/tenure-track, adjoint, or research faculty, or hold a current appointment by courtesy in the Department of Chemistry. Students may pursue thesis research under the direction of a researcher outside of the Department of Chemistry, but must also find a Department of Chemistry faculty member willing to act as research advisor (a faculty sponsor). Finding a Department of Chemistry advisor is the responsibility of the student wishing to work with faculty outside the department. It is recommended that meetings between the faculty sponsor, student and research advisor be frequent, perhaps in the form of a group meeting. The student may change their research advisor upon the advice and written consent of the director of graduate studies, and the agreement of a faculty member to become the new research advisor. Identifying a new research advisor is primarily the responsibility of the graduate student, who can also seek aid from the divisional graduate advisor.

The Department of Chemistry also has the following expectations of its graduate students:

1) Course requirements should be completed and research should be initiated as soon as possible.
2) The department sponsors seminars dealing with research in all areas of chemistry. Graduate students should attend seminars in their sub-discipline, and are encouraged to attend seminars in other areas. Such exposure to other areas of chemistry will broaden the student's knowledge of the field.
3) Students must meet the requirements of the Graduate School and make steady progress towards the M.S. or Ph.D. degree. Students should consult the graduate program manager for clarification of these rules or their status. Other academic matters are resolved by the graduate scholastic committee.

II. Interdisciplinary Programs

Some students may pursue certain approved interdisciplinary programs and degrees (https://www.colorado.edu/chemistry/research/interdisciplinary-programs). This can result in conferral of a certificate along with the Ph.D. degree in chemistry. For some programs, required coursework, the timing for selection of research advisors and/or oral examinations, and the composition of the thesis committee may be altered to conform to the guidelines of these programs, as approved by the department.

III. The Chemistry Ph.D. Degree Program

A. Preliminary Evaluation, Language, and Examination Requirements

Each Ph.D. student is required to satisfy a preliminary evaluation and pass a comprehensive examination to be advanced to candidacy. The candidate must then write an original Ph.D. thesis, pass a final thesis defense examination, and submit the approved Ph.D. thesis to the Graduate School to be awarded the Ph.D. degree.

1. Preliminary Evaluation

The department conducts a preliminary evaluation to determine for itself that students who wish to study for the Ph.D. degree are qualified. The evaluation is described below, and will be completed by the end of the second semester of study.

Upon beginning the chemistry Ph.D. program, students meet with the divisional graduate advisor to evaluate their qualifications and discuss appropriate first semester courses for satisfying the preliminary evaluation. All students are expected to demonstrate their qualifications through undergraduate preparation in three of the following four areas: analytical chemistry, organic chemistry, inorganic/materials chemistry, and physical chemistry. After meeting with the student, the divisional graduate advisor makes and records recommendations about suitable courses for the first semester of graduate study. These recommendations are advisory, but guaranteed to constitute an approved program of courses.

A mutual agreement between a research advisor and a student ideally needs to occur by the end of the first semester and no later than the end of the student's second semester. This advisor must be a member of the Department of Chemistry tenured/tenure-track, adjoint, or research faculty, or hold a current appointment by courtesy in the Department of Chemistry. Students may pursue thesis research under the direction of a researcher outside of the Department of Chemistry, but then must also find a faculty sponsor: a Department of Chemistry faculty member willing to act

as research advisor. Neither student nor faculty member can commit to thesis advising before the 11th week of graduate study.

Before the beginning of the second semester, the divisional graduate advisor will determine whether students assigned to them have passed the preliminary evaluation. The evaluation will be based on each student's undergraduate preparation (including recommended remedial coursework), performance in graduate coursework, seminar participation, teaching effectiveness, and acceptance into a research group. At the conclusion of this deliberation, one of four recommendations will be made:

1) The student has satisfied the preliminary evaluation requirements.

2) Remedial work is recommended for this student.

3) Remedial work is recommended, and the student is not encouraged to continue graduate study.

4) Students who have not maintained a GPA of at least 3.0 in formal graduate courses in chemistry will be notified that they are on departmental probation and at risk of failing the preliminary evaluation.

For any student who has satisfied the preliminary evaluation requirements, the research advisor or divisional graduate advisor (if the student does not have a research advisor) shall meet with the student and make and record recommendations about an approved program of courses for the second semester of graduate study. This approved program of formal courses may be directed towards satisfying the requirements for closely related programs, such as the Chemical Physics Ph.D. Program. This program exists to allow greater flexibility in a student's choice of curriculum and advisor, facilitating the development of the specialized background required to conduct research at the intersection of chemistry and physics. Since it is separate from the Ph.D. programs in the chemistry and physics, students are advised to speak with the current chemical physics graduate advisor in their parent department about admission to the program. Guidelines and requirements for the Chemical Physics Ph.D. Program can be found in the "Handbook" section on the chemistry graduate homepage.

For any student whose evaluation falls into categories 2–4 the recommendation is only advisory, but the student will be re-evaluated at the end of the second semester of graduate study. If normal progress is being made at that time, then the student will be certified as having fulfilled the preliminary evaluation requirements.

At the end of the second semester, students who have not maintained a GPA of at least 3.0 in an approved program of formal graduate courses are considered to not be making adequate progress and will ordinarily be deemed to have failed the

preliminary evaluation. And in the rare circumstance where a student has not found a research advisor for a Ph.D. thesis project, they must consult with the divisional graduate advisor and seek to find a research advisor for a M.S. thesis project (before possibly continuing to the Ph.D.), or make plans to complete a coursework M.S. degree.

It is the responsibility of the divisional graduate advisor to inform the student and the graduate program manager of the outcome of their deliberations.

2. Language Requirements

a. Foreign Language Requirement

The department does not require proficiency in a foreign language for the Ph.D. degree.

b. English Language Proficiency

The Graduate School rules state that "a student who is noticeably deficient in the written and/or oral use of the English language cannot obtain an advanced degree from CU-Boulder." The department evaluates the English language proficiency of each Ph.D. student prior to the first semester.

Evaluation of the English language proficiency of M.S. students (Thesis M.S. and Coursework M.S.), and recommendations for any remedial work, are the responsibility of the research advisor; certification of proficiency is part of the M.S. thesis final examination (Plan I) or thesis report approval (Coursework M.S.).

3. Comprehensive Examination

The comprehensive examination is made up of three parts: a thesis research proposition, an oral examination, and evaluation of a research proposal. The oral examination and the research proposition evaluation shall be conducted by a five-member examining board, according to the rules of the Graduate School. One member of this board shall be the student's research advisor, and one member shall be from outside the primary field of study of the student. The membership of this board shall be selected by the director of graduate studies, in consultation with other faculty members as necessary. The comprehensive examination is considered passed when the requirements of all three parts have been met. Students must be registered during the semester that the comprehensive examination is considered passed.

a. Research Proposition

At least one week before the oral examination date, students will provide a short thesis research proposition (approximately 5 pages) of their thesis research plan to

each committee member. This overview will outline clearly the direction of the student's thesis, will provide the committee with some advance idea of the thesis research area, and will describe promising research results (if any). The proposition should be both forward looking (work to be done) as well as summarizing work they have done. The amount of each will vary student to student. The proposition may be focused on an initial project that develops into a more complex project representative of the full scope of the Ph.D. The project could also be an initial project that helps them develop skills and their Ph.D. might have a different focus. Students might be asked at the time of the exam to describe and defend alternate experimental approaches to their research goals.

b. Oral Examination

Students must take the oral examination no later than the end of the fourth semester (summer semesters not counted). M.S. degree students in this department who wish to continue for a Ph.D. degree must take the oral examination no later than the end of the fifth semester even if they have not completed the M.S. degree. Students are responsible for arranging the examination date with their committee and should notify the graduate program manager at least two weeks prior to the scheduled date.

This examination will include questioning on (a) the student's research, and (b) general topics. Students are expected to demonstrate a clear understanding of their thesis research, an awareness of relevant literature, fundamental knowledge in chemistry, and show the ability to think creatively. Students are strongly advised to spend time reviewing material from chemistry courses they have taken as undergraduates and graduates, since this material is often the subject of questioning during the examination.

The oral examination committee consists of three of the five faculty members appointed to the examining board selected by the director of graduate studies. The student's research advisor, while a member of the examining board, should not be a member of this committee. The decision of this committee shall be determined by a simple majority of the members. The committee shall determine whether the student is capable of (a) Ph.D. degree work, (b) M.S. degree work, or (c) no advanced degree work. The committee may require that the student meet additional requirements in order to pass the exam. In most cases these would include one or more of the following: (a) repeat the examination, (b) provide written answers to questions or more detailed explanations on topics that the committee feels the student did not adequately address during the exam, or (c) take or audit additional courses. The committee may instead require that the student complete a thesis M.S. degree before continuing on to the Ph.D.; in this case the committee will decide if it is necessary for the student to repeat the oral comprehensive examination at some time during the

completion of the M.S. degree research. The committee may also require that a student complete a M.S. degree (thesis or coursework M.S.), and then leave the graduate program. Students who fail the examination have the right to request a second attempt; in this case the student should contact the graduate scholastic committee.

c. Research Proposal

Each student shall submit a research proposal that should be approved by the student's research advisor and the director of graduate studies. There are several ways to satisfy the research proposal. The student should consult with their research advisor to determine the recommended method. The proposal may have been submitted as part of a graduate fellowship application, as a requirement for a graduate course in the department, or as a group meeting activity. In this case, the proposal might have significant overlap with the research proposition. If not met by this means, then the requirement can be met by submitting a proposal whose topic is either related to that of the research proposition, but which addresses different questions, methods, or systems, or lies in an unrelated area. It is strongly encouraged that this requirement be met by submitting a fully developed research proposal to an outside agency (e.g., a predoctoral fellowship application) or by developing an original independent proposal on a topic that is unrelated to the topic of the research proposition. The research proposal must be submitted at the end of the 5^{th} semester of enrollment (typically fall semester of the third year). Students who do not meet this deadline will be in violation of the standards for adequate progress as defined by Graduate School rules. Students wishing to return to good standing may file an Academic Recovery Plan with the approval of their research advisor and the department's Director of Graduate Studies. If approved, the plan will allow for an extension to the end of the 6^{th} semester of enrollment.

Upon satisfactory completion of all three comprehensive examination requirements, the five members of the examination board shall recommend the student for advancement to candidacy for the Ph.D. degree.

4. Final Examination

This examination is primarily a defense of the candidate's thesis. The examining committee consists of the student's research advisor, as chair, and four other faculty members, at least one of whom is from outside of the department. These committee members are selected by the research advisor after consultation with the student. The student must arrange for one of these other committee members to be the "second reader" of the thesis. The second reader will carefully review the thesis with the candidate. The student is responsible for arranging the date of the examination and

notifying the graduate program manager at least two weeks prior to the date, and is responsible for distributing copies of the dissertation to the committee members, after it has been approved by the research advisor, at least two weeks before the examination. Failure to meet this latter deadline is a legitimate reason for any thesis committee member to postpone the examination. Students must be registered for 5 dissertation hours during the semester that the final examination is passed.

B. Course Requirements

1. General Requirements

1) Sixty credit hours of courses are required consisting of 30 hours of research (dissertation hours) in CHEM 8991, plus 30 hours of graduate level courses. The 30 hours must include at least 15 hours in formal courses (see section 2 below) plus additional graduate level courses (such as summer courses, seminar courses, group meeting courses, and research in CHEM 6901) to make a total of 30 hours in graduate level coursework.

2) A minimum grade of B– is required in all courses counting for the Ph.D. degree; students should also be aware that they must maintain a cumulative grade point average of 3.0 in all formal courses and an overall grade point average of 3.0, or they will be placed on academic probation. Students may also be placed on probation if they are not making satisfactory progress in their research. Probationary status must be removed within two semesters or a student will become ineligible to receive a Ph.D. degree from the Department of Chemistry. Students on probation will not have a high priority for financial support.

3) A degree plan of courses taken and yet to be taken must be filed with the Graduate School after the comprehensive examination has been passed. (see Section III. C.)

2. Selection of Formal Courses

All students will be required to take a minimum of 15 credit hours of formal courses. Formal courses are defined by the department as regularly scheduled, examined, and graded graduate courses in CHEM or related disciplines; courses such as summer courses, seminar courses, group meeting courses, and research in CHEM 6901 are not considered formal courses. One course outside the department at the 4000 level and above (but not a 4000 level course within the department) may be used for 3 credit hours of this requirement only if written approval is obtained from the director of graduate studies, and if they were not used for any other college degree. At least 12 of the 15 credits must be at the 5000 level or above and the coursework plan must be approved by the student's research advisor and the director of graduate studies. If a 4000-level course is used to fulfill the department's formal course requirements, it

does not count towards the required 30 credit hours of graduate level coursework. Each student's program plan for coursework must be approved by the student's research advisor and the director of graduate studies. These formal courses must be approved prior to the end of the second semester and students are encouraged to complete formal course requirements within their first three semesters. The department recommends that students complete 18 credits their first year and 12 their second, though this is not required. Once students have joined a research group, they should plan to take 3 credits of CHEM 6901 in the second semester their first year, then 6 credits of 6901 in the fall and spring semesters their second year. This will guarantee they reach the 15 non-formal credit requirements.

3. **Transfer of Credit**

Up to 10 credit hours of graduate level, formal coursework may be transferred from another school subject to demonstrate proficiency in the subject(s) and written approval by the director of graduate studies. Forms for this purpose can be obtained from the graduate program manager.

4. **Minimum Registration Requirements for Full-Time Status**

Students supported by a graduate research assistantship or teaching assistantship must maintain full-time status by meeting one of the following minimum registration requirements.

Prior to passing the comprehensive exam:

1) a minimum of 5 credits (pass/fail or for a grade) of graduate level coursework

2) 8 credits of combined undergraduate and graduate course work or 12 credits of undergraduate level course work

3) at least 1 doctoral dissertation credit

After passing the comprehensive exam:

1) a minimum of 5 dissertation hours.

There is no registration requirement over the summer.

C. Formal Application of Admission for Candidacy for the Ph.D. Degree

Once a student has passed the comprehensive examination, they must make a formal application for admission to candidacy for the Ph.D. degree using the form on the Graduate School website. This Graduate School requirement should be fulfilled even though students have not completed all their formal coursework. After filling in the form, it will follow a workflow process for review and approval.

Once a student has advanced to candidacy, they will also receive an increase in their salary, if they are being paid as a research assistant.

D. Research Requirements

The results of a completed research program are submitted as a thesis for the final examination described above.

E. Time Limit

Students should note the time limit specified in the Graduate School rules: “All doctoral students are expected to complete all degree requirements within six years from the date of the start of course work in the program”. Information on extension of the time limit can be found in the university catalog. The graduate school requires a petition with written recommendations to continue Ph.D. studies past year six (and annually thereafter). Before endorsing such a petition, the department will normally require an evaluation of the student’s research progress and plans from the research advisor.

F. Guidance and Thesis Committee Meetings

All graduate students will have guidance and thesis committees. A guidance committee, which will not include the research advisor, will be assigned to each student at the end of the first academic year. Its sole purpose is to provide additional mentoring for the student throughout their degree program, and thus will not involve an evaluation of student progress. At guidance committee meetings students will provide a summary of their research activities and will be given the opportunity to discuss topics such as programmatic issues, future plans, personal concerns; and to speak in confidence with their committee in the absence of their research advisor. Committee meetings will be annual events, which are recommended to be scheduled at the beginning or end of the academic year. They can also be part of a divisional seminar series where the student presents their research, after which the committee meets with the student. Students can also arrange additional meetings at other times of the year as they deem necessary. Approximately 6 months prior to a student’s planned defense, they should also form and meet with their thesis committee. At this meeting they will present an outline of the thesis, with the anticipated chapters, topics, and scope of research, and the committee will provide comments on the plan.

IV. The Master's Degree in Chemistry

In almost all cases, the Department of Chemistry only admits incoming students to the Ph.D. program. If, however, at some point a student decides to leave this program, they can apply to an M.S. program.

A. Type of Program

There are two methods of obtaining a M.S. degree: thesis (Thesis M.S. – Plan I) and coursework (Coursework M.S. - Plan II). A candidate for a M.S. degree may be allowed to select the Coursework M.S. track only on the recommendation of the director of graduate studies.

1. Thesis M.S. (Plan I)

1) Thirty credit hours of courses are required which are divided between formal coursework and research. Fifteen credit hours of formal coursework are required. One course outside the department at the 4000 level and above (but not a 4000-level course within the department) may be used to partially fulfill this requirement only if written approval is obtained from the director of graduate studies, and if they were not used for any other college degree. At least 12 of the 15 credits must be at the 5000 level or above and the coursework plan must be approved by the student's research advisor and the director of graduate studies. The remaining 15 graduate level credit hours should be in research, including 4 or 6 credit hours in CHEM 6951 (thesis hours), and the remainder in CHEM 6901, group meeting, divisional seminars, and special topic summer courses. Up to 8 credit hours may be transferred from another school subject to demonstrated proficiency in the subject(s) and written approval by the director of graduate studies.

2) Completion of a research investigation and the presentation of a thesis defense is required. The examining committee consists of the student's research advisor, as chair, and two other faculty members. These committee members are selected by the research advisor upon request and after consultation with the student. The student must arrange for one of these other committee members to be the "second reader" of the thesis. The second reader will carefully review the thesis with the candidate. The student is responsible for arranging the date of the examination and notifying the graduate program manager at least two weeks prior to the date, and is responsible for distributing copies of the dissertation to the committee members after it has been approved by the research advisor and at least two weeks before the examination. Failure to meet this latter deadline is a legitimate reason for any thesis committee member to postpone the examination.

2. Coursework M.S. (Plan II)

(Requires written permission of the director of graduate studies)

1) Thirty credit hours of courses are required which are divided between formal coursework and research. Twenty-one credit hours of formal coursework are required. One course outside the department at the 4000 level and above (but not

a 4000-level course within the department) may be used to partially fulfill this requirement only if written approval is obtained from the director of graduate studies, and if they were not used for any other college degree. At least 16 of the 21 credits must be at the 5000 level or above and the coursework plan must be approved by the student's research advisor and the director of graduate studies. The remaining 9 graduate level credit hours (research) must be taken in Chem. 6901, spread over at least two semesters or one semester and a summer, and up to 3 credit hours of graduate chemistry seminar, group meeting, or summer special topics courses. Up to 8 credit hours may be transferred from another school subject to demonstrated proficiency in the subject(s) and written approval by the director of graduate studies.

2) A research report is required. The research report is a concise (normally 10 pages; length to be specified by the research advisor) summary of the student's research activities. The report will include a statement of the research goals and significance as well as a description of the research performed and results obtained. The research report must be approved and signed by the research advisor and provided to the graduate program manager to form a part of the student's departmental file.

B. Preliminary Evaluation, Language, and Examination Requirements

Each M.S. degree student must satisfy the preliminary evaluation requirement, and thesis plan students must pass a final examination (thesis M.S.). There is no foreign language requirement.

1. Preliminary Evaluation

Each student will undergo a preliminary evaluation specified by their division (see section II.A.1 and Appendix 1) in the first year of study. The results of the preliminary evaluation may lead to a recommendation that the student complete a M.S. degree (rather than a Ph.D. degree).

2. Foreign Language

The department does not require proficiency in a foreign language for the M.S. degree.

3. Final Examination

Thesis M.S.: This oral examination is essentially a defense of the student's thesis but may include general questions. The examining committee consists of the student's research advisor, as chair, and two other faculty members. These committee members are selected by the research advisor upon request and after consultation with the

student. The student is responsible for arranging the date of the examination and notifying the graduate program manager at least two weeks prior to the date, and is responsible for distributing copies of the research report to the committee members, after it has been approved by the research advisor, at least two weeks before the examination. Failure to meet this latter deadline is a legitimate reason for any examining committee member to postpone the examination. Students must be registered during the semester that the final examination is considered passed.

Coursework M.S.: A final examination is not required.

C. Research Requirements

Thesis M.S. Students should select a research advisor and start research in their first year. The results of a completed research program are submitted as a thesis for final examination.

Coursework M.S. A student should select a research advisor and preferably start research in the first year. Results of the research are submitted as a research report. The format of the research report is given in part IV.A.2.b

D. Application for Admission to Candidacy

The Application for Admission to Candidacy for the M.S. degree should be submitted to the Graduate School by the posted deadline in order to graduate in any given semester. The student should note that a request for approval of any transfer of credits by the director of graduate studies must be done one semester, and at least 60 days, in advance of the submission of the Application for Candidacy.

E. Students Who Wish to Continue for Ph.D. Degree

Only students who are pursuing a thesis M.S. degree and have satisfied the preliminary examination requirement of their division may request admission to the chemistry Ph.D. program. If a student wishes to enter/re-enter a Ph.D. program after completion of the thesis M.S., they should make this request in writing to the graduate scholastic committee. If a positive recommendation is received, the director of graduate studies will constitute a Ph.D. oral comprehensive examination committee, and the student should arrange this examination as soon as possible.

1. Examination Requirements

The requirements for the preliminary, foreign language, and comprehensive examinations are described in section III.A.

2. Course Requirements.

Upon written approval of the research advisor and the director of graduate studies (for chemistry Ph.D. degree) a student pursuing a M.S. degree who wishes to continue for a Ph.D. degree may apply the credit hours taken for the M.S. degree towards the Ph.D. degree requirement, including one 4000 level course from outside the department but not research in CHEM 6951.

F. Time Limit

As specified by the Graduate School, all work, including the final examination and the filing of the thesis (thesis M.S.) must be completed within four years. Information on extension of the time limit can be found in the university catalog.