

DEPARTMENT OF CHEMISTRY
UNIVERSITY OF COLORADO BOULDER

Departmental Rules for Advanced Degrees¹
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¹These rules apply to students entering the Department in the Fall semester, 2018, 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 Ph.D. or 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 within the first two semesters of graduate study. It should be noted that these graduate programs are a full time endeavor and students are not allowed to work at outside jobs.

The passage 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. level performance. Specific formal requirements are presented in Section III for the Ph.D. degree program and in Section IV for the Master'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) Choice of a research advisor no later than the end of the student's 2nd semester in the chemistry graduate program. Thereafter, progress in research as specified by the research advisor is required.

Faculty Sponsor. In certain instances, students may desire to complete a majority of their research for an advanced degree under the direction of a research advisor who is not a faculty member in the Department. This is possible if the proposed research advisor is a member of the graduate faculty of the University. In this case, the student must also select a faculty member in the Department who is willing to serve as her/his faculty sponsor. The faculty sponsor will help the student to gauge normal progress towards the advanced degree and will represent the student's interests in Departmental matters. It is the student's responsibility to arrange for a faculty sponsor and to inform the Graduate Scholastic Committee in writing of these arrangements. Students working outside the Department, like all students, must demonstrate adequate progress towards the advanced degree, and should plan to meet each year with the faculty sponsor to discuss research progress (more frequent meetings are desirable).

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 Chemistry Department assigns each student an initial advisor from the Graduate Scholastic Committee upon entry. A student can change their initial advisor to another member of the Graduate Scholastic Committee by notifying their assigned initial advisor, the Graduate Administrator, and their new initial advisor of this selection. Students should normally begin meeting with mutually interested faculty research advisors as soon as possible after entry and then select a faculty research advisor between the 11th week of classes and the end of their first semester. The student may change their research advisor upon the advice and written notification of the departmental Graduate Advisor.

The Department of Chemistry has additional expectations of its graduate students. Course requirements should be completed and research should be initiated as soon as possible. The Department sponsors seminars dealing with research in all areas of chemistry. Graduate students are expected to attend seminars in their sub-discipline, as well as departmental seminars. Such exposure to all areas of chemistry will broaden the student's knowledge of the field.

Students are also expected to meet the requirements of the Graduate School and to make steady progress towards the M.S. or Ph.D. degree. Students should consult the Graduate Student Advisor of the Department 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, such as the formal Ph.D. degree in Chemical Physics, or interdisciplinary programs in Atmospheric Chemistry, or a Graduate training program: can result in that confers a certificate along with the Ph.D. degree in Chemistry. For some programs, required coursework, the timing for selection of research directors and/or oral examinations, and the composition of the Ph.D. committee may be altered to conform with the guidelines of these programs, as approved by the Department.

III. The Chemistry Ph.D. Program

A. Examination Requirements

Each Ph.D. student is required to satisfy preliminary examinations and pass a series of comprehensive examinations 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 Examinations

The Department administers Preliminary Examinations to determine for itself that students who wish to study for the doctoral degree are qualified. The Preliminary Examination will be completed before the end of the second semester of study.

There is no written examination upon entrance to graduate school. Upon beginning the Chemistry Ph.D. program, students meet with their initial advisor from the Graduate Scholastic Committee to evaluate their qualifications and discuss appropriate

first semester courses for satisfying the Preliminary Examination. 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 initial 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.

Students are expected to find a Chemistry faculty advisor who agrees to advise their thesis research by the end of the first semester. This advisor must be a member of the Chemistry TTT faculty, the Chemistry adjunct faculty, the Chemistry research faculty, or hold a current appointment by courtesy in Chemistry. Students may pursue thesis research under the direction of a researcher outside of Chemistry, but must find a Chemistry faculty member willing to act as thesis advisor. Neither student nor faculty member can commit to thesis advising before the 11th week of graduate study.

A member of the Graduate Scholastic Committee leads each Preliminary Examination. This is usually the student's initial advisor. Before the beginning of the second semester, students may, with the approval of their thesis advisor from the Chemistry faculty, choose a different member of the Graduate Scholastic Committee to lead their Preliminary Examination. If a student who has not yet found a thesis advisor has changed their anticipated area of thesis research, they may make a written request that the member of the Graduate Scholastic Committee most expert in their anticipated research lead their Preliminary Examination. Such requests require the approval of the Graduate Scholastic Committee. The thesis advisor or, if the student does not have a thesis advisor, their advisor from the Graduate Scholastic Committee, 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 Ph.D. in Chemical Physics.

Before the beginning of the second semester, the members of the Graduate Scholastic Committee will each convene and chair a Preliminary Examination sub-committee of not less than three Chemistry faculty members to determine whether students assigned to them have passed the Preliminary Examination. The students are not present at this meeting. This sub-committee shall invite all Chemistry faculty who have taught relevant courses or seminars or accepted a student for thesis work to discuss each student's undergraduate preparation (including recommended remedial coursework), performance in graduate coursework, seminar participation, acceptance into a research group, and teaching effectiveness. This sub-committee may consult with other University of Colorado faculty who have interacted with the student in professional or scholarly capacities. At the conclusion of this deliberation, one of four recommendations will be made:

- i) The student has satisfied the Preliminary Examination requirement.
- ii) Remedial work is recommended for this student.
- iii) Remedial work is recommended, and the student is not encouraged to continue graduate study.
- iv) 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 Examination.

For any student whose evaluation falls into categories B-D, 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 Examination requirement. At the end of the second semester, students who have not found a thesis advisor and maintained a GPA of at least 3.0 in an approved program of formal graduate courses are not making adequate progress and will ordinarily be deemed to have failed the Preliminary Examination.

It is the responsibility of each Preliminary Examination sub-committee chair to inform the student, the Graduate Scholastic Committee, and the Graduate Coordinator of the outcome of their sub-committee's 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 assesses the English language proficiency of each Ph.D. student in the Oral comprehensive examination.

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

3. Comprehensive Examinations

The comprehensive examinations are 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 Graduate Advisor, in consultation with other faculty members as necessary. The comprehensive examinations are considered passed when the requirements of all parts have been met. Students must be registered during the semester that the comprehensive examinations are considered passed.

a. Research Proposition.

At least one week before the oral examination date, students will present 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). Students might be asked at the time of the exam to describe and defend alternate experimental approaches to their research goals.

b. Oral Comprehensive Examination.

Students must take the oral comprehensive examination no later than the end of the fourth semester. Master'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 master's degree.

This examination will include questioning on (i) the student's research, and (ii) general topics. Students are expected to demonstrate a clear understanding of their thesis research and fundamental knowledge in chemistry, and show the ability to think creatively. Students are strongly advised to spend time reviewing material from chemistry and biochemistry 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 Graduate Advisor. The student's research advisor, while a member of the examining board, may 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) Master's degree work, or (c) no advanced degree work. The committee may require that the student repeat the examination, and/or may require the student to take additional courses. The committee may require that the student complete a thesis Master'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 Master's degree research. The committee may also require that a student complete a Master's degree (thesis or coursework M.S.), and then leave the graduate program. As described in the Graduate School rules, students who fail the examination have the right to request a second attempt; in this case the student should contact the Graduate Scholastic Committee. Students are responsible for arranging the examination date with their committee and should notify the Graduate Coordinator two weeks prior to the scheduled date.

c. Research Proposal.

Each student shall submit a research proposal to the two members of the examination board who were not members of the oral examination committee. The proposal may have been submitted as part of a graduate fellowship application, may be written as a part of any graduate course in the Department where written proposals are required, or may be written as a part of a group meeting activity. The proposal must obtain the approval of both the members of the research proposition committee. In the event of a dispute between the two members, the proposal will be referred to the full examination board for a decision.

Upon satisfactory completion of all three 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 thesis advisor, as chair, and four other faculty members, at least one of whom is rostered outside of the Department. These committee members are selected by the Graduate 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 Administrator 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 thesis 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

Sixty credit hours of courses are required consisting of 30 hours of research (dissertation hours) in Chemistry 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 Chemistry 6901) to make a total of 30 hours in graduate level coursework.

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.

A degree plan of courses taken and yet to be taken must be filed with the Graduate School by the end of the student's third semester (see Section II. E.)

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 courses; courses such as summer courses, seminar courses, group meeting courses, and research in Chemistry 6901 are not considered formal courses. Courses outside the Department at the 4000 level and above (but not 4000 level courses within the Department) may be used for 3 credit hours of this requirement only if written approval is obtained from the Graduate Advisor, 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 Departmental Graduate Advisor. (If a 4000 level course is used for the Department's formal course requirement, 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 Departmental Graduate Advisor. 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.

C. Transfer of Credit

Up to 10 credit hours of graduate level, formal coursework may be transferred from another school subject to demonstrated proficiency in the subject(s) and written approval by the Graduate Advisor. Forms for this purpose can be obtained from the Graduate Administrator.

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

All students must make formal application for admission to candidacy for the Ph.D. degree by the end of the third semester on forms that can be obtained from the Graduate Secretary. This Graduate School requirement should be fulfilled even though students have not completed all their formal coursework. After filling in the form, indicating graduate courses taken and to be taken, it should be approved and signed by the student's research advisor and then the Graduate Advisor.

Ph.D. students shall have passed the comprehensive examinations before they may be admitted to candidacy for the Ph.D. degree. Students should note that the approved research proposal must be filed in order for a student to be advanced to candidacy.

E. Research Requirements

The results of a completed research program are submitted as a thesis for the final examination described above. Students may pursue thesis research under the direction of a researcher outside of Chemistry, but must find a Chemistry faculty member willing to act as thesis advisor (faculty sponsor) who is a member of the Chemistry TTT faculty, the Chemistry adjoint faculty, the Chemistry research faculty, or holds a current appointment by courtesy in

Chemistry. It is recommended that meetings between the faculty sponsor, student and research advisor be frequent, perhaps in the form of a group meeting.

F. 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.

IV. The Master's Degree in Chemistry

A. Type of Program

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

Some students may pursue an interdisciplinary M.S. degree in the Optical Sciences and Engineering Program. For these students, required coursework, timing for selection of a research advisor, and the composition of the M.S. committee may be altered to conform with the guidelines of this Program, as approved by the Department.

1. Thesis M.S.

a. Thirty credit hours of courses are required which are divided between formal coursework and research. Fifteen credit hours of formal coursework are required. Courses outside the Department at the 4000 level and above (but not 4000 level courses within the Department) may be used to partially fulfill this requirement only if written approval is obtained from the Graduate Advisor, 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 Departmental Graduate Advisor. 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. Students should note that CHEM 5711 and 5731 can be taken for normal course credit only if the student has not had a similar undergraduate biochemistry course.

Up to 8 credit hours may be transferred from another school subject to demonstrated proficiency in the subject(s) and written approval by the Graduate Advisor.

b. Completion of a research investigation and the presentation of a thesis defense is required. The examining committee consists of the student's thesis advisor, as chair, and two other faculty members. These committee members are selected by the Graduate 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 Secretary 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 thesis 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. (Requires written permission of the Graduate Advisor)

a. Thirty credit hours of courses are required which are divided between formal coursework and research. 21 credit hours of formal coursework are required. Fifteen credit hours of formal coursework are required. Courses outside the Department at the 4000 level and above (but not 4000 level courses within the Department) may be used to partially fulfill this requirement only if written approval is obtained from the Graduate Advisor, 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 Departmental Graduate Advisor. 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 or biochemistry seminar, group meeting, or summer special topics courses. Students should note that CHEM 5711 and 5731 can be taken for normal course credit only if the student has not had a similar undergraduate biochemistry course.

Up to 8 credit hours may be transferred from another school subject to demonstrated proficiency in the subject(s) and written approval by the Graduate Advisor.

b. 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 Administrator to form a part of the student’s departmental file.

B. Examination Requirements

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

1. Preliminary Examination

Each student will take the Preliminary Examination specified by their division (see section II.A.1 and Appendix 1) in the first year of study. The results of the Preliminary Examination may lead to a recommendation that the student complete a Master's degree (rather than a Ph.D.).

2. Foreign Language

The Department does not require proficiency in a foreign language for the Masters degree.

3. Final Examination

The examining committee consists of the student's thesis advisor, as chair, and two other faculty members. These committee members are selected by the Graduate Advisor upon request and after consultation with the student. The student is responsible for arranging the date of the examination and notifying the Graduate Secretary 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.

Thesis M.S.: This oral examination is essentially a defense of the student's thesis but may include general questions.

Coursework M.S.: An oral examination is not required.

C. Research Requirements

1. 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.
2. 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 approval of any transfer of credits by the Graduate Advisor must be done at least 30 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, have satisfied the Preliminary Examination requirement of their division, and have passed more than half of the required cumulative examinations 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., he/she should make this request in writing to the Graduate Scholastic Committee.). If a positive recommendation is received, the Graduate Advisor 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 Graduate Advisor (for Chemistry Ph.D.) a student pursuing a Master's degree who wishes to continue for a Ph.D. degree may apply some or all of the credit hours taken for the Master's degree towards the Ph.D. requirement with the exception of research in Chem. 6951, and all 4000 level coursework.

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.