

GUIDELINES FOR GRADUATE STUDY IN CHEMISTRY

University of Iowa

College of Liberal Arts & Sciences

Department of Chemistry

Approved by departmental faculty vote on 6th Sept 2022.

This edition applies to students entering Fall 2022 and later.

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Instructions for Graduate Student Annual Reviews

Link:<https://chem.uiowa.edu/graduate-menu/for-current-graduate-students/annual-reviews>

Abbreviations:

CV: Curriculum Vitae, an individual's record of academic and work history

DEO: Departmental Executive Officer, appointed by the Dean of the CLAS (College of Liberal Arts and Sciences)

DGS: Director of Graduate Studies (appointed by the DEO)

GAC: Graduate Academic Committee (appointed for each student, by student invitation)

GEC: Graduate Education Committee (departmental committee, appointed by the DEO)

GPA: Grade Point Average

GPC: Graduate Program Coordinator

GSAR: Graduate Student Annual Review

IDP: Individual Development Plan

RPR: Research Progress Report

GUIDELINES FOR GRADUATE STUDY IN CHEMISTRY

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Department of Chemistry

I. Admission to Graduate Study

A. Admissions Process

Admission will be recommended by the department Graduate Recruiting and Admissions Committee after a review of the student's application and supporting evidence.

B. Advisor Selection (Standard Process)

1. A temporary advisor, assigned by the department upon entering the graduate program, will advise the entering graduate student until a research advisor is chosen.
2. Each student must choose a research advisor during the first semester in residence, subject to mutual agreement among the student, advisor, and department. Prior to selecting an advisor, the student is encouraged to meet with faculty members and their research groups as appropriate to the student's research interest. The student must meet a minimum of five faculty members and collect their signatures. The student's selected subdiscipline area does not need to reflect the area of interest stated on the student's application for admission.
3. Each student, except those who have an approved Early Advisor Selection, will complete a series of rotations in research groups during the first semester in residence. These are assigned by the department based upon preferences indicated by the student.
4. Additional details for research advisor selection will be announced before and during the first semester of graduate study.

C. Early Advisor Selection (Optional)

1. Incoming students may communicate with potential faculty research advisors during the admissions process. If a student wishes to choose a faculty research advisor prior to the deadline for accepting the departmental offer of admission (typically April 15 for fall admission), the student will send this request to that faculty member. If the faculty member agrees, they will forward the request along with their endorsement to the Director of Graduate Studies by the aforementioned deadline. If the request is approved, this completes the Advisor Selection process.
2. Otherwise, all incoming students will follow the standard process for choosing a research group (Section I.B) during their first semester in residence.

II. General Requirements for both Ph.D. and M.S. Degrees

The student's advisor and Graduate Academic Committee (GAC) will monitor the coursework and research progress of individual students and make periodic recommendations regarding renewal of teaching assistantships, degree completion deadlines, realistic degree objectives, and other matters.

A. Graduate Student Annual Review

1. Each student will complete a Graduate Student Annual Review (GSAR). Student components of the review are due annually. If desired, either the student or faculty advisor have the option to initiate more frequent reviews.
2. The student submits review documents to the advisor, who provides a response to the student documents and approves the review.
3. For more detailed guidance on preparation and submission of the GSAR, see the Dept of Chemistry website: <https://chem.uiowa.edu/graduate-menu/for-current-graduate-students/annual-reviews>

B. Proficiency Requirement

1. Students must demonstrate basic proficiency in three subdisciplines of chemistry: analytical, biochemistry, inorganic, organic, physical
2. The proficiency requirement must be fulfilled before the beginning of the student's third semester in residence for the student to remain in the graduate program.
3. Proficiency in a sub disciplinary area is established in one of the following ways:
 - i. Scoring at the 50th percentile level (national norm) on the corresponding proficiency exam. Exams in each area will be offered before the beginning of each semester (Fall and Spring), and at the end of the Spring semester. A proficiency exam in a given area may be taken a maximum of three times.
 - ii. Completing a one-semester review course with a grade of C or better.
 - iii. Completing a one-semester advanced course of at least 3 semester hours in that subdiscipline of chemistry with a grade of B or better. A list of advanced courses and the proficiencies they may satisfy is found in Appendix B.
 - iv. Some advanced courses may satisfy the Proficiency Requirement in two subdiscipline areas; the student may choose to count a course toward either of two different subdisciplines, but not both.

- v. Courses that are used to satisfy the Proficiency Requirement cannot also be used to satisfy the Advanced Course requirement (see section III A).
 - 4. A student who completes a proficiency course as an undergraduate at the University of Iowa will not receive proficiency credit unless they were dually enrolled in both graduate and undergraduate programs at the time the course was taken, and the proficiency course was not a requirement for completion of the undergraduate degree. Bachelors degree graduates of the University of Iowa are otherwise expected to fulfill the proficiency requirements (item A above) as would any other incoming graduate student.
- C. Review Courses (to satisfy item B.3.ii above)
- The designated review courses for each subdiscipline are:
- | | | |
|---------------|-----------|--------------------------------------|
| Analytical: | CHEM:4171 | Advanced Analytical Chemistry |
| Biochemistry: | BIOC:3120 | Biochemistry and Molecular Biology I |
| Inorganic: | CHEM:4270 | Advanced Inorganic Chemistry |
| Organic: | CHEM:4372 | Advanced Organic Chemistry |
| Physical: | CHEM:4431 | Physical Chemistry I |
| or | CHEM:4432 | Physical Chemistry II |
- D. Other Information
- 1. Summer sessions are not counted as semesters in establishing the dates for meeting various requirements.
 - 2. Students who are appointed to either a teaching or research assistantship may not enroll in more than twelve semester hours of credit in any semester. It is usually advantageous for students in their first semester to take a full schedule of courses.
 - 3. All new students are required to register for Graduate Chemistry Orientation (CHEM:5091) during the first fall semester. All students must complete Ethics in Chemical Sciences (CHEM:5092) during the first or second year of their graduate program, typically in their second spring semester.

III. Additional Requirements for the Ph.D. Degree

A. Advanced Course Requirement

1. Beyond the proficiency requirements, students must complete a minimum of four additional advanced courses, totaling at least eleven semester hours of graduate credit, by the end of their fourth semester in residence.
2. Research, seminar, and pedagogy credits; courses that are listed with lower division undergraduate level numbers; and courses taken with the S/U grade option cannot be used to fulfill this requirement.
3. Grades of "B" or higher are required to receive credit for advanced courses. A grade of "B–" does not meet this requirement.
4. Students are strongly encouraged to develop a detailed course plan that is reviewed and approved by the research advisor.
5. Graduate credit from other institutions will be given consideration for fulfillment of up to six of the eleven required semester hours of advanced level coursework. Graduate courses completed at other institutions do not need to duplicate courses offered at the University of Iowa in order to receive credit. This section also applies to courses taken at the University of Iowa prior to admission to the PhD program in Chemistry.
 - i. The student must initiate the request by sending an email making the request, along with supporting documentation, to the Director of Graduate Studies.
 - ii. Supporting documentation should include a brief description of the course, a course syllabus or outline, examinations taken by the student, an indication of the textbook used, and a statement of support from the advisor. Requests should not be initiated until a permanent advisor has been assigned and the advisor has agreed that the request is appropriate.
 - iii. The Graduate College must have already accepted the course(s) as graduate transfer credit(s).
 - iv. The Graduate Education Committee (GEC) will consider the basic content of the course, the student's performance in the course, the student's performance on examinations and coursework at the University of Iowa, and the support of the research advisor.
 - v. If approved by the GEC, the research advisor and student can consider the course for inclusion in the course plan.

B. Grade Point Average

1. The Graduate College requires that all students seeking a Ph.D. maintain a 3.00 GPA for work attempted at the University of Iowa. CHEM:7999 Research in Chemistry and CHEM:6990 Research Seminar may not be

taken for a letter grade (S/U only), and are thus not included when calculating the GPA.

2. A grade of C– or higher must be obtained in order to receive graduate credit in a given course, but all grades will be included in calculating the overall grade point average. Grades of C– through B– will not count toward departmental advanced course requirements.
- C. The Graduate Academic Committee (GAC)
1. GAC Composition
 - i. GACs will be composed of four faculty, at least three from Chemistry, who agree to support and advise the student during the course of the Ph.D. and beyond. GAC members will meet the student to discuss research progress and provide feedback and guidance as appropriate.
 - ii. The committee will consist of the research advisor and three additional members who are nominated by the student, subject to the advisor's approval, and assigned by the GEC.
 2. GAC Formation
 - i. The Graduate Program Coordinator, in consultation with the DGS/GEC, will notify students when the GAC Formation Process will start. A deadline will be given by which all students will submit:
 1. A brief CV/resume document (like that used for Annual Graduate Student Reviews)
 2. A <1 page description of their research project, methods, and progress to date.
 3. A list of up to eight faculty nominations for their GAC:
 - a. Students with a single advisor can indicate two high-priority requests for GAC members. Co-advised students can indicate one high-priority request for GAC members.
 - b. A graduate student may nominate up to 2 faculty who are external to the Department of Chemistry. These nominations will count against the total allowed eight nominations.
 - c. The final GAC may have one member external to the department.
 4. The GEC will distribute draft GAC assignments to faculty and students. The draft to students will include names of faculty who may be considered for substitutions, including faculty who are underutilized on GACs relative to departmental averages. The GEC will communicate a deadline for these

requests, which will be on the order of seven days after the draft committee assignments are issued.

5. Students may request changes to their draft GAC composition within the same (seven day) deadline by providing the names of possible replacements to the GEC, from the substitutions list provided by the GEC. Students are not required to provide a rationale for substitution requests.
6. Faculty may decline GAC assignment subject to the (ca. seven day) deadline.
7. The GEC will assign final GAC memberships, and will post the committee lists in an accessible location, viewable to graduate students and faculty (e.g. MS Teams).

D. Comprehensive Examination

The comprehensive examination is a two-part process consisting of a written research report and an oral defense of the report.

The exam is evaluated by the student's GAC. Each member of the GAC will use a departmentally prescribed rubric to score the oral exam, shared in the current form in Appendix C.

The exam typically occurs in a student's fourth semester in residence.

1. Eligibility to Take the Comprehensive Examination

To be eligible to take the Comprehensive Examination, the student must have a cumulative GPA average of 3.00 or greater on appropriate graduate coursework at the University of Iowa. The GAC is responsible for confirming student eligibility.

- i. Appropriate graduate coursework includes review courses (Section II.C.), graded seminar presentations (Section III.E.), courses that satisfy the advanced course requirement (Section III.A.), and additional courses in chemistry or related disciplines that are judged appropriate by the student's GAC.
- ii. Graduate Chemistry Orientation (CHEM:5091), Ethics in Chemical Sciences (CHEM:5092), Research in Chemistry (CHEM:7999) and Research Seminar (CHEM:6990) shall be graded on an S/U basis, and therefore are not included in the computation of the cumulative average.
- iii. A student on academic probation (see Section III.H.2) is not eligible to take the comprehensive exam.

2. Procedures and Schedules for the Comprehensive Examination

- i. The general comprehensive examination requirements set by the Graduate College must be completed by the end of the fourth semester in residence, unless an exception is approved by the DGS. Such exceptions are generally warranted if a student changes research groups. A student who fails to meet this requirement may be dismissed from the Ph.D. program. For information about re-admittance to the Ph.D. program or change to MS program, see Section III.H.2.
- ii. Students must submit an updated C.V. and Research Report (see appendix A) to the GAC. Students may also provide manuscripts or publications. These documents should be provided to the GAC six weeks prior to the last day of classes in the academic semester of the exam. For a spring semester exam, this is defined as the Friday prior to Spring Break.
- iii. The GAC will review the student's Research Report before the oral exam. If the committee approves the Research Report, the oral examination may be scheduled. The committee may request revision of the Research Report. The revision request will be detailed in a letter to the student including a deadline for resubmission. The committee may also reject the Research Report, which constitutes an outcome of "unsatisfactory" (see Section III.D.7).
- iv. After the GAC has agreed to schedule the Comprehensive Examination, the student should promptly contact the Graduate Program Coordinator to complete a "Doctoral Plan of Study Summary Form" and a "Request for Doctoral Comprehensive Examination Form" (see Section VIII). The plan of study will provide a listing of all graduate courses taken that apply toward the degree, courses in progress, and any courses to be completed after the comprehensive examination. Approval of the Plan of Study by the advisor and the DGS is required by the Graduate College. The plan may be amended by the GAC pending the outcome of the comprehensive examination.

3. Description of the Research Report

The Research Report is intended to inform the GAC of the student's research problem and research progress. The report should describe the goals of the research project that the student is working on, their progress to date, and their future plans. Key sections of the Research Report include:

- I. *Title Page*
- II. *Introduction and Background*
- III. *Goals and/or specific Aims*

- IV. *Research Plan, Results, and Discussion*
- V. *Conclusions and Future Work*
- VI. *References*

More detailed guidance on preparation of the Research Report is provided in Appendix A.

4. Scope of the Oral Examination

- i. The Research Report provides the basis for a wide-ranging oral examination designed to assess the student's overall progress, knowledge of fundamental chemical principles and chosen area of specialization, and general competency for Ph.D. research.
- ii. The student will be asked to prepare and present a short (ca. 20 minute) summary of their research project. During or following this presentation, the committee will ask questions designed to probe the student's understanding of the research topic and important background material, the experimental methods and techniques which are important in the particular area, and the goals and significance of the research.

5. Outcomes of the Comprehensive Examination

The outcome of the comprehensive exam will be determined by a vote of GAC members and recorded on the Graduate College form "Report of Doctoral Comprehensive Examination". Each member of the GAC will use a departmentally prescribed rubric to score the oral exam, provided in Appendix C. Possible outcomes of the exam, per the Graduate College Manual of Rules and Regulations, include:

- i. Satisfactory: If the faculty vote is 'satisfactory', the student has successfully completed the exam requirement.
- ii. Reservations: If the faculty vote is 'reservations', the student will receive guidance from the GAC with specific actions to remediate deficiencies, including a deadline for completion and follow up evaluation if necessary. These tasks must be completed successfully before the deadline and before the end of the student's fifth semester in residence.
- iii. Unsatisfactory: If the faculty vote is 'unsatisfactory', the student fails the exam. The Graduate College allows two attempts at the examination. If the first ends in failure, students who wish to stay in the program must repeat the exam between four and six months from the date of the first exam.
- iv. If a GAC member is absent during the comprehensive exam, that member's vote on the outcome is counted as 'unsatisfactory'.
- v. The comprehensive examination must be passed (including satisfying any reservations) before the end of the fifth semester in residence. This

time limit also applies to the second attempt. A student who has not met this deadline will be subject to dismissal from the Ph.D. program.

E. The Graduate Writing Course:

All students are required to successfully complete (as indicated by a grade of “S”) the graduate writing course for developing their independent proposal. Each student must successfully complete this course before scheduling their Research Conference (see section III. F) but not earlier than the semester after successful completion of their comprehensive examination. A requirement of this course is for the student to prepare a research proposal. The student must notify their GAC when they register for this course, as the GAC will participate in the proposal evaluation.

F. Seminar Requirements

Each student is expected to give a minimum of two acceptable seminars. One seminar must cover the student's research. The other may also deal with the student's research or can be an extensive literature report. The student may register for the appropriate divisional seminar course and receive letter grade credit during those semesters in which the seminars are presented. The final Ph.D. defense cannot be used to meet this requirement.

G. The Research Conference

1. At least three months before the anticipated final defense, the student must meet with their GAC for a research conference.
2. The composition of the GAC (see Section III.C.) for the Research Conference is generally the same as that for the Comprehensive Examination.
3. During the research conference, the student will summarize the research work to date, and will outline remaining work to be completed for the dissertation. The intent of the conference is to aid the student in organizing the material that will constitute the dissertation. The conference also enables the GAC members to become better acquainted with the objectives and outcomes of the student's research, and to make suggestions concerning work that needs to be completed before the dissertation is written.
4. If scheduling permits, the research work may be presented as a research seminar during a regularly scheduled divisional seminar program, with a subsequent committee meeting for questions and advice.
5. If the research conference includes a public presentation, then it may be used as one of the required seminars described in section III. E.

H. At least one reprint of a published or accepted paper based on original research with the candidate as the major or an equal contributor, in a peer-reviewed scientific journal, shall be made available to all committee members at the time the defense is being scheduled

I. Final Defense of the Ph.D. Dissertation

1. The GAC for the Research Conference will be the examining committee for the final defense.
2. Students must submit an “Application for Degree” online, and contact the Graduate Program Coordinator to complete the “Request for Final Examination: Advanced Degree” form. These forms must be submitted to the Graduate College in accordance with the deadlines for the session in which the degree is to be granted. The exact time and place of the examination and the title of the thesis must be stated on the request for the examination.
3. The Graduate College will make a public announcement of the final examination three weeks prior to the date of the exam. The examination will consist of a presentation that is open to the public followed by a final examination by the GAC.
4. Copies of the dissertation must be made available to all members of the examining committee not later than two weeks before the date of the examination.

J. Other Graduate College Rules and Procedures

1. Registration and Residence Requirements

- i. A total of 72 semester hours of graduate credit (including transfer credit) are required for the Ph.D. Of those 72 semester hours, at least 39 must be earned while registered in the University of Iowa Graduate College.
- ii. A student is required to register each semester after passing the comprehensive exam until the degree is awarded.

2. Academic Probation

- i. A student shall be placed on probation if, after completing nine semester hours of graded graduate work, their cumulative grade-point average (GPA) falls below 3.00. If, after completion of nine more semester hours of graded graduate work at this University, the student's cumulative grade point average remains below 3.00, the student will be dismissed from the Ph.D. program.
- ii. A student on probation who has not already received an M.S. degree from this Department may apply for M.S. candidacy if their grade point average is above 2.75. A student may only be readmitted to the Ph.D. program if they raise their cumulative grade point average above 3.0 within one semester after dropping to the M.S. track.

IV. Additional Requirements for The M.S. Degree

- A. The proficiency requirements and general guidelines outlined in *Section II, General Requirements for both Ph.D. and M.S. Degrees* apply to the Master of Science (M.S.) program.
- B. A grade point average of at least 2.75 must be maintained in all graduate work to avoid probation and dismissal by Graduate College rules.
- C. The M.S. student's Graduate Academic Committee (GAC) shall consist of the advisor, one additional faculty member in the area of the student's research, and a third member with different expertise. The student's GAC will approve courses required for the M.S. degree. In the case of a thesis-based M.S., the GAC will meet with the student to administer a final thesis examination.
- D. At least 30 semester hours of graduate credit (including transfer credit) are required for the M.S. degree, at least 24 of which must be completed under the auspices of The University of Iowa. Coursework that may be used to complete the M.S. degree includes advanced courses, review courses, pedagogy, seminar, and other courses deemed appropriate by the student's GAC.
- E. Of the required 30 semester hours of graduate work:
 - 1. at least three but no more than four semester hours of Research in Chemistry (CHEM:7999) will be included for the M.S. without thesis
 - 2. not more than nine hours of Research in Chemistry may be included for the M.S. with thesis.
- F. A candidate for the M.S. degree with thesis must present at least one research seminar.
- G. A candidate for the M.S. degree must submit an "Application for Degree" online, and contact the Graduate Program Coordinator to complete the "Application for Change in Plan of Study", "Non-Doctoral Plan of Study Summary Form", and the "Request for Final Examination: Advanced Degree" form. These forms must be filed in accordance with Graduate College deadlines for the session in which the degree is to be granted.

V. Procedure for Dismissal from Degree Programs

- A. If a student is not progressing toward fulfillment of the degree requirements or has not met program requirements, the research advisor (as chair of GAC), or DGS will deliver written notice of dismissal to the student. The letter will identify specific criteria from Sections II, III, or IV of these guidelines that have been violated or not met as appropriate. The letter of dismissal will include a statement outlining the right to appeal.

- B. Any student wishing to appeal dismissal from a degree program may do so by writing to the research advisor and the DGS. The student's GAC will meet within two weeks of receiving the appeal. If the student does not have a GAC, the DGS may appoint an ad-hoc committee of faculty to review the appeal. The student may request a personal appearance before the review committee. The faculty committee will present a recommendation to the DGS who will then inform the student of the decision.

VI. Graduate Teaching Assistant Reappointments and Dismissal

A. Requirements for Reappointment

1. All reappointments to teaching assistantship are dependent upon:
 - i. satisfactory academic standing;
 - ii. progress toward meeting thesis degree objectives;
 - iii. performance as a teaching assistant;
 - iv. availability of teaching assistantship positions.
2. Students who have not met the qualifications for Ph.D. candidacy by the end of the second year in residence may not be reappointed to a teaching assistantship. Departmental assistantships are usually not renewed for students beyond the fifth year.

B. Grounds for Dismissal

1. In accordance with the "Graduate Assistant Dismissal Policy" approved by the Iowa Board of Regents, teaching assistants may be dismissed during the term of appointment following dismissal from a degree program or loss of student status.
2. Other grounds for dismissal of a teaching assistant as defined by the "Graduate Assistant Dismissal Policy" include reasons sufficient to dismiss a faculty member, or failure to follow or implement instructions of the supervisor. More detailed reasons for dismissal include, but are not limited to the following:
 - i. Repeated failure to perform the assigned duties adequately. For example, failure to be present at scheduled class meetings, failure to return graded work to students on time, or failure to adequately prepare for teaching duties. Evidence concerning the lack of preparation must include statements from students in the assistant's class.
 - ii. Evidence that the assistant has assigned grades to students on the basis of personal preference or prejudice.
 - iii. Evidence of sexual harassment as defined by University of Iowa policy.

C. Dismissal Procedures

The Department Executive Officer (DEO) will consider formal faculty or student complaints brought against the teaching assistant. The DEO may recommend dismissal of the teaching assistant to the Dean of the College of Liberal Arts and Sciences (CLAS).

VII. Other Sources of Information

These guidelines and requirements are intended to supplement and clarify the regulations of the Graduate College for the various degrees. Additional rules that may apply to a student's degree progress are given in the Manual of Rules and Regulations of the Graduate College (<https://www.grad.uiowa.edu/graduate-college-manual>) and the General Catalog of the University of Iowa (<http://catalog.registrar.uiowa.edu/>). Regulations regarding preparation of the Master's thesis and Ph.D. dissertation may be obtained from the Graduate College (<https://www.grad.uiowa.edu/>).

VIII. Standard Forms

Graduate students should consult with their research advisors regarding preparation of these forms, but the student is responsible for submission of forms by the deadlines that are published each semester. All Graduate College forms are found on the Graduate College website (<https://grad.uiowa.edu/faculty-staff/dgs-graduate-faculty/academic-and-administrative-forms>), and should be completed and submitted in conjunction with the Graduate Program Coordinator.

A. Ph.D. Candidates

1. Doctoral Plan of Study Summary Form: This form requires the signature of a student's research advisor, and should be completed by the Graduate Program Coordinator, who will forward it to the Graduate College along with the Request/Report for Doctoral Comprehensive Exam. The plan of study is evaluated against the student's grade report and current registration, and an approved copy will be returned for inclusion in the student's file.
2. Request/Report for Doctoral Comprehensive Exam: This form will be prepared by the Graduate Program Coordinator after the student's GAC accepts the research proposal, and has determined a date and time for an oral comprehensive examination. This form, along with the Doctoral Plan of Study, should be submitted at least two weeks prior to the comprehensive examination date. This form will be used to record the results of the oral comprehensive exam.
3. Application for Graduate College Degree: This form must be filed early in the semester that the student wishes to graduate. Apply on MyUI at the following link: <https://myui.uiowa.edu>.

4. Request/Report for Final Examination: Advanced Degree: This form must be completed by the Graduate Program Coordinator at least three weeks prior to the examination date. This form will be used to record the results of the final oral thesis defense.

B. M. S. Candidates

1. Change of Graduate College Status: If a student is currently enrolled in the doctoral program and wishes to obtain a masters degree, this form will be submitted to the Graduate Admissions office. Please consult with the Graduate Program Coordinator about this form.
2. Application for Graduate College Degree: This form must be filed after the Change of Graduate College Status is processed, early in the semester that the student wishes to graduate. Apply on MyUI at the following link: <https://myui.uiowa.edu>.
3. Non-Doctoral Plan of Study Summary Form--Nondoctoral Degree: This form requires the signature of a student's research advisor, and should be completed by the Graduate Program Coordinator, who will forward it to the Graduate College along with a copy of the Request/Report for Final Examination: Advanced Degree. The plan of study is evaluated against the student's grade report and current registration, and an approved copy will be returned for inclusion in the student's file.
4. Request/Report for Final Examination: Advanced Degree: If required, this form must be completed by the Graduate Program Coordinator at least two weeks prior to the examination date. This form will be used to record the results of the M.S. final examination, if applicable.

Appendix A. Instructions for the Research Report

The Research Report is intended to inform the GAC of the student's research objectives, their progress to date, and their future research plans. Reports are limited to 2500 words, double-spaced, 1-inch margins and 12-point, Arial, Times Roman, or Courier font. Word count does not include the title page or references. The expected sections (and suggested section lengths) are as follows:

- I. *Title Page* (1 page). The title page should include a project title, the student's name, the names of advisor(s) and GAC members, and the date on which the report was submitted to the GAC.
- II. *Introduction and Background*. (≤ 2 pages) Concise discussion of research problem and critical summary of the relevant literature adequate to identify the state of knowledge in the field and to justify the working hypothesis about the research question.
- III. *Goals and/or specific Aims*. (1 paragraph) Explicit statement of the overarching goals of the student's research project. Objectives and/or working hypothesis(es) for the research question(s) should be clearly articulated and expressed. It must be clear that the research is motivated by the current state of knowledge in the field based on the background information presented in the introduction and that the hypothesis is testable.
- IV. *Research Plan, Results, and Discussion*. (6-7 pages) This section should include a description of the research methodology, the anticipated results if the working hypothesis is correct and alternative outcomes that can be anticipated if the working hypothesis is invalid. This section should also present the progress to date on the research plan that is outlined including a presentation of the data that have been collected thus far, the analysis and interpretation of those data, and the initial conclusions that may be drawn from that work.
- V. *Conclusions and Future Work*. (2-3 pages) Description of the current state of the project and foreseeable future plans for progress toward completion of the research goals.
- VI. *References*. A list of references should be provided, including the authors, full titles, and publication information in ACS format.

The document must list the word count of all text in sections II-V. The word count should appear after the *conclusion and future work* section, and must not exceed 2500 words.

Appendix B. Advanced Courses in Chemistry and the Proficiencies They Satisfy

Advanced courses must be taken for 3 semester hours to meet the proficiency requirement

<u>Course Number</u>	<u>Course Title</u>	<u>Proficiency</u>
CHEM:4480	Introduction to Molecular Modeling	P
CHEM:4760	Radiochem: Energy, Medicine, Environment	I
CHEM:4873	Atmospheric and Environmental Chemistry	P
CHEM:4875	Introduction to Polymer Chemistry	O
CHEM:5107	Electrochemistry	A or P
CHEM:5108	Spectroscopy	A
CHEM:5109	Separations	A
CHEM:5110	Chemical Sensors	A
CHEM:5114	Chemical Systems Modeling	A or P
CHEM:5115	Biophotonics	A
CHEM:5118	Nanomaterials	P or I
CHEM:5120	Electrochemistry of Polymer Films	A or P
CHEM:5150	Chemometrics	A
CHEM:5199	Special Topics in Analytical Chemistry	A
CHEM:5202	Coordination Chemistry and Spectroscopy	I
CHEM:5203	Organometallic Chemistry	I
CHEM:5204	Physical Methods in Inorganic Chemistry	I
CHEM:5205	Bioinorganic Chemistry	I or B
CHEM:5206	Solid-State and Materials Chemistry	I
CHEM:5212	Mass Spectrometry	A
CHEM:5299	Special Topics in Inorganic Chemistry	I
CHEM:5321	Spectroscopic Methods in Organic Chem	O
CHEM:5326	Organic Reactions	O
CHEM:5328	Mechanisms of Organic Reactions	O
CHEM:5329	Advanced Organic Synthesis	O
CHEM:5399	Organic Chemistry Special Topics	O
CHEM:5431	Statistical Thermodynamics I	P
CHEM:5433	Quantum and Computational Chemistry	P
CHEM:5434	Molecular Spectroscopy	P
CHEM:5435	Chemical Kinetics	P
CHEM:5436	Electronic Structure & Informatics Chemistry	P
CHEM:5438	Surface Chem & Heterogeneous Processes	P or A
CHEM:5499	Physical Chemistry Topics	P

Key: A = analytical, B = biochemistry, I = inorganic, O = organic, P = physical

Appendix C: Rubric for oral comprehensive exam

Student: _____ GAC Member Name: _____

Date: _____ Advisor / Co-advisor (circle)

Graduate Program Learning Outcome	Performance Expectations				
1. Independently learn new chemical principles and techniques beyond those typical of undergraduate academic training	1a. Demonstrate knowledge of chemical principles related to research project	Deficient	Fair	Good	Excellent
	1b. Demonstrate knowledge of research techniques related to research project	Deficient	Fair	Good	Excellent
2. Identify original and worthwhile chemical problems stated as research questions and hypotheses	2a. Critically analyze the research literature to establish a gap in knowledge	Deficient	Fair	Good	Excellent
	2b. State a hypothesis or research question that addresses a gap in knowledge	Deficient	Fair	Good	Excellent
3. Design and execute experiments as part of independent chemistry research investigations	3a. Provide rationale for selected approaches that draws upon theory and prior research	Deficient	Fair	Good	Excellent
	3b. Plan future studies and relate them to prior work	Deficient	Fair	Good	Excellent
4. Critically evaluate their data, results, and conclusions and/or those of others in the chemistry community	4a. Evaluate data and results to derive conclusions from completed studies	Deficient	Fair	Good	Excellent
	4b. Situate findings in the context of research in the field and establish how findings advance knowledge	Deficient	Fair	Good	Excellent
5. Communicate chemical knowledge, new models, and research results orally for technical audiences	5a. Convey the purpose and significance of the research	Deficient	Fair	Good	Excellent
	5b. Use data and representations of data to support assertions	Deficient	Fair	Good	Excellent

Pass:

Both performance expectations of Learning Outcome 1 are assessed as Good or Excellent
No more than two performance expectations in Learning Outcomes 2-4 are assessed as Fair
No performance expectations are assessed as Deficient

Reservation:

No more than two performance expectations are assessed as Fair
No more than one performance expectation is assessed as Deficient
The deficiency must be able to be addressed through a specific, targeted remediation

Fail:

Does not meet the guidelines for Pass or Reservation

Strengths:

Opportunities for Improvement: