

Addendum to

**SUMMARY OF PROCEDURES AND
REQUIREMENTS
FOR GRADUATE DEGREES**

Department of Chemistry and
Biochemistry

The Ohio State University

2017-2018

INTRODUCTION

The *Summary of Procedures and Requirements for Graduate Degrees* was not fully revised for 2017-2018, so the class entering in Autumn 2017 is still operating under the procedures specified in the 2016-2017 *Summary* document, which can be found on the Department's Graduate Studies website under Resources.

<https://chemistry.osu.edu/graduate/chemistry/resources>

However, four changes were approved by the Chemistry Program Graduate Studies Committee (GSC), and those changes are summarized here in this *Addendum*.

- A. In Section A, the GSC approved a single set of procedures for the First Year Oral Exam (FYOE). These procedures supersede Section II.A on pages 9-10 of the 2016-2017 *Summary* as well as the descriptions of the FYOE under each division's curriculum. These procedures apply to the 2017 entering class, and will be used in the Summer 2018 FYOE.
- B. In Section B, the GSC approved a single set of procedures for the Candidacy Examination. These procedures supersede Section II.B on pages 10-11 of the 2016-2017 *Summary* as well as the description of the Candidacy Exam under each division's curriculum. These procedures apply to the 2017 entering class, and will be used for Candidacy Exams for that class which will take place mostly in the Spring and Summer of 2019 and 2020. They will also retroactively apply to students from previous classes (especially the 2016 entering class) for any exams taking place in Autumn 2018 or later. Exams administered in Spring or Summer of 2018 may use either the rules as stated in the 2016-2017 *Summary*, or the rules as listed here. The Chair of the committee (the advisor) must inform the student and the committee which set of rules will apply to exams in this time frame.
- C. In Section C, approved changes to the Inorganic division's curriculum are listed. These changes were communicated to the 2017 entering class as well as to the 2016 entering class, and they apply to both classes.
- D. In Section D, approved changes to the Organic division's curriculum are listed. These changes were communicated to the 2017 entering class, and apply only to that class.

2017-2018 Chemistry Program Graduate Studies Committee

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A. FIRST-YEAR ORAL EXAMINATION

All students pursuing a Ph.D. degree must take an oral examination to qualify for the candidacy exam. These exams are conducted in the Summer term, typically in May or early June of the first year of study. The focal point of this examination is a paper selected jointly by the student and advisor that is related to the student's research topic. The purpose of this exam is to evaluate the student's progress within the context of an activity that is relevant to their research interests and to determine whether the student is ready to proceed with further requirements of the Ph.D. program. This is not a general exam, but it typically includes background questions related to the paper, especially as related to the first year coursework. The administration of the first-year oral examination is outlined below.

1. By April 1, the Secretary of each division notifies the Graduate Studies Office and announces to students:
 - (a) The date(s) on which the oral exams will be administered; and
 - (b) The members of the division's oral exam committee or committees.

The exam committee must be composed of three members of the graduate faculty of the Chemistry program (i.e., with P-status) appointed by the division. A single three-member committee is typical so that all students in a division will be evaluated by a common standard. However, it may not be practical for a single committee to examine all students in a given division, and multiple committees may be appointed. The student's advisor may serve on the committee, but the division may, at its discretion, choose to formulate alternate committees so that the advisor does not serve on a student's exam committee.

2. The Graduate Studies Office, in consultation with committee members and students, will schedule the individual exams. All exams must take place within the specified period unless the student has a valid excuse. Significant life events (e.g., wedding), documented medical excuses, or important scientific activities (e.g., presenting at a conference) may constitute valid excuses. Accommodations for valid excuses will be determined by the Vice Chair in consultation with the division and exam committee.
3. The basis of the exam will be a journal article that is related to the student's research topic and has been jointly selected by the student and advisor (i.e., it must be approved by the advisor). The article may or may not be one published with the advisor as a co-author. The article must be provided to the committee for approval at least two weeks prior to the exam, and it must be approved by the committee before proceeding to the exam. It is a good strategy to choose an article that covers substantial scientific issues and that is not overly difficult. An article that is, for example, a brief communication of measurements will give the examination committee little inspiration for exam questions. In that case, the line of questioning will be less predictable, which will put the student at a disadvantage.
4. The format of the exam will include a short presentation by the student of no more than 10 minutes, followed by approximately 50 min. of questions by the committee. The student may use slides or other figures during the 10 minute presentation, but should generally bring no more than five (5) such slides or figures. During the remainder of the exam, the student should use only the chalkboard or whiteboard. The presentation and paper will serve as the starting point for the subject of the questions. Students will be expected to discuss the content of the paper and respond to questions about broader concepts underlying the research described in the paper and work in the references therein.
5. The advisor, if not a member of the committee, may attend the exam as an observer. The advisor may not assist the student in any manner. In general, an attending advisor should not ask questions of the student, but may request permission from the committee to formulate a question.
6. After the exam, the student is excused. The exam committee, and the advisor if she or he is in attendance, will have a brief (5-10 minute) meeting to exchange impressions on the exam. This is very useful for getting an accurate view of the student's performance and preventing later misunderstandings.

Advisors are encouraged to attend the exam and this discussion.

7. Based on the student's overall performance on the oral exam and performance in first-year course work, the committee will determine whether each student is qualified to proceed directly to the candidacy exam, undergo further evaluation for qualification in the form of preparing and defending an M.S. thesis, or proceed to a terminal M.S. degree (no qualification is possible). The exam outcomes will not be determined until all students in the division's cohort have completed the exam.
8. Within three business days of a division's last exam, the results of the exams must be communicated to the division secretaries and to the Graduate Studies Office.

In general, repeat examinations are not administered. Students may petition the decision of the divisional committee to the Graduate Studies Committee, who will consider the proper redress for the stated grievance considering the advice of the advisor and divisional committee administering the exam.

Students who are directed to a terminal M.S. at the time of the oral exam are not eligible to petition to continue on to the Ph.D. even upon successful completion of the M.S. Students who are directed to the M.S. for further evaluation are usually, but not automatically, qualified for the candidacy exam upon a successful defense of the M.S. thesis. If it is clear at the time of the M.S. defense, even in the event of a successful M.S. exam, that there is no possibility of successful completion of the candidacy exam or Ph.D. dissertation, the M.S. committee may recommend to the GSC Chair that the student not be qualified for the candidacy exam. The final determination in such a case will be made by the GSC.

B. CANDIDACY EXAMINATION

1. Timing, Content, and Procedure

The precise timing of the Candidacy Examination should be determined collectively by the advisor and the student using the following guidelines. Students who have qualified for candidacy from the First-Year Oral Examination must advance to candidacy no later than end of summer of the second year. However, it is strongly recommended that students develop their aims and get them approved by the end of fall of the second year, write the written portion (proposal) and get it approved by the end of spring of the second year, and hold the oral exam no later than May of the second year. Students directed to further evaluation by completion of an M.S. degree should initiate their Candidacy Examination during the semester immediately following the M.S. defense, and must advance to candidacy no later than the end of summer of the third year. To qualify for the candidacy exam, students must complete required courses as specified by each division; students are encouraged but not required to complete electives before taking the exam, unless the candidacy committee specifically requires those classes to be completed before the exam.

The Candidacy Examination includes both written and oral portions. The examination is a general exam, a comprehensive test administered by a committee of faculty based on the fundamentals and depth of knowledge of the broad area of chemistry in which the student is specializing. The student's progress in research will be evaluated by the examination committee, as well as the student's ability to formulate a sound, innovative, independent proposal within their area of research. Satisfactory performance in this examination or series of examinations admits the student to candidacy for the doctoral degree effective the subsequent semester.

The written portion of the Candidacy Examination for the Ph.D. takes the form of progress to date and proposed future work written by the candidate on the topic of their thesis research. At least one portion of the proposed work (one element or aim) must be original from the student. To be clear, the entire proposal must be written by the student in her or his own words, but one aim of the proposal must be something conceived independently by the student that is not under active investigation in the student's lab or described in the advisor's papers or grant proposals. It is common, although not required, for these proposals to contain three aims, with one aim describing work under current investigation, one aim describing further work that will be

developed in the dissertation, and one aim independently conceived and formulated by the student. The purpose of this written exam is to examine the progress to date, the creative potential of the candidate, and their knowledge of the field and relevant literature surrounding their ongoing research and proposed work.

Before the student begins to write the proposal and at least one month before the oral exam date, the student must prepare an abstract or specific aims page of no more than one page that outlines the topic, aims and research strategy of the proposal, as well as the significance and innovation. The abstract must be approved by all members of the committee for the student to proceed to the written exam. The committee should respond to the student within one week of receiving the abstract. The abstract topic may be approved even if there are issues in the actual text of the abstract that the committee would like to see addressed in the full proposal. The advisor should assure the committee of the independence of at least one of the aims of the proposal, and the rest of the committee must approve that it is sufficiently original and distinct from the advisor's research.

The written proposal should be no more than 10 pages with no less than half inch margins and a font size no less than Arial 11 or its equivalent. The 10 page limit includes any figures, but not the abstract/aims page or references cited. References should include full titles of articles, and pages should be numbered throughout. It is recommended that the proposal be formatted generally as an NIH or NSF research proposal. The candidacy committee may provide additional guidance on the exact format. The committee should respond with their judgement of the written proposal and any required issues to address within two weeks.

The approval of the written proposal is an exam exercise and should not simply consist of a series of suggested edits from different committee members. Each iteration of the proposal should be examined by all committee members and the results should be returned to the chair of the committee (the advisor). The chair can then give the collective judgement and comments to the student. In general the committee should respond with an overall judgement along the lines of Pass, Minor Edit, or Major Rewrite. It is not necessary for the written proposal to be flawless for the committee to approve it in order to move on to the oral exam; some issues may be left to address in the oral exam. However, all committee members must approve the proposal to move on to the oral exam. If it becomes clear after two revisions of the document that there is no possibility for a satisfactory overall performance on the candidacy exam, the student may be advised to waive taking the oral exam; however, the student may not be denied the opportunity to take the oral exam (see section 7.5.2 of the Graduate School Handbook). The advisor should consult with the GSC Chair before advising the student to waive the oral exam.

The written portion of the Candidacy Exam must be approved by the examination committee at least two weeks prior to the oral exam. A final draft of the student's written examination must be available to all members of the oral examination committee, including a possible university representative appointed by the Graduate School (see next section), at least two weeks prior to the examination. A copy of the approved proposal must be submitted to the Graduate Studies Office, and the Candidacy Examination committee must acknowledge approval of the proposal by signing a form that will be distributed electronically by the Graduate Studies Office.

The oral portion of the Ph.D. Candidacy Examination consists of questions related to ongoing research, defense of proposed work, and general questions that may be related to the written portion of the Candidacy Examination or, if unrelated, on subjects in which the candidate is expected to be proficient (related to the research topic or larger area of chemistry, for example). The oral exam lasts approximately two hours, and it must entirely consist of questions by the committee. Typically, the first hour will focus more on the proposal itself, and the second hour will include more general questions. By rule of the Graduate School, the exam cannot begin with an uninterrupted presentation by the student, but the committee will typically ask the student to describe the proposal as part of the exam. The student may bring a copy of the proposal and up to five slides or figures in any format (electronic or printed), but should expect to be asked questions and answer at the chalkboard or whiteboard throughout the exam.

The written or oral portions of the candidacy exam constitute a single exam and are considered together. The candidate will be evaluated on his or her performance on the general questions, academic ability, research progress and understanding of the research problem, and the defense of the research proposal including the

ability to meaningfully formulate problems and hypotheses and devise suitable tests for those problems.

The student is considered to have passed the candidacy exam only when the committee members unanimously affirm that the performance was satisfactory. In the event of an unsatisfactory exam, the candidacy committee may specify the nature of the second exam. Typically, it will still have both written and oral portions, although if there were no issues with the written exam, the original written proposal may be accepted as the written portion for the second exam. A second oral exam is required, unless the committee believes there is no possible path to a satisfactory second exam, which must be indicated on the Report on Candidacy on gradforms.osu.edu. This option would normally be applied only in exceptional circumstances and in consultation with the GSC Chair. The second exam must be administered by the same committee, and the Graduate School will also assign a Graduate Faculty Representative who will vote as a normal member of the candidacy committee. A student who fails the candidacy exam twice is not permitted to be a candidate in any doctoral program at the University, but may transfer to a Master's program (including the Chemistry M.S. track) with the support of the GSC chair and the approval of the program.

2. Selection of Candidacy Examination Committee and Initiation of the Candidacy Exam

1. Students will assign an Advisory Committee in the summer of the first year that must include the preceptor and two other members of the Chemistry graduate faculty (i.e., faculty that have P-status in Chemistry), at least one of whom must be in the student's division. One member of the Advisory Committee may be from outside of the Chemistry program provided they are a member of the Graduate Faculty of some program at the University (i.e., have P-status).
2. At the beginning of the second year, the Vice Chair will assign the Candidacy Committee with the preceptor as Chair, the other members of the Advisory Committee, and one additional member of the Chemistry graduate faculty. Of the three assigned members, two must be in the student's division, and one must be from outside the student's division. The advisor may suggest the final member for the Candidacy Committee, but the Vice Chair will make these assignments in part to divide the work load among the faculty. A member of the graduate faculty of the University from another graduate program may serve in place of one of the divisional members.
3. A university representative will sometimes be assigned by the Dean of the Graduate School, as during a second candidacy exam.
4. The Chair of the Candidacy Committee (the advisor)—*not* the student—will arrange a time and location for the exam in consultation with his or her colleagues and the Vice Chair's office. The advisor may place a tentative date on the calendar for the exam, but the exam may not be scheduled firmly until the written proposal is approved. Exams must be held during announced University business hours, Monday through Friday. One member of the committee (including the advisor) may participate by videoconference without filing a petition, provided the conditions of Appendix B of the *Graduate School Handbook* are met.
5. The written portion of the candidacy exam must be approved by each committee member. Once the committee agrees to approve the written portion, the student must provide a copy of the approved exam to the Graduate Studies Office. A record of approval of the written portion will be conducted electronically by the Graduate Studies Office, and must be completed before the Graduate Studies Office will approve the Application for Candidacy in gradforms.osu.edu.
6. After the written portion is approved, the student must initiate an Application for Candidacy form electronically at gradforms.osu.edu, which must be signed electronically by the advisor and the GSC Chair. All signatures must be completed at least two weeks prior to the examination date. *This two week period before the exam is required by the Graduate School and may not be appealed.*

C. Inorganic Division Curriculum

The degree programs available to students in Inorganic Chemistry are M.S. and Ph.D. Students may pursue and earn a Ph.D. degree without receiving an M.S. degree. The total hours for required Inorganic and Elective courses, excluding other required courses, should be 18 hours (9 hours in Autumn and 9 hours in Spring).

Ph.D. Degree

Course and credit hour requirements

A Ph.D. candidate is required to take the courses listed below, in addition to graduate courses recommended by his/her advisor.

Required Inorganic courses: In Autumn: Chem 6310, Chem 6320, Chem 6330, Chem 6340, and two core elective Chem 6xxx half-semester courses outside the inorganic division. In Spring: select six 7000+ courses, including at least three from the inorganic offerings (Chem 7320, 7330, 7340, 7350, 7360, 8399).

Elective Courses: Non-inorganic course electives can include 3 hours of core elective Chem 6xxx courses in Autumn and up to 3 hours outside the division (level \geq 6xxx) in Spring if approved by the Inorganic Division.

Other required courses: Chem 6780, Chem 6781, Chem 6782, Chem 8893, and Chem 8899.

Typical Progress Timeline and Seminar Requirements

Year one: Take required courses; attend faculty research presentations and choose an advisor; take safety course and attend seminars; begin thesis research; complete summer literature oral exam.

Year two: Complete M.S. degree if assigned by first-year oral committee; continue thesis research; complete Ph.D. Candidacy exam

Years three and four: Thesis research, and seminar presentation (research-in-progress, year 3).

Sample Curriculum for First and Second Year Students

Year 1

Autumn 1	Autumn 2
6310 Fundamentals of Coordination Chemistry	6320 Inorganic Synthesis
6330 Group Theory and Bonding	6340 Physical Methods in Inorganic Chemistry
6xxx Core elective	6xxx Core elective
Chem 8893 Inorganic Seminar	
Chem 6780 Faculty research presentations	Chem 6781 Laboratory Safety
Spring 1	Spring 2
Chem 7360 Bioinorganic Chemistry	7320 Organometallic Chemistry
Chem 7330 Solid State Chemistry	Elective
Chem 6782 Ethics Course	Elective
Chem 8893 Inorganic Seminar	
Chem 8899 Doctoral Seminar	
Chem 8999 Research (variable - please refer to Graduate School Handbook for requirements)	

Summer

Chem 8999 Research (variable - please refer to Graduate School Handbook for requirements)

Year 2

Elective Courses
Chem 8893 Inorganic Seminar
Chem 8999 Research (variable - please refer to Graduate School Handbook for requirements)

Spring 2 - additional courses offered periodically; every two or three years depending on demand

7350 *Inorganic Photochemistry*

7340 *Diffraction Methods*

7370 *Nanochemistry and Nanomaterials*

8399 *Advanced Topics*

M.S. Degree

Students who intend to terminate graduate studies after the M.S. degree follow this degree program. The M.S. program is also followed by students whose early graduate performance indicates that completion of a thesis problem and writing of a M.S. thesis would be of considerable help in advancing their academic program and students who cannot complete a given requirement of the Ph.D. program. For example, students who do not pass the Candidacy Examination portion of the Ph.D. program often complete the thesis M.S. degree program. In the M.S. program, the candidate must conduct independent research under the guidance of an advisor, prepare and present his/her thesis and demonstrate that it adds new knowledge to some area of chemistry.

The candidate is required to complete 15 hours of graduate course work in chemistry (6000-level and above) including the following required Inorganic courses. Other required courses include Chem 6780, Chem 6781, Chem 6782, and Chem 8893. Inorganic elective courses are also listed below, but other non-inorganic course electives within the department are acceptable, or courses in related fields if approved by the Inorganic Division.

Required

Chem 6310 Fundamentals of Coordination Chemistry (1.5 hr)

Chem 6320 Inorganic Synthesis (1.5 hr)

Chem 6330 Group Theory and Bonding (1.5 hr)

Chem 6340 Physical Methods in Inorganic Chemistry (1.5 hr)

Electives

Chem 7320 Organometallic Chemistry (1.5 hr)

Chem 7330 Solid State Chemistry (1.5 hr)

Chem 7340 Diffraction Methods (1.5 hr)

Chem 7350 Inorganic Photochemistry (1.5 hr)

Chem 7360 Bioinorganic Chemistry (1.5 hr)

Chem 7370 Nanochemistry and Nanomaterials (1.5 hr)

Thesis work will require a minimum of 15 additional credit hours in Chemistry 8999. The total credit hours must be a minimum of 30 hours. Students not continuing on to the Ph.D. degree are expected to pursue this M.S. program. The student must write an M.S. thesis describing original research and defend this thesis as an oral examination in front of a committee consisting of their advisor and one other faculty member.

D. Organic Division Curriculum

The degree programs available to students in Organic Chemistry are M.S. and Ph.D. Students may pursue and earn a Ph.D. degree without receiving an M.S. degree.

Ph.D. Degree

Course and credit hour requirements

A Ph.D. candidate is required to take the courses listed below, in addition to graduate courses recommended by his/her advisor.

Required Organic courses: Chem 6410, 6420, 6430, 6440, 7450, 7460, and 5420.

Electives: Two 6000-level classes (3 credit hours) outside the division are required (core electives). At least 3 credit hours, which may include Chem 7470, 8499 or courses outside the division (level >6000) are required.

Other required courses: Chem 6780, Chem 6781, Chem 6782, Chem 8894, Chem 8899.

Typical Progress Timeline and Seminar Requirements

Year one: Take required courses; attend faculty research presentations and choose an advisor; take safety and ethics courses and attend seminars; begin thesis research.

Year two: Complete written cumulative exams and/or M.S. degree if assigned by first-year oral committee; continue thesis research. Complete Ph.D. Candidacy exam.

Years three and four: Thesis research, and seminar presentation.

Proposed Curriculum

Year 1 - Required Courses

Autumn 1	Autumn 2
Chem 6410	Chem 6430
Chem 6420	Chem 6440
Chem 6xxx Core elective	Chem 6xxx Core elective
Chem 8894 Organic Seminar	
Chem 6780 Faculty research presentations	Chem 6781 Laboratory Safety
Spring 1	Spring 2
Chem 7460	Chem 7450
Chem 5420 Spectroscopy	Elective
Elective	Elective
Chem 6782 Ethics	
Chem 8894 Organic Seminar	
Chem 8899 Doctoral Seminar	
Chem 8999 Research (variable - please refer to Graduate School Handbook for requirements)	

Summer

Chem 8999 Research (variable - please refer to Graduate School Handbook for requirements)

Year 2

Electives
Chem 8999 Research (variable - please refer to Graduate School Handbook for requirements)

Optional organic courses

Chem 7470 Computational Chemistry

Chem 8499 Special Topics

Lab Rotations

Organic division students are not required to carry out lab rotations, but are permitted to do so. Once a mutually agreeable rotation assignment is found, the rotation must be reported to the organic division secretary before beginning. The rotation period is a maximum of 4 weeks. The student is not permitted to spend additional time in the lab following a rotation, including holding desk space or attending additional lab meetings. All rotations must be within the department. Students are not required to join a lab in which they have done a rotation.

Seminar Presentation

After passing the candidacy exam, each student will present a one-hour seminar, following the guidelines established by the division. In planning the seminar and prior to the presentation, the student should consult with the division faculty member in charge of student seminars during the term in which the seminar will be presented to obtain approval. This faculty member, in addition to helping the student with the technical aspects of the presentation, should make sure that the guidelines are followed. The responsible faculty member for Chem 8894, in consultation with other members of the division, will assign a grade (S or U) for the seminar. If the performance is judged unsatisfactory, the student will be asked to repeat the presentation to available organic faculty members.

The focus of the seminar will be the student's Ph.D. thesis research project. The talk should last 45-50 minutes and the student may choose any of the standard formats for presentation, including presentation software such as PowerPoint, blackboards, or overheads. The first part of the talk (20-30 minutes) should include a thorough review of the literature with the goal of providing a meaningful context and global perspective for current and future work. The material gathered for this review should be appropriate for and may eventually be used as introductory sections of the student's thesis. For the remaining portion of the talk, a progress report on the student's research accomplishments should be presented. The student should distribute a concise and carefully worded abstract (1-2 pages) before the beginning of the seminar.

M.S. Degree

In the M.S. program, the candidate must conduct independent research under the guidance of an advisor, prepare and present his/her thesis and demonstrate that it adds new knowledge to some area of chemistry. The candidate must complete a minimum of 30 hours of graduate course work in chemistry including the following organic courses: Chemistry 5420, 6410, 6420, 6430, 6440, and 3 credit hours of 7000-level courses or above. In addition, 6 credit hours of elective classes either from or outside the organic division are required. Other required courses include Chem 6780, Chem 6781, 6782, and Chem 8894. Thesis work requires a minimum of 15 credit hours in Chemistry 8999. Students completing this program must write and defend a thesis.

The Graduate School requires the completion of a minimum of 30 graduate credit hours over a period of at least two semesters for the M.S. degree.