
# *GRADUATE STUDENT HANDBOOK 2012-2013*

**University of Minnesota**
**Department of Chemistry**

# Graduate Student Handbook

**2012-2013**

This handbook contains basic information and policies regarding the Ph.D. and M.S. program in the Department of Chemistry, as well as the specific policies of our 7 specialty areas.

More information for current graduate students in our department can be found online:

http://www.chem.umn.edu/grad

The UMN Graduate School also provides a wealth of information online. In particular, refer to the "Enrolled Students" link:

http://www.grad.umn.edu

You may always contact anyone in the Graduate Office with questions or concerns about your time in the department.

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## I. STATEMENT OF GENERAL PURPOSE AND POLICIES

This handbook contains essential information for all graduate students in the Department of Chemistry as well as the Chemical Physics graduate program. All students are responsible for understanding and following the information and policies contained in this document.

## II. UMN ONLINE RESOURCES AND POLICIES

UMN Student Conduct Code
www1.umn.edu/regents/policies/academic/Student_Conduct_Code.html

OneStop website (registration, class info and schedules)
www.onestop.umn.edu

Center for Teaching and Learning's CSE TALK and ITA courses
http://www1.umn.edu/ohr/teachlearn/graduate/itap/courses/ittalk/

Boynton Health Services – Graduate Assistant Health Plan
www.bhs.umn.edu/insurance/graduate

Coping with Emotional Distress
www.mentalhealth.umn.edu

International Student and Scholar Services (ISSS)
www.isss.umn.edu

Graduate Assistant Employment Office
www.umn.edu/ohr/gae

Graduate and Professional Student Assembly (GAPSA)
www.gapsa.umn.edu

Student Conflict Resolution Office
http://www.sos.umn.edu/

Chemistry - Graduate Student Workshop Committee
www.chem.umn.edu/grad/workshop

Chemistry - Women in Science and Engineering (WISE)
nmr.chem.umn.edu/wise/wise.html

Chemistry - Outreach Program
http://www.chem.umn.edu/outreach

# III. ORIENTATION

## PROFICIENCY EXAMS

Students in the Ph.D. program must pass four proficiency examinations by the end of the first academic year in residence (for students entering in Fall, the end of the academic year is the last day of May session). Five examinations are given: analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, and physical chemistry. These are ACS standardized exams, covering undergraduate-level material. Students choose which four of the exams they wish to take. The exams are first administered in August during orientation, before the first meeting with the Three Member Advising Committee. Students have three opportunities to pass each of their four chosen exams. Retake examinations are offered in January and June. Students may change which exams they choose to attempt after a failed performance, but the total number of attempts remains the same.

## THREE MEMBER COMMITTEE (TMC)

This advising committee of three members of the Chemistry graduate faculty will have been assigned to each student before his or her arrival and will meet with the student near the end of the orientation period (prior to registration and after taking proficiency examinations) to be advised on proficiency examination results, plan a course program, and talk over short– and long–range plans. Some of the responsibilities that can be assumed by a three-member advising committee (TMC) on its own initiative, or by request from the Graduate Committee, are:

a. Advising students on their course program and discussion of specialty area requirements.

b. Ensuring that each student gets a broad range of learning experiences.

c. Review of performance in courses, examinations, and research.

d. Recommendations to the Graduate Committee regarding a student's progress.

e. Establishing the written and oral prelim examination deadlines for students entering the program at times other than the beginning of Fall Term.

f. Recommending to the Director of Graduate Studies the inclusion or exclusion of previous graduate-level coursework as part of the Degree Program.

## FACULTY RESEARCH ADVISOR

Students should find a research advisor (or co-advisors) before the end of the first term in residence. The research advisor(s) will often, but not always, be a member(s) of the specialty area nearest to the student's research interests. The research advisor(s) automatically become(s) chair(s) of the TMC and assume(s) primary responsibility for advising the student on coursework and other academic matters.

During graduate student orientation, a series of sessions will be held at which most faculty will give a brief overview of their research programs. All new graduate students must attend these sessions, as they are particularly useful in helping to identify faculty who should be interviewed at length about their research. Before selecting a research advisor(s), the student should become well acquainted with the research interests of various groups in the department by arranging individual interviews with at least four members of Chemistry's Graduate Faculty. A current listing of the Graduate Faculty can be found on the Department of Chemistry's website. The Advisor Selection Form at the back of this handbook should be used to report which faculty members were contacted during this process. On this form students will also give a ranked list of their top three choices for a research advisor. Completed Advisor Selection Forms should be returned to the Graduate Operations Office (115 Smith Hall) by Nov. 15, or the following Monday if this date falls on a weekend. Faculty will not be allowed to admit a student into their group before Nov. 15. Students are strongly encouraged to submit their selections by Nov. 15 since faculty will make decisions regarding admission into their group on that date. Students will be informed of their placement as soon as possible. Every effort will be made to pair students with their first choice but this may not always be possible due to limited resources. Any student that has not found a research advisor by the end of their first semester of residence will no longer be considered to be in good standing and may be removed from the Ph.D. program.

## TERM OF SERVICE

Appointments on the teaching staff are normally offered on an academic year basis. In making its plans for the succeeding year, the department infers from the acceptance of such offers that graduate students accept the commitment to remain for the full academic year. Some summer teaching appointments are available in connection with the limited offering of chemistry courses in the summer.

Graduate Assistants on the teaching staff should expect to devote a total of about 20 hours per week to a 50% appointment or 10 hours per week to a 25% assignment. This time requirement may vary considerably from week to week. Assignments which miss this estimate significantly should be brought to the attention of the faculty in charge of the course or the Vice Chair of the Department.

## TEACHING ASSISTANT (TA) TRAINING

During orientation each August, TA training will be held for General Chemistry, Organic Chemistry and Analytical Chemistry. Students who are ultimately assigned to teach other courses should also participate in this training. Your TA assignment in future terms may be to teach these larger undergraduate lab courses.

## TEACHING ASSISTANTSHIPS

In the first two years, most graduate students will be appointed as Teaching Assistants. No restrictions on the type of assignment should be inferred from the title. The graduate student may be assigned to grading, developing written solutions to problem sets, instructing

laboratory or recitation sections, developing new laboratory experiments, other duties, or a combination of any or all of these. Students should note that an appointment as Teaching Assistant during the Fall or Spring semesters covers a 19-week period (and not just the 15-week instructional period). Teaching Assistants need to be available during the entire 19-week period. For a policy governing any absences during this period, please see the "Teaching Assistant Leave of Absence" policy in the same section of this handbook.

All Teaching Assistants for whom English is a second language are required to take the three-week CSE TALK teaching course in English before the start of the of August orientation. The cost of this mandatory course is covered by the University. A test of spoken English proficiency is given at the end of this course to determine the type of teaching duties you can be assigned. If that exam is not passed, the student is required to take an English language course in each term until able to demonstrate a sufficient mastery of language skills. ***Students who have not passed the ESL exam by demonstrating level 1 or 2 proficiency by the end of their first academic year in residence will not be eligible for further Department of Chemistry support. If further training is required in the ESL program, additional costs will be the responsibility of the student.***

## RESEARCH ASSISTANTSHIPS

Appointments as Research Assistants are made from funds granted by government agencies, non-profit foundations, or other sources for specific research projects proposed by members of the faculty. Such appointments are normally arranged between the graduate adviser and the student. The research performed under these appointments may be used to satisfy dissertation requirements. Research Assistantships are nearly always made at the 50% time level (i.e., full tuition benefit is provided), and the stipend level is set by the research adviser.

The continuity of a Research Assistantship is subject to the continued availability of funds. The Department of Chemistry does, however, attempt to find alternative support in case of an unexpected termination/interruption of a research grant or program. To ensure reappointment in subsequent periods as an RA, it is expected that Research Assistants will remain on duty during periods between terms, and that they will devote all their time, except that pre-empted by studies, to the research program providing their appointment.

## SUMMER SUPPORT

Support for the summer is independent of academic year support and may come from some combination of three different sources: Teaching Assistantships, Research Assistantships, and Departmental Fellowships. The sources of support for students will normally be communicated to them by their advisors. Research Assistants will also be paid according to regular payroll dates but appointments may begin and end at different times during the summer and stipend amounts may differ from the academic year. You should check with your research advisor and/or Chemistry Accounting to learn the schedule of payroll dates for individual situations.

## REGISTRATION AND TUITION

To hold a Teaching or Research Assistantship, students must be registered for 6 credits each Fall and Spring term.

Students with a standard assistantship of 50 percent or more for an entire semester will receive a 100 percent tuition benefit. Graduate assistants with an appointment of at least 25 percent will receive half of the full tuition benefit (based on resident tuition rates

If a student does not register in a semester, or if he or she cancels all credits, the assistantship will automatically be terminated retroactive to the beginning of the semester, the job classification will change to a non-student title, and the student will be billed for a proportional amount of for any tuition benefit received that term. Health insurance benefits will be cancelled, and social security taxes will be withheld from wages.

All graduate students employed at the University must meet two conditions for exclusion from FICA tax withholding: (1) students must enroll for a minimum of 6 credits per semester, or 1 credit per semester for Ph.D. students who have passed the oral prelim exam and are working on a dissertation; (2) appointments must not exceed a combined total of 50 percent or 20 hours per week. This applies to all University employment, including assistantships, during the summer as well as the academic year.

Nonresident students holding an assistantship of at least 25 percent for an entire semester will be assessed tuition at the resident rates. This is a semester-specific privilege that does not change your basic nonresident classification.

Permission from the Director of Graduate Studies must be obtained before any student can register for GRAD 999 –Graduate School Active Status‖ during any semester.

## TUITION AND FEE STATEMENTS

Notices regarding a student's tuition and will be sent to your central University e-mail account. This is the only way that you will be contacted regarding your fee statement.

## GRADUATE ASSISTANT HEALTH CARE PLAN

All students taking six or more credits are required to carry hospitalization insurance. Graduate students can obtain health and dental care benefits by purchasing the University-sponsored health insurance for students, or, if they are employed as graduate assistants (GAs) with at least a 25 percent appointment, by enrolling in the health care coverage available to them.

The University pays twice the appointment percentage as a benefit. For example, GAs with a 50 percent appointment receive full Graduate School tuition and benefit coverage. The University also contributes part of the cost of dependent coverage. Dental benefits are provided separately from the medical care plan, through the University's School of Dentistry.

GAs eligible for coverage must enroll in the GA Health Care Plan to obtain coverage. Enrollment forms can be obtained from the payroll officer in your department or at the GA Insurance Office in N323 Boynton Health Service, and they must be completed and returned by the specified enrollment deadline.

If you don't qualify for the Graduate Assistant Health Care Plan and you don't have your own insurance, you may purchase the University-Sponsored Health Insurance. If you register for 6 or more credits and you don't have hospitalization insurance, you will automatically be enrolled in the University-sponsored plan when you register. If you already have insurance through your parents, employer, or spouse, bring the name of your insurance company or HMO and your policy number when registering and you will not be charged for the University sponsored plan. For more information, call (612) 624-0627.

## EMPLOYEE BENEFITS

Below are a few common items, taken from the Graduate Assistant Employment office's policies. The full list of employment policies is online:

http://www1.umn.edu/ohr/gae/

Unemployment: Graduate Assistants are covered by Workers' Compensation but do not qualify for unemployment compensation, because Minnesota law specifically excludes registered students from this benefit.

Parental leave: A woman may take up to six weeks leave with pay related to the birth of her child; a man may take up to two weeks leave with pay and four weeks leave without pay related to the birth or adoption of his child; a woman may take up to two weeks leave with pay and four weeks leave without pay related to the adoption of her child. Students should contact the Graduate Operations Office (115 Smith Hall) to make arrangements for parental leaves.

Vacation: Although Graduate Assistants are afforded no –formal‖ vacation leave, this does not imply that they cannot take vacation time. Students with Teaching Assistantships are expected to be available for all duties through each term. Any extended absences must be agreed upon by the student's adviser, and also approved by the Vice Chair. Students on Research Assistantships should consult with their advisers regarding the time they wish to take for vacation.

## TEACHING ASSISTANT LEAVE OF ABSENCE POLICY

If a student appointed to a Teaching Assistantship needs to leave campus for an extended period during the semester, the following departmental procedures apply. Step 4 below in his policy also applies to situations where a student is not able to return in a timely fashion as originally planned. This includes delays due to U.S. visa issues which cause a delay in a student's return to campus.

1) Students on TA contracts must be available for assignment to appropriate teaching duties every day the semester is in session.

2) A student appointed as a TA must obtain permission from both their advisor and the Vice Chair to go on an extended leave (three or more days). Leaves will normally be granted only for one of the following reasons: (i) illness, (ii) family or personal emergency, and (iii) activities that are directly related to research, i.e., attending a scientific conference or making a research visit to another institution. In all cases, permission to be absent will be granted only if the absent TA has been able to arrange for adequate substitutes to cover their assigned duties and have so-informed the instructor for the course or Head TA, as appropriate.

3) If the TA has not yet chosen a research advisor, both the Director of Graduate Studies and the Vice Chair must grant permission to go on an extended leave.

4) If a TA is not able to return on or before the agreed-upon date, the student will automatically lose his or her TA funding for the period of time they are absent and they may risk losing their TA appointment for the remainder of the term.

## KEYS AND UCARD ACCESS

Graduate students are issued keys to their assigned office and lab space. A deposit of $2.00 per key (in cash) is charged, refundable upon return of the keys *and the deposit receipt* to the Department of Chemistry. Copying or altering of keys is not permitted. *Loss of a key requires the payment of a $5.00 fine,* plus an additional $2.00 deposit for the replacement key. Additional keys, e.g., for research offices, may be obtained as needed with the proper authorization, again with a deposit of $2.00 per key. This is handled in room 139 Smith Hall. Access to the exterior doors of Smith and Kolthoff Halls is done using your U Card. During orientation, your U Card information will be recorded to give you 24-hour access to both buildings.

## E-MAIL ACCOUNTS

E-mail communication is critical in our department. You are responsible for all e-mail sent to these addresses, and should check your e-mail at least once or twice a day. Official communication will be sent to your central UMN e-mail address (also referred to as your "Internet ID" or "X.500 address".) Your central e-mail address ends in "umn.edu."

## OUTSIDE EMPLOYMENT

Graduate Assistants and Fellows are strongly discouraged from accepting outside employment during the term of their appointment or award. This reflects the faculty's conviction that prompt completion of graduate degree requirements should be the only demand on a graduate student's time other than duties related to a Teaching Assistant appointment. Should you decide to be a private tutor for pay, consult with your advisor prior to doing so. Outside employment without the prior approval of the Director of Graduate Studies and Vice Chair may jeopardize your position in the graduate program.

## GRADUATE SCHOOL FORMS

All departmental and Graduate School forms requiring the approval of the Director of Graduate Studies should be brought to 115 Smith Hall, (rather than put into a mailbox or the faculty office of the DGS) for review and signature by the DGS.

## ACADEMIC PERFORMANCE

What follows is a guide to the level of academic performance expected of Ph.D. students. It is necessarily approximate, since decisions regarding any individual student's status are based on an interpretation of the entire record, including any special circumstances. (It should also be noted that somewhat different rules apply to students in the Chemical Physics graduate program).

If a student has any doubts regarding their present academic status, the student should consult with his or her Three-Member Advising Committee, research advisor or the Director of Graduate Studies. In the following, whenever grade point average (GPA) is mentioned, it means the GPA in actual courses graded on the A-F scale and appearing on the Degree Program Form, exclusive of research credits.

**1**. **Academic performance:** Any of the following items on a student's record is considered to be an indication of unsatisfactory performance, is a cause for concern, and may jeopardize a student's standing as a Ph.D. candidate:

a. Any course grade below B-. Grades of D, F, and N must be either made up or not included in the Degree Program.

b. Failure to pass all four proficiency examinations by the end of the first academic year in residence.

c. A cumulative GPA below 3.00.

d. Completion of fewer than 18 credits of coursework with a grade of B- or better by the end of the first year in residence.

e. Students who have not passed the ESL exam by demonstrating level 1 or 2 proficiency by the end of their first academic year in residence will not be eligible for further departmental support (although Research Assistantships may still be arranged with individual faculty members).

f. Failure of the written preliminary examination.

**2. Review of the student's progress:** Each term the Graduate Committee reviews the progress of first-year graduate students. Other than in exceptional circumstances, a decision to reassign a student from the Ph.D. to M.S. degree program is not made until the end of the first year. Following the first year, academic review is done annually at the end of Spring term.

**3. Reassignment from the Ph.D. to the M.S Degree Program**: At the following points in a student's career, the student faces the possibility of being assigned to the M.S. program if academic progress has not been satisfactory.

a. End of first year: At this point, students must meet **all** of the following requirements to remain in good standing in the Ph.D. program:

(i) Grade point average (GPA) of 3.0 or better
(ii) 18 credits of coursework with a grade of B- or better
(iii) Passing grades on all four proficiency exams

If any one of these requirements is not satisfied, students will usually be terminated from the Ph.D. program and assigned to the M.S. program. In exceptional circumstances, students may be given **one** additional semester to improve their GPA or complete additional coursework with a grade of B- or better. Termination from the Ph.D. program will be automatic for any students who fall short on two or more of the above requirements.

b. End of subsequent academic years: A student must maintain a GPA of at least 3.0. In exceptional circumstances, students may be given **one** additional semester to improve their GPA. Failure to satisfy the GPA requirement will be sufficient cause for termination from the Ph.D. program.

c. Repeating courses: While officially allowed by the Graduate School, retaking courses is strongly discouraged. If a course is taken a second time in the Chemistry graduate program, the grade earned for the initial attempt is the only one that will be used in the calculation of your GPA.

d. Preliminary examination: Failure to take and pass the written and oral preliminary examination in accordance with departmental will be sufficient cause for termination from the Ph.D. program. All students must pass the oral preliminary exam by the end of May term (mid-June) following the second year in residence. A second failure of the oral preliminary examination at any time requires permanent removal from the Ph.D. program.

e. A recommendation for termination from the Ph.D. program from the student's specialty area, or TMC, or research adviser may, after review by the Director of Graduate Studies and/or the Graduate Committee, be sufficient cause for such termination.

All deadlines above apply to students who start their graduate study at the beginning of the Fall term. Students beginning at other times during the year will receive individual consideration. In general, students terminated from the Ph.D. program will be reclassified as Master's degree students. However, students with particularly unsatisfactory records may be eliminated from the Graduate Program entirely.

# IV. THE Ph.D. PROGRAM IN CHEMISTRY

The Ph.D. program in Chemistry includes several specialty areas, each with its own programmatic aspects and requirements. In addition, students may develop personalized interdisciplinary programs. The specialty areas are:

Analytical Chemistry
Chemical Biology
Inorganic Chemistry
Materials Chemistry
Organic Chemistry
Physical Chemistry

In addition, the Chemistry, Physics, Chemical Engineering and Material Science, Biochemistry and Medicinal Chemistry Departments jointly offer a degree in Chemical Physics, which has its own requirements and Director of Graduate Studies.

Supervision of the entire chemistry graduate program is the task of the Graduate Committee and its chair, the Director of Graduate Studies. Below you will find a brief summary of the overall departmental and specialty area program requirements. Further details may be obtained by consulting your Three Member Advising Committee, the Graduate Operations Office (115 Smith Hall), the specialty area faculty coordinator, or the Director of Graduate Studies.

## COURSE REQUIREMENTS

Each specialty area has a "core" of recommended courses closely related to the area. Students are generally responsible for the material in these courses on written or oral preliminary (Ph.D. candidacy) examinations. In addition, each student will normally take courses in related fields (minor or supporting program) sufficient to bring the total number of credits to the minimum of 24 required for the Ph.D. in chemistry. The 24 graduate-level credits include 1 credit of seminar (CHEM 8601) and 1 credit for the ethics course (CHEM 8066.) English language proficiency courses to not count toward the 24 credits.

If a student desires that graduate courses taken at other universities count toward the minimum number of credits for a Ph.D. in chemistry, this may be requested by including the courses on the Degree Program Form. In such cases the Degree Program Form should be accompanied by a recommendation from the TMC or the specialty area coordinator advising the DGS on the appropriateness of the proposed transfer(s) for satisfying the requirements of the specialty area Ph.D. program in chemistry.

Courses that may be used for graduate credit include all 8xxx-numbered courses in Chemistry or related fields. Courses from other departments at the 5xxx level, and certain 4xxx level courses, may be appropriate for specific degree programs. Registration for such courses should occur only after consultation with either your adviser or Three-Member Committee. Chemistry courses at the 5xxx level are typically not appropriate for individual degree programs, but petitions may be made in specific situations.

**Ethics Course:** All graduate students must take CHEM 8066 (Professional Conduct of Chemical Research) during the Spring Term of their first year in residence.

**Seminar Course: All first year students must register for Chemistry 8601 on an S/N basis during both Fall and Spring terms. Students who do not attend the required number of seminars will fail CHEM 8601.** Students are expected to attend the weekly departmental seminars, as well as applicable specialty area seminars. This experience has intrinsic value, and questions about seminars sometimes occur in preliminary oral examinations.

Students who cannot register for CHEM 8601, may attend seminar and register for the course in the following semester.

## LABORATORY ROTATIONS

Laboratory Rotations: Students may elect to take Introduction to Graduate Research (CHEM 8025) for one or two credits. The objective of this course is to broaden the exposure of students to new areas of chemistry by giving them practical hands-on exposure to graduate research in a participating faculty's lab. Students will receive training in research methods and techniques related to each lab's research area. Students will rotate through up to two different laboratories. Each rotation lasts approximately seven weeks, with one credit earned for each rotation. The second 7-week rotation must be carried out in a different lab. The format for lab rotation projects will vary depending on the research group. Students may be given an independent laboratory research project and/or may assist other members of the lab in data acquisition and analysis. They also will attend and participate in laboratory group meetings and related events. Students are responsible for arranging their own laboratory rotations by contacting their first rotation professor no later than the end of the first week of fall term. The second rotation, which must be carried out in a different lab from the first rotation, should be arranged by the end of week 6 of the term and will typically begin on week 8.

## TRANSFER CREDIT COURSE ALLOWANCES

M.S. track: Up to 40% of total degree program credits can be used in any combination of the above categories of courses.

Ph.D. track: Up to 12 credits of courses taken through the continuing education program or through graduate programs at other institutions may be submitted for consideration for transfer credit. Such credit transfers are usually only approved if the language of instruction was English and if the student can provide syllabi, lecture notes, and exams for review by the TMC. Students wishing to do so should make a proposal to their TMCs. Discussion and agreement about the appropriateness of the transfer credits with that committee should be followed by a written recommendation to the Director of Graduate Studies from and approved by at least two-thirds of the TMC. The agreed upon courses should then later be included on the Degree Program Form for ultimate approval by the DGS who will normally follow the recommendation of the TMC.

## DEGREE PROGRAM FORM

The Degree Program Form must be filed in the Fall term of the second year in residence. This form lists all of the coursework that will apply toward the Ph.D., and it informs the Graduate School as to the names of the Oral Preliminary Exam committee members (see below.) In addition, students will fill out a separate Degree Program Form at the same time for a M.S. – Plan B degree, which will be attempted concurrently with the Ph.D. preliminary exams.

## WRITTEN PRELIMINARY EXAMINATION AND COMMITTEE

The written preliminary examination is required by the Graduate School and is submitted during the Fall term of the second year in residence. In addition, all students will be pursuing a M.S.-Plan B degree concurrent with the written and oral preliminary exams. All specialty areas follow the same policy for the written preliminary exam.

The first step is submitting an abstract and potential written committee member names in mid-August, prior to the start of the second year in residence. The three members of the written preliminary exam committee are selected by the Director of Graduate Studies in consultation with the specialty area coordinators. Please see the full Written Preliminary Exam policy in Appendix I of this handbook.

It is sometimes the case that not all Ph.D. coursework has been completed when the form is filed and this is perfectly acceptable. Remaining courses should be identified. If there are changes in the course program after the form has been filed, necessary to file a change to the Degree Program Form with the Graduate School.

## ORAL PRELIMINARY EXAMINATION AND COMMITTEE

The members of the Preliminary Oral Examination committee will be the same three Chemistry faculty members who served on the student's Preliminary Written Exam committee, plus on additional committee member from outside of Chemistry. This new name should be submitted to 115 Smith along with the Degree Program Form.

Each Ph.D. candidate must pass the oral preliminary examination. Possible outcomes of the first examination are

i) pass
ii) pass with reservation
iii) fail

*Students who have not made an initial attempt at the oral preliminary examination ten weeks before the start of Summer term of their second year or who have not passed this examination by the beginning of Summer Term of their second year will no longer be in good standing in the Ph.D. Program.* They will be reclassified into the M.S. program and will be reconsidered for the Ph.D. program only under extraordinary circumstances.

Students who fail the first attempt at the oral preliminary exam are allowed one opportunity to re-take the exam. It should be noted that there is a Graduate School requirement that ten calendar weeks must pass before a retake of the preliminary oral examination may be scheduled.

The Preliminary Oral Exam is also the Final Defense for students' M.S.-Plan B degree. Again, refer to the full policy in Appendix I.

Students who must delay taking their preliminary oral examination until after the eleventh week before the end of Spring/Summer intersession of their second year in residence, due to extenuating circumstances, must submit a letter of explanation to the Director of Graduate Studies. In all cases the oral must be passed by the last day of the May session of the second year in residence with no exceptions.

The above dates apply to students beginning their graduate studies Fall Term. For students beginning in Spring, an alternative schedule should be established by the TMC. In the case of other special circumstances, a student may petition the Director of Graduate Studies for an exception. The petition must be submitted at least one month prior to the deadline in question and must include a proposed alternative date.

Note that the above rules apply to all specialty areas and also to interdisciplinary students. However, some specialty areas have stricter requirements.

The deadline for passing the preliminary oral examination for students classified as M.S. students and later reinstated in the Ph.D. program is 6 months after readmission to the Ph.D. program. Students not passing the Ph.D. oral examination by this deadline shall be reclassified to the M.S. program again and this reclassification will be final.

The oral preliminary examination may cover coursework or research topics and related areas. Individual specialty areas may have more rigorous time requirements. Specific requirements regarding the timing and content of the oral preliminary examinations are listed within each of the specialty area sections of this handbook.

It is imperative that each student register the time and date of the preliminary oral examination with the Graduate School (316 Johnston Hall). In addition it is strongly advised that students remind faculty in writing or by e-mail of the time, date, and location of the preliminary oral examination the day before the exam. If a full committee of faculty is not assembled for the exam, there is usually no option but to postpone the exam—an event inconvenient for all involved.

## THESIS CREDITS

Once a student has passed the Preliminary Oral Exam, the student should begin taking the required 24 Ph.D. thesis credits (CHEM 8888) during the next term. These credits can be divided up as needed, provided that all 24 are completed over the course of the next two terms. It is also possible that a faculty research adviser would choose to have a student take these credits during a summer term.

## THESIS PROPOSAL FORM

This form must be submitted to the Graduate School at the start of the Spring term of the third year of study, and requires a tentative thesis title and abstract. In addition, you will submit a departmental form indicating the members of your Ph.D. Final Defense (see below). All of these forms are available online or from the Graduate Operations Office, 115 Smith Hall.

## SELECTION OF Ph.D. FINAL ORAL EXAMINATION COMMITTEE

When the Thesis Proposal Form is submitted, students should submit the Ph.D. Oral Examination Prospective Committee Form with the names of three faculty names from Chemistry, and one faculty member from outside of Chemistry. The three reviewers (or readers) should be identified. The student's adviser and the non-Chemistry faculty member are automatically assigned as reviewers. Students should identify which of the remaining two members will serve as the third reviewer. Ordinarily at least three members should be the same as those who served on the preliminary oral examination. It is the student's responsibility to contact all four persons regarding their willingness to serve as a committee member or reader. All signatures should be obtained before the form is submitted.

## THIRD-YEAR SYMPOSIUM

All graduate students will deliver a seminar on their research in the Spring term of their third year in residence, as part of the Departmental Research Symposium. Students will be provided with information about the symposium early in their third year

## THESIS PREPARATION

A successful Ph.D. candidate must carry out original research that is described in a written thesis, and he or she must successfully defend the completed work in a final oral examination. Detailed instructions for the preparation of the thesis may be found on the Graduate School website: www.grad.umn.edu.

The Graduate School requires that each copy of any thesis [either Plan A Masters or Doctoral] delivered to the Graduate School contain a separate page for the signature of the adviser. The signature page should be bound into both copies of the thesis as the first page in the volume, immediately preceding the title page. Both copies should be signed in order to assure that the adviser has seen and approved the actual, bound, final version of the thesis.

## GRADUATION PROCEDURES AND FORMS

Once the Thesis Proposal Form has been approved by the Graduate School, you will automatically be sent a Graduation Packet with instructions and forms to complete the path to completing your degree. Many questions can be answered via the Graduate School website or by their staff in 316 Johnston Hall.

## FINAL ORAL DEFENSE

The format of the final defense can vary, but typically involves the Ph.D. candidate giving a presentation on their research to the committee and any other attendees. This is then followed by questions from the committee. The questions period is held in private, with only the student and the committee members present.

## CHANGES IN COMMITTEES

Any changes to assigned committee require approval by the Director of Graduate Studies. Report any necessary changes to the Graduate Operation Office in 115 Smith.

NOTE: It is virtually impossible (by university-wide policy) to change the membership of a preliminary oral examination committee between an initially failed examination and the retake of the exam (if permitted.) Students and faculty alike should consider this in their planning when faculty will be on leave in the term/year subsequent to the first examination date. Recall that the university-wide policy also requires that a minimum of ten weeks pass between the first exam date and a retake.

## V. THE M.S. PROGRAM IN CHEMISTRY

There are two types of Masters degrees offered at Minnesota:

**M.S. Plan A:** requires a formal, published thesis, 10 M.S. Thesis Credits (CHEM 8777) and 20 credits of coursework. An oral final defense with a three-member committee is required.

**M.S. Plan B**: requires two graded projects (CHEM 8081 and CHEM 8082, 4 credits each) and 30 credits of coursework. The eight (8) credits for the project count toward the 30 credit total. An oral final defense is optional, but a three-member committee still renders a final decision on the M.S. projects.

Effective with the entering class of Fall 2006, students will pursue an M.S. Plan B degree concurrent with the written and oral preliminary exams during the second year of study. All of the instructions below still apply, regardless of whether a student is attempting an M.S. degree independent of the preliminary exam process, or during that process.

Any student wishing to plan a Master's program should consult with his or her adviser or the Three–Member Advising Committee. Courses for Masters programs are normally selected from the recommended courses and supporting programs of a specialty area in accordance with the Graduate School requirement; however, M.S. students do not belong to a specialty area *per se.*

A Masters candidate must pass the proficiency examination in the field nearest his or her specialty area, but need not do so in the other fields. A Masters candidate in an interdisciplinary area should establish which proficiency or proficiencies will be required in consultation with his or her three-member advising committee. Masters candidates are not required to take written or oral preliminary examinations.

### M.S. DEGREE - ACADEMIC PERFORMANCE

The Department of Chemistry requires that M.S. candidates maintain a GPA of 2.8 among those graduate courses ultimately submitted on the M.S. Degree Program Form. When this requirement is not met or if the necessary proficiency exam(s) are not passed within the first year of graduate study, M.S. candidates will be dropped from the program. To be considered in good academic standing, and therefore eligible for continuation of departmental support, reasonable progress toward completion of the non-course requirements of the M.S. degree program is expected. Normally the Plan B M.S. program for a full-time student should be completed by the end of the second academic year in residence (i.e., ~21 months after beginning the program).

### M.S. PLAN A - FINAL ORAL EXAMINATION

At the time that the Degree Program Form is submitted the student should submit the M.S. Oral Examination Prospective Committee Form with the names of two Chemistry faculty and one non-departmental member. It is the student's responsibility to contact all three members regarding their willingness to serve. All signatures should be obtained before the form is submitted. A final oral examination is required for Plan A M.S. degrees.

### M.S. PLAN B – COURSES

Students must complete an approved program of coursework consisting of a minimum of 22 credits in the major field or related fields outside the major. The balance of credits to be completed to meet the 30-credit minimum requirement is chosen by agreement between the adviser and the student. All credits in the official degree must be in graduate-level courses

### M.S. PLAN B – PROJECTS

Students must demonstrate familiarity with the tools of research or scholarship in their major field, the ability to work independently, and the ability to present the results of their investigation by completing at least eight credits of Plan B Projects (CHEM 8081 & 8082).

Each Plan B project should involve a combined total of approximately 160 hours (the equivalent of four full-time weeks) of library research, reading, and/or writing. Each should result in the preparation of a significant written document. Students who plan to work on Plan B projects independent of the Preliminary Examination should present a plan, after consultation with the chosen instructor for the Plan B project, outlining the number and content of the projects to the DGS. Projects should be completed to the satisfaction of the instructor and the grade is determined by the instructors.

Students who are completing the Plan B projects as part of the Preliminary Examination can find guidelines regarding the two projects in Appendix I. The grades for the two projects will be determined by the Oral Preliminary Exam Committee.

### M.S. PLAN B - FINAL EXAMINATION

The Graduate School requires a final examination for Plan B candidates; this may be written, oral or both. Students should make the Plan B project(s) available to the examining committee for its review well in advance of the final examination. If a final oral is held, it is conducted as a closed examination, attended only by the student and the examining committee. All committee members must be present at the oral examination; the absence of any member results in an invalid examination.

### REINSTATEMENT INTO THE PH.D. PROGRAM

**(FOR STUDENTS PREVIOUSLY RECLASSIFIED AS MASTERS DEGREE STUDENTS)**

In general, if a student is reclassified into the M.S. program, it is recommended that the student reconsider his or her plan of study with the goal of attaining a terminal M.S. degree within four terms of beginning in the Chemistry graduate program or within a minimum

number of terms after the change in program status. In certain exceptional circumstances in the course of pursuing an M.S. degree, a student may demonstrate such

improvement in coursework and/or research that reconsideration of the status in the Ph.D program is called for. The procedure for requesting such reconsideration consists of two steps:

1. Petition to the TMC. If at least two thirds of the TMC recommends reinstatement into the Ph.D. program, the student may undertake step 2.

2. Petition to the Department of Chemistry Graduate Committee. Upon written request of the student and a signed request by two thirds or more of the TMC stating reasons for reconsideration, the Graduate Committee will meet formally and make a recommendation.

In no case may the reinstatement request be initiated (Step 1 above) less than one full term after the completion of the term on which the original reclassification to M.S. program was based. Furthermore, since the Graduate School allows only one possible retake of the oral preliminary examination for the Ph.D., students who fail this examination twice may not petition for reinstatement.

## VI. OTHER INFORMATION

### TIME LIMITATIONS FOR COMPLETING DEGREE REQUIREMENTS

The university-wide policy imposes various limits on the total duration of various courses of study leading to graduate degrees. These are summarized below although anyone wishing further clarification should contact the Graduate Operations Office in 115 Smith for the "long" version of the university-wide policy requirements from which these were distilled.

M.S. (Plan A or Plan B): Must be completed within five years from the date of the oldest coursework on the degree program.

Ph.D.: Must be completed by five years from the end of the Fall or Spring term following the term in which the student passes the preliminary oral examination.

A petition for extension is permitted:

It is possible to petition the College of Science and Engineering to request an extension in the time limit for either degree. However, university-wide policy states that "only under the most extraordinary circumstances will a petition be considered to extend the deadline to more than six years beyond the date of the [Ph.D.] preliminary oral examination" or to "more than eight years from the date of the earliest [M.S.] program coursework."

### COMMITTEES

Any student interested in serving on departmental and/or collegiate educational or policy-making bodies should indicate this interest to the Department of Chemistry Chair.

## GRIEVANCES

If a conflict should arise between a graduate student and another member of the department regarding a course, a teaching assignment, or a matter of research supervision, the student should make every effort to resolve this with the party or parties involved. If the problem remains unresolved at this level, the student may request a meeting with the departmental administration. In particular, grievances should be brought to the Director of Graduate Studies, the Vice Chair, or the Chair of the Department, as appropriate to the problem.

# VII. SPECIALTY AREA POLICIES

## ANALYTICAL CHEMISTRY

**Members:** Professors Edgar A. Arriaga, Michael T. Bowser, Philippe Buhlmann, Peter W. Carr, Christy L. Haynes, Steven R. Kass, Timothy P. Lodge, and Valerie C. Pierre

Area Coordinator: Professor Christy L. Haynes

Please find a brief description of the analytical chemistry specialty area as well as links to all area faculty's individual research webpages at: http://www.chem.umn.edu/analytical/

The following courses are available:

8151 Analytical Separations and Chemical Equilibria (4 cr, offered Spring 2013)
8152 Analytical Spectroscopy (4 cr, offered Fall 2012)
8153 Extracting Signal from Noise (5 cr, Spring 2013)
8155 Advanced Electrochemistry (4 cr, not offered Fall 2012 or Spring 2013)
8157 Bioanalytical Chemistry (4 cr, offered Fall 2012)

Requirements for all first-year students include:

• Attend the departmental seminar series. When not in conflict, register for:

8601 Modern Problems in Chemistry (1 cr, Fall 2012 and Spring 2013)

• Register for:

8066 Professional Conduct of Chemical Research (1 cr, Spring 2013)

Laboratory Rotations (optional). When interested, register for:

Chem 8025 (2 cr, either Fall 2012 or Spring 2013)

## CHEMICAL BIOLOGY

**Members**: Professors Edgar A. Arriaga, George Barany, Victor A. Bloomfield, Michael Bowser, Mark D. Distefano, Jiali Gao, Gunda Georg, Timothy Griffin, Carrie Haskel-Luevano, Christy L. Haynes, John D. Lipscomb, Connie Lu, Valerie Pierre, William Pomerantz, Lawrence Que, T. Andrew Taton, William B. Tolman, Natalia Tretyakova, Donald G. Truhlar, Gianluigi Veglia, Carston R. Wagner

**Area Coordinator**: Professor Mark Distefano

The University of Minnesota has a long and proud tradition of cutting-edge research in Chemical Biology. Please visit the web site: http://www.chem.umn.edu/grad/Areas.html#Biological for further details. In addition, students should be aware of the NIH Chemistry-Biology Interface Training Grant (CBITG), which provides opportunities for interdisciplinary education and training. Criteria for appointment, and recommended coursework, are described further at http://www.chem.umn.edu/cbitg/ [Professor Mark Distefano is the CBITG Principal Investigator/Program Director].

I. Course Program

For students interested in Chemical Biology, the Chemistry Department has developed the following specific courses:

Chem 8411 Introduction to Chemical Biology (Fall each year)
Chem 8412* Chemical Biology of Enzymes (offered Spring 2012)
Chem 8413* Nucleic Acids (may be offered Spring 2012)

Currently, Chemical Biology students are required to take the following courses:

Chem 8011 Mechanisms of Chemical Reactions (Fall, each year)
Chem 8066 Professional Conduct of Chemical Research (Spring of first year)

In addition to these required courses, students should take additional courses in Chemistry and Biological Science to complete the 24 credit requirement. Suggested courses that may be used to include, but are not limited to

Chem 8021 Computational Chemistry (Spring, each year)
Chem 8025 Introduction to Graduate Research (Laboratory Rotations, discussed below)
Chem 8157 Bioanalytical Chemistry (Fall 2012)
Chem 8361 Interpretation of Organic Spectra (Fall each year)
Chem 8321 Organic Synthesis I (Fall each year)
Chem 8411 Introduction to Chemical Biology (Fall each year)
Chem 8412 Chemical Biology of Enzymes (offered Spring 2013)
Chem 8413 Nucleic Acids (offered Spring 2013)
Chem 8735 Bioinorganic Chemistry (offered Spring 2013)

BioC 4025 Laboratory in Biochemistry (Fall each year)
BioC 4125 Laboratory in Molecular Biology and Biotechnology (Spring each year)
BioC 5527 Introduction to Modern Structural Biology (Fall each year)
BioC 5528 Physical Biochemistry: Spectroscopy & Kinetics (Spring each year)
BioC 4331 Biochemistry I: Structure, Catalysis, and Metabolism (Fall and Spring)
BioC 4332 Biochemistry II: Molecular Biology and Regulation (Fall and Spring each year)
BioC 8001 Advanced Biochemistry: Structure, Catalysis, and Metabolism (Fall and Spring)
BioC 8002 Advanced Biochemistry: Molecular Biology and Regulation (Fall and Spring)
MedC 5245/Chem 5245 Introduction to Drug Design (may be offered Fall 2013)
MedC 8700/Chem 8700 Advanced Concepts in Drug Design (may be offered Spring 2013)

**Selection of Program**

The student should plan a course program in consultation with his or her TMC that includes the required courses outlined in the previous section. Additional courses may be selected from the areas of analytical, inorganic, organic, or physical chemistry; biochemistry; medicinal chemistry; pharmacology; microbiology; etc., which would contribute to the development of the student's particular interests. The one-credit course on Professional Conduct of Chemical Research is required of all graduate students and is usually taken in the second year. A minimum of 24 credits is required for the Ph.D. degree. Please consult with your research advisor or the Area Coordinator as to which courses should be listed as "supporting program" on the Degree Program Form.

Laboratory Rotations: Students in the Chemical Biology specialty area may wish to take Introduction to Graduate Research (Chem 8025) for two credits. The objective of this course is to broaden the exposure of students to new areas of chemistry by giving them practical hands-on exposure to graduate research in a participating faculty's laboratory. Students will receive training in research methods and techniques related to each laboratory's research area. Students will rotate through two different laboratories. Each rotation lasts approximately seven weeks, with one credit earned for each rotation. The second 7-week rotation must be carried out in a different laboratory. The format for laboratory rotation projects will vary depending on the research group. Students may be given an independent laboratory research project and/or may assist other members of the laboratory in data acquisition and analysis. They will also attend and participate in laboratory group meetings and related events. Students are responsible for arranging their own laboratory rotations by contacting their first rotation professor no later than the end of the first week of fall semester. The second rotation, which must be carried out in a different laboratory from the first rotation, should be arranged by the end of week 6 of the semester and will typically begin in week 8.

## II. Selection of Research Advisor

New graduate students entering in the fall may choose a research advisor any time during fall semester but no later than November 15 (or the following Monday if this date falls on a weekend) of the student's first year in residence. In choosing a research advisor, graduate students are expected to interview at least four faculty members regarding their research. Once they have selected a research advisor, students should submit their choice, along with dated signatures of interviewed faculty, to the Graduate Operations Office (see attached form at the back of this Bulletin).

## III. Seminars

Departmental seminars by leading researchers from other universities and from government and industrial laboratories are given in the Chemistry Department approximately weekly throughout the academic year. For the schedule, see: http://www.chem.umn.edu/seminar/. You should try to attend at

least one seminar each week. You should also attend the special Kolthoff and Gassman Lectures. These are endowed lectureships that permit us to host internationally renowned scientists for week-long visits.

The Chemical Biology Colloquium seminar program will meet at 12:10-1:00 PM on select Mondays throughout the 2012-2013 academic year. Regular attendance is expected, so be sure to arrange your TA schedules to keep this time available if possible.

All graduate students will deliver a seminar on their research at the end of their third year as part of the Departmental Graduate Research Symposium. This Symposium gives graduate students experience in preparing and delivering oral presentations.

## IV. Guidelines for the Written Preliminary Exam

The written preliminary examination in Chemical Biology follows the "Common Rules for the Written Preliminary Exam in Chemistry" established by the Department of Chemistry. Detailed instructions including a timetable can be found elsewhere in this manual.

## V. Guidelines for Propositional Oral Preliminary Examination

The Oral Preliminary Examination in Chemical Biology follows the "Common Rules for the Oral Preliminary Exam in Chemistry" established by the Department of Chemistry. Detailed instructions including a timetable can be found elsewhere in this manual.

## INORGANIC CHEMISTRY

**Members**: Professors John E. Ellis, Laura Gagliardi, Wayne L. Gladfelter, Doreen G. Leopold, Kenneth R. Leopold, John Lipscomb, Connie C. Lu, Kent R. Mann, Valerie C. Pierre, Lawrence Que, Jr., Andreas Stein, and William B. Tolman

**Area Coordinator**: Professor Larry Que

A graduate major in inorganic chemistry prepares students for an academic or industrial career in the field of modern inorganic chemistry that includes synthetic and physical aspects of organometallic chemistry, catalysis, coordination chemistry, environmental chemistry, main group chemistry, bioinorganic chemistry, inorganic materials, solid-state chemistry, and spectroscopic applications to inorganic systems.

### I. Recommended Course Program

The following are considered the core of the inorganic course program and will be offered every year:

| | |
|---|---|
| Chem 8715 | Physical Inorganic Chemistry (Fall 2012) |
| Chem 8011 | Mechanisms of Chemical Reactions (Fall 2012) |

The following courses are also offered (some in alternate years) and can be used to complete the inorganic major:

| | |
|---|---|
| Chem 8745 | Advanced Inorganic Chemistry (Spring 2013) |
| Chem 8735 | Bioinorganic Chemistry (Spring 2014) |
| Chem 8361 | Interpretation of Spectra (Fall 2012) |
| Chem 8201 | Materials Chemistry (Fall 2012) |
| Chem 8725 | Organometallic Chemistry (Spring 2013) |
| Chem 5755 | X-Ray Crystallography (Spring 2013) |

Depending on your specialization, you may choose additional courses in analytical, biological, organic, materials, and physical chemistry for the supporting program. Courses from other disciplines, such as Chemical Engineering or Materials Science, may also be used for the supporting program. It is important to consult with your TMC or research advisor in making these choices.

It is expected that a coherent course program be taken. Normally, a student takes a total of 24 credits; however, credit may be received in any course by means of an exemption exam. The student's TMC, the Director of Graduate Studies, and the Graduate School must approve the course program. A minimum of 4 credits must be taken outside the student's major area.

A one-credit course on Professional Conduct of Chemical Research (Chem 8066 – taken in the Spring term of the first year) is also required of all graduate students. All first year students must register for Modern Problems in Chemistry (Chem 8601) during both semesters of the first year.

## II. Written Preliminary Examination

Please see the "Common Rules for the Written Preliminary Exam in Chemistry" in Appendix I of this handbook.

## III. Oral Preliminary Examination

Please see the "Common Rules for the Oral Preliminary Exam in Chemistry" in Appendix I of this handbook.

## IV. Research

See common rules for choosing a research advisor.

## V. Seminars

Inorganic students are expected to attend at least one of the Departmental Seminars (or named lecture series) each week. All graduate students will deliver a seminar on their research at the end of their third year as part of a Departmental Research Symposium.

## MATERIALS CHEMISTRY

**Members:** Professors George Barany, Frank Bates, David Blank, Philippe Buhlmann, Peter Carr, Christopher Douglas, Daniel Frisbie, Wayne Gladfelter, Christy Haynes, Marc Hillmyer, Timothy Lodge, Kent Mann, Aaron Massari, Lee Penn, Ilja Siepmann, Andreas Stein, Andrew Taton, Donald Truhlar

**Area Coordinator:** Professor R. Lee Penn

Research interests of our faculty include biomaterials, solid state inorganic materials, polymers, materials for separations and environmental applications, materials for energy applications, materials for photonics, surfaces and interfaces, materials characterization, crystal growth, simulation, and modeling. Many graduate students become involved in existing collaborative programs between faculty members in the Materials Chemistry specialty area and other chemistry faculty as well as faculty from other departments, such as Chemical Engineering and Materials Science, Mechanical Engineering, Biochemistry, and Physics. The course program for graduate students in Materials Chemistry has been specially designed to emphasize the interdisciplinary nature of this field.

### *I. Coursework for Students Specializing in Materials Chemistry*

Students are given wide latitude to take courses appropriate to their research, and it is expected that they will consult with their advisors about this subject once they join a research group.
The following is a selection of courses offered by the Chemistry department that are recommended for Materials Chemistry students:

- [*]Materials Chemistry (Chem 8201, fall, 4 cr)
- Synthetic Polymer Chemistry (Chem 8221, fall, 4 cr)
- Mechanisms of Chemical Reactions (Chem 8011, fall, 4 cr)
- Dynamics (Chemistry 8541, Fall, 4 credits)
- [*]Materials Characterization (Chem 5210, spring, 4 cr)
- Physical Chemistry of Polymers (Chem 8211, spring, 4 cr)
- X-Ray Crystallography (Chem 5755, spring, 4 cr)
- Introduction to Graduate Research (CHEM 8025, fall, 1-2 credits)
- Physical Inorganic Chemistry (CHEM 8715, fall, 4 credits)
- Computational CHemistry (CHEM 8021, spring, 4 credits)
- [†]Seminar: Modern Problems in Chemistry (Chem 8601/8602, both semesters, 1 cr)
- [†]Professional Conduct of Chemistry Research (Chem 8066, spring, 1 cr)
- [*]Highly recommended for Materials Chemistry students.
- [†]Required for all chemistry graduate students.

In addition, Materials Chemistry students are encouraged to take graduate-level materials courses offered by other departments. Some courses that have been taken for Materials Chemistry credit include:

- Advanced Biomaterials (BMEn 5001, fall, 3 cr)
- Survey of Renewable Energy Technologies (ChEn 5551, fall, 3 cr)
- Colloids and Dispersions (ChEn 5771, fall, 3 cr)
- Microelectronic Fabrication (EE 5171, fall, 4 cr)

- Basic Microelectronics Laboratory (EE 5173, fall, 1 cr)
- Introduction to Nanotechnology (EE 5181, fall, 4 cr)
- Electron Microscopy (MatS 5517, spring, 3 cr)
- Structure and Symmetry of Materials (MatS 8001, fall, 3 cr)
- Solid-State Physics for Engineers and Scientists (Phys 5701, spring, 4 cr)
- CHEN 4301/8301 (Physical Rate Processes I: Transport)

### *II. Written and Oral Preliminary Examinations*

The guidelines and schedule common to all specialty areas are discussed in Appendix I at the end of this handbook.

## ORGANIC CHEMISTRY

**Members:** Professors George Barany, Mark D. Distefano, Christopher J. Douglas, Jiali Gao, Andrew M. Harned, Marc A. Hillmyer, Thomas R. Hoye, Steven R. Kass, Wayland Noland, T. Andrew Taton, William B. Tolman and Jane Wissinger.

**Area Coordinator:** T. Andrew Taton

### I. Course requirements

A minimum of 6 courses, totaling at least 24 semester credit hours, is required for the Ph.D. degree program in the organic chemistry specialty area. All students are required to take:

| ***The two core courses (4 credits each):*** | | ***Instructors (2012-13)*** |
|---|---|---|
| Chem 8011* | "Mechanisms of Chemical Reactions" | *K. Mann* |
| Chem 8321* | "Organic Synthesis" | *T. Hoye* |

***At least two of the following additional courses (4 credits each):***

| | | |
|---|---|---|
| Chem 8361 | "Interpretation of Organic Spectra" | *A. Taton* |
| Chem 8322 | "Advanced Organic Chemistry"<br>(Modern Topics in Organic Synthesis) | *A. Harned* |
| Chem 8352 | "Physical Organic Chemistry" | *S. Kass* |
| Chem 8021 | "Computational Chemistry" | *C. Cramer* |
| Chem 8725 | “Organometallic Chemistry” | *J. Ellis* |

*Courses required of all organic chemistry students

A one-credit course on Professional Conduct of Chemical Research (Chem 8066) is also required of all graduate students, taken in the spring terms of the first year. First-year students must register for the seminar course, Modern Problems in Chemistry (Chem 8061), during the Fall and Spring semesters.

### II. Seminars

Departmental seminars by leading researchers from other universities and from government and industrial laboratories are given in the Chemistry Department approximately weekly throughout the academic year. For the schedule, see: http://www.chem.umn.edu/seminar/. You should try to attend at least one seminar each week. You should also attend the special Kolthoff and Gassman Lectures. These are endowed lectureships that permit us to host internationally renowned scientists for week-long visits.

All graduate students will deliver a seminar on their research at the end of their third year as part of the Departmental Graduate Research Symposium. This Symposium gives graduate students experience in preparing and delivering oral presentations.

## III. Guidelines for the Written Preliminary Exam for the Organic Area

The written preliminary examination in Organic Chemistry is in the form of an extensive Research Dossier, which is written and prepared by the candidate in consultation with his or her research advisor. The guidelines and schedule common to all of the specialty areas are discussed in Appendix I of this handbook.

**PLEASE INDICATE ON THE COVER PAGE OF YOUR DOSSIER THE MEMBERS OF YOUR COMMITTEE AND THE DUE DATE FOR THE COMMITTEE EVALUATIONS**.

A few specific suggestions for the preparation of your dossier:

(1) Provide a table of contents with an appropriate set of headings and subheadings. This will serve as an outline as you construct your document.
(2) Use schemes and graphics to your advantage. A good rule to follow is to assign EVERY structure in a scheme a unique number and then to refer to that number at least once in the text. Schemes should be incorporated into the text close to the point where they are discussed.
(3) If appropriate, provide 2-3 representative detailed experimental procedures that follow, e.g., *J. Org. Chem.*, style. Choose examples where you have thoroughly characterized the products and include the spectroscopic data.
(4) Carefully proofread your document.

## IV. Guidelines for Propositional Oral Examinations in Organic Chemistry

Department-wide guidelines for the preliminary oral examination should be followed.

## PHYSICAL CHEMISTRY

### PHYSICAL CHEMISTRY SPECIALTY AREA

**Faculty:** David A. Blank, Laura Gagliardi, Jiali Gao, Christy L. Haynes, Steven R. Kass, Doreen G. Leopold, Kenneth R. Leopold, John Lipscomb, Timothy P. Lodge, Aaron M. Massari, R. Lee Penn, J. Ilja Siepmann, Andreas Stein, Donald G. Truhlar, and Gianluigi Veglia

**Area Coordinator:** Kenneth R. Leopold

Graduate students in physical chemistry have the opportunity to participate in research on the fundamental physical principles and phenomena that form the basis for all of chemistry, and also on important applications. The University of Minnesota has one of the world's leading research programs in this area, with 15 faculty members whose groups span an extremely broad range of research interests. Molecular spectroscopy, ultrafast laser chemistry, atmospheric and environmental chemistry, surface science, biophysical chemistry, nanophase materials, and polymer chemistry are some of the areas in which there are active experimental programs. Computational chemistry programs include research in the areas of electronic structure theory, chemical reactivity, quantum dynamics, statistical mechanics and biomolecular simulations. Much of the research takes advantage of the excellent computational resources found at the University of Minnesota Supercomputing Institute. Further information about graduate studies in physical chemistry is available at ***http://www.chem.umn.edu/pchem/*** and ***http://comp.chem.umn.edu/***.

For more information concerning the graduate student timeline and to obtain the necessary forms, see: ***http://www.chem.umn.edu/grad/CurTime.html***

#### *I. Course Program*

The course program in physical chemistry is designed to enable students with typical undergraduate backgrounds to begin research during the summer of their first year in residence. Two 2-semester course sequences are offered annually - one in quantum mechanics and spectroscopy, and one in thermodynamics, statistical mechanics, and reaction dynamics. Additional courses on dynamics (Fall) and computational chemistry (Spring) are also offered. Although no courses are specifically required, most students choose to take most or all of these courses (listed in Part A below) during their first year. In addition to, or in place of, one or more of these courses, students may also choose courses from graduate offerings in other areas of chemistry (some of which are listed in Part B) or in physics, mathematics, scientific computation, chemical engineering, materials science, biochemistry or indeed in any area that suits their backgrounds and interests.

To be prepared to begin their thesis research during the summer following the first year, physical chemistry students are encouraged to take 3 courses during each of the fall and spring semesters. Since this represents a challenging course load, physical chemistry students are generally not advised to also undertake a formal lab rotation (described earlier in this *Bulletin*) during the fall semester, especially if they are also working as teaching assistants. As for all Chemistry graduate students, the course program should include 24 or more credits (not including seminars and research), and satisfactory progress at the end of the first year requires the completion of at least 18 credits with a grade of B- or better and a GPA of 3.0 or better.

## A. Physical Chemistry Graduate Courses to be Offered in 2011-2012

| | | |
|---|---|---|
| 8541 | Dynamics | (4 cr., Fall, 11:15-12:30 MF, Truhlar) |
| 8551 | Quantum Mechanics I | (4 cr., Fall, 2:30-3:20 MWF, Massari) |
| 8561 | Thermo., Stat. Mech. & Dynamics I | (4 cr., Fall, 1:25-2:15 MWF, Siepmann) |
| 8552 | Quantum Mechanics II | (4 cr., Sp, 2:30-3:20 MWF, Gagliardi) |
| 8562 | Thermo., Stat. Mech. & Dynamics II | (4 cr., Sp, 1:25-2:15 MWF, Blank/Veglia) |
| 8021 | Computational Chemistry | (4 cr., Sp, 9:05-9:55 MWF, Cramer) |

Current descriptions of these courses are given below:

**8541. Dynamics:** Mathematical methods for graduate physical chemistry and an introduction to classical mechanics and classical dynamics, including normal modes of vibration. If time permits, there will coverage of special topics such as rotational motion, the Langevin equation, Brownian motion, time correlation functions, collision theory, cross sections, energy transfer, molecular forces, potential energy surfaces, classical electrostatics, and Shannon entropy. [Prereq: Undergraduate Physical Chemsitry]

**8551. Quantum Mechanics I:** Fundamentals of quantum mechanics such as momentum state of free particles and wavepackets, uncertainty relations, and the time-independent and time-dependent Schroedinger Equation. Time-independent and time-dependent perturbation theory will be covered along with absorption and emission of radiation and the coherent coupling of molecules to light. [Prereq: Undergraduate Physical Chemistry]

**8552. Quantum Mechanics II:** Rotational/point-group symmetries. Perturbation, variation, semi-classical approximation. Hamiltonian of charged particles in electromagnetic fields (Landau levels, Aharonov-Bohm effect, atomic hyperfine interactions). Time-dependent perturbation (radiative, non-radiative transitions). Quantization of electromagnetic field and multiphoton processes. Identical particles. Hartree-Fock, density-functional, and second-quantization. [Prereq: 8551]

**8561-2 Thermodynamics, Statistical Mechanics and Reaction Dynamics I and II:** Two-part sequence. Thermodynamics, equilibrium statistical mechanics, ensemble theory, partition functions. Applications, including ideal gases/crystals. Theories of simple liquids, Monte Carlo, and molecular dynamics simulations. Reaction dynamics from microscopic viewpoint. 8562 will be taught in alternate years by Ilja Siepmann and Aaron Massari (even years) and David Blank and Gianluigi Veglia (odd years). In even years: Molecular simulations and laser spectroscopy. In odd years: The connection between microscopic dynamics and macroscopic reaction rates in both gas and condensed phases, and correlation of nuclear spin dynamics with structure and motion in molecules. [Prereq for 8561: Undergraduate Physical Chemistry; Prereq for 8562: 8561]

**8021. Computational Chemistry:** Modern theoretical (classical and quantum) methods used in study of molecular structure, bonding, and reactivity. Concepts and practical applications. Determination of spectra; relationship to experimental techniques. Molecular mechanics. Critical assessment of reliability of methods with emphasis on understanding the literature. [Prereq: undergrad quantum chemistry course]

**B. Other Chemistry Courses to be Offered in 2011-2012** that may also be of interest to physical chemistry students include the following. For their current descriptions and prerequisites, see **http://www.catalogs.umn.edu/grad/index.html** .

| | | |
|---|---|---|
| 8011 | Mechanisms of Chem. Reactions | (4 cr., Fall, 10:10-11:00 MWF, Mann) |
| 8152 | Analytical Spectroscopy | (4 cr., Fall, 9:05-9:55 MWF, Haynes) |
| 8201 | Materials Chemistry | (4 cr., Fall, 11:15-12:30 TTh, Gladfelter) |
| 8221 | Synthetic Polymer Chemistry | (4 cr., Fall, 2:30-3:45 TTh, Reineke) |
| 8411 | Intro. to Chemical Biology | (4 cr., Fall, 1:00-2:15 TTh, Pomerantz) |
| 8715 | Physical Inorganic | (4 cr., Fall, 12:20-1:10 MWF, Stein) |
| | | |
| 5210 | Materials Characterization | (4 cr., Spring, 1:25-3:20 MW, TBA) |
| 8352 | Physical Organic | (4 cr., Spring, 10:10-11:00 MWF, Kass) |

**C.** A course on Professional Conduct of Chemical Research (Chem 8066, 1 cr., T, 4:40 – 6:00, S-N only, Truhlar) is required of all chemistry graduate students.

**D.** All first-year graduate students should also register for Seminar (Chem 8601, 1 cr., 9:45-11:00 TTh, S-N only, Lu) during the Fall and Spring semesters.

### *II. Seminars* *(also see **http://www.chem.umn.edu/seminar/** )*

Seminars by leading researchers from other universities and from government and industrial laboratories are given in the Chemistry Department approximately weekly throughout the academic year. Physical chemistry students also frequently find the research seminars held in Physics, Chemical Engineering and Materials Science, and other departments to be of interest. At the end of their third year, all graduate students present a seminar on their research at the Annual Chemistry Graduate Student Research Symposium ( ***http://www.chem.umn.edu/GradResSymp/*** ).

### *III. Choice of a Research Advisor*

Chemistry graduate students entering in Fall 2012 must choose a research advisor by **November 15, 2012.** To help students make an informed decision as to which research group to join, a Graduate Student Research Symposium is held at the end of August, at which faculty members present brief overviews of their research. In addition, before officially selecting an advisor, students are required to meet with at least 4 faculty members to learn more about their research. Some groups may also schedule an "Open House" to provide additional opportunities for new students to meet the group members. Students should submit their choice of a research advisor (along with the signatures of at least 4 faculty members with whom the student has met) to the Graduate Advising Office using the appropriate form (see ***http://www.chem.umn.edu/grad/CurTime.html*** ).

*(Rev. 8-3-12)*

## CHEMICAL PHYSICS

**Members:** Professors David Blank, Phillippe Buhlmann, Christopher Cramer, Kevin Dorfman, David Ferguson, Daniel Frisbie, Laura Gagliardi, Jiali Gao, Allen Goldman, Woods Halley, Christy Haynes, Cheng-Cher Huang, Doreen Leopold, Kenneth Leopold, Sanford Lipsky, Aaron Massari, David Morse, Lanny Schmidt, Ilja Siepmann, David Thomas, Donald Truhlar, Gianluigi Veglia, and Renata Wentzcovitch [members not accepting new graduate students: Sanford Lipsky, Jeff Roberts, Darrin York, and Xiaoyang Zhu]

**Director of Graduate Studies:** Professor J. Ilja Siepmann

The Graduate Program in Chemical Physics may be selected by students who wish to satisfy their degree requirement by a thesis in chemical physics combined with interdisciplinary course work. Chemical Physics graduate students may select an advisor or advisors from the members listed above whose research programs are described on the Web at http://www.chem.umn.edu/chemphys/.

### *I. Prerequisites for entering the Chemical Physics Graduate Program*

The prerequisites are:
Adequate preparation in mathematics, intermediate physics, and physical chemistry

Acceptance by the Graduate School

C. Approval by the Chemical Physics Program's Director of Graduate Studies **(**DGS**)**. This approval will be granted only to those who demonstrate the ability to obtain support. For beginning graduate students, this financial support usually consists of a fellowship or a teaching assistantship from one of the departments represented on our graduate faculty. In this regard, note that the Chemistry and Physics Departments consider entering Chemical Physics students for support with the same priority as students majoring in Chemistry and Physics, respectively.

Current graduate students with a teaching assistantship, research assistantship, or fellowship who wish to switch to Chemical Physics may do so upon obtaining the approval of the DGS.

### *II. Proficiency examination*

After the student's admission into the Chemical Physics Program, he or she must pass a proficiency exam in physical chemistry, which presupposes knowledge equivalent to a full year study of physical chemistry at the undergraduate upper division level.

### *III. Course program*

Each first-year chemical physics student will choose a program of study in consultation with his or her TMC (three member committee). Ordinarily course programs for Ph.D. students will include at least 24 graduate credits (5000 or 8000 level), which must include either:

(a) at least 5 credits in chemistry (CHEM) and at least 5 credits in physics (PHYS),

(b) or, at least 16 credits in chemistry and/or physics combined, including at least 5 credits of quantum mechanics and at least 5 credits chosen from among the areas of

thermodynamics, statistical mechanics, statistical physics, and chemical dynamics.

There is no minor or supporting field requirement, and no foreign language requirement.

### *IV. Ethics training*

Every student in the Chemical Physics Program must become acquainted with basic concepts of professional and research ethics as part of new student orientation and also receive subsequent training in the responsible conduct of research/professional ethics. Both the Chemistry Department and the Physics Department have programs in place to provide this training. Each student in the Chemical Physics Program should choose whether he or she wishes to receive this training in the Chemistry Department or the Physics Department and will be responsible for completing the requirements of the department chosen.

### *V. Seminar*

Seminars by leading researchers from other universities and from government and industrial laboratories are given in the Chemistry Department approximately weekly throughout the academic year. Chemical physics students also frequently find the research seminars held in Physics, Chemical Engineering and Material Science, and other departments to be of interest. First-year chemical physics students are expected to attend at least 15 seminars per semester and must register for CHPH 8601 for both semesters. At the end of their third year, all chemical physics students also present a seminar on their research at the Chemistry Department Research Symposium.

### *VI. Choice of research adviser*

The deadline for chemical physics students to choose a permanent research adviser to remain in good academic standing is the end of February for students who begin in Fall Semester. However, chemical physics students who require financial support (e.g., in the form of a teaching or research assistantship) from the Chemistry Department during the summer following their first year (as is the case for most students) must meet the **Chemistry Department's earlier deadline** for choosing an adviser. *Chemical physics students must report their choice of adviser to the Graduate Operations Office (115 Smith Hall) by this date to ensure summer support from the Chemistry Department.* Students are expected to interview at least four faculty members regarding their research. Students should submit their choice, along with signatures of the interviewed faculty, to the Graduate Operations office using the form attached at the end of this handbook.

### *VII. M.S. Plan B Project, M.S. Plan A Thesis, and Doctoral Thesis Credits*

As soon as a research advisor has been selected, students are expected to participate in research and register for the appropriate number of credits of CHPH 8081/2, CHPH 8777, and/or CHPH 8888 (but do not exceed the 14-credit per semester limit of the tuition benefit). Students admitted for the Ph.D. program who have not been awarded an M.S. degree in Chemical Physics from another institution, usually complete 4 credits of CHPH 8081 and 4 credits of CHPH 8082 before starting to enroll for CHPH 8888. This will allow the students to follow a concurrent procedure for the Preliminary Exam and the M.S. Plan B according to the guidelines for chemistry students described in Appendices I-III. Upon completion of the 8 credits of CHPH 8081/2, students will enroll for a total of 24 credits of CHPH 8888 as expediently as permitted by the tuition benefit.

### *VIII. Written preliminary examination*

For the written preliminary exam, a student may select one of the three options:

(i) Chemical Physics format, as described further below.

(ii) Chemistry format.

(iii) Physics format. Interested students should contact the Physics Department for additional information.

Students should inform the Graduate Operations Office by the end of Spring Semester of their first year about their choice of the preliminary exam format.

The Chemical Physics format for the written preliminary exam consists of two parts:

I. A thesis-project proposal

II. A research proposal or critique based on a paper from the chemical physics literature, published within the last 3 years, not in the student's primary thesis research area.

The literature paper upon which Paper II is based must be selected by the last day of Summer Term of the first year. Students will be informed of their Committee Member assignments on the Friday of the first week of Fall Semester. Students must submit their Degree Program Form/Oral Committee Form by Friday of the third week of Fall Semester. Both papers must be submitted to the student's Written Preliminary Exam Committee by Monday of the tenth week of Fall Semester. Students will be informed about the outcome of their Written Preliminary Exam on Monday of the twelfth week of Fall Semester. If revisions are requested by the Written Prelim Exam committee, then the revised Written Preliminary Exam must be submitted by Monday of the sixteenth week of Fall Semester. Students will be informed about the outcome by the second Monday in January.

Each paper should be 8-16 pages long (not including references). The writing style and quality should be that of a journal article or a proposal to a funding agency. Figures and tables should be embedded into the text. Background and motivation should be given in an introductory section; the student's own contributions should be clearly identified as such. Proposals should be specific concerning the measurements or calculations to be made, the apparatus or methods to be employed, and the possible significance of the results.

### *IX. Oral preliminary examination*

To remain in good standing, students who have begun their graduate studies in chemical physics during Fall semester of their first year must take their oral preliminary examination by the end of the third week in February of their second year, and must have passed the exam by the end of May intersession of that year. *However, students are encouraged to complete the oral preliminary examination before the start of spring semester.* Those who do not meet these deadlines will no longer be in good standing in the Ph.D. Program and will be reclassified into the M.S. program in Chemical Physics. For a student beginning in Spring Semester or entering the program as advanced graduate students, an alternative schedule should be established by the Chemical Physics TMC at the first meeting.

The oral exam usually lasts between 1 and 2 hours. Typically, for students who passed the written preliminary exam under the chemical physics or the chemistry format, the oral exam begins with a 20-minute long presentation of the written preliminary paper(s). The presentation is followed by questions based primarily on the paper(s) and on the underlying fundamentals of chemical physics. The student will be expected to answer fairly specialized questions on areas that are close to the proposed research topics, written preliminary paper(s), and courses taken,

but the further the questioning is from these areas, the less knowledge will be expected. For students passing the written preliminary exam by the physics format, the exam usually begins with a brief research presentation and is followed by questions on the presentation, the research, the fundamentals underlying the research, and general chemical physics.

### *X. Checklist of normal progress and deadlines for the Ph.D. in Chemical Physics*

☐ *During the orientation period:* Pass the proficiency examination in physical chemistry (if not, pass by the end of spring semester). Plan a course program in consultation with the TMC.

☐ *November 15th:* (for students requiring summer support from the Chemistry Department): Choose a permanent research adviser and submit "Choice Form: Research Adviser and Type of Written Preliminary Examination".

☐ *End of first year:* Should have a GPA of 3.0 and have completed at least 14 credits of graduate-level courses (excluding research credits) with a grade of B or better.

☐ *Third Monday in August:* Select Paper for Part 2 of Written Preliminary Exam (if chemical physics format was chosen) and submit Written Preliminary Exam Abstract (all) with suggestions for members of the preliminary exam committee.

☐ *Friday of the third week of Fall Semester:* Submit “Request for Approval of a Graduate Program” and “Degree Program Form”.

☐ *Monday of the tenth week of Fall Semester:* Hand in written preliminary examination papers, if chemical physics format was chosen

☐ *Monday of the sixteenth week of Fall Semester:* Hand in revised written preliminary examination papers (if necessary), if chemical physics format was chosen.

☐ *End of January, second year:* Written preliminary examination passed.

☐ *Third week of February, second year:* Oral preliminary exam taken.

☐ *Last day of May intersession, second year:* Oral preliminary exam passed.

☐ *Fall semester, third year:* (or the first semester after passing the oral preliminary exam): Submit "Thesis Proposal Form" and "Ph.D. Final Examination Committee Form". Start registering for the maximum number of doctoral thesis credits (ChPh 8888) each semester (14 cr/semester if not registering for other credits), until 24 credits have been accrued (thereafter, register for 1 thesis or graded credit per semester).

☐ *May of third year:* Present research seminar at the Chemistry Department Research Symposium. If not already on advanced FTE status, register for CHPH 8101, 1 cr., during this Spring semester.

# VIII. Appendices

## Common Rules for the Written Preliminary Exam in Chemistry

(approved on April 24, 2007)

*A. Overview of Written Preliminary Exam*

The written preliminary examination in chemistry is in the form of a research dossier, which is *written and prepared by the candidate* in consultation (as defined in section D) with her or his research advisor(s). The purpose of the research dossier is to demonstrate that the candidate has attained a good understanding of the thesis project including the fundamental background and current literature. In view of the unpredictable nature of research, it is understood that specific projects described in this preliminary research dossier may well differ from those actually reported in the student's Ph.D. thesis.

The dossier should succinctly describe the research the candidate is engaged in for her/his thesis. In particular, the following topics should be discussed in a balanced fashion:

- the specific objective, including a discussion of the motivation for and the potential impact of the research project(s); part of M.S. Plan B Project I
- a critical assessment of previous work found in the scientific literature relevant to the proposed thesis research; part of M.S. Plan B Project I
- the thesis research plan (synthesis, characterization, and/or computational methods that will be developed/employed), including a discussion of existing practical and/or fundamental problems and how initial experiments to be conducted may influence the direction of subsequent research; part of M.S. Plan B Project II
- the research progress made to date; part of M.S. Plan B Project II.

The upper page limit for this document is 40 double-spaced typed pages (12 pt font, 1" margins), including embedded figures and tables. The research dossier should also include an abstract (less than 300 words), a table of contents, a list of abbreviations, and exhaustive references (complete with title and inclusive pagination). The latter four items do not count toward the 40-page limit.

*B. Schedule for Written Preliminary Examination*

Third Monday of August: The candidate submits to 115 Smith a brief written abstract (less than one page) and a list of three chemistry faculty members (not including the advisor(s)) whom the candidate feels would be well suited to serve on the written and oral preliminary exam committees.

Fourth Monday of August: The Graduate Office informs the candidate of the names of the three faculty members who will comprise the candidate's written preliminary exam committee and who will

also be members of the candidate's oral preliminary exam committee. The committee assignment will be made in a joint meeting of the area coordinators and the DGS. The candidate's advisor will be one of the three members, but not the chair of the committee. If a candidate has two advisors, then the second advisor will serve as an extra (internal) member on the candidate's written and oral prelim exam committees.

Monday of 3rd week, fall semester: The candidate submits the Ph.D. and M.S. Plan B Degree Program Forms and the External Committee Member Form (signed by the proposed external oral preliminary exam committee member).

Monday of 6th week, fall semester: The candidate submits printed copies of the research dossier to the members of the written preliminary exam committee. Any committee member should feel free to provide initial feedback on shortcomings in the written preliminary exam to the candidate at any time after the initial submission.

Monday of 8th week, fall semester: The chair of the written preliminary exam committee informs the candidate about the outcome of the initial submission.

Monday of 11th week, fall semester: (If needed) the candidate submits printed copies of the revised research dossier and a cover letter describing the major changes to the members of the written preliminary exam committee.

Monday of 13th week, fall semester: The chair of the written preliminary exam committee informs the candidate about the outcome of the revised submission.

*C. Allowed Outcomes of the Written Preliminary Exam*

Possible outcomes of the initial submission:

pass
pass with reservation (i.e., minor revisions are required and it is expected that the candidate will be able to address these revisions in a shorter timeframe than the usual 3-week period; the candidate should proceed with scheduling of the oral preliminary exam; the reservation must be lifted prior to taking the oral preliminary exam)
not acceptable in current form with one resubmission allowed (i.e., major revisions are required; the candidate should not proceed with scheduling of the oral preliminary exam)
fail and no resubmission allowed (i.e., the research dossier is in such poor shape that the committee deems it impossible that the candidate could submit a satisfactory revised research dossier within a 3-week period)

Possible outcomes of the revised submission:

pass
pass with reservation (i.e., minor revisions are required, but the student should proceed with scheduling of the oral preliminary exam; the reservation must be lifted prior to taking the oral preliminary exam)
fail (i.e., the revised research dossier is substantially deficient)

With the exception of a "fail" on the initial submission, a majority vote of the committee members decides on the outcome. In case of a tie vote (i.e. for a student with two co-advisors), the more restrictive outcome is applied. For example, when two members vote "pass" and two vote "pass with reservation", the outcome is the latter. A unanimous vote of the committee is required for a "fail" on the initial submission.

A "fail" on the written preliminary exam does not constitute a grade of "F" for the M.S. Plan B projects. In case of a "fail" on the written preliminary exam, the written preliminary exam committee may decide that the research dossier while lacking in important aspects is still satisfactory for a passing grade for the M.S. Plan B projects or the committee may ask the candidate for further revision to yield a passing grade for the M.S. Plan B projects. The written preliminary committee decides independently on the grades for the two M.S. Plan B projects. An "incomplete" on one or both of the M.S. Plan B projects should only be assigned in extenuating circumstances.

The decisions of the written prelim exam committee need to by communicated to the candidate in written form (electronic mail is acceptable) with a copy to the Graduate Office.

*D. Additional Information*

The advisor's role in the preparation of the initial research dossier is to advise the student's research in all possible ways, just as one advises students who have passed the prelim exam, with one exception: the advisor is not to participate in the writing or editing of the research dossier. The advisor may provide the candidate with copies of grant proposals related to the candidate's research, but the candidate needs to understand that issues relating to plagiarism also apply to the use of these grant proposals in writing the research dossier. The advisor is not allowed to directly read and comment on the research dossier prior to submission. After the candidate has received the outcome of the initial submission, the candidate can discuss all concerns raised by the committee with any of the committee members (including the advisor).

Careful attention should be paid to organization, grammar, spelling, and punctuation. Unnecessary jargon and undefined terms should be avoided. The candidate is responsible for careful proofreading of the research dossier. An unusually large number of mistakes that makes it hard for the committee to follow the research dossier may result in a "not-acceptable" or "fail" decision.

The candidate is encouraged to consult with other graduate students or postdoctoral associates on the writing of the research dossier, but again the candidate needs to understand that issues relating to plagiarism also apply to the use of prior research dossiers and M.S. or Ph.D. dissertations from other students in writing the research dossier.

Cases of plagiarism can differ in severity, but the candidate should realize that in all cases of plagiarism the most probable outcome is a "fail" on the written preliminary exam with automatic

removal from the Ph.D. program. Severe cases of plagiarism can lead to the candidate's expulsion from the Graduate School.

The candidate should indicate on the cover page of the research dossier the names of the preliminary exam committee members (with the chair underlined) and the due date for the committee ev

## Common Rules for the Oral Preliminary Exam in Chemistry

(approved on March 18, 2009)

### *A. The Goal of the Oral Preliminary Exam*

The principal goal of the oral preliminary exam (OPE) is to determine if the candidate has the competence and capability to carry out and complete a Ph.D. thesis in Chemistry.

### *B. Choice of Format for the Oral Preliminary Exam*

The OPE in Chemistry can be taken in two different formats: RC, dissertation research and coursework format; IP, independent proposal format. The advisor(s) select(s) the format of the OPE in consultation with the candidate.

### *C. Format of the Oral Preliminary Exam*

*C.1. Dissertation Research and Coursework (RC) Format*

The RC format of the OPE in chemistry will begin with a 25-minute presentation covering the following topics related to the candidate's Ph.D. research: (a) the objective of, motivation for, and potential impact of the thesis research, (b) the scientific background, (c) the thesis research plan, and (d) the research progress made to date.

Following the candidate's presentation will be a period of questions related to the research presentation. A logical flow of questioning, however, may drift fairly far from the proposed research and the candidate should be prepared for such an eventuality. There may be a short break after this round of questioning and the exam will conclude with an additional period of questioning on topics directly related to graduate coursework completed by the student.

*C.2. Independent Proposal (IP) Format*

The IP format of the OPE in chemistry is a propositional oral exam for which the candidate must present an original research proposal that is appropriate for a Ph.D. research project. The topic must be approved by the candidate's OPE committee and must not be closely related to the candidate's own dissertation research or duplicate on-going research in the department or published research. The candidate should not consult faculty for ideas, feedback on the proposal, or solutions to specific problems prior to the exam.

The candidate must prepare a 200-word abstract of the proposal with pertinent references to be submitted for approval to the committee members four weeks before the exam date (see Schedule).

The exam itself will consist of a 25-minute presentation that begins with a brief summary of the thesis research and focuses on the independent proposal. It is expected that questioning by the committee will follow logically from the candidate's presentation. A logical flow of questioning, however, may drift fairly far from the problem at hand, and the candidate should be prepared for such an eventuality. There may be a short break after this round of questioning and the exam will conclude with an additional period of questioning on topics the committee deems appropriate to determine whether the candidate has achieved the goal of the OPE.

### *D. Schedule for Oral Preliminary Examination*

As soon as a candidate has either *passed* or *passed with reservation* the Written Prelim Exam, he/she should schedule the OPE with the committee members (including the external member). Candidates are encouraged to schedule the OPE to take place in December or January. The first two weeks of Spring Semester are usually very busy and it may be advantageous to schedule the exam to take place before the start of Spring Semester.

Four Weeks before the Scheduled Exam Date: If the candidate plans to take the OPE under the IP format, then a brief abstract (less than 200 words) must be submitted at least four weeks before the scheduled exam date to the committee. The committee must decide within one week after submission of the abstract whether the proposed topic is *sufficiently independent* of the candidate's dissertation research. If the committee concurs, then the exam can go ahead as scheduled. If not, then the candidate needs to schedule the OPE at a later point and submit a new abstract at least four weeks before the new scheduled exam date to the committee. Again, the committee must decide within one week after submission of the abstract whether the proposed topic is *sufficiently independent* of the candidate's dissertation research. If the committee concurs, then the exam can go ahead as scheduled. If not, then the candidate will take the OPE under the RC format on the scheduled date.

Two Weeks before the Scheduled Exam Date: The OPE must be officially scheduled with the Graduate School by submitting the Scheduling Form.

Second Friday of Spring Semester: To allow for timely progress toward the Ph.D. degree, candidates are *strongly* encouraged to schedule the OPE to take place before the second Friday of Spring Semester to allow them to take CHEM 8888 thesis credits during Spring Semester.

Last Friday in March: This is usually the last day at which the first attempt at the OPE can take place and still allow for a second attempt after the mandatory minimum period of 10 weeks required by the Graduate School for any retake, but before the Chemistry deadline for passing the OPE.

Last Day of May Term (mid-June): A candidate must pass the OPE by the end of May Term following the second academic year in residence to remain in good standing in the Chemistry Ph.D. program. A second failure of the OPE at any time requires permanent removal from the Chemistry Ph.D. program.

### *E. Possible Outcomes of the Oral Preliminary Exam*

Possible outcomes of the first attempt:

pass
pass with reservation (i.e., conditionally passed with specific subject matter deficiency to be made up through specified means; the chair of the exam committee must inform the student in writing within one week about the specific means required to remove the reservation)
fail with one retake allowed (10 weeks have to pass before the retake can take place)
fail and no retake allowed

Possible outcomes of the retake:

pass
pass with reservation (i.e., conditionally passed with specific subject matter deficiency to be made up through specified means; the chair of the exam committee must inform the student in writing within one week about the specific means required to remove the reservation)
fail

### *F. Additional Information on the IP Format*

In evaluating a propositional oral, committee members will assess the candidate's performance in each of the following five areas:

**Significance:**

(1) Is the subject matter timely and important?

(2) Will the successful completion of the proposed research constitute a non-trivial extension of current understanding?

**Scientific Background:**

(1) Has an adequate search and evaluation of background literature been undertaken? A thorough understanding of background research and careful identification of any

ambiguities are expected.

**Experimental or Computational Approach:**

(1) Have the appropriate techniques and methods been selected?
(2) Have weak points been identified and alternative approaches proposed?
(3) Is the approach creative?

**Presentation:**

(1) Have the goals of the proposed research been clearly stated?
(2) Was the presentation organized, logical, coherent, and convincing?

**Defense:**

(1) Have questions arising during the exam been satisfactorily addressed?
(2) Overall, has the candidate shown himself or herself to be sufficiently well-versed in this field of chemistry to competently carry out the proposed research?

## Preparations For Preliminary Oral Exam and M.S. Final Defense

When you meet with your committee, there will be two events happening at the same time, and your committee will be making two decisions on that day.

The Preliminary Oral Exam for your Ph.D. is also the Final Defense for your M.S. degree. The committee will take a separate vote for each of the decisions.

**For students scheduling the Oral Prelim/MS Final Defense prior to start of Spring term:**

For Spring Semester 2013, the final day on which you can have your examination is Feburary 4th, 2013. It is not recommended to wait until the last possible day.

That is the last day on which you can pass your Preliminary Oral Exam, turn the signature form in to the Graduate School and then change your Spring 2013 registration to Doctoral Thesis Credits (CHEM 8888.) See the staff in 115 Smith if you have questions about this.

**For all graduate students**, here are the steps and forms YOU need to take care of prior to meeting with your committee for your examination:

**Master's Degree (M.S. – Plan B) Final Defense**

1) Follow the link below and request an M.S. degree Graduation Packet. The answer to the first three questions on that page is "YES." The packet will be mailed by U.S. Mail to the address you enter.

**http://www.grad.umn.edu/current_students/forms/masters.html**

The Graduation Packet contains:

2) **Graduate Application for Degree –**This form should be turned in to the OneStop Office in 333 Science Teaching and Student Services by the end of the first business day of the month in which you will have your MS Final Defense/Oral Prelim. **NOTE**: If you are going to have your Oral Prelim/M.S. Final Defense in January, you may turn in this form after the first business day of January, and still schedule your exam(s) for the month of January. That will result in your degree appearing on your transcript in February instead of January. For nearly all students, this is not a concern.

3) **Final Examination Report Form:** This is the form your committee members will sign at your Oral Prelim/M.S. Final Defense. You are responsible for bringing it to the exam.

4) **Commencement Attendance Approval Form and Instructions:** The form for signing up for the Spring commencement ceremony, in which you may choose to participate.

**Letter grades for CHEM 8081 and CHEM 8082:** At the conclusion of your exam, your committee will assign two letter grades for the M.S. Plan B Project courses on your transcript for Fall term. If you get an e-mail notice prior to your exam from the Graduate School about these "missing" grades, that is normal. Know that those grades will be entered after the exam.

## Ph.D. Preliminary Oral Exam

1) After your Preliminary Written Exam committee informs you that you've passed, complete the following form with your adviser(s) and turn it in to 115 Smith for the DGS signature and submission to the Graduate School. The form is here:

http://www.grad.umn.edu/current_students/forms/GS17.pdf

2) Once you have determined the date, time and location of your Preliminary Oral Exam, complete the online Preliminary Oral Exam Scheduling Form at least one week before your examination:

http://www.grad.umn.edu/students/prelimschedule/index.html

3) The Graduate School will send the official Preliminary Oral Examination form directly to the chair of your committee (usually this is your advisor) by campus mail. This is the form that your committee members will sign at the conclusion of your exam. Your committee chair (advisor) must bring this form to your examination.

4) Prior to your exam, come to 115 Smith to pick up a memo with instructions for your committee and a copy of your current UMN transcript.

## Registration for Spring term

The following instructions assume you are not taking any actual courses in Spring term.

1) If your Preliminary Oral Examination will be prior to February 4th, 2013, you should register for 6 credits of CHEM 8666 (Pre-Thesis Credits.) If you pass your exam, you should take your signed form to 160 Williamson and tell them you now need to change your spring term registration to 14 credits of CHEM 8888 (PhD Thesis Credits.) Ultimately you need to register for 24 credits of CHEM 8888, divided between the two semesters following your passing the Preliminary Oral Exam.

Your tuition benefit covers 14 credits per semester. You may divide the 24 credits of CHEM 8888 between the two terms however you wish.

2) If your Preliminary Oral Examination will be after January February 4th, 2013, you should register for 6 credits of CHEM 8666 (Pre-Thesis Credits) for Spring term. Your registration will not change at all after your exam(s).

## Policy on Collaborative Research Contributions for Inclusion in M.S. Plan A and Ph.D. Dissertations in Chemistry

(approved on November 13, 2007)

The Chemistry Graduate Program strongly encourages collaborative research carried out by graduate students, undergraduate students, postdoctoral associates, and faculty within a given research group and with other research groups from this or other graduate programs or from outside of the University of Minnesota.

In recognition of the importance of collaborative research, the Chemistry Graduate Program accepts that collaborative research can contribute a significant part of a graduate student's M.S. Plan A or Ph.D. dissertation research. Upon approval by the advisor(s), collaborative research may be included in a chemistry M.S. Plan A or Ph.D. dissertation, but it should, at a minimum, be identified by the following footnote:

> *This chapter/section describes the outcome of a collaborative research project carried out by student-postdoc-list (and advised by advisor-list). A report on this research project will be submitted for publication [ref]/has been submitted for publication [ref]/has been published [ref].*
>
> The term in parenthesis is only required if multiple advisers beyond the official set of thesis advisers were involved in the research.
> The second sentence is not required if there is no intention to publish the research.
> Pick the appropriate term or phrase from the underlined parts.

The Chemistry Graduate Program strongly discourages collaborative M.S. Plan A or Ph.D. dissertations with joined authorship by multiple students.

## IX. Department of Chemistry Forms

**ADVISOR SELECTION FORM**

_____

Your Name Specialty Area (or write "Interdisciplinary")

_____

Date

Indicate the names of 4 faculty members with whom you have met to discuss research opportunities in their group. Signatures are **required** from all four faculty members.

1. _____ faculty name
2. _____ faculty name
3. _____ faculty name
4. _____ faculty name

Give a ranked list of your top three choices for a research advisor:

1. _____
2. _____
3. _____

More than one name can be listed on a single line ***if you have already discussed co-advising arrangements with all involved faculty.***

RETURN THIS FORM TO THE GRADUATE OPERATIONS OFFICE, 115 SMITH HALL, BY NOVEMBER 15 (OR THE FOLLOWING MONDAY IF THIS DATE FALLS ON A WEEKEND).

# Questions To Ask When Choosing Your Research Adviser

These are examples of questions you may wish to ask faculty when you meet with them to determine your research adviser. While nothing replaces your gut instinct as to whether or not the advisor is a good match for you, these questions will address other career issues that you may want to consider.

1. Are you taking students?
2. How many graduate students do you have?
3. How many post docs do you have?
4. How many students are on RA support?
5. How do you decide who gets an RA?
6. How long, on average, does it take to get the Ph.D. degree in your lab?
7. How many papers does an average student have?
8. How many presentations at national meetings does the average student do?
9. Do you help support graduate travel?
10. What is your total federal grant support?
11. Are you going on sabbatical?
12. What are you looking for in a good student?
13. How many papers a year do you publish?
14. How do you determine what warrants publication and how many names will appear on it?
15. How long before I can expect my first paper?
16. How is the group run? Group meetings? When?
17. Would I be mentoring undergraduates? How is this determined?
18. Where are your former students?
19. Do they need to post doc to get a nonacademic job?
20. What is the policy on vacation days for students in your research group?

PRELIMINARY ORAL EXAMINATION and M.S. PLAN B DEFENSE COMMITTEE FORM

University of Minnesota Department of Chemistry and Chemical Physics Graduate Program

DATE: _____

STUDENT NAME: _____ ID #: _____

ADVISER NAME: _____

**The members of your Preliminary Oral Exam Committee will include all members of your Preliminary Written Exam Committee, plus one additional committee member with a Graduate Faculty appointment from outside the Chemistry or the Chemical Physics Graduate Programs.**

The non-departmental member of my Preliminary Oral Exam and M.S. Plan B committee will be:

Name: _____ Department: _____

**REQUIRED SIGNATURES:**

NON-DEPARTMENTAL FACULTY: _____

signature of non-departmental faculty

ADVISOR APPROVAL: _____

signature of adviser(s)

STUDENT SIGNATURE: _____

signature of student

**Notes:**

a) Return this form to 115 Smith along with the completed Degree Program Form, which must also be signed by your advisor(s).

b) Once you know the date and time of your preliminary oral exam, you must notify the Graduate School **two weeks in advance of the exam.** This form is the only way to initiate their preparation of the necessary examination forms.

**M.S. FINAL DEFENSE COMMITTEE FORM Department of Chemistry and Chemical Physics Graduate Program University of Minnesota**

DATE: _____

STUDENT NAME: _____

ID: _____

ADVISER: _____

M.S. Plan A or M.S. Plan B? _____

The chair may be, but need not be, the advisor. This form must be signed by all committee members to indicate their willingness to serve as indicated.

1) Do not submit this form for M.S. Plan B defenses held at the same time as the Preliminary Oral Examination, only the *Preliminary Oral Examination and M.S. Plan B Defense Committee Form* is required.

2) For M.S. final defenses (Plan A or Plan B) that are held independent of any preliminary exam, a total of three committee members are required (2 from your graduate program, 1 from outside your graduate program)

PROPOSED M.S. FINAL DEFENSE COMMITTEE:

Program faculty members: _____ (Adviser)

_____

External faculty member: _____ (Name)
_____ (Dept.)

Chair (one of above): _____

SIGNATURES OF ALL MEMBERS: _____

_____

_____

STUDENT SIGNATURE: _____

## Ph.D. FINAL EXAMINATION PROSPECTIVE COMMITTEE FORM (CHEMISTRY)

Name of student: _____ ID#: _____ Specialty Area:_____
Advisor: _____ Date submitted:_____

Thesis Title: _____

**YOU MUST ASK EACH INDIVIDUAL FACULTY MEMBER IF THEY WILL SERVE ON YOUR COMMITTEE BEFORE SUBMITTING THEIR NAMES.**

Group 1 - Chemistry faculty in student's specialty area

_____ _____

_____ (advisor)

Group 2 - Non-departmental member (who must be a reviewer)

_____ _____
(name) (dept.)

Name of committee Chair (any of the above except advisor)

_____

The three reviewers (readers) will be the adviser and the non-departmental member plus the third reviewer:

_____

Note: Chair may be reviewer but need not be.

**REQUIRED SIGNATURES:**

I approve the above committee and will serve as a reviewer:

Signature of adviser: _____

I agree to serve as a **reviewer**:

Two remaining reviewer's signatures _____(non-CHEM member)

_____(CHEM member)

I agree to serve as a member and/or chair as indicated above:

_____(CHEM member, non-reviewer)

Submitted by: _____
(signature of student)

Notes: a) Return this sheet to 115 Smith for co-submission with the Thesis Title Form.
b) It is mandatory that you preschedule the time and date of the final oral examination at least two weeks in advance with the Graduate School. This is the only way to initiate their preparation of the necessary examination forms