

**THE UNIVERSITY OF ARIZONA**

**DEPARTMENT OF CHEMISTRY &  
BIOCHEMISTRY**

**GRADUATE HANDBOOK  
CHEMISTRY**

**FALL 2011**



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## **A. GENERAL DESCRIPTION OF THE GRADUATE PROGRAM**

The major emphasis of the Ph.D. degree in Chemistry, after completion of all other degree requirements, is an original research project culminating in the writing and defending of a dissertation. With the help of the Research Director, the Research Directory Committee (Committee of Studies), and the departmental Graduate Program Committee (GPC), successful students complete the Chemistry graduate program with a solid training in contemporary chemical research, with an emphasis on academic scholarship, the creation of new knowledge, and the dissemination and defense of the product(s) of this research effort.

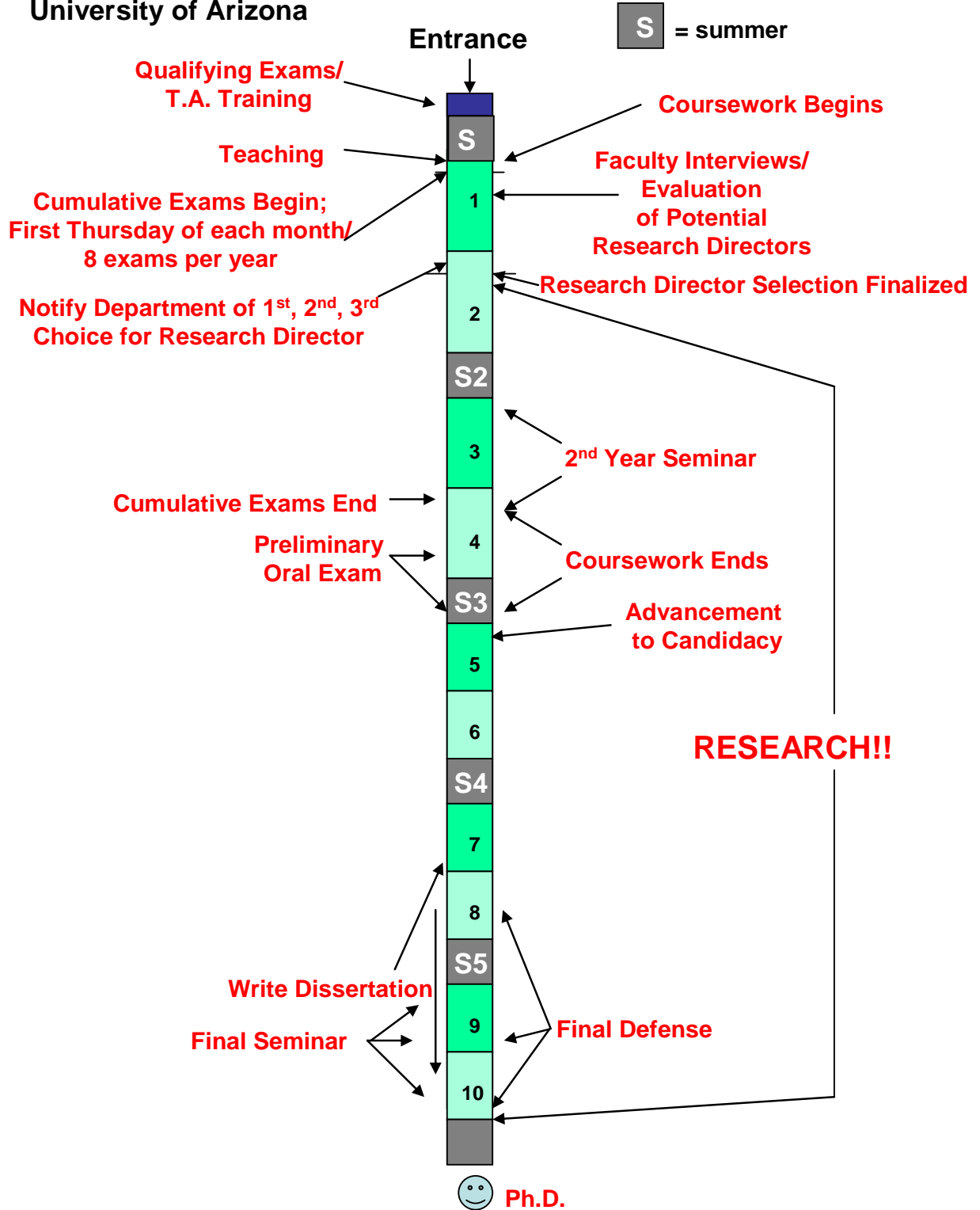
An alternate track which students may be placed into, or may choose to move into, is the Master of Science degree (M.S.), which involves less time and less course work commitment, but still involves an original research project, and training in research, culminating in an M.S. thesis.

For those interested in the study of chemistry beyond the undergraduate level, but who are not interested in a career involving chemical research, the option of an M.A. is offered.

It is important to realize that successful completion of a graduate degree program in Chemistry is your responsibility as a student. All of the necessary steps that are required to finally receive the degree are important. You should utilize resources the Graduate College makes available, including the Graduate Catalog and the Graduate College Handbook. This Department of Chemistry Graduate Handbook is designed to assist you through the maze of graduate school requirements, but it is not all-inclusive. It is meant to be a useful guide, but does NOT serve as a contractual document.

The Research Director, along with the Dissertation or Dissertation Committee, will serve as guides and mentors to help train you as a scientist. Finally, the Graduate Program Coordinator and the Graduate Program Committee will do everything they can to keep you on track and to point you in the right direction. Nevertheless, you need to be focused and self-motivated to reach your goals.

**Graduate School Timeline  
(by semester)  
Chemistry Ph.D.  
University of Arizona**



## **PRE-FIRST SEMESTER**

Qualifying Examinations      Qualifying exams, prior to the start of the semester, help define the program of study for the first semester; identify deficiencies in background and possible pathways for remediation.

## **FIRST SEMESTER**

Course Work, Seminars, and Intermediate Course Work      Advised by the GPC. To remain in the Ph.D. program, students must qualify in at least three core areas by the end of the second semester in the program.

Cumulative Examinations      Ph.D. students begin to take cumulative examinations.

Faculty Interviews      All students must attend CHEM 695a (poster sessions) and are required to interview individually with at least 6 faculty members. Begin individual interviews early and meet throughout the semester.

Research Director Selection      Students must submit Report of Selection of Research Director form to the Graduate Program Coordinator by December 1, 2011 (for fall admits).

## **SECOND SEMESTER**

Course Work and Seminars      Advised by Research Director. Submit Plan of Study to Graduate Program Committee

Cumulative Examinations      Ph.D. students must continue to take cumulative examinations until requirement is satisfied.

Dissertation Committee      In consultation with Research Director a Dissertation Committee and research topic must be selected. Submit Proposed Dissertation Committee and Plan of Study forms to the Graduate Program Coordinator.

Research      Begin research.

Evaluation of teaching performance – 1st Year      Your performance as a T.A. is considered to be a critical component of your training and your responsibility as an employee of the University of Arizona

## **FIRST SUMMER**

Continue Research

Committee Report      A written research summary must be given to committee members at the end of July each year.

### **THIRD SEMESTER**

Course Work and 1 <sup>st</sup> Seminar	As in accepted Plan of Study. Contact divisional seminar coordinator to schedule first seminar
Cumulative Examinations	Continue until requirement is satisfied.
Research	Continue research.
Oral Comprehensive Examination	Begin working on the required written proposal and continue studying for Oral Comprehensive Examination. All students must take their oral examination in the semester following satisfying the Cumulative Examination requirements or no later than the end of their fifth semester.

### **FOURTH SEMESTER**

Course Work and Seminars	As in accepted Plan of Study
Research	Continue research.
Written Proposal	Written proposal must be approved by your Dissertation Committee one month prior to Oral Comprehensive Examination.
Oral Comprehensive Examination	Schedule Oral Comprehensive Examination; submit paperwork on Application for Oral Comprehensive Examination form to the Graduate Coordinator AT LEAST two weeks prior to proposed date. This requirement must be completed before the end of the fourth semester.
Committee Appointment Form	Submit the Committee Appointment form to Graduate Coordinator with in one semester after passing the Oral Comprehensive Examination.

### **SECOND SUMMER**

Continue research

### **REMAINING SEMESTERS**

Course Work and Seminars	Make sure courses in Plan of Study have been completed and required seminars have been given
Research	Continue research  A written research summary must be given to committee members at the end of July each year.



## FINAL STEPS – AT LEAST 6 Months Prior to Dissertation Defense

Final Meeting of Committee	Distribute written dissertation outline to the committee members at least <b>two weeks</b> before the meeting. Thoroughly discuss the outline and come to a consensus on what research needs to be completed to satisfy the requirements for the Ph.D. and your committee of studies.
Seminar	Schedule and give final seminar as required by your division.
Dissertation	Complete dissertation, including proofreading, prior to delivery to committee members.
Final Oral Examination	Schedule dissertation defense (final oral). Submit Announcement of Oral Defense Examination form at least <b>two week</b> prior to oral. A penultimate draft of your dissertation should be given to your committee members at this time.
Submission of Dissertation	The dissertation must be submitted to the Graduate College within one year of the final oral examination. (Normally this should be done within a matter of days or weeks). <b>Continuous registration is required until the dissertation is submitted.</b> See the Graduate Program Office for guidelines.



## **B. EXPECTATIONS OF STUDENT & FACULTY**

### **1. WHAT THE FACULTY EXPECT FROM THE STUDENTS**

The faculty expect the students in this program to abide by the University of Arizona Academic Code of Conduct and the Academic Code of Integrity, as summarized in Section C of this Handbook. Failure to do so, at any time, may be grounds for dismissal from the graduate program, and from The University of Arizona. In addition, the faculty's expectations of the graduate students in this program are:

#### ***Research***

- a) to discover and enthusiastically pursue a unique topic of research in order to participate in the construction of new knowledge in your chosen field, and in the application of that knowledge to the solving of new problems in the chemical sciences,
- b) to learn the research methods and historical knowledge basis of the discipline -- honoring the scholarship of those who came before you and learning what is needed to form viable research hypotheses,
- c) to communicate regularly with faculty mentors and the masters/doctoral committees, especially in matters relating to your research and your progress within the degree program,
- d) to exercise the highest integrity in all aspects of your work, especially in the tasks of collecting, analyzing and presenting research data,
- e) to work responsibly toward completion of the degree in a timely fashion,
- f) to mentor other students in the group and foster the regular exchange of research ideas and teamwork between group members.

#### ***Teaching***

- a) to participate enthusiastically in appropriate training and evaluation for all instructional roles you are asked to take on,
- b) to take on (as opportunities arise) an appropriately sequenced variety of teaching duties relevant to your career expectations and likelihoods,
- c) to devote the same seriousness to undergraduate instructional duties that you would expect from your own instructors, remembering that you are an employee of the State of Arizona in your role as a teaching assistant.

#### ***Professional Development/Program Progress***

- a) to develop, to the extent possible, a broad network of professional relations,
- b) to contribute, wherever possible, to the discourse of the scholarly discipline through conference presentations, publications, collaborative projects, and other means,
- c) to seek out a range of faculty and peer mentors that can help you prepare for a variety of professional and career roles and responsibilities,
- d) to take responsibility for keeping informed of regulations and policies governing your graduate studies and to complete all required paperwork and other degree obligations in a timely fashion.

### **Community**

- a) to create, in your classrooms and laboratories, an ethos of collegiality and collaboration,
- b) to realize your responsibilities as an individual and professional representative of both the university as a whole, and the department or program in which you are studying,
- c) to assist graduate student peers in their own professional and scholarly development.

### **2. WHAT THE STUDENT SHOULD EXPECT OF THE RESEARCH DIRECTOR AND HIS/HER COMMITTEE**

In general, you should expect your Research Director to:

- a) be willing to meet with you regularly,
- b) be someone with whom you can talk freely and easily about research ideas, and your professional development, and who never feels threatened by your capabilities,
- c) be someone you can trust to look out for your professional interests,
- d) be willing and enthusiastic in giving you credit for the work you do,
- e) be willing to tell you when your work does or does not meet the standards he/she has set for their research program,
- f) be willing to help you graduate in a reasonable time frame, with a dissertation which tells a complete story, and is representative of Ph.D. level research at all of our peer institutions,
- g) have an active well-functioning research group for additional support when you are encountering difficulties.

It is unreasonable to expect one person to have all of the mentor qualities that you desire. You should therefore choose dissertation committee members who complement the strengths of your advisor.

### **3. WHAT THE STUDENT SHOULD EXPECT OF THE DEPARTMENT**

- a) A guarantee of funding for up to 5 years from the time of enrollment, provided that you remain in good standing in the program, and are making adequate progress toward completion of the Ph.D. degree,
- b) Opportunities to develop skills beyond your specialty through seminars, short courses in department facilities, and interactions with renowned researchers,
- c) Opportunities to provide feedback to the department and to review policies to ensure the quality of the department,
- d) A guarantee that current students will not be held responsible for new requirements implemented in the middle of their tenure within the department, i.e. that you are held accountable for the rules in place in the Graduate Handbook, at the time of your admission.

## FALL 2011 INCOMING GRADUATE STUDENTS

Chem/Bio	First Name	Last Name	School
Chem	Olajuyigbe	Adebayo	University of Ibadan
Biochem	Trisiani	Affandi	University of MI - Flint
Chem	Ran	An	Nankai University
Chem	Joseph	Awino	Moi University
Chem	Robb	Bagge	Hamline University
Chem	Christopher	Blackstone	Allegheny College
Chem	Javier	Castillo-Montoya	Universidad De Sonora
Chem	Cody	Corbin	Univ of AL, Birmingham
Chem	Iman	Daryaei	Southern Illinois Univ
Chem	Mira anne dela Cruz	dela Rosa	University of the Philippines
Chem	Philip	Dirlam	CA Polytechnic St U
Chem	Andrew	Dixon	Millersville Univ of PA
Chem	Erin	Dugat	University of Mississippi
Chem	Michael	Dzierlenga	Trinity University
Chem	Ryan	Eismin	Purdue University
Chem	Francis	Engel	Indiana University
Chem	Mahsa	Ghaffari	Southern Illinois Univ
Chem	Samuel	Gilmore	Northern Arizona Univ
Biochem	Stephanie	Jensen	AZ State Univ
Chem	Venkateswara	Karrepu	Wright State Univ
Chem	Nikola	Kenjic	Univ of FL
Chem	Flora Wambui	Kimani	University of Nairobi
Chem	Zachary	Lachance	Florida State Univ
Chem	Katherine	Leight	Denison University
Chem	Mutha Meringna Varuni	Livera	University of Colombo
Chem	Tesfayesus	Mehari	Asmara University
Chem	Nieves	Montano	ASU
Chem	Chi Huynh	Nguyen	Northern AZ University
Biochem	Keith	Olson	Beloit College
Chem	Buket	Onel	Boston University
Chem	Amanda	Paske	Siena College
Chem	Alexandra	Petlick	Saint Mary's College
Chem	Idris	Raji	University of Ibadan
Chem	Kara	Saaty	NAU
Chem	Krishnachary	Salikolimi	Pondicherry University
Chem	Mehrdad	Shadmehr	Southern Illinois Univ
Chem	Krishna	Sharmah Gautam	Southern Illinois Univ
Chem	Lindsey	Shear	University of Texas-Austin
Chem	Katayoun	Tabatabaei	University of Tehran
Chem	Michael	Williams	Mercyhurst College
Chem	Svenja	Woerner	Heidelberg University
Chem	Xin	Wu	Nankai University



## C. ACADEMIC CODE OF INTEGRITY AND CODE OF CONDUCT

**Graduate Students in the Department of Chemistry and Biochemistry, University of Arizona are expected to have read, and understand, at least, the excerpts from the Academic Code of Conduct for the University of Arizona.**

Excerpts and highlights from the Code of Academic Integrity for the University of Arizona: <http://dos.web.arizona.edu/uapolicies/>

### PRINCIPLE

Integrity and ethical behavior are expected of every student in all academic work. This Academic Integrity principle stands for honesty in all class work, and ethical conduct in all labs and clinical assignments. This principle is furthered by the student Code of Conduct and disciplinary procedures established by ABOR Policies 5-308 through 5-404, all provisions of which apply to all University of Arizona students. This Code of Academic Integrity (hereinafter "the Code") is intended to fulfill the requirement imposed by ABOR Policy 5-403.A.4 and otherwise to supplement the student Code of Conduct as permitted by ABOR Policy 5-308.C.1.

### PROHIBITED CONDUCT

Conduct prohibited by the Code consists of all forms of academic dishonesty, including, but not limited to:

1. Cheating, fabrication, facilitating academic dishonesty, and plagiarism as set out and defined in the Student Code of Conduct, ABOR Policy 5-308-E.6, E.10 and F.1
2. Submitting an item of academic work that has previously been submitted without fair citation of the original work or authorization by the faculty member supervising the work.
3. Violating required professional ethics rules contained or referenced in the student handbook (hardcopy or online) of undergraduate or graduate programs, or professional colleges.
4. Violating health, safety or ethical requirements to gain any unfair advantage in lab(s) or clinical assignments.
5. Failing to observe rules of academic integrity established by a faculty member for a particular course.
6. Attempting to commit an act prohibited by this Code. Any attempt to commit an act prohibited by these rules shall be subject to sanctions to the same extent as completed acts.
7. Assisting or attempting to assist another to violate this Code.

### STUDENT RESPONSIBILITY

Students engaging in academic dishonesty diminish their education and bring discredit to the academic community. Students shall not violate the Code of Academic Integrity and shall avoid situations likely to compromise academic integrity. Students shall observe the generally applicable provisions of this Code whether or not faculty members establish special rules of academic integrity for particular classes. Students are not excused from complying with this Code because of faculty members' failure to prevent cheating.

### FACULTY RESPONSIBILITY

Faculty members shall foster an expectation of academic integrity and shall notify students of their policy for the submission of academic work that has previously been submitted for academic advancement, as well as any special rules of academic integrity or ethics established for a particular class or program (e.g. whether or not a faculty member permits collaboration on coursework; ethical requirements, for lab and clinical assignments; etc.) and make every reasonable effort to avoid situations conducive to infractions of the Code.

### STUDENT RIGHTS

Students have the right to a fair consideration of the charges, to see the evidence, and to confidentiality as allowed by law and fairness to other affected persons. Procedures under the Code shall be conducted in a confidential manner, although a student has the right to an advisor in any appeal to a University Hearing Board under this Code.

## ACADEMIC INTEGRITY PROCEDURES

### **I. Faculty-Student Conference**

The faculty member of record for the course (i.e., responsible for signing the grade sheet) conducts these procedures. Faculty shall make sure that students receive notice and fair consideration of the charges against them. The faculty member must confer with the student within 15 academic days (hereinafter referred to as "days") of receiving evidence of a suspected violation of this Code, unless good cause is shown for an extension of no more than 30 days. The faculty member shall confer with the student in private, explain the allegations, present any evidence, and hear the student's response. If more than one student is involved in an incident, separate conferences are recommended but not required. When dealing with students who are unavailable for the conference, students not enrolled in the class, or graduate students, refer to the General Provisions.

After the conference the faculty member shall decide, by a preponderance of the evidence, whether or not the student has committed an act prohibited by this Code. "Preponderance of the evidence" means that it is more likely than not that a violation of this Code occurred. If the evidence does not support a finding of a violation, the University will make no record of the incident in any University files. The student may continue in the class without prejudice.

If the evidence supports a finding that the student has engaged in misconduct, the faculty member shall impose sanctions after considering the seriousness of the misconduct, the student's state of mind, and the harm done to the University and to other students. In addition, the faculty member shall consider mitigating and aggravating factors in accordance with the provisions of ABOR Policy 5-308.H. A faculty member may impose any one or a combination of the following sanctions: a written warning, loss of credit for the work involved, reduction in grade, notation of the violation(s) on the student's transcript (temporary or permanent), or a failing grade in the course. The faculty member may also impose a sanction of suspension or expulsion from the program, department, college, or University. Within 10 days of the conference, the faculty member shall prepare a written decision outlining the charges, evidence, findings, conclusions and sanctions imposed. The faculty member should use the standard form entitled "Record of Faculty-Student Conference," and furnish copies to the student (as provided in the "Notice" section under General Provisions) and to all others as noted on the form, including the Dean of Students Office. See the General Provisions section for Grade Before Appeals.

### **II. Additional Sanctions for Multiple Violations**

Multiple violations of this Code may subject students to additional sanctions, including suspension or expulsion at the discretion of the Dean of the student's College ("Academic Dean") or his/her designee. Students found responsible by a faculty member for a violation of the Code must immediately contact the Dean of Students Office to determine if they have multiple violations subjecting them to additional sanctions by their Academic Deans.

Upon receiving the Record of Faculty-Student Conference, the Dean of Students Office will notify the student and the Academic Dean of the existence of multiple violations. The Academic Dean will decide if any additional sanctions are to be imposed on the student as a result of multiple violations. The Academic Dean will convey this information to the faculty member, the student and the Dean of the college where the violation occurred ("Dean of the College"), as provided in the "Notice" section under General Provisions. The Academic Dean should use the form entitled "Sanctions for Multiple Violations," and outline the findings and conclusions supporting his/her decision for an additional sanction. If the case is appealed as set forth below, the Academic Dean will present the case for the additional sanction.

### **III. Appeal to Dean of the College**

The student may appeal the faculty member's decision and sanctions to the Dean of the College



or his/her designee. The student shall deliver the written appeal to the Dean of the College within 10 days of the date on which the notice of the decision is received. The Dean of the College may extend this filing period if the student shows good cause for the extension. If a student does not appeal within the time provided, the decision and sanctions of the faculty member will be final.

Within 15 days of receiving the appeal, the Dean of the College shall review the faculty member's decision, sanctions and supporting evidence, and shall confer with the faculty member and the student. The Dean of the College shall have the authority to uphold, modify, or rescind the faculty member's decision and sanctions. If the Dean of the College finds:

1. that the conclusion of a violation is not supported by the evidence, then he/she shall render a finding of no violation and that the sanction(s) imposed be rescinded.
2. that the conclusion of a violation is supported by the evidence and the sanction imposed is appropriate, then he/she shall uphold the faculty member's decision and sanction(s).
3. that the conclusion of a violation is supported by the evidence, and the sanction(s) imposed are inadequate or excessive, then he/she shall modify the sanction(s) as appropriate.

The Dean of the College shall notify the student, the faculty member and the Dean of Students in writing of his/her decision as provided in the "Notice" section under General Provisions. The Dean of the College should use the form "Record of Appeal to Dean of the College" for this purpose. If the Dean of the College fails to act within the 15 day period, the student may, within 10 days thereafter, appeal to a University Hearing Board by providing a written notice of appeal to the Dean of Students Office. If the Dean of the College decides no violation occurred, all reference to the charge shall be removed from the student's University records, and the student may continue in the class without prejudice. If the semester has ended, the faculty member shall calculate the grade without the sanction. If work was not completed due to the academic integrity allegation, the faculty member and the student shall confer and a grade of "W" or "I" shall be assigned. If a grade of "I" is assigned, the student shall have the opportunity to complete remaining work without prejudice

#### **IV. Interim Action**

1. The Dean of the College involved may suspend the student from one or more classes, clinics or labs for an interim period prior to resolution of the academic integrity proceeding if the Dean believes that the information supporting the allegations of academic misconduct is reliable and determines that the continued presence of the student in classes or class-related activities poses a significant threat to any person or property.
2. The Dean must provide a written notice of the interim suspension to the student, with a copy to the Provost. The interim suspension will become effective immediately as of the date of the written notice.
3. A student who is suspended for an interim period may request a meeting with the Provost or his/her designee to review the Dean's decision and to respond to the allegations that he or she poses a threat, by making a written request to the Provost for a meeting, including the student's dates of availability. The Provost or his/her designee will schedule the meeting no later than five (5) days following receipt of the written request and decide whether the reasons for imposing the interim suspension are supported by the available evidence.
4. The interim suspension will remain in effect until a final decision has been made on the pending academic misconduct charges or until the Provost, or his/her designee, determines that the reasons for imposing the interim suspension no longer exist or are not supported by the available evidence.

#### **V. Appeal to University Hearing Board**

The student may appeal any decision of the Dean of the College or the Academic Dean that imposes suspension or expulsion or provides for a notation on the student's transcript. The

student may also appeal if the Dean of the College failed to act within the 15 day period. The Dean may grant the student the option to appeal if the sanction of a failing grade is imposed and the Dean believes reasonable persons would disagree on whether a violation occurred. The appeal must be filed within 10 days from receipt of the decision or the Dean of the College's failure to act, by providing written notice of appeal to the Dean of Students Office. If a student does not appeal within the time provided, the decisions of the Academic Dean, and the Dean of the College or the faculty member if the Dean of the College failed to act, will be final. The University Hearing Board shall follow the procedures set forth in the Student Disciplinary Procedures ABOR Policy 5-403.D. with the following modifications:

1. The Hearing Board shall be composed of three faculty and two students and shall convene within 30 working days of the time the student files the appeal.
2. Wherever the term Vice President of Student Affairs appears, it shall be replaced with Senior Vice President for Academic Affairs/Provost. The Provost is empowered to change grades and the Registrar shall accept the Provost's decision. The Provost shall also notify the parties of the final decision.
3. Wherever the Dean of Students is indicated as presenting evidence or witnesses, it shall be replaced with the faculty member who made the charges or his/her representative. Additionally, the Academic Dean or designee may also present evidence to support sanctions for multiple violations.
4. The student may be assisted throughout the proceedings by an advisor or may be represented by an attorney. If the student is represented by an attorney, the faculty member may also be represented by an attorney selected by the University Attorneys Office..
5. The faculty member has the same right as students to challenge the participation of any Board member, as noted in the Student Disciplinary Procedures (5-403.D.3.f.)
6. The Board may, in its recommendations, address any egregious violations of process.
7. Sanctions for multiple violations will be recommended and presented to the Board by the Academic Dean or his/her designee.

## GENERAL PROVISIONS

**Academic Day** - "Academic Days" are the days in which school is in session during the regular fall and spring semesters, excluding weekends and holidays. If possible, Faculty-Student Conferences and appeals may be heard during the summer or winter break. The Dean of the College or Dean of Students may extend these time limits when serving the interests of a fair consideration or for good cause shown.

**Advisor** – An individual selected by the student to advise him/her. The advisor may be a faculty or staff member, student, attorney, or other representative of the student. The student will be responsible for any fees charged by the advisor.

**Grade Before Appeals** - Students must be allowed to continue in class without prejudice until all un-expired or pending appeals are completed. If the semester ends before all appeals are concluded, a grade of "I" shall be recorded until appeals are completed.

**Graduate Students** - In cases involving graduate students, faculty shall follow the procedures outlined for undergraduate students except that in all cases where the student is found to have violated the Code, the faculty member (and in the case of appeals, the Dean of the College or Hearing Board) shall notify the Associate Dean of the Graduate College.

**Notice** - Whenever notice is required in these procedures it shall be written notice delivered by hand or by other means that provides for verification of delivery.

**Record** - Whenever a sanction is imposed, the sanction and the rationale shall be recorded in the student's academic file. It is recommended that the standard forms "Record of Faculty-Student Conference," "Record of Appeal to Department Head," and "Record of Modification of Sanctions"

be used. These forms are available from the Dean of Students office. Students may petition the Senior Vice President for Academic Affairs/Provost after five years from the semester of the determination or upon graduation, whichever occurs first, to have the record expunged.

**Rights and Responsibilities of Witnesses** - Witnesses are expected to cooperate in any proceedings under this Code. The privacy of a witness shall be protected to the extent allowed by law and with consideration to fairness to the students charged and other affected persons. Retaliation of any kind against witnesses is prohibited and shall be treated as a violation of the Student Code of Conduct or of the applicable University rules.

**Students or Faculty Not Available For Conference** - In cases where the student is not available, e.g. out of the area after final exams, the faculty member shall make every reasonable effort to contact the student through personal contact, telephone, University email, or mail to inform the student of the charges. If the faculty member is able to contact the student, the Faculty-Student Conference shall be scheduled as soon as both parties are available, e.g. at the beginning of next semester. The student shall be given the of Incomplete until the conference is held. If either of the parties will not be available for an extended period, the Faculty-Student Conference shall be held via the telephone or by mail. If after several efforts, contact cannot be established, the faculty member may impose sanctions but must send a letter or copy of the "Record of Faculty-Student Conference" form via certified return receipt requested mail to the student's last permanent address outlining the charges, findings, conclusions and sanctions.

**Students Not In Class** - If students not enrolled in the class are involved in a violation of this Code, faculty shall file a Code of Conduct complaint with the Dean of Students office.

All policies found in the Policy Manual are subject to change from time to time as approved by the Arizona Board of Regents. The central office disseminates hard copies of additions/revisions not more than 3 times each year. The web copy, located at <http://www.abor.asu.edu>, is updated every 1-2 months, as needed. Prior to acting in reliance upon a specific board policy as it appears in any copy of the policy manual, please check to make sure that the board has not recently approved any additions/revisions to that specific policy.

### **5-303 Prohibited Conduct**

The following misconduct is subject to disciplinary action:

1. All forms of student academic dishonesty, including cheating, fabrication, facilitating academic dishonesty and plagiarism.
2. Intentionally or recklessly causing physical harm to any person on the university campus or at a university sponsored activity, or intentionally or recklessly causing reasonable apprehension of such harm.
3. Unauthorized use, possession or storage of any weapon, explosive device or fireworks on the university campus or at a university-sponsored activity.
4. Initiating or causing to be initiated any false report, warning or threat of fire, explosion or other emergency on the university campus or at a university-sponsored activity.
5. Intentionally or recklessly interfering with normal university or university-sponsored activities, including, but not limited to, studying, teaching, research, university administration, or fire, police, or emergency services.
6. Knowingly violating the terms of any disciplinary sanction imposed for an earlier violation of this Code of Conduct.
7. Unauthorized use, possession or distribution or possession for purposes of distribution of any controlled substance or illegal drug on the university campus or at a university-sponsored activity.
8. Intentionally or recklessly misusing or damaging fire safety equipment.
9. Intentionally furnishing false information, including false identification to the university.
10. Forgery, unauthorized alteration, or unauthorized use of any university document or instrument of identification.
11. Intentionally and substantially interfering with the freedom of expression of others on the university campus or at a university-sponsored activity.
12. Theft or misappropriation of property, or of services on the university campus or at a university-sponsored activity; knowing possession of stolen property on the university campus or at a university-sponsored activity.
13. Intentionally or recklessly destroying, damaging or misappropriating university property or the property of others on the university campus or at a university-sponsored activity.
14. Failure to comply with the directions of university officials, including campus police officers, acting in good faith and in the performance of their duties.
15. Failure to comply with other published rules and regulations of conduct that may from time to time be adopted by the Board or the University, including, without limitation, restrictions on the sale or possession of alcoholic beverages on the university campus or at university-sponsored activities.
16. Unauthorized presence in or use of the university campus, facilities or property.

### **5-304 Sanctions**

- A. In addition to any other interim or final action which may be taken to enforce this Code of

Conduct, any person, whether a member of the university community or not, may be ordered to leave the university campus when the president, or such other officer or employee designated by the president to maintain order on the university campus, has reasonable grounds to believe the person is committing any act which interferes with or disrupts the lawful use of university property by others or has reasonable grounds to believe any person has entered upon the university campus for the purpose of committing such an act.

- B.** One or more of the following sanctions may be imposed for violation of the disciplinary regulations set forth in ABOR Policy 5-303 (Prohibited Conduct):
1. **EXPULSION:** Permanent separation of the person from the university. As applied to faculty and other university employees, expulsion may involve dismissal and termination of employment or non-renewal of an employment contract. An indication of expulsion will appear on the student's transcript or be maintained in the permanent file of the university employee. The person will also be barred from the university campus.
  2. **SUSPENSION:** Separation of the person from the university for a specified period of time. Permanent notification may appear on the student's transcript or in the file of the university employee. Except where any administrative decision under this Code of Conduct indicates otherwise, a person suspended under this Code of Conduct shall not participate in any university sponsored activity, may be barred from the university campus, and where such person is a faculty member or other university employee, any suspension shall be without pay or other benefits incidental to the person's employment position.
  3. **PROBATION:** This sanction shall be applicable to students only and may include forfeiture of campus privileges for a definite period of time. Additional restrictions or conditions may also be imposed. Appropriate university officials shall be notified of the imposition of such sanctions.
  4. **FORFEITURE:** This sanction shall only be applicable to faculty members or other university employees, and shall include forfeiture of the right or expectation to an increase in pay, sabbatical leave, or summer employment for a definite period of time.
  5. **WARNING:** The person is warned that further misconduct may result in more severe disciplinary action.
  6. **RESTITUTION:** Payment to the university or to other persons, groups, or organizations for damages incurred as a result of the violation of this Code of Conduct.
- C.** Imposition of any sanctions shall take into account the following:
1. Sanctions shall be imposed pursuant to the administrative procedures referred to in a ABOR Policy 5-306(Enforcement of the Code).
  2. Mitigating factors may be considered. Factors to be considered in mitigation shall be the present demeanor and past disciplinary record of the individual charged with a Code of Conduct violation, as well as the nature of the offense and the severity of any damage, injury or harm resulting from it.
  3. Repeated violations or an aggravated violation of any section of this Code of Conduct may result in the imposition of a more severe sanction.
  4. Attempts to commit acts prohibited by this Code of Conduct shall be subject to sanctions of the Code to the same extent as completed violations.

### **5-305 Groups and Organizations**

- A.** Student, faculty and employee groups or organizations may be charged with violations of this Code of Conduct.
- B.** Such a group or organization and its officers may be held collectively or individually responsible when violations of this Code of Conduct by those associated with the group or organization have received the tacit or overt consent or encouragement of the group or the

organization or its leaders, officers or spokespersons.

- C. The officers or leaders or any identifiable spokesperson for such a group or an organization may be directed by the presidency of the university to take appropriate action designed to prevent or end violations of this Code by the group or organization or by any persons associated with the group or organization who can reasonably be said to be acting on its behalf. Failure to make reasonable efforts to comply with such a directive shall be considered a violation of ABOR Policy 5-303.14 (Prohibited Conduct) of this Code, both by the officers, leaders or spokesperson of the group or the organization and by the group or organization itself.
- D. Sanctions for group or organization misconduct may include revocation of the use of university facilities for a definite period of time or denial of recognition or registration, as well as other appropriate sanctions, permitted under this Code of Conduct.

### **5-306 Enforcement of the Code**

- A. The provisions of this Code shall be enforced through use of the following administrative procedures:
  - 1. Faculty shall be subject to those procedures set forth in ABOR Policy 6-201.L (Conditions of Faculty Service, Hearing Procedures for Faculty).
  - 2. Administrators shall be subject to those procedures set forth in ABOR Policy 6-101.H (Conditions of Administrative Service, Termination and Release).
  - 3. All other university employees shall be subject to the applicable grievance procedures existing at the university.
  - 4. Students shall be subject to ABOR Policy 5-401, et seq. (Student Disciplinary Procedures) adopted by the Board.
- B. For purpose of enforcement of this Code of Conduct, a group or organization shall be subject to the same procedures as the majority of its members would be subject to if charged on an individual basis with a violation of this Code of Conduct.

### **5-307 Miscellaneous Provisions**

- A. The several sections and provisions of this Code of Conduct are hereby declared to be independent and severable and if any section, subdivision, word, sentence or clause be held void or non-enforceable such holding shall not affect the validity or enforceability of any other part or parts of this Code of Conduct which can be given effect without the invalid or non-enforceable portion.
- B. The list of prohibited misconduct set forth in ABOR 5-303 (Prohibited Conduct) shall be interpreted broadly and is not designed to define misconduct in exhaustive terms.
- C. The Board reserves the right to take necessary and appropriate action to protect the safety and well-being of the university community.
- D. Any prior existing Code of Conduct is repealed except that any pending action or proceeding shall not be affected by this Code and will be subject to the Code provisions in effect at the time the action or proceeding was originally brought.

### **5-302 Definitions**

In this Code of Conduct, unless the context otherwise provides or requires:

- 1. "Aggravated violation" means a violation which resulted or foreseeably could have resulted in significant damage to persons or property or which otherwise posed a substantial threat to the stability and continuance of normal university or university-sponsored activities.
- 2. "Board" means the Arizona Board of Regents.
- 3. "Cheating" means intentionally using or attempting to use unauthorized materials,

information or study aids in any academic exercise.

4. "Controlled substance" means a drug or substance listed in schedules contained in A.R.S. 36-2512 through 36-2516.
5. "Distribution" means sale or exchange for personal profit.
6. "Fabrication" means intentional and unauthorized falsification or invention of any information of citation in an academic exercise.
7. "Faculty" means all employees of the Arizona Board of Regents in teaching, research, or service, whose notice of appointment is as lecturer, instructor, assistant professor, associate professor, professor or otherwise designated as faculty on the notice of appointment. Graduate students who serve as assistants, associates or otherwise, are academic appointees as well as graduate students but are not members of the faculty.
8. "Group" means a number of persons who are associated with each other and who have not complied with university requirements for registration as an organization.
9. "Illegal drug" means any drug whose use, possession or distribution is prohibited or restricted by provisions of Title 13 of the Arizona Revised Statutes, and includes, without limitation, narcotic drugs, dangerous drugs, marijuana and peyote.
10. "Organization" means a number of persons who are associated with each other and who have complied with university requirements for registration.
11. "Plagiarism" means intentionally or knowingly representing the words or ideas of another as one's own in any academic exercise.
12. "President" means the president of the university or a designee.
13. "Reckless" means conduct which one should reasonably be expected to know would create a substantial risk of harm to persons or property or which would otherwise be likely to result in interference with university or university-sponsored activities.
14. "Student" means any person registered or enrolled in one or more classes except a faculty member or full-time employee who takes any course as a privilege of employment. Graduate students who serve as assistants, associates or otherwise, and all other students employed part-time are classified as students rather than faculty or other university employee.
15. "University" means the appropriate university involved: The University of Arizona, Arizona State University, Northern Arizona University, and any other university governed by the Arizona Board of Regents.
16. "University campus" means all land, buildings, facilities and other property owned, used or controlled by the university.
17. "University community" means university students, administrative and staff personnel, members of the faculty and all other university employees.
18. "University property" means all real and personal property owned by the Arizona Board of Regents and used by the university and includes all such property in the possession of or subject to the control of the university.
19. "University-sponsored activity" means any activity on or off campus which is initiated, aided, authorized or supervised by the university.
20. "Weapon" means any object or substance designed to inflict a wound, cause injury, or incapacitate, including, without limitation, all firearms, pellet guns, switch-blade knives, knives with blades five or more inches in length, and chemicals such as "mace" or tear-gas, but excluding normally available over-the-counter self-defense chemical repellents.





## D. GRADUATE PROGRAM COMMITTEE - STRUCTURE AND FUNCTION

The Graduate Program Committee has several important roles with regard to overseeing the graduate program. These include advising new students, monitoring student progress, and recommending awardees for fellowships. The committee consists of several faculty members, up to four graduate students who have passed their Oral Comprehensive Examination, and two staff members. One of the goals of the committee is to help you tailor an academic program that fits your needs prior to your selection of a Research Director and Supervisory Committee who will guide the research component of your training. The Graduate Program Committee also tracks each student during their entire time in the program and meets regularly to discuss student progress. If you have a problem that cannot be solved by your advisor, or are unsure about what you need to do to meet departmental or Graduate College requirements, you should talk to one of the faculty, staff, or student representatives on the Graduate Program Committee at any time.

The following people are serving on the Graduate Program Committee in 2009-2010:

<b>GPC MEMBER</b>	<b>ROOM</b>	<b>PHONE</b>	<b>E-MAIL</b>
Dr. Dom McGrath, Chair	CSML 630	626-4690	<a href="mailto:mcgrath@email.arizona.edu">mcgrath@email.arizona.edu</a>
Dr. Vahe Bandarian	BSW 537	626-0389	<a href="mailto:vahe@email.arizona.edu">vahe@email.arizona.edu</a>
Dr. Brooke Beam	KECK	626-2591	<a href="mailto:bbeam@email.arizona.edu">bbeam@email.arizona.edu</a>
Dr. Neel Ghosh	CSB 410	621-6331	<a href="mailto:ghosh@email.arizona.edu">ghosh@email.arizona.edu</a>
Dr. Katrina Miranda	CSML 518	626-3655	<a href="mailto:kmiranda@email.arizona.edu">kmiranda@email.arizona.edu</a>
Dr. Anne Padias	KOFF 201	621-9978	<a href="mailto:anne@u.arizona.edu">anne@u.arizona.edu</a>
Dr. Jeanne Pemberton	CSB 302	621-8245	<a href="mailto:pemberton@u.arizona.edu">pemberton@u.arizona.edu</a>
Dr. Andrei Sanov	CSML 220	626-8399	<a href="mailto:Sanov@u.arizona.edu">Sanov@u.arizona.edu</a>
Ms. Lori Boyd	CHEM 223	621-4348	<a href="mailto:lboyd@email.arizona.edu">lboyd@email.arizona.edu</a>

### **GRADUATE ADVISOR'S OFFICE**

The Graduate Program Coordinator is responsible for keeping all records relating to your academic progress. All the various forms you will need during your career as a graduate student may be obtained from the Graduate College (Admin 3rd floor) or the Graduate Program Coordinator.



## **E. FINANCIAL ASSISTANCE WHILE PURSUING THE PH.D. OR M.S. DEGREES**

Most full-time students in good standing in the Ph.D. program in the Department of Chemistry and Biochemistry are provided with some form of financial assistance. Generally, financial assistance during the first year is provided in the form of a teaching assistantship for the academic year (August 15 to June 15) and a research assistantship for the summer (June 15 to August 15). The summer research assistantship is generally paid by the student's Research Director. Otherwise, the student may be employed as a teaching assistant in the summer school program. Both In-state and Out-of-state tuition are waived for all teaching and research assistants. A limited number of University Fellowships are available and are awarded competitively. Students should meet regularly with their Research Director and/or teaching supervisor to insure that their performance is satisfactory. Unsatisfactory performance can result in removal from the program. Adequate performance in our graduate program is a full-time commitment and students are expected to work on teaching, coursework and research for a minimum of 40 hours per week. ***Realistically, your commitment needs to be greater than that, on average, if you are to have a chance of finishing your degree program in 5 years or less.***

***Registration for at least 6 units of graduate level credit (audit credits do not count) is required for having an assistantship.***

### **1. TEACHING ASSISTANTSHIPS (TA)**

While it is true that the teaching assistantship is a mechanism for supporting students during their graduate training, it can and should be an integral part of the training itself. As a TA you will have the opportunity to further consolidate your understanding of basic chemical principles, develop a formal, professional style of speaking and presentation of technical materials, and learn how to interact with a variety of personalities on a professional level.

#### ***Responsibilities and duties of a teaching assistant:***

TAs are employees of the State of Arizona and representatives of the University of Arizona and Department of Chemistry and Biochemistry, and are subject to all Arizona Board of Regents policies regarding personnel. Your actions as a TA reflect on all of us. It is expected that all TAs will demonstrate the utmost in professional behavior.

All TAs are required to work 20 hours per week for a half-time position regardless of the assignment. Because of the nature of teaching, the workload will vary from week to week so that the 20 hours is an average over the term. Specific job descriptions exist for every TA assignment and are available from the Teaching Support Office on request. Further information regarding the duties and responsibilities of TAs is provided in the department's "TA Training Manual".

All TAs start out at Level 1. TA performance is reviewed at the end of each semester. After two semesters of performance at a satisfactory level, TAs are eligible for promotion to Level 2. Outstanding Level 2 TAs are eligible for promotion to Level 3. Awards for outstanding teaching are also made periodically.

Students awarded a teaching assistantship must attend the Graduate College Training Orientation, the Department of Chemistry and Biochemistry Orientation and Training, and the Red Cross Multimedia Standard First Aid Course. They also have to

successfully complete specific units on TATO, TA training on-line. Students must provide written evidence of satisfactory completion of all these three requirements. This is required once and is typically accomplished during the weeks prior to the first semester of graduate school.

In addition to the above requirements, international students must have a minimum TOEFL (Test of English as a Foreign Language) score of 550 paper based (PB), 79 internet based (iBT), or IELTS (International English Language Testing System) composite score of 7 (no subject area below a 6).

***At the end of the first semester foreign students must qualify to teach to remain eligible for support. Appeals may be made.***

## **2. RESEARCH ASSISTANTSHIPS (RA)**

Students who have been offered financial assistance are eligible to be paid as graduate research assistants by the Research Director, with the stipend level depending on their progress in the program. (A RA during the first year of graduate study must be approved by the Department Head.) The Chemistry and Biochemistry Department has three levels of support for graduate students serving as RAs. Level 1 pertains to all students in their first year as a research assistant. After the first year students may be promoted to Level 2 upon the recommendation of their Research Director. Advanced graduate students may be promoted to Level 3 based on outstanding student progress in the program. The Research Director provides the necessary funding for these advancements.

Continuation in these research assistantships is based upon availability of research funds and adequate performance of the students in making progress toward completion of their degree program.

## F. DEPARTMENTAL AND GRADUATE COLLEGE POLICIES

### 1. Registration Policy

- a) All students who are accepted into the graduate program in the Department of Chemistry and Biochemistry are expected to have completed one year of **PHYSICAL CHEMISTRY** during their undergraduate studies. Students who lack the physical chemistry requirement are occasionally admitted into the program with the understanding that they will remedy the deficiency during their first year of studies at the University of Arizona by taking CHEM 480A and 481.
- b) By Graduate College rules, all requirements for the degree of Doctor of Philosophy must be completed within **5 YEARS** of passing the Comprehensive Exam, whether the student is supported financially, or not. Should a student not finish within that time period, he/she may be allowed to re-take the Comprehensive Exam (written and oral) with the permission of the program, then proceed to complete other requirements. This in no way implies that the Department of Chemistry is bound to financially support the student for more than five years from the start of their program.
- c) Full-time students must take 12 units for the first three semesters in residence in order to be eligible for either a research or a teaching assistantship.
- d) From the fourth semester onward all students must register for a minimum of 6 graduate level units during a Fall or Spring semester or a minimum of 1 unit during a Summer semester if summer registration is required (i.e. for purposes of the orals).
- e) Students past their second semester in residence may drop courses with the approval of their dissertation or thesis advisor but the total number of units must remain at 12 (or 6) by the addition of other courses or supplemental registration (Chem 900). First semester students must obtain the permission of the Graduate Program Committee before dropping courses, and in general this is not permitted, except for students leaving the program.
- f) The Graduate College requires registration each fall and spring from original matriculation until all degree requirements, including submission of the final copy of the thesis or dissertation, are completed.

### 2. Academic Probation Policy

#### ***At the end of the first semester:***

- a) Full-time graduate students who qualify for the Ph.D. or M.S. degrees after two semesters in residence, but who are placed on academic probation according to Graduate College or Department of Chemistry rules,\* may be recommended for Departmental financial support for a second semester, during which time the **academic probation must be removed**. These appointments are based upon availability of funds and the department's needs for teaching assistants.
- b) Full-time Chemistry graduate students who do not qualify for either the Ph.D. or M.S. degrees, after two semesters of residence, are not eligible for continued Departmental financial support and will be counseled to withdraw from the

program.

\*Graduate College rules require a GPA of 3.00 or better in ALL graduate courses; The Department of Chemistry and Biochemistry rules require a minimum GPA of 3.00 in all graduate courses approved by the GPC as counting toward the Ph.D. degree.

Students whose GPA falls below 3.0 as calculated by the Graduate College OR the Department of Chemistry and Biochemistry may be placed on academic probation or be dismissed from the program depending on the severity of the GPA deficit. Students on academic probation have one semester in which to bring their GPA up to 3.0. No student will be allowed more than one semester on academic probation.

### **Continuing Graduate Students:**

- a) Continuing graduate students who have not previously been on academic probation, but whose cumulative GPA by Graduate College and/or Departmental rules falls below 3.00, and are therefore placed on academic probation, may be eligible for Departmental support as a Teaching or Research Assistant during the subsequent semester, depending upon the support available and the student's overall record.
- b) Probationary status **must** be removed in the semester immediately following its incurrence.
- c) A student may be on probationary status for no more than one semester during their entire graduate program. A second instance of probationary status will result in loss of eligibility for continued Departmental financial support and will be counseled to withdraw from the program.

### **3. Grade Replacement Option**

Graduate students are not eligible for grade replacement.

### **4. Teaching Probation Policy**

- a) It is expected that graduate students who are employed as TA's by the Department of Chemistry and Biochemistry will make every effort to perform their duties to the satisfaction of the Department and the University of Arizona. TA performance will be reviewed each term by the TA and Lab Course Evaluation Committee\*, which will make its recommendations known to the Department Head and others the Department Head shall designate.
- b) In the event that the performance of a TA is deemed unsatisfactory in any term, the TA may be placed on teaching probation by the Department Head to alert the TA that improvement in performance of teaching duties is expected. The TA will be informed in writing of the TA's specific teaching deficiencies. Such improvement will be measured in the next term in which the student is employed as a TA. In the event that the deficiencies are remedied, the probationary status of the TA will end. In the event that deficiencies are not remedied, the TA will become ineligible for support as a TA in the Department of Chemistry and Biochemistry at The University of Arizona.
- c) A TA may be placed on teaching probation only once. In the event that the performance of a TA is deemed unsatisfactory in any two terms, the TA will, at

the discretion of the Department Head, become ineligible for support as a TA in the Department of Chemistry and Biochemistry at The University of Arizona and may be counseled out of the program.

\* The TA and Lab Course Evaluation Committee will consist of such faculty, staff, and student members designated by the Department. Current procedures are available from committee members and the TSO (Koffler/CBS 201).

## **5. Continuous Enrollment**

### **Master's Continuous Enrollment Policy**

A student admitted to a Master's degree program must register each fall and spring semester for a minimum of 3 graduate units, from original matriculation until all degree requirements are met. If the degree program requirements are to be completed in the summer, the student must register for a minimum of 1 unit of graduate credit during that term.

### **Doctoral Continuous Enrollment Policy**

A student admitted to a graduate degree program must register each fall and spring semester for a minimum of 3 graduate units from original matriculation until the completion of all course requirements, written and oral comprehensive exams, and 18 dissertation units. When these requirements are met, doctoral students not on financial assistance and/or needing to maintain appropriate visa status, must register for a minimum of 1 unit each semester until final copies of the dissertation are submitted to the Graduate Degree Certification Office. Students receiving teaching or research assistantships/associateships must register for at least 6 units. If degree requirements are completed during the summer term, the student must be registered for the minimum of 1 unit of graduate credit during the term. If degree requirements are completed during an intersession, the student must have been registered during the preceding semester.

Summer-only students must continuously enroll during consecutive summers until all degree requirements are fulfilled. Unless excused by an official Leave of Absence, all graduate students are subject to the Continuous Enrollment Policy.

## **6. Leave of Absence**

### **Academic Leaves**

Academic LOAs (i.e. leaves to take course work at another university, for research, field work, internships, professional development, etc.) are handled on a case-by-case basis by the student's Department and the Graduate College

### **Medical Leaves**

With appropriate documentation from their medical provider, graduate students in degree programs may be granted a Medical Leave of Absence by the Dean of the Graduate College.

### **Personal Leaves**

Graduate students in degree programs may be granted a Leave of Absence for a maximum of one year throughout the course of their degree program by the Dean of the Graduate College. LOAs are granted on a case-by-case basis for compelling reasons, including birth or adoption of a child, personal or family reasons, military duty or financial hardship.

LOAs may be granted retroactively for up to one year. Students will be readmitted without reapplying to the department and the Graduate College. Only when the LOA is approved prior to the beginning of the semester for which the LOA is being sought will students be exempt from fees for that semester.



## **G. COURSEWORK FOR THE Ph.D. DEGREE IN CHEMISTRY**

### **1. Total Credits**

- a) A minimum of 63 units of graduate credit are required for a Ph.D. in Chemistry.
- b) A total of 45 graded and ungraded units and 18 dissertation units comprise the 63 overall credits.
- c) At least 18 units must be in courses for which a letter grade (A,B,C,D,E) is awarded. A 'B' or better must be earned in each graded course that is to be counted towards the Major and Minor requirements for graded courses. Note: the Graduate College requires a minimum of 18 graded units, but for some Chemistry programs of study more graded units may be required.
- d) If a 'C' is received in a major or minor course, the student must: 1) repeat the course, or 2) take a different course at the discretion of the division in question and receive a at least a 'B' in that replacement course. The GPC must be advised of, and approve of, this change. Note that this does not automatically remediate the GPA, which must be raised to a minimum of 3.0.
- e) The ungraded course work (approx. 27 units) is mostly comprised of seminar, group meetings, college teaching, research opportunities, or intermediate level courses.
- f) In some divisions, students may take up to two (2) units of "Advanced Seminar" (696e) for a letter grade credit as part of their 22 units. (See following pages in this section for detailed programs of study that satisfy these overall requirements).

**NOTE: See section F2 for rules regarding academic probation.**

### **2. Transfer Credits**

It is a Departmental policy that no more than 12 units of graduate credit may be transferred from another institution. All transfer credit must be approved first by division affected, which will compare the content of the course with similar courses taught in our program. The approval process then moves to the Graduate Program Committee, and then finally the Graduate College. The Graduate College determines if the courses are eligible for transfer. You must obtain the Transfer Credit Form from the Graduate College and submit it to that office before the end of the first year of study for courses to be reviewed.

### **3. College Teaching**

One unit of College Teaching (Chemistry 595c) with a grade of S or P, is required of graduate students the first semester they hold a teaching assistantship.

### **4. Research Opportunities**

All entering Chemistry students are required to take one unit of Chemical Research Opportunities (CHEM 695a) before selecting a Research Director (**see Section I**).

### **5. Chemistry Required Coursework in the Major and Minor areas**

- a) A minimum of fifteen (15) units of graduate courses in the major, (the sub-discipline of specialization or division) are required for the Ph.D. in Chemistry. Some divisions require more coursework than this minimum (see summary tables in the back of this section). Courses of study other than those shown in the summary tables (e/g/ multidivisional courses of study) are possible with the approval of the student's dissertation committee and the Graduate Program

Committee. These required courses provide the background necessary for taking the Oral Comprehensive Examination (see Section J) and for initiating independent research. The time required to complete the required coursework will depend upon your preparedness, as evidenced by your performance on the Placement Examinations. For all full-time students, the required courses should be completed by the end of the second year (other rules apply to students admitted on a part-time basis; see Section M).

- b) For Ph.D. students in Chemistry who elect a minor in chemistry, a minimum of three units of advanced coursework outside the area of specialization, and for which a letter grade is awarded, are required.
- c) A minor in an area outside of chemistry must be approved in advance by the Graduate Program Committee and must satisfy all the coursework, written and oral preliminary exam requirements of the minor department.
- d) A 'B' or better is required in all graded courses to be counted towards the requirements of the major or minor. An average of 3.0 (B) is required for overall good standing within the program. If a 'C' is received in a major or minor course, the student must: 1) repeat the course, or 2) take a different course at the discretion of the division, and the GPC, and receive a at least a 'B' in that replacement course

## **6. Elective courses**

Students are encouraged to broaden their knowledge through participation in courses beyond the minimum requirements. Elective graduate courses are offered on a regular basis to provide students the conceptual background to plan and execute original graduate research and to provide breadth in related areas of chemistry (see the list of course offerings in Section H).

## **7. Chemistry Seminar**

Regular attendance at seminar is expected of all students each semester. Up to ten (10) units of divisional seminar (CHEM 696) may be used to meet graduation requirements. Up to two (2) units of graded seminar (CHEM 696e) may be taken.

In addition to the CHEM696 class, students are required to give at least 2 seminars to the department during their residency. The first is to occur during the student's 2nd year. The format will depend on the student's division and research progress. The second seminar is to be given shortly prior to the student's defense of the Dissertation. The department encourages students to give more seminars than the minimum as a way to develop formal presentation skills and share research within the department.

It is the student's responsibility to contact the seminar coordinator for their division to schedule seminars. This should be done over the summer before the 2nd year and approximately 1 semester before their expected graduation.

## **8. Group Meeting**

At least one unit of Exchange of Chemical Information (CHEM 695b) should be taken each semester in residence after joining a research group. Up to ten (10) units may be used to meet graduation requirements. The format for this course is set by individual research directors.

## **9. Dissertation Research**

Independent Dissertation Research (CHEM 920) under the guidance of your Research Director and Dissertation Committee forms the heart of a Ph.D. degree in Chemistry. The Graduate College requires a *minimum of 18 units of Chemistry 920*.



#### **H. DEPARTMENTAL PLAN OF STUDY (DPOS)**

In conjunction with his/her major advisor, each student is responsible for developing a Plan of Study during their first year in residence, to be filed with the Graduate College no later than the student's third semester in residence. The Plan of Study identifies (1) courses the student intends to transfer from other institutions; (2) courses already completed at The University of Arizona which the student intends to apply toward the graduate degree; and (3) additional course work to be completed in order to fulfill degree requirements. The Plan of Study must have the approval of the student's major professor and department head (or Director of Graduate Studies) before it is submitted to the Graduate College.

Submit the completed DPOS form to your Graduate Program Coordinator.

## ANALYTICAL

Major		Minor	Total Graded
<b>CHEM 526b</b> Fall	3		
<b>CHEM 527</b> Fall	3		
<b>CHEM 528</b> Spring	3		
<b>CHEM 521A</b> Fall only	3		
Choose either <b>CHEM 522</b> or <b>CHEM 525</b> Spring	3		
Major Courses Total (minimum):	<b>15</b>	Minor Courses Total (minimum) : <b>3</b>	Graded Courses Total (minimum): <b>18</b>

## Other Courses

Group Meeting	Seminar	Other	Total units
<b>695b</b>  1 credit/semester (after joining a research group)	<b>696a</b>  1 credit/semester	<b>595c College Teaching</b> (Fall I), 1 credit  <b>695a Research Opportunities</b> (Fall I), 1 credit  <b>900 Research</b> 1-5 credits per semester	
Maximum counted toward degree: <b>10</b>	Maximum counted toward degree <b>10</b>		Ungraded total: <b>27</b>

Graded (min. 18) and ungraded courses listed in above tables must equal at least 45 credits.  
CHEM 920 Dissertation Research must be taken for a minimum of 18 credits. Total: 45+18=63

All students should register for at least 12 credits.  
All students must earn a grade of B or better in all required major coursework.

## INORGANIC

Major		Minor	Total Graded
<b>510</b> Fall only	3	3 credits minimum choose courses to broaden general knowledge of chemistry or to focus on a secondary area that complements the major	
<b>514</b>	3		
<b>515</b>	3		
6 credits chosen from 512, 513 (multiple times if different topics), 511A, 518 or course approved by committee	6		
Major Courses Total (minimum):	<b>15</b>	Minor Courses Total (minimum) : <b>3</b>	Graded Courses Total (minimum): <b>18</b>

## Other Courses

Group Meeting	Seminar	Other	Total units
<b>695b</b>  1 credit/semester  (after joining a research group)	<b>696b</b>  1 credit/semester  <b>696e</b> graded seminar at discretion of division	<b>595c College Teaching</b> (Fall I), 1 credit  <b>695a Research Opportunities</b> (Fall I), 1 credit  <b>900 Research</b> 1-5 credits per semester	
Maximum counted toward degree: <b>10</b>	Maximum counted toward degree <b>10</b>		Ungraded Courses total: <b>27</b>

Graded (min. 18) and ungraded courses listed in above tables must equal at least 45 credits.  
CHEM 920 Dissertation Research must be taken for a minimum of 18 credits. Total: 45+18=63

All students should register for at least 12 credits.

**ORGANIC**

Major		Minor	Total Graded
<b>550</b>	3	3 credits minimum  choose courses to broaden general knowledge of chemistry or to focus on a secondary area that complements the major	
<b>541</b>	3		
<b>543</b>	3		
Courses chosen from 542B, 640 or 546, 549b, 548 or course approved by committee	6		
Major Courses Total (minimum):	<b>15</b>	Minor Courses Total (minimum) : <b>3</b>	Graded Courses Total (minimum): <b>18</b>

**Other Courses**

Group Meeting	Seminar	Other	Total units
<b>695b</b>  1 credit/semester  (after joining a research group)	<b>696c</b>  1 credit/semester  ( <b>696e</b> graded seminar at discretion of division)	<b>595c College Teaching</b> (Fall I), 1 credit  <b>695a Research Opportunities</b> (Fall I) 1 credit  <b>900 Research</b> 1-5 credits per semester	
Maximum counted toward degree: <b>10</b>	Maximum counted toward degree <b>10</b>		Ungraded total: <b>27</b>

Graded (min. 18) and ungraded courses listed in above tables must equal at least 45 credits.  
CHEM 920 Dissertation Research must be taken for a minimum of 18 credits. Total: 45+18=63

All students should register for at least 12 credits



## PHYSICAL

Major		Minor	Total Graded
<b>580</b> Fall only	3	3 credits minimum  choose courses to broaden general knowledge of chemistry or to focus on a secondary area that complements the major	
<b>582</b> Fall only	3		
<b>587</b> Spring only	3		
<b>680</b> Spring Only	3		
Elective course chosen from 583, 682, 684, 687, or course approved by committee	3		
Major Courses Total (minimum):	<b>15</b>	Minor Courses Total (minimum) : <b>3</b>	Graded Courses Total (minimum): 19

## Other Courses

Group Meeting	Seminar	Other	Total units
<b>695b</b>  1 credit/semester (after joining a research group)	<b>696d</b>  1 credit/semester	<b>595c College Teaching</b> (Fall I), 1 credit  <b>695a Research Opportunities</b> (Fall I) 1 credit  <b>900 Research</b> 1-5 credits per semester	
Maximum counted toward degree: <b>10</b>	Maximum counted toward degree <b>10</b>		Ungraded total: <b>27</b>

Graded (min. 18) and ungraded courses listed in above tables must equal at least 45 credits.  
CHEM 920 Dissertation Research must be taken for a minimum of 18 credits. Total: 45+18=63

All students should register for at least 12 credits

## CHEMICAL EDUCATION

The Ph.D. in Chemistry with a research component in Chemical Education is designed for individuals who intend to pursue careers in chemical education research or teaching at the high school, college, or university level. Graduate course work in chemistry is accompanied by courses in education and chemical education, which enable the graduate to undertake research in the teaching and learning of chemistry.

Major	Minor	Total Graded
15 credits minimum  complete major course requirements in any of these subject areas: analytical, biological, inorganic, organic, or physical chemistry.	9 credits minimum  choose courses to complete a minor in education or science education (must satisfy the requirements of the minor department).	
Major Courses Total (minimum): <b>15</b>	Minor Courses Total (minimum): <b>9</b>	Graded Courses Total (minimum): <b>24</b>

### Other Courses

Group Meeting	Seminar	Other	Total units
<b>695b</b>  1 credit/semester  (after joining a research group)	<b>696a</b>  1 credit/semester	<b>595c College Teaching</b> (Fall I), 1 credit  <b>695a Research Opportunities</b> (Fall I), 1 credit	
Maximum counted toward degree: <b>10</b>	Maximum counted toward degree <b>10</b>	2 credits	Ungraded total: <b>min 21</b>

Graded (min. 24) and ungraded courses listed in above tables must equal at least 45 credits. CHEM 920 Dissertation Research must be taken for a minimum of 18 credits. Total: 45+18=63

All students should register for at least 12 credits

### BIOLOGICAL PHYSICS PROGRAM (BPP)

The Biological Physics Program (BPP) is a multidisciplinary graduate training program that can be joined as a track through three departments: Biochemistry & Molecular Biophysics, Chemistry, or Physics. The course background for BPP students is expected to include a year of introductory Physics, Biochemistry, and a year of Physical Chemistry or equivalent upper division Physics. Additional admission requirements correspond to the home department. The degree is granted in Home Department with a focus in Biological Physics.

Major & Distributed Minor		Introduction to Research	Total Graded
Core courses in Chemistry or Biochemistry & Molecular Biophysics <b>CHEM 565</b> Proteins and Enzymes	3	<b>795a</b>  3 credits/semester Laboratory rotations during first and second semester in residence	
<b>CHEM 585</b> Biological Structure	3		
Core courses in Physics <b>PHYS 530</b> Intro to Biophysics	3		
<b>PHYS 531</b> Molecular Biophysics <b>Chem 580 &amp; 582</b>	6		
Major Courses Total (minimum):	<b>18</b>	Minor Courses Total (minimum) : <b>6</b>	Graded Courses Total (minimum): <b>24</b>

### Other Courses Required

Journal Club	Group Meeting	Seminar	Other	Total units
<b>BIOC 595B</b> 1 credit/semester (Required attendance for students in Biological Physics Program)	<b>695b</b> 1 credit/semester  (After joining a research group)	<b>696c</b> 1 credit/semester  ( <b>696e</b> graded seminar at discretion of division)	<b>595c College Teaching</b> (Fall I), 1 credit  <b>695a Research Opportunities</b> (Fall I) 1 credit	
Maximum counted toward degree: <b>10</b>	Maximum counted toward degree: <b>10</b>	Maximum counted toward degree <b>10</b>	<b>2 credits</b>	Ungraded total: <b>21</b>

### BIOLOGICAL CHEMISTRY PROGRAM (BCP)

Major & Distributed Minor		Introduction to research	Total Graded
Any one from <b>565</b> (Proteins and Enzymes) <b>BIOC 568</b> (Nucleic Acids) <b>PCOL 530</b> (Proteins and Nucleic Acids as Drug Targets) <b>PHSC 670</b> (Principles in drug Discovery, Design, and Development)	3	<b>795a</b>  3 credits/semester Laboratory rotations during first and second semester in residence	
Any one from Fundamental Chemistry Course <b>550 / 510 / 521B / 580</b>	3		
Courses chosen from upper division chemistry or courses approved by committee.	9		
Major Courses Total (minimum):	<b>15</b>	Maximum counted toward degree: <b>6</b>	Graded Courses Total (minimum): <b>21</b>

### Other Courses Required

Journal Club	Group Meeting	Seminar	Other	Total units
<b>BIOC 595B</b>  1 credit/semester (Required attendance for students in Biological Chemistry Program)	<b>695b</b>  1 credit/semester  (After joining a research group)	<b>696c</b>  1 credit/semester  ( <b>696e</b> graded seminar at discretion of division)	<b>595c College Teaching</b> (Fall I), 1 credit  <b>695a Research Opportunities</b> (Fall I) 1 credit  <b>MCB 695e</b> (Science, Society, & Ethics) 1 credit	
Maximum counted toward degree: <b>10</b>	Maximum counted toward degree: <b>10</b>	Maximum counted toward degree <b>10</b>	<b>3 credits</b>	Ungraded total:  <b>21</b>

Graded (minimum 21) and ungraded courses listed in above tables must equal at least 45 credits. CHEM 920 Dissertation Research must be taken for a minimum of 18 credits. Total: 45+18=63

All students should register for at least 12 credits

## CHEMICAL PHYSICS PROGRAM (CPP)

The Chemical Physics Program (CPP) is a multidisciplinary graduate training program that can be joined as a track through either the Chemistry or Physics departments. Students undertake courses and seminars involving both departments that are optimized for individual student interests with a maximum of flexibility. Admission requirements for CPP students correspond to the Home Department (Chemistry or Physics). The degree is granted in the Home Department with a focus in Chemical Physics.

Major		Minor	Total Graded
Choose any courses from the following options:*		Choose courses from the indicated options to broaden general knowledge of chemistry and physics	*A minimum of 6 units of graduate coursework are required (and 9 units recommended) from each of the home departments (physics and chemistry).
Electricity & Magnetism <b>(PHYS 515A/B)</b>	3/3		
Quantum Mechanics <b>(CHEM 580/680 or PHYS 570A/B)</b>	3/3		
Thermodynamics & Statistical Mechanics <b>(CHEM 580 or PHYS 528)</b>	3		
Kinetics <b>(CHEM 583)</b>	3		
Spectroscopy <b>(CHEM 584/587/687)</b>	3/3/3		
Mathematical Methods <b>(CHEM 585)</b>	3		
Condensed Matter <b>(CHEM 686 or PHYS 560A/B)</b>	3/3		
Major Courses Total (minimum):	<b>18</b>	Minor Courses Total (minimum) : <b>3</b>	Graded Courses Total (minimum): <b>18</b>

### Other Courses Required

Journal Club	Group Meeting	Seminar	Other	Total units
<b>CHEM 599 or PHYS 599</b> 1 credit/semester (Required attendance for students in Chemical Physics Program)	<b>CHEM 695b</b> 1 credit/semester  (After joining a research group)	<b>CHEM 696c</b> 1 credit/semester  (696e graded seminar at discretion of division)	<b>595c College Teaching</b> (Fall I), 1 credit  <b>695a Research Opportunities</b> (Fall I) 1 credit	
Maximum counted toward degree: <b>10</b>	Maximum counted toward degree: <b>10</b>	Maximum counted toward degree <b>10</b>	<b>2 credits</b>	Ungraded total: <b>21</b>

Graded (minimum 21) and ungraded courses listed in above tables must equal at least 45 credits. CHEM 920 Dissertation Research must be taken for a minimum of 18 credits. Total: 45+18=63

All students should register for at least 12 credits

### Certificate in Entrepreneurial Chemistry

This program is only offered to PhD graduate students who want to be successful as entrepreneurs or working in start-up companies.

<b>PhD requirements</b>	<b>Business</b>	<b>Other</b>	<b>Total units</b>
Students must fulfill all requirements for the Chemistry PhD program	BNAD 510 Business for Scientists 3 credits  MIS578 Management 3 credits  ENTR595F Entrepreneurship 1 credit	CHEM 909 One chapter in the doctoral dissertation on the business aspects of the research	
<b>63</b>	<b>7 credits</b>	<b>2 credits</b>	<b>72</b>

**Worksheet to plan schedule:**

Courses for which all students should register are listed.

Choose any necessary courses and then use the Program of Study guidelines, by division, on the previous pages to choose additional courses.

Most students will take three, 3-credit courses in the first semester in addition to 595c, 696x, and 695a.

<b>Fall I</b>			<b>Spring I</b>		
Course #	Topic	Units	Course #	Topic	Units
595c	College Teaching	1	900	Research	1-5
696a - Analytical 696b - Inorganic 696c - Organic 696d - Physical	Seminar (Choose one)	1	696a - Analytical 696b - Inorganic 696c - Organic 696d - Physical	Seminar (Choose one)	1
695a	Research Opportunities	1	695b	Group Meeting	1
	Total	12		Total	12
<b>Fall II</b>			<b>Spring II</b>		
Course #	Topic	Units	Course #	Topic	Units
900	Research	1-5	900	Research	1-5
696a - Analytical 696b - Inorganic 696c - Organic 696d - Physical 696e - (Graded)	Seminar (Choose one)	1	696a - Analytical 696b - Inorganic 696c - Organic 696d - Physical 696e - (Graded)	Seminar (Choose one)	1
695b	Group Meeting	1	695b	Group Meeting	1
920	Dissertation Research	1-9	920	Dissertation Research	1-9
	Total	12		Total	12

## Requirements for the Graduate Minor in Chemistry

The graduate minor in chemistry for students with a major outside of chemistry will consist of an approved sequence of at least 9 units of chemistry courses, each to be passed with a grade of "B" or better. The written preliminary examination will be comprised of the final examinations on the courses.

Acceptable sequences of chemistry courses include:

- a. Analytical  
521a, 528, and one from 522, 526b, 527, and 525
- b. Inorganic  
510 and two from 511, 513, 514, 515, and 518
- c. Organic  
550 and two from 541, 542a, 542b, 543, 544, 548 and 640
- d. Physical  
580, 582, and one from 583, 587, 680, and 687

Other sequences may be accepted to fit special students needs, but it is the student's responsibility to obtain written approval from the minor members of his/her Dissertation Committee and from the Graduate Program Committee of the chemistry Department prior to embarking on such a course of study.



## CHEMISTRY GRADUATE COURSE LISTINGS

### **CHEM 510 -- Advanced Inorganic Chemistry (3 units)**

**Description:** Aspects of modern inorganic chemistry: Structure and bonding, magnetic and spectroscopic properties, and reactions and reaction mechanisms of transition metal compounds. Catalytic properties of transition metal complexes. Selected topics of main group elements and new directions in inorganic chemistry.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 404 or consent of instructor.

**Usually offered:** Fall.

### **CHEM 511A -- Designer Inorganic Materials (3 units)**

**Description:** Concepts and practice of molecule-based materials with emphasis on metal-ligand interactions and synthetic methods for selected classes of inorganic and organometallic materials. Interrelationship of structure and bonding to properties and functions of designed materials. Recent developments in materials chemistry, synthetic techniques and self-assembled supramolecular materials.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 404 or consent of instructor.

**Usually offered:** Fall.

### **CHEM 512 -- Inorganic Preparations (3 units)**

**Description:** Standard inorganic laboratory preparations, including coordination compounds, isomeric, organometallic, bioinorganic, air sensitive compounds, and compounds typifying the groups of the periodic table. High temperature, inert atmosphere, materials synthesis, and characterization of products by various spectroscopic techniques. Graduate level requirements include an individual synthesis project.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Special course fee required:** \$100.

**May be convened with:** CHEM 412.

**Usually offered:** Fall, Spring.

### **CHEM 513 -- Current Topics in Inorganic Research (1-4 units)**

**Description:** In-depth treatment of advanced topics in inorganic chemistry. Examples include kinetics and mechanisms of inorganic reactions, bioinorganic chemistry, EPR spectroscopy, solid state materials chemistry, chemistry of particular elements or families of elements, and other topics characterized by faculty expertise. Topics will vary each semester.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 510 or consent of instructor.

**May be repeated:** for a total of 6 units of credit.

**Usually offered:** Fall, Spring.

### **CHEM 514 -- Organometallic Compounds (3 units)**

**Description:** Compounds containing carbon-metal bonds, with emphasis on those of the transition elements, their reactivity, and the determination of their structure.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 404 or consent of instructor.

**Usually offered:** Fall.

### **CHEM 515 -- Physical Methods in Inorganic Chemistry (3 units)**

**Description:** Selected topics in the area of physical characterization of inorganic molecules and materials, with particular emphasis on ligand field theory, symmetry aspects, spectral properties and magnetic behavior of transition metal complexes.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 510.

**Usually offered:** Fall.

**CHEM 518 -- Computational Chemistry (2-4 units)**

**Description:** State of the art computational methods in chemical research including approximate abinitio electronic structure methods, molecular mechanics, and modeling graphics; the course is designed to guide students through the application of computers to their own research.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** consent of instructor.

**Usually offered:** Fall, Spring.

**CHEM 520 -- Advanced Topics in Analytical Chemistry (2-3 units)**

**Description:** Special topics in modern analytical chemistry. Recent offerings have included principles of bioanalytical chemistry and mass spectrometry. Students enrolled for 3 units are required to complete an additional research project including a written paper and an oral presentation.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 401A or consent of instructor.

**May be repeated:** for a total of 6 units of credit.

**Usually offered:** Fall, Spring.

**CHEM 521B -- Advanced Analytical Chemistry (3 units)**

**Description:** Advanced fundamentals of equilibrium chemistry, principles of analytical separations including chromatography, principles of electroanalysis including ion selective electrodes and chemical sensors.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 325, CHEM 401A, CHEM 480B or consent of instructor.

**Usually offered:** Fall.

**CHEM 521C -- Advanced Analytical Chemistry (1 units)**

**Description:** Principles of electronics and signal processing for analytical instrumentation.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 401A, CHEM 480B, or consent of instructor.

**Usually offered:** Fall.

**CHEM 522 -- Electroanalytical Chemistry (2-3 units)**

**Description:** Principles of electrochemistry and electroanalysis, including topics on electrochemical equilibria, electrode kinetics, potentiometry, coulometry, voltammetry and spectroelectrochemistry. Students enrolled in 3 units are required to complete an additional research project including a written paper and an oral presentation.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 401A or consent of instructor.

**Usually offered:** Spring.

**CHEM 523A -- Bioanalytical Chemistry (2-3 units)**

**Description:** Bioanalytical chemistry covers the principles behind the essential measurements used for analysis of biological systems, including but not limited to separations, mass spectrometry, microarrays, immunoassays, and DNA sequencing. The current literature is examined to understand today's research questions in bioanalysis, developments in the biotech industry, and opportunities to have a creative impact on improving human health.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 521B.

**Usually offered:** Fall, Spring.

**525A – Mass Spectrometry (2-3 units)**

**Description:** Modern mass spectrometric techniques and instrumentation.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Typical structure:** 3 hours laboratory, 2 hours lecture

**Usually offered:** Fall

**CHEM 526B -- Analytical Spectroscopy (2-3 units)**

**Description:** Principles of molecular absorption, emission and scattering spectroscopies for chemical analysis. Students enrolled for 3 units are required to complete an additional research project including a written paper and an oral presentation.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 401A or consent of instructor.

**Usually offered:** Spring.

**CHEM 527 -- Analytical Separations (2-3 units)**

**Description:** Fundamentals of separation processes including single and multistage analytical chromatographic methods. Students enrolled for 3 units are required to complete an additional research project including a written paper and an oral presentation.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 401A or consent of instructor.

**Usually offered:** Fall.

**CHEM 528 -- Advanced Analytical Chemistry Laboratory (3 units)**

**Description:** Advanced laboratory experiments in analytical instrumentation.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Special course fee required:** \$100.

**Prerequisite(s):** CHEM 401A4, CHEM 480B; Concurrent registration, CHEM 521A.

**Usually offered:** Spring.

**CHEM 529 -- Methods of Surface and Materials Analysis (2-3 units)**

**Description:** Fundamentals of electron, atomic and molecular spectroscopies for surface and materials analysis. This course is suitable for enrollment by advanced undergraduates. Students enrolled for 3 units are required to complete an additional research project with paper and oral presentation.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 401A or consent of instructor.

**Usually offered:** Fall.

**CHEM 530 -- Proteins and Nucleic Acids as Drug Targets (3 units)**

**Description:** [Taught alternate years beginning Spring 2005]. The course will be coordinated through the Medicinal Chemistry Division of Pharmacology & Toxicology and will be Team Taught. Each semester four to five topics will be chosen for which the core areas of (chemistry, biochemistry, and medicinal chemistry) have been brought to bear on a specific biological question. Faculty, from the core areas, will lecture on each topic and lead discussions. Students will present material and lead discussions.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Identical to:** PHSC 530; PHSC is home department.

**Usually offered:** Spring.

**CHEM 532A -- Chemical Characterization for Cultural Material (2 units)**

**Description:** The class combines lecture and laboratory sessions for hand-on practice in the preparation, testing and interpretation of results for a representative range of organic and inorganic materials. The course work includes the use of a variety of micro-sampling techniques with chemical spot testing methods and analytical instrumentation for the analysis of a range of artifact materials such as metals, proteins, cellulose and plastics; analysis of contextual materials including surface deposits, soils and stains; and interpretation of results, chemical processes and the effects of interference materials. Graduate -level requirements include a presentation of their Materials Characterization Project.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Special course fee required:** \$50.

**Typical structure:** 3 hours laboratory, 1 hour lecture.

**Identical to:** ANTH 532A, MSE 532A.

**May be convened with:** CHEM 432A.

**Usually offered:** Fall.

**CHEM 534A -- Practical NMR Spectroscopy Laboratory (3 units)**

**Description:** This laboratory course will cover a wide variety of nuclear magnetic resonance (NMR) methods useful in organic chemistry research. Both one-dimensional and two-dimensional methods will be covered, with hands-on access to state-of-the-art instruments. Students will have 2 hours of instrument time and a 90 minute lecture each week, covering the practical aspects of setting up each experiment and interpreting the

**Grading:** Regular grades are awarded for this course: A B C D E.

**Special course fee required:** \$100.

**Typical structure:** 6 hours laboratory, 1 hour lecture.

**Usually offered:** Fall, Spring.

**CHEM 534B -- Practical NMR Spectroscopy Lecture (3 units)**

**Description:** The course will cover the theory and interpretation of a wide variety of NMR methods useful in organic chemistry research, at a level appropriate for organic chemists. Both one-dimensional and two-dimensional methods will be covered, with emphasis on up-to-date methods with practical application to research problems. A coherent theoretical basis for understanding NMR experiments will be presented, without a rigorous basis in physics and mathematics, starting with the classical spinning-top model and adding just enough of the quantum picture to provide an accurate description.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Usually offered:** Fall.

**CHEM 535A -- Chemistry of Electronic and Photonic Materials - Part A (3 units)**

**Description:** Introduction to the basic chemical and physical concepts impacting the properties of organic and inorganic materials with specific electronic and optical response. The course is designed to provide a broad perspective with discussion going from synthetic aspects to electronic-structure characteristics and device fabrication aspects. Materials under scrutiny include e.g. high-T<sub>c</sub> superconductors, conducting polymers, nonlinear optical compounds, liquid crystals, optical fibers, luminescent and photochromic compounds.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Usually offered:** Fall, Spring.

**CHEM 536 -- Scientific and Ethical Aspects of Modifying Human Behavior (3 units)**

**Description:** Scientific and Ethical Aspects of Modifying Human Behavior. Modern chemistry, biology and medicine in conjunction with the neuroscience revolution are providing tools which can modify basic human behaviors (learning, addictive, aggressive, feeding, etc.). An examination of the scientific, cultural, religious and ethical issues related to this emerging science will be examined. Basic knowledge of chemistry and biology (two years of each) and of social sciences (psychology, philosophy, religious studies, etc.) are useful prerequisites or consent of instructor. Graduate-level requirements include a more extensive term paper.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Identical to:** RELI 536.

**May be convened with:** CHEM 436.

**Usually offered:** Spring.

**CHEM 537 -- Advanced Topics in Microelectronics Manufacturing (3 units)**

**Description:** Fundamental material, electrical, and chemical properties of solid metal, semiconductor, insulator, and organic surfaces applied to selected gas/solid surface chemical reactions important in semiconductor processing and heterogeneous catalysis. This course is designed to introduce students to the chemistry and physics of solid surfaces and interfaces with an emphasis on the gas/solid interface. The first half of the course will be devoted to learning the fundamental material, electrical, and chemical properties of solid surfaces. The fundamentals will be applied in the second half of the course to topics in chemical catalysis and integrated circuit

manufacture. Graduate-level requirements include completion of two projects of their choice with the approval of the instructor.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Identical to:** CHEE 537; CHEE is home department.

**May be convened with:** CHEM 437.

**Usually offered:** Spring.

**CHEM 541 -- Mechanisms of Organic Reactions (3 units)**

**Description:** Detailed analysis of the factors which influence the rates and courses of organic processes.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 241B or CHEM 242B or CHEM 246B and CHEM 480B or consent of instructor.

**Usually offered:** Spring.

**CHEM 542B -- Polymer Chemistry (3 units)**

**Description:** Synthesis, stereochemistry, and mechanisms of formation of high polymers. Vinyl polymers.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 542A is not prerequisite to CHEM 542B.

**Usually offered:** Fall.

**CHEM 543 -- Structural Organic Chemistry (3 units)**

**Description:** Structure determination of organic molecules.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 241B or CHEM 242B or CHEM 246B and CHEM 480B or consent of instructor.

**Usually offered:** Fall.

**CHEM 544 -- Heterocyclic Compounds (3 units)**

**Description:** The behavior of the more important heterocyclic systems.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Usually offered:** Fall.

**CHEM 546 -- Advanced Organic Chemistry (3 units)**

**Description:** Advanced topics in organic chemistry, such as peptide chemistry, computer simulations, bio-organic chemistry, and other topics characterized by faculty expertise. Topics will vary each semester.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** consult department before enrolling.

**May be repeated:** for credit 1 time (maximum 2 enrollments).

**Usually offered:** Fall.

**CHEM 547 -- Organic Structural Analysis Laboratory (3 units)**

**Description:** Determination of structure and composition of organic compounds and mixtures using modern spectroscopic and separation methods. Graduate-level requirements include additional laboratory experiments.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Special course fee required:** \$70.

**Prerequisite(s):** consent of instructor.

**May be convened with:** CHEM 447.

**Usually offered:** Spring.

**CHEM 548 -- Advanced Synthetic Chemistry (3 units)**

**Description:** Many of the most important, and commonly used, synthetic transformations will be examined. Some reactions, familiar from lower level organic classes, will be analyzed in more

detail, highlighting scope and limitations. Many more methods of synthesis will be introduced as will innovative solutions to significant synthetic methodology problems. Some of the latest developments, including enantioselective processes, will be highlighted to indicate the limits and current trends in the field

**Grading:** Regular grades are awarded for this course: A B C D E

**Usually offered:** Spring

**CHEM 549 -- Chemistry of Natural Products (3 units)**

**Description:** Chemical, biochemical and genetic survey of secondary metabolic pathways leading to biologically active natural products. Combinatorial biosynthesis of hybrid "unnatural" natural products.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Identical to:** PCOL 549, PHSC 549.

**Usually offered:** Fall.

**CHEM 549b -- Topics in Chemical Biology (3 units)**

**Description:** This course is focused on Organic chemistry as it applies to mimicking and understanding biological systems (bioorganic) and for developing new chemical methodologies to probe biological systems (chemical biology).

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** BIOC 462A, BIOC 556, or consent of instructor.

**Usually offered:** Fall, Spring.

**CHEM 550 -- Synthetic and Mechanistic Organic Chemistry (3 units)**

**Description:** Commonly used reactions for organic synthesis will be discussed. Examples, limitations, and mechanistic considerations will be examined. Graduate-level requirements include mastery of additional topics from the textbook and writing a term paper based on these topics.

**Grading:** Regular grades are awarded for this course: A B C D E.

**May be convened with:** CHEM450

**Usually offered:** Fall.

**CHEM 565 -- Proteins and Enzymes (3 units)**

**Description:** Advanced consideration of enzyme structure and function.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** BIOC 462A, CHEM 480B.

**Identical to:** BIOC 565; BIOC is home department.

**Usually offered:** Fall.

**CHEM 580 -- Introduction to Quantum Chemistry (3 units)**

**Description:** An introduction to quantum mechanics, with applications to atomic structure and spectra, the nature of chemical bonding and molecular structure.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 480B or consent of instructor.

**Usually offered:** Fall.

**CHEM 582 -- Statistical Thermodynamics (3 units)**

**Description:** Introduction to classical and quantum statistical thermodynamics with application to ideal gases and simple solids; equations of state and elementary solution theory.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 480B or consent of instructor.

**Usually offered:** Fall.

**CHEM 583 -- Chemical Kinetics (3 units)**

**Description:** Classical and modern techniques in studies of chemical reactions.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 480B or consent of instructor.

**Usually offered:** Spring.

**CHEM 584 -- Nuclear Magnetic Resonance Spectroscopy** (3 units)

**Description:** Basic theory and interpretation of nuclear magnetic resonance (NMR) methods from a multidisciplinary perspective. The course covers experimental NMR methods; nuclear spin interactions; relaxation and dynamics; solid state NMR; liquid state NMR; and magnetic resonance imaging (MRI). Emphasis is placed on a unified description of magnetic resonance phenomena at a level appropriate for chemists, physicists, biochemists, and engineers.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 480B or CHEM 481; or PHYS 371 or equivalent or consent of instructor.

**May be repeated:** for credit 1 time (maximum 2 enrollments).

**Identical to:** BIOC 584, PHYS 584.

**Usually offered:** Fall.

**CHEM 585 -- Biological Structure I** (4 units)

**Description:** Introduction to the current understanding and methods used for study of the structure, thermodynamics, and dynamics of proteins, nucleic acids, and membranes.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** BIOC 462A; BIOC 565, CHEM 480B, or consent of instructor.

**Identical to:** BIOC 585; BIOC is home department.

**Usually offered:** Spring.

**CHEM 587 -- Introduction to Molecular Spectroscopy** (3 units)

**Description:** Modern molecular spectroscopy including rotational, vibrational, and electronic spectroscopy and their various combinations.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 480A, CHEM 480B or consult department before enrolling.

**Usually offered:** Spring.

**CHEM 591C -- Professional Services** (1 unit)

**Description:** A combination of CHEM 491B and CHEM 491C may be taken up to a total of 4 units. Specialized work on an individual basis, consisting of instruction and practice in actual service in a department, program, or discipline. Teaching formats may include seminars, in-depth studies, laboratory work and patient study.

**Grading:** Alternative grades are awarded for this course: S P C D E.

**May be repeated:** for credit 1 time (maximum 2 enrollments).

**May be convened with:** CHEM 491C.

**Usually offered:** Fall, Spring, Summer.

**CHEM 593 -- Internship** (1-3 units)

**Description:** Specialized work on an individual basis, consisting of training and practice in actual service in a technical, business, or governmental establishment.

**Grading:** Alternative grades are awarded for this course: S P C D E.

**May be repeated:** an unlimited number of times, consult your department for details and possible restrictions.

**Usually offered:** Fall, Spring, Summer.

**CHEM 595B -- Journal Club** (1 unit)

**Description:** The exchange of scholarly information and/or secondary research, usually in a small group setting. Instruction often includes lectures by several different persons. Research projects may or may not be required of course registrants.

**Grading:** Regular or alternative grades can be awarded for this course: A B C D E or S P C D E.

**May be repeated:** for credit 5 times (maximum 6 enrollments).

**Identical to:** BIOC 595B; BIOC is home department.

**Usually offered:** Fall, Spring.

**CHEM 595C -- College Teaching** (1 unit)

**Description:** This course serves as the weekly group meeting for those who are currently teaching Chemistry laboratory courses, and serves the purpose of maintaining consistency in the delivery of education in chemistry labs. Weekly discussions address how to prepare for lectures, grade lab reports using an established rubric, assess student learning and performance, and how to navigate safety issues relevant to the experiments. Current issues in teaching college-level labs and development of the teaching skills and methods utilized by course participants are also discussed as necessary. Graduate level enrollment requires students to be teaching assistants in the Chemistry Department.

**Grading:** Regular or alternative grades can be awarded for this course: A B C D E or S P C D E.

**May be repeated:** for credit 1 time (maximum 2 enrollments).

**May be convened with:** CHEM 495C.

**Usually offered:** Fall, Spring, Summer.

**CHEM 595D -- Advanced College Teaching** (1 unit)

**Description:** This course provides students with an interest in a teaching career the opportunity to continue to develop their understanding of current chemical educational theory and practice. Graduate-level requirements include four additional reading assignments and one additional evaluation.

**Grading:** Regular or alternative grades can be awarded for this course: A B C D E or S P C D E.

**May be repeated:** for a total of 2 units of credit.

**May be convened with:** CHEM 495D.

**Usually offered:** Spring.

**CHEM 599 -- Independent Study** (1-3 units)

**Description:** Qualified students working on an individual basis with professors who have agreed to supervise such work. Graduate students doing independent work which cannot be classified as actual research will register for credit under course number 599, 699, or 799.

**Grading:** Alternative grades are awarded for this course: S P C D E.

**May be repeated:** an unlimited number of times, consult your department for details and possible restrictions.

**Usually offered:** Fall, Spring, Summer.

**CHEM 640 -- Advanced Organic Synthesis** (3 units)

**Description:** Theory and practice of molecular design and construction as applied to synthesis of complex organic molecules.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 540 or consult department before enrolling.

**Usually offered:** Spring.

**CHEM 680 -- Quantum Chemistry** (3 units)

**Description:** Principles of quantum mechanics with applications to the properties of molecules.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 580.

**Usually offered:** Spring.

**CHEM 687 -- Molecular Spectroscopy** (3 units)

**Description:** Applications of quantum mechanics to the interpretation of the spectra of molecules of chemical and biological interest.

**Grading:** Regular grades are awarded for this course: A B C D E.

**Prerequisite(s):** CHEM 580.

**Usually offered:** Fall, Spring.

**CHEM 694 -- Practicum** (1-3 units)

**Description:** The practical application, on an individual basis, of previously studied theory and the collection of data for future theoretical interpretation.



**Grading:** Alternative grades are awarded for this course: S P C D E.

**May be repeated:** an unlimited number of times, consult your department for details and possible restrictions.

**Usually offered:** Fall, Spring, Summer.

**CHEM 695A -- Chemical Research Opportunities (1 unit)**

**Description:** Enrollment is restricted to new students in the Chemistry graduate program. This course involves weekly attendance at group meetings, and the exchange of scholarly information in the form of lectures and presentations by group participants involved in chemical research with specific faculty members. Participants will be expected to identify a research advisor at the end of this experience.

**Grading:** Regular or alternative grades can be awarded for this course: A B C D E or S P C D E.

**Usually offered:** Fall.

**CHEM 695B -- Exchange of Chemical Information (1-3 units)**

**Description:** Enrollment is restricted to students in the Chemistry graduate program. This course involves the weekly attendance at group meeting, and the exchange of scholarly information in the form of lectures and presentations by group participants involved in chemical research with specific faculty members.

**Grading:** Regular or alternative grades can be awarded for this course: A B C D E or S P C D E.

**May be repeated:** for a total of 10 units of credit.

**Usually offered:** Fall, Spring, Summer.

**CHEM 696A -- Analytical Chemistry (1-3 units)**

**Description:** Enrollment is restricted to students in the Chemistry graduate program or to those with instructor approval. The scope of work shall consist of attendance at the weekly seminar associated with the Analytical division; along with individual research by course registrants within their groups, and the development and exchange of scholarly information through discussion, reports, and/or papers.

**Grading:** Regular or alternative grades can be awarded for this course: A B C D E or S P C D E.

**May be repeated:** for a total of 10 units of credit.

**Usually offered:** Fall, Spring.

**CHEM 696B -- Inorganic Chemistry (1-3 units)**

**Description:** Enrollment is restricted to students in the Chemistry graduate program or to those with instructor approval. The scope of work shall consist of attendance at the weekly seminar associated with the Inorganic division; along with individual research by course registrants within their groups, and the development and exchange of scholarly information through discussion, reports, and/or papers.

**Grading:** Regular or alternative grades can be awarded for this course: A B C D E or S P C D E.

**Prerequisite(s):** students in the Chemistry graduate program or consent of instructor.

**May be repeated:** for a total of 10 units of credit.

**Usually offered:** Fall, Spring.

**CHEM 696C -- Organic Chemistry (1-3 units)**

**Description:** Enrollment is restricted to students in the Chemistry graduate program or to those with instructor approval. The scope of work shall consist of attendance at the weekly seminar associated with the Organic division; along with individual research by course registrants within their groups, and the development and exchange of scholarly information through discussion, reports, and/or papers.

**Grading:** Regular or alternative grades can be awarded for this course: A B C D E or S P C D E.

**Prerequisite(s):** students in the Chemistry graduate program or consent of instructor.

**May be repeated:** for a total of 10 units of credit.

**Usually offered:** Fall, Spring.

**CHEM 696D -- Physical Chemistry and Chemical Physics** (1-3 units)

**Description:** Enrollment is restricted to students in the Chemistry graduate program or to those with instructor approval. The scope of work shall consist of attendance at the weekly seminar associated with the Physical division; along with individual research by course registrants within their groups, and the development and exchange of scholarly information through discussion, reports, and/or papers.

**Grading:** Regular or alternative grades can be awarded for this course: A B C D E or S P C D E.

**Prerequisite(s):** students in the Chemistry graduate program or consent of instructor.

**May be repeated:** for a total of 10 units of credit.

**Usually offered:** Fall, Spring.

**CHEM 696E -- Advanced Seminar** (1-3 units)

**Description:** Enrollment is restricted to students in the Chemistry graduate program or to those with instructor approval. The scope of work shall consist of preparing and presenting a seminar on individual research conducted by course registrants within their divisional research groups.

**Grading:** Regular or alternative grades can be awarded for this course: A B C D E or S P C D E.

**Prerequisite(s):** students in the Chemistry graduate program or consent of instructor.

**May be repeated:** for a total of 10 units of credit.

**Usually offered:** Fall, Spring.

**CHEM 795A -- Introduction to Research** (1-6 units)

**Description:** The exchange of scholarly information and/or secondary research, usually in a small group setting. Instruction often includes lectures by several different persons. Research projects may or may not be required of course registrants.

**Grading:** Regular or alternative grades can be awarded for this course: A B C D E or S P C D E.

**Prerequisite(s):** open to MCB, CHEM, PHSC, and BIOC majors only.

**May be repeated:** for a total of 10 units of credit.

**Identical to:** BIOC 795A; BIOC is home department.

**Usually offered:** Fall, Spring.

**CHEM 900 -- Research** (1-5 units)

**Description:** Individual research, not related to thesis or dissertation preparation, by graduate students.

**Grading:** Alternative grades are awarded for this course: S P C D E K.

**May be repeated:** an unlimited number of times, consult your department for details and possible restrictions.

**Usually offered:** Fall, Spring, Summer.

**CHEM 908 -- Case Studies** (3 units)

**Description:** Individual study of a particular case, or report thereof.

**Grading:** Alternative grades are awarded for this course: S P E K.

**May be repeated:** an unlimited number of times, consult your department for details and possible restrictions.

**Usually offered:** Fall, Spring, Summer.

**CHEM 909 -- Master's Report** (1-5 units)

**Description:** Individual study or special project or formal report thereof submitted in lieu of thesis for certain master's degrees.

**Grading:** Alternative grades are awarded for this course: S P E K.

**May be repeated:** an unlimited number of times, consult your department for details and possible restrictions.

**Usually offered:** Fall, Spring, Summer.

**CHEM 910 -- Thesis** (1-8 units)

**Description:** Research for the master's thesis (whether library research, laboratory or field observation or research, artistic creation, or thesis writing). Maximum total credit permitted varies

with the major department.

**Grading:** Alternative grades are awarded for this course: S P E K.

**May be repeated:** an unlimited number of times, consult your department for details and possible restrictions.

**Usually offered:** Fall, Spring, Summer.

**CHEM 920 -- Dissertation** (1-9 units)

**Description:** Research for the doctoral dissertation (whether library research, laboratory or field observation or research, artistic creation, or dissertation writing).

**Grading:** Alternative grades are awarded for this course: S P E K.

**May be repeated:** an unlimited number of times, consult your department for details and possible restrictions.

**Usually offered:** Fall, Spring, Summer.

**CHEM 930 -- Supplementary Registration** (1-9 units)

**Description:** For students who have completed all course requirements for their advanced degree programs. May be used concurrently with other enrollments to bring to total number of units to the required minimum.

**Grading:** Grade of K is awarded for this course except for the final term.

**May be repeated:** an unlimited number of times, consult your department for details and possible restrictions.

**Usually offered:** Fall, Spring, Summer.



## I. CHOOSING A RESEARCH PROJECT AND RESEARCH DIRECTOR

### 1. Selecting a Research Director – 1st semester in residence

- a) Prior to selection of a research director, you will become familiar with the research interests of the faculty through attendance at CHEM 695a (Research Opportunities). CHEM 695a will consist of two Saturday morning poster sessions, put on by the faculty in the department, where you will have an opportunity to talk informally with at least 6-10 faculty about their research interests.
- b) Following these poster sessions you must make individual appointments to discuss research opportunities with at least 6 faculty, during which time you will narrow your choices for research director.
- c) Near the end of the first semester, you will complete the process of selecting a research director. Your 1st, 2nd and 3rd choices for research director should be indicated on the Report of Selection of Research Director form and returned to the Graduate Program Coordinator by the first Monday in December (fall entrance) or April (spring entrance). Once your choices have been submitted, the Professor(s) selected will discuss this selection process with their division. The Division Chair will then forward their recommendations to the Graduate Program Committee and the GPC will make a final recommendation of research director selection to the Department Head.
- d) To complete the process, the student and Research Director will, shortly after the latter is selected, define a thesis research problem. A one-page statement describing the areas to be explored and the techniques to be utilized must be presented to the Graduate Program Committee along with a list of suggested committee members and their signatures (see below) at the beginning of the second semester in residence. The Graduate Program Committee reviews the proposed Dissertation Committee in the context of the proposed research and makes suggestions where appropriate.

This is an important step in your career and it deserves careful consideration. Several aspects of this decision should be kept in mind.

- Attendance at Chem 695a is required prior to selection of a research director.
- After these poster sessions, you must interview with at least 6 faculty members prior to selection of your research director.
- This decision is a mutual one between you and the chosen professor(s). The research director will be responsible for your training through a mentoring relationship.
- It is very important that you and the professor discuss the expectations each has for the dissertation research and that both agree on general policies that affect the "working environment". See section B for further expectations to consider when choosing a research director.

### 2. Selecting a Dissertation Committee

During the second semester, following the selection of the Research Director, you (in consultation with the Research Director) must select a Research Directory Committee. For Ph.D. students, this committee is comprised of five tenure or tenure-track faculty members: the Research Director, two members from the major Chemistry division faculty, plus two additional members from the minor division. Typically, four members from the major division are not allowed to sit on this committee, even if one of the faculty could be representing the minor area. In appropriate instances, faculty members from other departments may be substituted for the minor chemistry department participants.

Questions of committee composition should be referred to the GPC for final approval.

The Proposed Dissertation Committee form must be signed by the Chairman of the Graduate Program Committee. The Research Directory Committee advises you, helps plan the remaining graduate program and evaluates your progress during all phases of training.

### **3. Changing Research Directors**

In unusual circumstances, a student may consider changing Research Directors. This is a decision that has profound implications and should be undertaken only after thoughtful discussion with faculty members in the department who can guide the student and discuss the pros and cons of the situation.

Graduate school is challenging and worthwhile research projects are not easy. Researchers often encounter rough spots or tedious sets of experiments on the way to the Ph.D. Research directors who push students to perform quality research and write quality manuscripts generally have the best interests of the students in mind. Students who have thoughtfully considered whether a change is necessary should meet with a faculty member who can provide guidance. A member of the student's dissertation committee, the GPC chairperson, or one of the division heads would be appropriate. The initial contact person will undoubtedly suggest others who may be able to provide valuable input. The processes of separating from one advisor, and selecting a new advisor should be sequential, not concerted processes.

- a) The Research Director and the GPC should be made aware of the situation at the earliest stage possible. Once it is clear to the student that this change is needed, a short memo should be delivered to the GPC explaining the need for a change in advisor. The GPC will consider the case on its merits, and then, if it is clear that a change is warranted, will act to facilitate the change of Research Directors.
- b) Once the GPC has ruled on the need for the student to select a new advisor the student should pick up a Research Director selection form from the Graduate Program Coordinator. Next, the student should meet with and obtain signatures from at least 3 faculty members and turn in the completed form with the selected advisor listed to the Graduate Program Coordinator. Finally, a letter must be submitted to the Graduate Program Committee explaining the reasons for the selection of the new advisor.
- c) Once the new advisor has been selected, and a new Committee of Studies constituted, it is an extremely good idea for the student to meet with this committee, to map out exactly what the new research effort will involve, and the expected time to completion of the degree.

### **4. Keeping the Dissertation Committee Updated on your Progress Toward the Ph.D. Degree**

It is important that your dissertation committee stay updated of your progress during your time in the Department, because this committee serves as a secondary source of advising and council in your journey to graduation, and will be called upon to write letters of recommendation for you as you approach graduation. Department of Chemistry rules state that all Ph.D. students should prepare an annual research summary, due at the end of July. One copy of the summary should be given to each committee member and to the Graduate Program Coordinator.

The format of the summary should be as follows: On page 1, list the student's name, the advisor's name and names of the committee members. This is followed by a listing of the student's progress on the formal requirements for the Ph.D. (courses taken with grades earned, cumulative exam record, date the preliminary oral is planned (or date(s) taken and result(s)), presentations given locally or at conferences, manuscripts submitted or published. On the following pages (2-3 suggested), summarize research progress made in the past year, describe future research objectives and discuss problems. The student or committee members may choose to hold a meeting to discuss the student's progress.

**Committee Meetings (with individuals or complete committee)**

- Provide an outline of your research progress to the committee members.
- Describe future research objectives and discuss any problems.

**Final Meeting of Committee before the Dissertation Defense (at least 6 months prior to defense)**





## J. QUALIFYING EXAMINATIONS, WRITTEN AND ORAL COMPREHENSIVE EXAMS, AND ADVANCEMENT TO CANDIDACY

### 1. Qualifying Examinations - Chemistry

The Department of Chemistry and Biochemistry Qualifying Examinations are equivalent to the Qualifying (Diagnostic) Examinations required by the Graduate College. All entering students will take Qualifying Examinations in the five core study areas: Analytical, Biological, Inorganic, and Physical Chemistry. The placement exams will be ACS standardized examinations to allow comparison to national norms.

Students who achieve a designated percentile ranking (to be determined by a group of examining faculty) on any of these exams will be considered to have met our expected entry level of achievement for that subject area and will be “qualified” in that topic. For successful admission to candidacy, Ph.D. students must qualify in at least three of the above core areas, with the following qualification timeline.

1) The outcome of the Qualifying Exams will not affect a student’s standing in the Ph.D. program *during the first semester of study*. The performance on the Qualifying Exams will, however, be used as one of the criteria (in addition to the student’s interest) in advising the student on their plan of study, specifically on what coursework they should take in their first semester.

2) At the end of the first and second semesters, students who have not yet passed Qualifying Examinations in any area must retake the Examinations in these areas. To remain in the Ph.D. program, **students must qualify in at least three core areas by the end of the second semester in the program.**

3) At the end of the second semester, students who have not yet passed Qualifying Examinations in any area must retake the Examinations in these areas. To remain in the Ph.D. program, **students must qualify in at least three core areas by the end of the second semester in the program.**

Students who qualify in only two areas at the end of their second semester in residence are automatically placed in the M.S. or M.A. programs (see re-admission policy below). If a student was admitted to the program with an M.S. degree in Chemistry from a U.S. institution, and fails to qualify in at least three areas, that student will be counseled to leave the program, since obtaining another M.S. in Chemistry is not an option at the University of Arizona.

### 2. Policy for re-admission of M.S. students (placed in the M.S. program by way of qualifying exams, written comprehensive exam or course performance):

#### Qualifying Exams:

Students placed in the M.S. program as a result of a failure to qualify in at least three areas by the end of their second semester in residence may, at the discretion of their Research Director, their committee of studies, and the GPC, pursue the following options:

- a) These students must continue to take cumulative exams just as with the remainder of the Ph.D. students, passing these requirements in the same time limits required of the Ph.D. students.
- b) These students must demonstrate competency in the area in which they did not qualify by taking an appropriate remedial course(s), to be agreed upon by their

Committee of Studies, the affected division in which they did not qualify, and the GPC. They must get a B or better in this course(s).

- c) These students must complete an M.S. degree, including the final defense of that thesis, in a timely fashion.
- d) Following completion of this M.S. degree, the student's Committee of Studies may, at their discretion, appeal the case of this student to the GPC that may readmit the student to the Ph.D. program.
- e) The student is then expected to schedule their preliminary oral within one semester of their re-admittance to the Ph.D. program. At this point the student has rejoined the Ph.D. program and is expected to complete the Ph.D. degree within 3 years.

### **3. Description of the Comprehensive Examination**

Students must pass a Comprehensive Examination before they can be advanced to formal candidacy for the Ph.D. degree. The Comprehensive Examination provides evidence that the candidate can independently analyze and solve complex chemical problems that are may or may not be directly related to his or her own dissertation research problem. The examination consists of a written portion (cumes) and an oral portion.

#### ***i) The Written Comprehensive Exam (Cumes)***

The Cumulative Examinations are two-hour written examinations (15 minutes to decide on the area and 1 3/4 hours for writing) offered in each of the five subject areas: analytical, inorganic, organic, physical, and biological chemistry. Only one examination may be completed and submitted for grading.

- Students begin taking cumes in their first semester in residence
- 2 year cume system (16 total cumes, pass/fail – No January cume), given monthly eight times a year (Sept – May)
- 2 announced and 2 unannounced topics per semester, continue to alternate between announced and unannounced topics
- Pass 6 before failing 10 (if a student is unsuccessful they are out of the PhD program)
- When a student passes the 6<sup>th</sup> cumulative exam their oral prelim exam will automatically be scheduled for the same month in the following semester. The student will have to petition the GPC with their advisor's support to change their oral preliminary exam.

#### ***ii) The Oral Comprehensive Examination***

**All students take their oral examination no later than the end of the fourth semester.** Students cannot schedule an Oral Comprehensive Examination while on academic probation as defined by the Chemistry Department or by the Graduate College.

The Oral Comprehensive Examination is administered by the student's Research Directory Committee (a member of the committee other than the student's advisor will file the report with the Graduate College).

The Oral Comprehensive Examination begins with a presentation and defense of the **Oral Comprehensive Examination Proposal.**

The Oral Comprehensive Examination Proposal consists of two parts: a) short

Independent Proposal and b) a short Dissertation Research Summary (5 -10 pages each). The Independent Proposal is a written proposal for an original, but hypothetical, research project in an area that may or may not be directly related to the student's own research program. This Independent Proposal may be an expanded version of a short independent proposal that the student has completed for one of his/her classes.

An explanation and defense of the Independent Proposal will be a significant part of the Oral Comprehensive Examination. It is expected that the student will be able to explain and justify the proposal and demonstrate a reasonable knowledge of the literature and special techniques of the field. In addition, a portion of the examination will consist of general questioning in the student's major and minor course areas which test the student's comprehensive knowledge both in breadth across the general field of study and in depth within the area of specialization.

The Dissertation Research Summary should include an appropriate literature background section and sections describing the goals and significance of the research, experimental details, and results obtained or anticipated. This Dissertation Research Summary may be an updated revision of the annual report that the student turns in at the end of the first full year of graduate study (due July).

The examination will not focus on the student's research progress but may use the student's Dissertation Research Summary as a springboard for questions that examine the student's ability to understand the scientific process, to formulate a logical research plan, and to think creatively.

At the end of 1-1.5 hours of examination the Committee of Studies typically takes a break to discuss the student's performance. For the second half of the exam the committee can continue to question the student on their research proposal, or (as is typically done) focus on the student's general understanding of the chemical sciences, most often drawing upon their course work background for questions to be addressed.

The Oral Comprehensive Examination will last a minimum of 2 hours but not more than 3 hours. If a student does not pass the exam on their first try, their Committee of Studies may recommend a second trial, and can dictate the scope and focus of questioning to be conducted in that second exam.

No student will be permitted a second attempt to pass the Oral Comprehensive Examination unless it is recommended by the examining committee, endorsed by the major department and approved by the Dean of the Graduate College. The second examination, if approved, may not take place until four months after the date of the first examination.

#### **4. Preparing for the Oral Comprehensive Examination**

The Oral Comprehensive Examination is scheduled by submitting the **Application for Comprehensive Oral Examination** form to the Graduate College. **No student will be allowed to officially schedule the oral examination until the written portion (cumes) of the examination has been passed, although a tentative date can be arranged at any time with the Research Directory Committee.** The student is responsible for scheduling the room for the oral examination.

The best way to study for this examination is to 1) know the proposal thoroughly,

including all related topics, 2) review all class notes and lecture material from all the classes taken as a graduate student up to that point, 3) review the general principles of major and minor areas of interest; sometimes perusal of a textbook can help guide this studying, and 4) be familiar with the recent literature (particularly in the fields represented by the committee members). **It is important to plan your studying so that you do not get "burned out" before the examination. Know what material you want to cover and then systematically go through it.** It is an excellent idea to have at least one "practice oral examination" with other graduate students and postdocs before the scheduled examination. This can be very helpful for identifying your weaknesses and giving you practice thinking on your feet.

## **5. Guidelines for the Oral Comprehensive Proposal**

Suitable proposals may take a variety of forms. For example, an original interpretation or a reinterpretation of existing data; or a proposed series of experiments to test a theory or hypothesis; or a new theoretical approach to a problem; or the design of a new piece of equipment. This proposal should be treated as if it were a potential dissertation project so that students should not plan a study which would take 10 years to complete. The student is advised to develop a well-focused proposal which is not overly broad.

Most students find that this process consumes far more time than they had anticipated, therefore the process of choosing a proposal topic should begin early. Students may begin working on the Proposal before all their Cumulative Examinations have been passed. ***A student should discuss the suitability of the proposal topic with the members of the Research Directory Committee before devoting a substantial amount of time to it.***

At least two weeks before submitting the proposal, copies of it must be provided to all members of the Research Directory Committee. The proposal must have the written approval of each member of the Committee.

Like any good grant proposal, quality will come from spending a lot of time thinking about the potential flaws in the proposal and then finding solutions. It is advisable to ask fellow students and colleagues to critique the document before it is handed out to the committee. The proposal should have a Title that accurately describes the major hypothesis. This should be followed by an Abstract (< 200 words) that concisely summarizes the problem being addressed, the proposed approaches, and specific goals. The body of the proposal should include background information, enumerated specific goals, methods of approach, and an appraisal of the significance of the proposal. The bibliography should include pertinent references in which methods are described and any relevant papers that support the goals of the proposal, but it should not be excessive. Detailed descriptions of established methods can be left to the oral defense. The submitted document should be proofread carefully for grammar and spelling.

A general format which can be used is given below:

- I. Title Page
- II Abstract
- III. Research Plan

- A. Hypothesis/Specific Aims
  - B. Background and Significance
  - C. Project Design and Methods  
(include a general sequence of the work)
- IV. References
- V. Appendix (Figures, Tables, flow diagrams)

You may also find that the proposal is easier to read if the figures and tables are included in the text of the research plan rather than as a separate appendix. The above format should be taken as a suggestion with the exception of total length of the text.

#### **6. Re-taking the Oral Examination**

In the event that a student fails the Oral Exam, s/he may be granted a second attempt by their examining committee. If this happens, the second exam may be scheduled for no sooner than 4 months after the first attempt. The second attempt may require a new proposal, a re-draft of the original proposal, or may consist only of general questions. A new research update may also be required. The student should contact each committee member individually to find out what areas need to be improved and what expectations each may have for the second attempt. If a student passes the second attempt at the oral exam, s/he proceeds to the Ph.D. program. If the student fails the second attempt also, s/he is not granted advancement to the Ph.D. program and enters the terminal Master's Degree program.



## K. DISSERTATION AND FINAL DEFENSE

### 1. General Description of the Dissertation and Final Oral Defense

The Graduate College allows two formats for the dissertation. Option 1 follows the more traditional style with an introduction, materials and methods, results and discussion sections. Option 2 is not presently available to students in the Department of Chemistry and Biochemistry.

A formal defense of the dissertation research constitutes the final examination. This consists of a public seminar by the candidate followed by an oral examination by the candidate's committee and other interested faculty. Be sure to bring all the necessary paperwork that requires signatures from members of the supervisory committee to the examination. This includes the multiple cover pages to the Dissertation if all of the final revisions have already been made.

### 2. Requirements for Ph.D.

There are a number of requirements that need to be met to satisfy both the Department of Chemistry and the Graduate College. Ultimately, you will earn your degree by meeting all the requirements of the Graduate College which by design, incorporates Departmental requirements. **It is very important to familiarize yourself with the most current Graduate College guidelines, specifically with regard to preparation of the Dissertation.** You should also buy the Manual for Theses and Dissertations, which is available at <http://grad.arizona.edu/degrecert/thesismanual/front.htm>

### 3. List of Specific Steps Necessary for Graduation

The following list shows the major steps that need to be taken once your Research Director and Research Directory Committee agree that your dissertation research is defensible:

<u>WHEN</u>	<u>WHAT</u>
penultimate semester	File Committee Formation form with the Graduate College. This should be done immediately after passing the oral cumulative exam. This form will can be obtained from the Graduate Program Coordinator.
6 months prior to oral defense	Submit a detailed Dissertation Outline to your Research Directory Committee and then schedule a meeting to discuss it.
5 weeks prior to oral defense	Submit a penultimate draft of the dissertation to the Research Directory Committee

No later than 2 week prior to oral defense      Submit Announcement of Oral Defense Examination form to the Graduate College. This form can be found at <http://grad.arizona.edu/gcforms>. You will need signatures from your Committee members.

Final semester      Upon successful completion of the Final Oral Defense Examination, the candidate submits the dissertation **electronically** to the Graduate College for forwarding to the Library of The University of Arizona and to University Microfilms, Inc. A **processing and microfilming fee** also must be paid to the University Bursar. Upon receipt of the finalized dissertation, the Dean of the Graduate College will recommend conferral of the doctoral degree by the Arizona Board of Regents.

Provide a bound copy of the dissertation to the Research Director, at their discretion. (Microfilming of the M.S. thesis is also at the discretion of the Research Director.)

Before the last week of final semester all fees must be cleared with the Bursar's Office.

#### **4. Guidelines for Preparation of the Dissertation**

No later than 6 months before the final oral defense, the candidate should submit a 5-10 page detailed **Dissertation Outline** to the Research Directory Committee outlining the research progress to date. This document should clearly list those studies which the student intends to complete prior to writing the dissertation. The candidate then meets with the Research Directory Committee to discuss the outline. It is common for the Committee to recommend a limited number of experiments and to make specific recommendations regarding a timeline for writing of the dissertation.

The candidate submits a completed, penultimate draft to each member of the Research Directory Committee at least **five weeks** prior to the final examination. It is anticipated that the Research Directory Committee will be able to read the dissertation and return it to the candidate within two weeks of receipt. This timing allows the candidate to make any suggested changes, provided they are minor, and to obtain final approval of the penultimate draft three weeks prior to the final examination. Then, no later than two weeks before the proposed date of the examination, the student must submit the form **Announcement of Oral Defense Examination** to the Graduate College. Faculty members cannot sign this form unless they have approved the penultimate draft of the dissertation.

#### **5. Description of the Format Allowed by the Department**

The Graduate College policy states that each Department can establish their own guidelines for the Dissertation format, however, the final document must adhere to all the items specified in checklists 2 and 3. The Chemistry Department has the following list of guidelines for preparation of a traditional dissertation:

A. The suggested Dissertation format should include the following components



- **ABSTRACT** - describing the problem, the results and the interpretation
  - **INTRODUCTION** - general introduction to the field
  - **MATERIAL AND METHODS** - a complete description all in one section
  - **RESULTS** - should be logically divided into separate chapters with an introductory paragraph at the beginning of each chapter and a summary paragraph at the end
  - **DISCUSSION** - a thorough analysis of the data and its implications, this section should tie the Dissertation together into a cohesive theme/thesis
  - **SUMMARY** - a short synopsis, including future directions that should be taken
  - **LITERATURE CITED** - should follow the format of the Journal of the American Chemical Society
- B. Figures and tables should be included in the chapters rather than as an appendix. Permission to use copyrighted material is the responsibility of the student.
- C. If appropriate, the dissertation may include portions of manuscripts being prepared for submission, but the text should reflect the student's own writing. The Research Directory Committee has the responsibility of checking the Dissertation for adherence to Graduate College specifications and for approving the overall appearance and format.

#### **6. Committee Composition and Attendance at Final Defense.**

The Department of Chemistry and Biochemistry requires students to compose a committee of five members: three within the major and two in the minor.

The student should make all attempts to have the five members attend the final defense. If, however, a scheduling conflict exists, there must be at least a minimum of four members in attendance, three of which must be in the major. If a committee member is unable to attend the defense because of unforeseen circumstances a substitution is allowed, provided that the originally scheduled committee member has read and approved the dissertation.

#### **7. Policy on Inclusion of Published Papers as Appendices to Dissertations and Theses.**

Note: The following rules have no impact on the body of the dissertation or thesis. The dissertation or thesis must stand on its own even without the appendices described here.

1. Subject to the approval of the Dissertation/Dissertation Committee, material published, or accepted for publication, in a refereed journal may be included as an appendix in the dissertation/thesis.
2. The dissertation/thesis author need not be the primary author of the publication(s).
3. The dissertation/thesis author need not be the principal contributor to the publication(s) as long as the Dissertation/Dissertation Committee agrees that the author's contribution is sufficient to warrant inclusion in the dissertation/thesis.
4. Since the appendices contain supplementary material, there is no conflict of interest when the dissertation/thesis advisor is coauthor of the publication(s).
5. The dissertation/thesis advisor's signature on the dissertation/thesis approval form will certify that the Dissertation/Dissertation Committee has approved the published material in the appendix.



## L. REQUIREMENTS FOR A MASTER'S DEGREE

### 1. Master of Science and Master of Science with Emphasis in Chemical Education

This information is a supplement to the general regulations for graduate study as set forth in the catalog of the Graduate College. In addition to the classical M.S. degree in Chemistry, the Department of Chemistry also offers an M.S. degree program with emphasis in Chemical Education. This program is designed as a component of an M.S./Ph.D. program that affords students additional training in Chemical Education. Terminal M.S. students may also elect to follow this program.

By Department of Chemistry & Biochemistry rules, all requirements for the degree of Master of Science must be completed within **3 YEARS** of joining the program, whether the student is supported financially, or not. Should a student not finish within that time period, he/she may appeal to the Graduate Program Committee for a one year extension. The student must provide a research update including a time line of completion that has been approved by his/her committee. This in no way implies that the Department of Chemistry & Biochemistry is bound to financially support the student for more than three years from the start of their program.

**a) Qualifying Examinations:** All entering students for a M.S. degree in Chemistry will take Qualifying Examinations in the five core study areas: Analytical, Biological, Inorganic, Organic or Physical Chemistry. The placement exams will be ACS standardized examinations to allow comparison to national norms.

Students who achieve a designated percentile ranking (to be determined by a group of examining faculty) on any of these exams will be considered to have met our expected entry level of achievement for that subject area and will be "qualified" in that topic. For successful admission to candidacy, M.S. students must qualify in at least two of the above core areas, with the following timeline.

1) The outcome of the Qualifying Exams will not affect a student's standing in the M.S. program *during the first semester of study*. The performance on the Qualifying Exams will, however, be used as one of the criteria (in addition to the student's interest) in advising the student on their plan of study, specifically on what coursework they should take in their first semester.

2) At the end of the first and second semester, students who have not yet passed Qualifying Examinations in any area must retake the Examinations in these areas. To remain in the M.S. program, **students must qualify in at least two core areas by the end of the second semester in the program.**

Students who do not qualify in two areas at the end of the second semester in residence will be counseled to leave the program.

**b) Cumulative Examinations:** M.S. students are not required to take cumes; however, if they have any intention of proceeding to the Ph.D. degree after receiving the M.S. degree, they are strongly urged to take cumes. A student who drops from the Ph.D. program to the M.S. program and stops taking cumes is expected to complete the M.S. degree. If a student transfers back to the Ph.D. program without finishing the Master's degree, missed cumes are recorded as failures.

**c) Advisement:** The Graduate Program Committee is the academic advisor to all new students. The student and the Committee plan a program of course work based on the results of the Placement Examinations and the student's interests. The Graduate Program Committee continues to serve as the student's advisor until the student selects a Research Director.

**d) Research Director:** Prior to selection of a research director, students become familiar with the research interests of the faculty through attendance at 695a presentations and by meeting individually with participating faculty. After completion of 695a and individual meetings with the faculty, it is necessary for the student to discuss with the appropriate professor(s) their interest in joining a research group. The student's choice of a research director should be indicated on the Report of Selection of Research Director form and returned to the Graduate Program Coordinator by the first Monday in December (fall entrance) or April (spring entrance). Some divisions expect students to indicate both a first and second choice. Once the choices have been submitted, approval by the Professor, his/her Division, the Graduate Program Committee, and the Department Head are needed.

**e) Thesis Committee:** A Thesis Committee consists of three members, no more than two of whom can be from the student's major division. The Research Director will serve as chair of this Committee. The student and Research Director will, shortly after the latter is selected, define a thesis research problem. A one-page statement describing the areas to be explored and the techniques to be utilized must be presented to the Graduate Program Committee along with a list of suggested committee members and their signatures. The Graduate Program Committee reviews the proposed Dissertation Committee in the context of the proposed research and makes suggestions where appropriate.

**f) Plan of Study:** The student will consult with the Dissertation Committee shortly after it is formed to prepare a Plan of Study which should be submitted to the Graduate Program Committee. A total of 30 units of credit is required and at least 15 units must be in courses for which a letter grade (A,B,C) is awarded. Attendance at seminar (Chem 696) is also required of all students, but no more than 4 units of Chem 696 can be applied toward the 30 unit requirement. A maximum of 8 units of Thesis (Chem 910), 4 units of Exchange of Chemical Information (Chem 695b) and 2 units of College Teaching (Chem 595c) can be counted in the 30 unit total.

In addition a minimum of two graduate courses in education, approved by the Dissertation Committee, is required for students (M.S./Ph.D. or M.S. in chemistry) who elect an emphasis in Chemical Education.

**g) Thesis:** Original research and reporting the results of the research in a Thesis are the most important parts of the M.S. degree. Additional information about preparing theses may be obtained from the Chemistry Graduate Program Coordinator or the Graduate College or at <http://grad.admin.arizona.edu/degrecert/thesismanual/front.htm>

Approximately one semester before the student expects to complete the thesis research, the student meets with the Dissertation Committee. At this meeting the student summarizes the completed research and outlines the goals and proposed approaches for the remainder to the project. The Committee reviews this information and advises the student on the completion of the thesis research.

Thesis research and the thesis for the M.S. with emphasis in Chemical Education degree must represent original work in Chemical Education and must conform to the same high standards as for the traditional M.S. degree in Chemistry.

The Chemical Education research must be separated and apart from any work the student is assigned as a Departmental Teaching Assistant.

**h) Final Oral Examination:** After a candidate's thesis has been reviewed and accepted by the Thesis Advisory Committee, a final public oral examination covering the research and field of major interest will be administered.

**i) Graduate Student Support:** Graduate students in the M.S. program who remain in good standing and are making adequate progress in their degree program may be eligible for support as Graduate Teaching Assistants (TA) and/or as Graduate Research Assistants (RA). TA support is generally not available beyond a student's third semester. Extensions of this time limit must be through a letter of appeal to the Graduate Program Committee. In addition to the requirement of being in good standing, the TA's teaching performance is evaluated each year. RA positions are provided at the discretion of the Research Director and are renewed subject to demonstrated productivity as measured by the Research Director.

## 2. Master of Arts

The Master of Arts Degree is a non-thesis degree that is awarded for advanced study in chemistry beyond the bachelor's degree. This degree is typically awarded after two years of graduate study if the following have been satisfied.

**a) Qualifying Examinations:** All entering students for a M.A. degree in Chemistry will take Qualifying Examinations in the five core study areas: Analytical, Biological, Inorganic, Organic or Physical Chemistry. The placement exams will be ACS standardized examinations to allow comparison to national norms.

Students who achieve a designated percentile ranking (to be determined by a group of examining faculty) on any of these exams will be considered to have met our expected entry level of achievement for that subject and will be "qualified" in that topic. For successful admission to candidacy, M.A. students must qualify in at least two of the above core areas, with the following timeline.

1) The outcome of the Qualifying Exams will not affect a student's standing in the M.A. program *during the first semester of study*. The performance on the Qualifying Exams will, however, be used as one of the criteria (in addition to the student's interest) in advising the student on their plan of study, specifically on what coursework they should take in their first semester.

2) At the end of the first and second semester, students who have not yet passed Qualifying Examinations in any area must retake the Examinations in these areas. To remain in the M.A. program, **students must qualify in at least two core areas by the end of the second semester in the program.**

Students who do not qualify in two areas at the end of the second semester in residence will be counseled to leave the program.

**b) Faculty Mentor:** The student's choice of mentor should be indicated on the Report of Faculty Mentor form and returned to the Graduate Program Coordinator by the first Monday in December (fall entrance) or April (spring entrance). Once the choice has been submitted, approval by the Professor, the Graduate Program Committee and Department Head are needed.

**c) Plan of Study:** The student will consult with the faculty mentor to prepare a Plan of Study, which should be submitted to the Graduate Program Committee for approval. A total of 30 units of credit is required and at least 15 units must be in courses for which a letter grade (A,B,C) is awarded. Attendance at seminar (Chem 696) is required, but not more than 4 units of Chem 696 can be applied to the 30-unit requirement. Up to 4 units of Chem 695b (Exchange of Chemical Information) and 2 units of Chem 595c (College Teaching) can be counted in the 30 unit total.

An overall 3.0 (B) GPA has been maintained for all courses in Chemistry, cross listed in Chemistry, or those approved by the Graduate Program Committee.

Graduate students admitted to Ph.D. candidacy are encouraged to apply for an M.A. degree. Students should be aware that they cannot use the same course work to obtain both an M.A. and an M.S. degree.

## **M. PART-TIME GRADUATE PROGRAMS**

### **1. Policy on Part-Time M.A./M.S. Graduate Students**

The Part-Time M.A./M.S. program is designed for students who are working full-time in “permanent” jobs in or near Tucson and wish to pursue the M.A. or M.S. degree part-time. Employment constraints may make it impossible for these students to take more than one course per semester and it is not expected that they would be able to take more than two courses per semester.

Incoming students must take Qualifying Examinations.

Students who do not pass two Qualifying Examinations must meet the qualification requirements for the M.A. and M.S. degrees by the end of their second semester in residence.

The student selects a faculty mentor: The student’s choice of mentor should be indicated on the Report of Faculty Mentor form and returned to the Graduate Program Coordinator by the first Monday in December (fall entrance) or April (spring entrance). Once the choice has been submitted approval by the Professor, the Graduate Program Committee and Department Head are needed.

The M.A. degree must be completed within three years from the first date of enrollment. M.S. students must complete the course work requirements within three years.

A total of 30 units of credit are required for the M.A. and M.S. degrees, of which at least 15 units must be in graded courses A, B, C, etc.

Part-Time M.A./M.S. students are expected to enroll in Chemistry 696 (seminar) and/or Chemistry 695b (Exchange of Chemical Information) each semester and may include up to 6 units of each in the required 30 units.

### **2. Policy on Part-Time Ph.D. Program**

The Part-Time Ph.D. Program in Chemistry is designed for students who are working full time in “permanent” jobs in or near Tucson and wish to pursue the Ph.D. degree part-time. Employment constraints may make it impossible for these students to take more than one course per semester and it is not expected that they would be able to take more than two courses per semester.

[Students must apply specifically to the Part-Time Ph.D. Program. Students who have been admitted to, and have begun, the regular, full-time, Ph.D. Program may not transfer into the Part-Time Ph.D. Program. Students in the Part-Time Ph.D. Program are not eligible for TA support. Students must take at least one major or minor course each semester until coursework is complete].

#### **Qualifying Examinations**

Students must take Qualifying Examinations on entrance into the Part-Time Ph.D. Program. (Students are encouraged to make up as many known or expected deficiencies as possible before application. This can be accomplished by registering as non-degree seeking students).

### Qualifying

Students who do not pass three Qualifying Examinations must meet the qualification requirements for the Ph.D. degrees by the end of their second semester in residence.

### Cumes

Students may delay starting cumes until they have completed two courses (chosen with the advice of the GPC) in their major, but must start taking cumes no later than their fifth semester (third semester if they are taking two courses per semester). After they start taking cumes they will be on the same schedule as full-time students. (See section J1). [Students may not substitute minor courses for major courses in order to further delay starting cumes].

### Coursework

The minimum level of coursework can be completed in four and one-half years [two and one-half years at the rate of two courses per semester].

### Seminars

Students will be expected to participate (attend and give) the seminars in their area(s). They will take the same number of units of seminar (10 units) as full-time students.

### Faculty Interviews

Students will be expected to take 695a.

### Research Director Selection

Students will select a Research Director immediately after completion of 695a.

### Committees

The student and the Research Director will recommend a Committee during the semester immediately following selection of the Research Director.

### Plan of Study

Students must file a Plan of Study before the end of their first year.

### Prelim Proposal

The prelim proposal will be prepared within three semesters after finishing cumes.

### Oral Comprehensive Examination

The oral prelim will be taken within three semesters after finishing cumes. The standards will be the same as for full-time students.

### Research

Research may begin very early in the program. Standards for acceptable dissertation research (quantity and quality) will be the same as for full-time students.

Control and direction of the research must reside within the Research Director. Issues, such as publication, patents, etc., must be agreed upon, in writing, beforehand by the Research Director, the University, and the student's employer.



#### Group Meetings

Students will be expected to take the same number of 695b units as full-time students. Attendance at group meetings will be agreed upon by the student and the Research Director.

#### Dissertation

Same standards as full-time students.

#### 10 Year Limitation

Students applying for the Part-Time Ph.D. Program need to be aware that course credit expires after ten years. It is possible to petition for an extension, but approval of the extension is not guaranteed.

#### Final oral

Same standards as full-time students.



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