

HANDBOOK FOR GRADUATE STUDENTS
Department of Chemistry and Biochemistry , Texas Tech University
(Revised August 2008)

TABLE OF CONTENTS

I. INTRODUCTION AND OVERVIEW	2
A. Some Introductory Information and Guidelines	2
The Graduate Advisor	2
The Graduate Advising Assistant	2
Some Basic Requirements for Graduate Study	3
B. Registration Requirements, Coursework, and Grading	3
Registration Requirements	3
Grading	4
Course Offerings	5
Lecture Course Requirements	6
C. Additional Requirements for the M.S. and Ph.D. Degrees	6
List of M.S. Degree Requirements	7
List of Ph.D. Degree Requirements	8
II. DISCUSSION OF DEGREE REQUIREMENTS	10
A. Diagnostic Examination Requirements	10
B. Choosing a Division, Research Advisor, and Advisory Committee	11
Your Division	11
Your Research Advisor	11
Your Advisory Committee	12
C. Degree Program Forms	12
D. Literature Seminar Requirements	13
E. Qualifying Examinations for Ph.D. Students	14
Research Examination	14
Cumulative Examinations	15
Research Proposal	16
F. Final Oral Examination (Thesis/Dissertation Defense)	16
Final Oral Examination for M.S. Degree	16
Final Oral Examination for Ph.D. Degree	17
III. APPENDICES	19
A. Requirements for M.S./Ph.D Degree	
with Specialization in Chemical Education	19
B. Requirements for M.S./Ph.D Degree	
with Specialization in Chemical Physics	21
C. Checklist for the M.S. Degree in Chemistry	23
D. Checklist for the Ph.D. Degree in Chemistry	24
E. Sample of Completed "Program for the Master's Degree" Form	26
F. Sample of Completed "Program for the Doctoral Degree" Form	27

All forms referenced in this handbook can be downloaded from the department's website:
www.depts.ttu.edu/chemistry under the "Current Graduate Students" link.

I. INTRODUCTION AND OVERVIEW

Welcome to the Graduate Program in the Department of Chemistry and Biochemistry at Texas Tech University! The purpose of this handbook is to give you a description of the departmental requirements for earning an advanced degree in chemistry. General requirements for graduate degrees are given in the Catalog of the Graduate School for the current year; those requirements govern advanced degree study at all times. The requirements presented in this Handbook are intended to amplify and supplement those stated by the Graduate School, particularly as they pertain to the Department of Chemistry and Biochemistry. If you have questions about your graduate program that the graduate catalog and this handbook do not answer, then you should consult with your Research Advisor, the departmental Graduate Advisor, or the Dean of the Graduate School. Good luck with your studies.

A. Some Introductory Information and Guidelines

The Graduate Advisor

The Graduate Advisor is a member of the Department of Chemistry and Biochemistry faculty who is in charge of overseeing the orientation of newly enrolled graduate students and the progress of each graduate student as they progress through their degree programs.

The Graduate Advisor:

- 1) Signs the Program for the Master's Degree, or the Program for the Doctoral Degree;
- 2) Notifies you of your progress in meeting the degree requirements;
- 3) Assists you in requesting to have graduate courses transferred for credit at Texas Tech, and
- 4) Submits your name for admission to candidacy for the Doctoral Degree.

While the Graduate Advisor will help you to decide what courses you should enroll in during your first year of graduate studies, the Research Advisor that you choose in your first year will begin to play a major role in such decisions as you progress in your studies. The Graduate Advisor can act as an intermediary between you and the departmental faculty and as an intermediary between you and the Graduate School, in cases where you need such an intermediary. It is important to emphasize that your Research Advisor will become your principal advisor/mentor once you take the important step of joining a research group.

The Graduate Advising Assistant

The Graduate Advising Assistant maintains the database system that tracks your progress with the departmental requirements. This office is located in Room 109. It is very important that the Assistant receives the required forms in a timely manner so that your records can be kept current. Until the Assistant receives the forms, the Department does not recognize that you have completed the requirement and this may cause delays in your graduation plans.

Some Basic Requirements for Graduate Study in the Department of Chemistry and Biochemistry

Every student who is pursuing an M.S. or Ph.D. degree in this department must, in order to attain or maintain their candidacy for their degree, do the following:

- 1) Be registered as outlined below;
- 2) Meet the deadlines indicated in this handbook for the degree requirements.
- 3) Submit a degree plan ("Program for the Master's Degree and Admission to Candidacy" or "Program for the Doctoral Degree") by the deadlines listed in this handbook;
- 4) Maintain a GPA of 3.0 or higher in graduate coursework;
- 5) Complete the required number of courses for the degree, as outlined in this handbook; and
- 6) Complete the Final Examination requirement to the satisfaction of the student's Advisory Committee by the established deadline.

B. Registration Requirements, Coursework, and Grading

Registration Requirements

1) University Enrollment Requirements

The credit hour minimum for registration is governed by Texas Tech University Operating Policy and Procedures Manuals, OP 64.02, which states

Full-time Study: "Students must be enrolled full-time (at least 9 hours in each long term, 3 hours in each relevant summer session) to be eligible to hold fellowships, teaching assistantships, graduate part-time instructorships, research assistantships, or other appointments designed for the support of graduate study, as well as certain types of financial aid. Foreign students are also required to be enrolled full-time. If a student is devoting full time to research, utilizing university facilities and faculty time, the schedule should reflect at least 9 hours enrollment (at least 3 hours in each summer session). Enrollment may include research, individual study, thesis or dissertation. *Exceptions to full-time enrollment for employment purposes require approval by the Graduate Dean.*"

Continuous Enrollment: "Each student who has begun thesis or dissertation research must register in each regular semester and at least once each summer until the degree has been completed, unless granted an official leave of absence from the program for medical or other exceptional reasons."

2) Chemistry and Biochemistry Seminar Enrollment Requirements

M.S. Students: Registration in two different Fall semesters (CHEM 5101) and two different Spring semesters (CHEM 5102) is minimally required. Ordinarily this requirement is fulfilled during the first two years of graduate study. However, if the literature seminar requirement is not satisfied at the end of the fourth semester

of enrollment, continued enrollment in CHEM 5101 and/or CHEM 5102 is required until the literature seminar requirement is satisfied.

Ph.D. Students: Registration in three different Fall semesters (CHEM 5101) and three different Spring semesters (CHEM 5102) is minimally required. Ordinarily this requirement is fulfilled during the first three years of graduate study. However, if the literature seminar requirement is not satisfied at the end of the sixth semester of enrollment, continued enrollment in CHEM 5101 and/or CHEM 5102 is required until the literature seminar requirement is satisfied.

3) Additional Registration Requirements

The Graduate School requires a minimum of 30 hours of graduate work for the Master's Degree and a minimum of 72 hours of graduate work for the Ph.D. Degree. Most students must take more than the minimum to complete their degrees. Additional fees and/or tuition, however, will be charged if the number of doctoral hours taken exceeds 115 hours for doctoral students. However, doctoral students with more than 99 doctoral hours may be dismissed if they are not making progress toward their degree. On the basis of 9 hours per semester and 3 hours per summer session course loads, doctoral students will have a bit less than four years, if they already have a Master's Degree, and a bit less than 5 years, if they do not have a Master's Degree, to complete their degree program, before incurring these additional fees and/or tuition charges. Note that students who already have a Master's Degree "start the clock" with a certain number of doctoral hours, at the start of their Ph.D. programs. In either case, it is imperative that students pursue their studies in a timely fashion to avoid these financial penalties. Currently, there are no credit limitations for MS students.

A typical 9 credit hour course load for first-year students is two or three lecture courses, a varying number of research credit hours (CHEM 7000), and the seminar course. After the first year, a typical course load is one or two lecture courses, research (CHEM 7000), a varying number of thesis or dissertation credit hours (CHEM 6000 for M.S. students, CHEM 8000 for Ph.D. students) and the seminar course. During the summer, when few if any lecture courses are offered, the typical course load is for thesis or dissertation and research.

Grading

A grade of "CR" (for "credit") is assigned for the thesis (CHEM 6000) or dissertation (CHEM 8000) credit hours taken each semester, while a letter grade (from "A" to "F") is assigned for CHEM 7000 credit hours taken each semester. A letter grade is assigned for the thesis or dissertation credit hours after the student has passed his/her final oral examination. The CHEM 7000 grade is assigned for first-year students by the Graduate Advisor, based on the effort that the student has made in interviewing prospective Research Advisors. Once a student has chosen a Research Advisor, then it is that Research Advisor who assigns the student's grade in CHEM 7000, based upon that student's effort and progress on his or her research project.

Course Offerings

The Graduate Catalog lists the courses offered by the department, as well as graduate-level (i.e. with numbers of 5000 or greater) courses offered by other departments on campus. As indicated in detail below, a limited number of graduate-level courses from departments other than the Department of Chemistry and Biochemistry can be taken and counted toward a chemistry graduate student's degree plan.

Each division has courses that are required for students specializing in that area:

<u>Division</u>	<u>Courses</u>
Analytical Chemistry	Advanced Analytical Chemistry (CHEM 5314)
Biochemistry	Enzymes (CHEM 5337) Lipids (CHEM 5336) Nucleic Acids (CHEM 5339) Physical Biochemistry (CHEM 5335) Proteins (CHEM 5333)
Chemical Education	see the section entitled "Requirements for M.S. and Ph.D. Degree with Specialization in Chemical Education"
Inorganic Chemistry	Advanced Inorganic Chemistry I (CHEM 5301) Advanced Inorganic Chemistry II (CHEM 5302)
Organic Chemistry	Advanced Organic Chemistry I (CHEM 5321)
Physical Chemistry	Advanced Physical Chemistry (CHEM 5342) For a specialization in Chemical Physics, see the section entitled "Requirements for M.S. and Ph.D. Degree with Specialization in Chemical Physics"

In addition, each division offers, at various times, "topics" courses (CHEM 5304 - Topics in Chemistry), with specific sections dedicated to each division or topic. CHEM 5304 may be repeated for credit if a different topic is covered. Indeed, different sections of CHEM 5304, each covering a different topic, may be taken in the same semester.

The Biochemistry Laboratory (CHEM 3313) taught each Spring semester, is recommended for all students who did not have a biochemical methods course as an undergraduate. (Enrollment in this course is at the discretion of the student and his or her research advisor.) This course does not count toward required hours.

If you have earned credit for graduate courses at other institutions that are equivalent to ones offered in our department, then you may petition to have these courses included in your degree program. In order to initiate course transfers, fill out the "Course Transfer Request" form on the departmental website under "Current Graduate Students", attach the appropriate documentation and give it to the Graduate Advising Assistant. This information will be conveyed to the division normally involved in teaching this course along with the scores on your diagnostic exam. You will be informed of the division's decision on your request through a memo from the Graduate Advisor.

Lecture Course Requirements

For the M.S. degree in specializations different than chemical education, six lecture courses (three credits each) are required, one of which must be taken outside the student's division. That course may be taken either within the department or outside the department. For the M.S. degree with a specialization in chemical education, seven lecture courses are required, of which five must be in chemistry and two must be in education or chemical education from the approved list (p. 20).

For the Ph.D. degree in specializations different than chemical education, eight lecture courses are required. Of these, at least two must be outside the student's division, and up to three may be outside of the department. For the Ph.D. degree with a specialization in chemical education, nine courses are required, of which five must be in chemistry and four must be in education or chemical education from the approved list (p. 20).

The choice of which courses you should take in order to fulfill your coursework requirements will be made by you, based on your area of specialty, the requirements that the division of your area of specialty may make, and on the special training that your research project may require. You should seek the advice of your Research Advisor.

In summary, graduate credit hours must be distributed so that there are at least

Masters Candidates:

18 graduate level lecture course hours (six courses)
4 hours in graduate seminar (CHEM 5101 and/or 5102; one credit hour per semester)
2 hours in research (CHEM 7000), and
6 hours in Master's Thesis (CHEM 6000)

Doctoral Candidates:

24 graduate level lecture course hours (eight courses)
6 hours in graduate seminar (CHEM 5101 and/or 5102; one credit hour per semester)
30 hours in research (CHEM 7000), and
12 hours in Doctoral Dissertation (CHEM 8000)

C. Additional Requirements for the M.S. and Ph.D. Degrees

The following discussion lists the explicit requirements for each of the two degrees. Note that a checklist for each degree can be found on pages 23 and 24 of this Handbook. You and your Research Advisor should each maintain a copy of this checklist in order to ascertain the progress you are making toward your degree. Also, be sure to consult the Graduate Catalog for the year that you entered the program to determine the Graduate School requirements that you must meet. In addition to the specializations of analytical chemistry, biochemistry, inorganic chemistry, organic chemistry, physical chemistry and theoretical chemistry, you may earn degrees with a specialization in Chemical Education or in Chemical Physics. The requirements for these interdisciplinary specializations are slightly different than for the other areas. A brief description and specific requirements for these specializations are given on pages 19 and 21 of this Handbook.

List of M.S. Degree Requirements

In Order to Earn the M.S. Degree in Chemistry, You Must
Do the Following:

By the Following Deadline:

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- | | | |
|----|--|---|
| 1) | Complete the Diagnostic Requirements | the end of your second long semester (see Diagnostic Exam Requirements, p. 10) |
| 2) | Choose your Research Advisor and at least one other faculty member to be on your advisory committee | the beginning of your second long semester, and the other faculty member in your second long semester.
The form is on the departmental website under "Current Graduate Students" |
| 3) | Fill out, obtain signatures on, and submit the form "Program for the Master's Degree and Admission to Candidacy" to the Graduate School (see Degree Program Forms on p. 12) | the beginning of your second long semester.
The form is on the departmental website under "Current Graduate Students" |
| 4) | Complete an approved seminar to your division (this is <u>not</u> the same as your Final Examination), as evidenced by the Graduate Advising Assistant receiving a completed, signed "Report of Literature Seminar" form (see Literature Seminar Requirements, p. 13) | the end of your fourth long semester.
The form is on the departmental website under "Current Graduate Students" |
| 5) | Complete required graduate-level lecture courses, including 4 hours of CHEM 5101 and/or CHEM 5102 | whenever completed |
| 6) | Complete at least 2 credit hours of CHEM 7000 and 6 credit hours of CHEM 6000 (Master's Thesis) | the departmental registration requirements assures that you will have completed this with extra credit hours to spare |
| 7) | Complete a research project as supervised by your Research Advisor, write up your results in a thesis which follows Graduate School guidelines, undergo a final oral examination with your advisory committee, and submit the requisite number of corrected copies of your thesis to the Graduate School according to the deadlines set by them each semester. | whenever completed |

List of Ph.D. Degree Requirements

In Order to Earn the Ph.D. Degree in Chemistry, You Must

Do the Following:

By the Following Deadline:

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|----|---|--|
| 1) | Complete the Diagnostic Requirements | the end of your second long semester (see Discussion of Degree Requirements, p. 10) |
| 2) | Choose your Research Advisor | the beginning of your second long semester.
The form is on the departmental website under "Current Graduate Students" |
| 3) | Choose at least 2 but no more than 4 other faculty members to be on your advisory committee | end of your first calendar year of enrollment. |
| 4) | Fill out, obtain signatures on, and submit the form "Program for the Doctoral Degree" to the Graduate School (see Degree Program Forms, p. 12) | beginning of your second calendar year of enrollment.
The form is on the departmental website under "Current Graduate Students" |
| 5) | Submit a written report to your committee, meet with them to give an oral presentation on your progress and outline of proposed work and successfully complete an oral examination, as evidenced by the Graduate Advising Assistant receiving a completed, signed "Report of Research Examination" form (see Research Examination, p. 14) | by the end of your second calendar year of enrollment.
The form is on the departmental website under "Current Graduate Students" |
| 6) | Successfully complete six Cumulative Examinations | the end of your fourth long semester for the first three cumulative examinations; the end of your sixth long semester for all six cumulative examinations |
| 7) | Become admitted into candidacy for the doctoral degree | The Graduate Advisor will submit your name for candidacy when you have passed your sixth cumulative examination and passed your research examination (the date that you were admitted into candidacy is important; see item 12 below). |

- | | | |
|-----|---|--|
| 8) | Complete <u>two</u> approved seminars to your division (these are <u>not</u> the same as your Final Examination), as evidenced by the Graduate Advising Assistant receiving completed, signed "Report of Literature Seminar" forms (see Literature Seminar Requirements, p. 13) | Complete the first by the end of your fourth long semester and the second by the end of your third academic year of enrollment.
The forms are on the departmental website under "Current Graduate Students" |
| 9) | Submit a written original research proposal to your committee, meet with them to give an oral presentation on it, and successfully defend it, evidenced by the Graduate Advising Assistant receiving a completed, signed "Report of Research Proposal" form (see Research Proposal, p. 16) | Submit RP no later than end of 7th long semester; defend RP no later than end of 8th long semester.
The form is on the departmental website under "Current Graduate Students" |
| 10) | Complete required graduate-level lecture courses including 6 hours of CHEM 5101 and/or CHEM 5102 | whenever completed |
| 11) | Complete at least 30 credit hours of CHEM 7000 and 12 credit hours of CHEM 8000 (Doctor's Dissertation) | the departmental registration requirements assures that you will have completed this with extra credit hours to spare |
| 12) | Complete a research project as supervised by your Research Advisor, write up your results in a dissertation which follows Graduate School guidelines, undergo a final oral examination (which has been announced according to Graduate School guidelines) with your advisory committee, and submit the requisite number of corrected copies of your thesis to the Graduate School according to the deadlines set by them each semester. | within 4 years of the date that you were admitted into candidacy |

II. DISCUSSION OF DEGREE REQUIREMENTS

A. Diagnostic Examination Requirements

Each entering graduate student must demonstrate a working knowledge of basic undergraduate chemistry in three fields, as assessed by their scores on standardized multiple choice examinations written by the American Chemical Society.

Students who enter the Graduate School of Texas Tech University with general GRE scores (verbal + quantitative) of at least 1100 and an advanced chemistry GRE score in the 80th percentile are exempt from taking the diagnostic examinations. Students specializing in Biochemistry may be exempt from the Biological Chemistry diagnostic requirement* if they have general GRE scores (verbal + quantitative) of at least 1100 and an advanced biochemistry, cell and molecular biology GRE score in the 80th percentile.

All entering graduate students must take three diagnostic exams in their first semester. You must pass the three diagnostic examinations by the end of your second long semester (or by your third attempt, whichever comes first) in order to remain in the graduate program in the Department of Chemistry and Biochemistry. These diagnostic exams are given by each of the six divisions of the Department of Chemistry and Biochemistry prior to registration for each fall and spring semester, and at the end of the spring semester. Each exam is comprehensive, three hours in length, and covers undergraduate material only. Each student must select the three fields in which he/she will take the diagnostic exams according to the following requirements:

Area of specialization:

Analytical Chemistry
Biochemistry*

Chemical Education
Inorganic Chemistry
Organic Chemistry
Physical Chemistry
Chemical Physics

Required Exams:

Analytical Chemistry and any two others
Biochemistry and any two others. Physical Chemistry for Biological Sciences may be substituted for the regular Physical Chemistry exam (only students in Biochemistry are allowed to make this substitution).
any three diagnostic examinations
Inorganic Chemistry and any two others
Organic Chemistry and any two others
Physical Chemistry and any two others
Physical Chemistry and any two others

*For students pursuing biochemistry having an undergraduate degree which emphasized biology over chemistry, there is a special series of diagnostic examinations; Biological Chemistry, parts 1, 2, & 3. This series of examinations is available only to biochemistry students. If you are uncertain as to your area of specialization, you should not take this series. The successful completion of this series requires that all three parts be passed by your second long semester (or by your third attempt, whichever comes first). A successful completion cannot be achieved by combining passes from the Biological Chemistry series with passes from the other track of diagnostic examinations.

If you do not pass the diagnostic exam in a subject, then you must engage in self-study (possibly including enrollment in an undergraduate-level course in the subject) in that subject and then retake the examination the next time that it is given. Diagnostic exams are given three times a year: prior to the beginning of the fall and spring semesters, and at the end of the spring semester.

Please note the following additional information relating to diagnostic requirements:

- 1) Graduate students who are specializing in biochemistry and who have not taken an undergraduate laboratory course in biochemistry (or do not have laboratory experience in biochemistry from prior graduate-level research work) must take CHEM 3313 ("Biological Chemistry Lab," offered in the Spring), even if they have passed the Biochemistry diagnostic examination. This CHEM 3313 course will not count toward the student's graduate degree.
- 2) Entering students who plan to petition the Department for approval to have graduate-level courses that they have taken elsewhere transferred for credit toward their Ph.D. program will have their diagnostic exam performances scrutinized as part of the approval process.

B. Choosing a Division, Research Advisor, and Advisory Committee

Your Division

At the time you enter the graduate program, you will also select a Division of the department that best represents your area of specialization. This choice will determine your specific diagnostic exam, cumulative exam, seminar, and course requirements. You may choose a Division other than that of your Research Advisor, but your choice should be appropriate for your research. The departmental Divisions are: Analytical Chemistry, Biochemistry, Chemical Education, Inorganic Chemistry, Organic Chemistry, and Physical Chemistry.

Your Research Advisor

During your first long semester, you must select a Research Advisor, the professor with whom you will do research work in your graduate career. This professor becomes your primary advisor and is in charge of your work and your program. Your Research Advisor is the key person in your graduate work. To acquaint yourself with the research activities of the faculty, you must talk with at least three professors before making a choice. A form to record these three interviews can be found on the departmental website under "Current Graduate Students"; it should be signed by all the professors with whom you interview. You must return the form with the three signatures to the Graduate Advising Assistant before the end of the first semester. By this time you should have found a professor with whom you wish to work and who has agreed to mentor you, and in this case, the faculty member's signature should be on the form. If you have not yet found a mutually acceptable research mentor, you must nevertheless turn in the interview form at the end

of your first semester and work diligently to find a mentor as soon as possible. If you are having unusual difficulties finding a mentor, feel free to discuss the matter with the Graduate Advisor.

You are urged to consider all factors carefully before making this important choice. It is often helpful to talk to experienced graduate students, especially those working with professors being interviewed, in order to get their opinions. Remember, also, that many professors have research projects in areas outside the area of their normal teaching duties.

Your Advisory Committee

The advisory committee is the group of faculty who, along with your Research Advisor, will evaluate your progress toward your degree, offer guidance on your research project, and assess your qualifications for the degree via oral examination.

The advisory committee for the Master's degree study must consist of at least two individuals, your Research Advisor (the chairman of the committee) and at least one other member of the Chemistry and Biochemistry faculty.

The advisory committee for the Doctoral degree must consist of at least three individuals, your research advisor (the chairman) and at least two other faculty members. There should be no more than 5 members on your committee. Your doctoral committee is typically made up of faculty from the Department of Chemistry and Biochemistry, but your particular research project may merit the inclusion of faculty from other departments on your committee.

You choose your advisory committee by considering, with the advice of your Research Advisor, a list of faculty whom you think would be most appropriate (based on the nature of your research project), then asking each of those faculty if he/she would be willing to serve on your committee. (In some cases, a faculty member will decline serving on your committee due to impending absences from the department or other circumstances). The members of your committee will be listed on the degree program that you will submit to the Graduate School.

If a member of your committee leaves the university, or for some other reason can no longer serve on your committee, then you can replace him/her with another faculty member, and notify the Graduate School of this change by submitting a "Change of Degree Plan" form which must be signed by the Graduate Advisor. The "Change of Degree Plan" form is in the Graduate Advising Office, Room 109.

C. Degree Program Forms

In order to be approved by the Graduate School for completing your degree, you must submit a completed degree program to them according to the deadlines indicated above. These forms (one for the M.S. degree, one for the Ph.D. degree) require, in addition to your name and address, the following information:

- Your thesis/dissertation topic (a preliminary title for your thesis/dissertation)
- The names of the members of your advisory committee
- A list of the courses that you have taken, or intend to take, in order to fulfill the coursework requirements for the degree
- Your expected graduation date, which will be May, August, or December of some year in the future.

Note that anything designated on your degree program—thesis/dissertation title, advisory committee members, courses, graduation date—can be changed by submitting a signed (by the Graduate Advisor) “Change of Degree Plan” form to the Graduate School. The “Change of Degree Plan” form is in the Graduate Advising Office, Room 109.

The degree program forms are straightforward to complete, but you should feel free to show the Graduate Advisor a rough draft before you submit the final version to him for approval. Samples of completed forms are on pages 26 and 27 of this handbook. Blank forms are on the departmental website under “Current Graduate Students”.

One thing to note about your degree program is that the Department of Chemistry and Biochemistry does not require that you choose a minor area of study.

D. Literature Seminar Requirements

The requirements for the Master's degree include the presentation of one acceptable literature seminar by the end of the fourth long semester. The requirements for the Ph.D. degree include the presentation of two acceptable literature seminars, one by the end of the fourth long semester and the second by the end of the third academic year. Each seminar requirement is satisfied by the formal presentation of a 50-minute lecture on a specific topic that you have chosen in your major area that is not directly related to your research project. Each seminar is presented as a divisional seminar, but it must be formally announced to the department as a whole and be open for attendance by all interested listeners. Most divisions require that a written abstract of the seminar topic be prepared for distribution at the time of the seminar. You should discuss the appropriateness of your chosen seminar topic with your Research Advisor and seek his/her advice during the preparation of your seminar. Furthermore, you should make a special effort to arrange for the members of your Advisory Committee to attend your seminar.

The faculty attending your seminar will evaluate your performance, after which your Research Advisor will notify the Graduate Advisor when you have successfully completed this requirement. In order to assist your Research Advisor in this, present him with a copy of the "Report of Research Seminar" form which can be found on the departmental website under “Current Graduate Students”; he/she must sign the form and give it to the Graduate Advising Assistant.

E. Qualifying Examinations for Ph.D. Students

The Qualifying Examination for the Ph.D. degree in Chemistry consists of the Research Examination, the Cumulative Examinations, and the Research Proposal. Exact deadlines (indicated in the summary on p. 8) exist for each part of the Qualifying Examination, and the failure of a student to abide by these deadlines will result in his/her disqualification from the Ph.D. program of the Department of Chemistry and Biochemistry.

Research Examination

By the end of a student's second calendar year as a graduate student in the department, the student must submit a written outline of his/her research project to his/her advisory committee, and meet with the committee to orally discuss the research project. It is common for this meeting to consist of the student giving a 30-45 minute presentation of his/her research project to the committee, which is then followed by a question and answer session. However, the exact format of the research examination (both written and oral parts), will be determined by the student's Research Advisor. Therefore students must enlist the aid of their research advisors during their preparation for the examination. Students are encouraged to submit progress reports to their committees at least once a year after passing the Research Exam.

The primary purpose of the research examination is to evaluate the development of the student into a Ph.D.-caliber scientist. Thus the committee will expect the student to demonstrate:

- scholarship (development of a strong background in the subject),
- ability (development of expertise in the techniques required by the project),
- communication skills (development of expertise in presenting the research subject and discussing it on an ad hoc basis), and
- creativity (development of the ability to solve problems independently and to foresee research directions which may be revealed by the research project).

A secondary purpose of the research examination is to allow the various committee members to critique the student's research project and to offer advice about its design and direction.

Upon completion of the research examination session, the committee will vote on whether or not the student has demonstrated sufficient development as a predoctoral student to assure ultimate success in attaining the Ph.D. degree. If the committee votes that the student has not demonstrated sufficient development, then it will recommend that the student be disqualified from pursuing a Ph.D. degree in the department, and the Graduate School will be notified that the student has failed his/her qualifying examination. In some cases, the committee might vote that a student retake all or part of the research examination (e.g. repeat the oral part or rewrite the written part).

When a student has successfully completed the research examination, he/she must have his/her research advisor and committee sign a "Report of Research Examination" form (a

blank copy of this form is on the departmental website under “Current Graduate Students”). The completed form must then be given to the Graduate Advising Assistant.

Any student who does not successfully complete his/her research examination by the end of his/her second calendar year (August 31 for Fall entering students, December 31 for Spring entering students) will fail the qualifying examination, and will be disqualified from pursuing the Ph.D. in the Department of Chemistry and Biochemistry.

Cumulative Examinations

Cumulative examinations are administered once a month during the academic year (September through April), on one Saturday morning of each month according to a schedule distributed to students and posted on the Departmental website under “Current Graduate Students” before the beginning of the academic year. Thus eight cumulative examinations are offered each academic year. Each division in the department (except Chemical Education) will offer a cumulative examination on each scheduled date. Upon entering the examination room, students are allowed to peruse the examinations before choosing the examination(s) that they will actually take that day. It is customary for students to attempt the examination in their area of specialization.

The purpose of the cumulative examinations is to encourage and measure the development of a student's comprehension of advanced-level topics in his or her area of specialization. The questions may vary from detailed essay questions to calculations to short answers. A common format for a cumulative examination is a series of questions about some recent journal article (or articles) that must be answered in blue books which accompany the examination. In general, the exams will emphasize data interpretation and problem solving (i.e. given these data, tell us what happened? How did it happen? How could you change what happened?) Depending upon the division giving the exam, the topic of a cumulative examination may or may not be announced beforehand (different divisions follow different procedures in this regard). A file of cumulative examinations is maintained in Room 109 for students to examine in order to assess typical questions.

The departmental rules concerning cumulative examinations are as follows:

- a) Starting with the first month of the first semester that a student enters the department's Ph.D. program, a student must pass at least three cumulative exams by the last month of his/her fourth long semester in the Ph.D. program, and he/she must pass six cumulative examinations by the last month of his/her sixth long semester in the Ph.D. program.
- b) At least four out of the six examinations counted toward this requirement must be in the student's major subject area.
- c) A student is allowed to attempt no more than a total of 24 cumulative examinations. Each examination paper (bluebook) handed in by a student at the end of an examination period is counted toward this total.
- d) If a student has not passed the required number of cumulative examinations within the time and/or number constraints indicated above, then the student will have failed the qualifying examination, and will be

disqualified from pursuing the Ph.D. degree in the Department of Chemistry and Biochemistry.

Note that students are allowed to hand in more than one completed cumulative exam paper on a single Saturday. However, all exams that are handed in count toward the 24-examination limit, thus in such cases the student may meet his or her 24-examination limit before the end of his or her sixth long semester.

Research Proposal

The Research Proposal requirement consists of the presentation and defense of an independent research proposal on a topic different from your dissertation research topic. It must include a written presentation of the proposed research idea (10-15 pages of text in length), in a format similar to that required of typical research grant applications, submitted to your committee ahead of time, followed by an oral presentation of the proposal to your committee, followed immediately by a period of questioning about the proposal and related topics by your committee. Your presentation must clearly offer documented background on, and significance of, the topic of your research idea, a clear description of the research idea, a discussion which supports the feasibility of the research idea, and a plan that you would follow to actually test and develop the idea.

Based upon the originality, correctness, neatness, and degree of sophistication which both the written and oral parts of your research proposal presentation and defense indicate, your committee will recommend either that you have passed the RP requirement, that you have failed the requirement and are no longer eligible to pursue the Ph.D. degree in the department, or that you must repeat the RP requirement. If you successfully complete the RP requirement, then your Research Advisor must submit a signed "Report of Research Proposal" form to the Graduate Advising Assistant. A blank copy of this form is on the departmental website under "Current Graduate Students".

The RP must be submitted no later than the end of the student's seventh long semester and must be successfully defended no later than the end of the student's eighth long semester.

Any student who does not submit and successfully defend his/her Research Proposal within the given time frame, will be disqualified from completing the Ph.D. degree in the Department of Chemistry and Biochemistry.

F. Final Oral Examination (Thesis/Dissertation Defense)

Final Oral Examination for M.S. Degree

The Final Oral Examination consists of an oral presentation, in seminar format, of your research results, followed immediately by an oral examination session in which your committee members ask you questions about your research project and related subjects. The presentation for the M.S. degree does not have to be open to the public; typically it is

made to your committee. You must present copies of your thesis to your committee at least a week before the oral examination. Following the oral examination, your committee will decide if you have passed the examination or not, and they will recommend changes in your thesis based on their reading of it. When your committee has decided that you have passed the examination and you have corrected the thesis according to their instructions, you must prepare a final copy of your thesis and submit it to the Graduate School for their approval. It is important that you pay close attention to the deadlines and thesis format requirements set by the Graduate School when you are completing your M.S. degree requirements.

As soon as a date and time has been arranged with your committee members for your Final Oral Examination, you need to reserve the room through the Departmental Office, Room 104. The Final Oral Examination must be announced on the weekly departmental seminar list. The title, as well as a copy of an abstract, should be given to the departmental office by Thursday of the week preceding your Oral Examination.

Final Oral Examination for Ph.D. Degree

The Final Oral Examination must be announced via a formal announcement that follows format guidelines established by the Graduate School. The examination may not be administered until at least three weeks after the announcement has been submitted to the Graduate School. Copies of this announcement will be mailed throughout the campus, and the Graduate School will select a graduate school dean's representative to serve as an additional member of your committee to participate in the final oral examination and report to the Graduate School about the examination. As stated in the Graduate Catalog, your Advisory Committee must approve the first written draft of the dissertation before the oral examination is scheduled.

The final oral examination for the Ph.D. degree will consist of a public presentation of your research results in the form of a 50-minute seminar. This presentation will be followed by a period of questions from the public audience, then a closed-door oral examination by your advisory committee. You must present a copy of your dissertation to each member of your committee (including the dean's representative) at least a week before the date of your final examination. Following the oral examination, your committee will decide if you have passed the examination or not, and they will recommend changes in your dissertation based on their reading of it. When your committee has decided that you have passed the examination and you have corrected the dissertation according to their instructions, you must prepare a final copy of your dissertation and submit it to the Graduate School for their approval. Your Research Advisor will notify the Graduate School at this time that you have successfully completed your final oral examination. It is important that you pay close attention to the deadlines and dissertation format requirements set by the Graduate School when you are completing your Ph.D. degree requirements.

As soon as a date/time has been arranged with the committee members for the Final Oral Examination, you need to reserve a room through the Departmental Office, Room 104.

To clarify the process by which a doctoral student obtains preliminary approval of his/her dissertation from his/her doctoral committee members prior to the scheduling of his/her final oral examination with the Graduate School, the following procedure is established.

- 1) The committee members will provide a preliminary evaluation of the dissertation within seven days of its acceptance from the candidate for review.
- 2) If a committee member feels that major changes are required, this will be communicated to the candidate within the seven-day period. Such major changes will have to be made by the student and the committee members will have another seven days to evaluate the revised dissertation once they accept it for review.
- 3) If only minor changes are required, the committee member will give preliminary approval to the dissertation. (Note that some modifications of the dissertation will undoubtedly still be required after the dissertation defense. However these will be of a relatively minor nature and will not involve, for example, the rewriting of an entire chapter.)
- 4) If the candidate receives no communication from a committee member by the end of the seven-day period, it will be assumed that committee member has given preliminary approval to the dissertation.

III. APPENDICES

A. Requirements for M.S./Ph.D. Degree with Specialization in Chemical Education

The masters degree program in Chemical Education is designed for students interested in teaching careers at the secondary level, at the two-year college level, as well as at four-year colleges and universities. This degree is appropriate for high school teachers wishing to expand their content and educational backgrounds. However, it is also appropriate for those individuals wishing to teach in a post-secondary education setting. Typically, those interested in pursuing a Ph.D. in a traditional area of chemistry with the goal of pursuing an academic career at a liberal arts college or university will find that the M.S. in Chemical Education gives them a competitive edge in the job market because of their experience with education.

The Ph.D. degree program in Chemical Education is designed for students interested in research and/or teaching careers at the secondary level, at the two-year college level, as well as at four-year and Ph.D. granting colleges and universities. This degree is appropriate for high school teachers wishing to expand their content and educational backgrounds. However, it is equally appropriate for those individuals wishing to teach and perform research at the post-secondary level. Typically, those interested in pursuing a Ph.D. in Chemical Education may wish to also obtain an M.S. in a “traditional” area of chemistry as well. However, this is not a requirement of the degree program.

Academic Requirements

The academic requirements for the M.S. degree are the same as those for other areas of chemistry with the exception of the course work requirement (see below).

The academic requirements for the Ph.D. degree are the same as those for other areas of chemistry with the exception of the course work requirement (see below) and the Research Exam (see below).

Diagnostic Exams

All Chemical Education students must demonstrate a working knowledge of chemistry by passing three diagnostic exams within their first year.

Advisory Committee

The Advisory Committee for an M.S. student must consist of a minimum of two members, which includes the research advisor.

The Advisory committee for a Ph.D. student must consist of a minimum of three members, which includes the research advisor.

Course Work

M.S. Degree

Graduate work totaling a minimum of 33 semester credit hours beyond the Bachelor's degree are required for this specialization.

- 21 hours in graduate level lecture courses (seven courses)
- 1 hour in graduate seminar (CHEM 5101 or CHEM 5102)
- 5 hours in Research (CHEM 7000)
- 6 hours in Master's Thesis (CHEM 6000)

Of the seven graduate level courses, five must be chemistry courses and two must be in education or chemical education from the approved list (see below). The two education courses must be from different categories in the approved list.

Ph.D. Degree

Graduate work totaling a minimum of 75 semester credit hours beyond the Bachelor's degree is required for this specialization.

- 27 hours in graduate-level lecture courses (nine courses)
- 1 hour in graduate seminar in chemistry (CHEM 5101 or CHEM 5102)
- 1 hour in graduate seminar in education (EDCI 6306 and/or EPSY 5249)
- 34 hours in Research (CHEM 7000)
- 12 hours in Doctor's Dissertation (CHEM 8000)

Of the nine graduate level courses, five must be chemistry courses and four must be in education or chemical education from the approved list (see below). Each of the four courses in education must come from a different category.

Approved Education Courses (by content area)

<u>Category</u>	<u>Course Number</u>	<u>Category</u>	<u>Course Number</u>
Curriculum	EDCI 5321	Qual/Quant	EDHE 5342
EDCI 6320		EPSY 5385	
EDHE 5343		EPSY 6301	
EDCI 5310		EPSY 6302	
EPSY 6304			
Ed. Theory		EPSY 5310	EPSY 6305
EPSY 5332			
EPSY 5382	Teaching		EDCI 5335
EPSY 6332		EPSY 5356	

Research Exam – Ph.D. Only

By the end of the fifth long semester, Ph.D. candidates with a specialization in chemical education must satisfactorily pass a written preliminary examination. Students must pass the exam by the second attempt.

Seminars – Ph.D. Only

The first seminar must be successfully presented by the end of the fourth long semester and should be in any of the traditional areas of chemistry. The second seminar required of Ph.D. candidates must be given by the end of the sixth long semester and should be on a topic in chemical education research.

B. Requirements for M.S./Ph.D. Degree with Specialization in Chemical Physics

The main goal of this specialization is to prepare students who wish to study chemical problems by the methods and theories of modern physics. This specialization includes courses in chemistry, physics, and mathematics and research on a suitable problem under the direction of a faculty member in the Department of Chemistry and Biochemistry or the Department of Physics. It is envisioned that a large fraction of students who choose the chemical physics specialization will be chemistry students with strong backgrounds in mathematics and physics. However, the academic requirements for the chemical physics specialization should make it also attractive to physics students. Because the coursework is difficult, this specialization will be recommended to students who are academically strong in chemistry, physics, and mathematics, as judged by transcripts and test scores.

Academic Requirements

Since this specialization will be administered in the Department of Chemistry and Biochemistry, the academic requirements are similar to those that are currently required in the other areas of chemistry. The cumulative examinations, research examination, research proposal, and final oral examination are the same.

Diagnostic Exams

Chemical physics students in both the masters and doctoral program must demonstrate a working knowledge of basic undergraduate chemistry and physics. To demonstrate this knowledge, students must pass within the first year three diagnostic exams, one of which must be in physical chemistry.

Required Physics Courses

The students must show proficiency in Electricity and Magnetism and Mechanics by passing with a grade of B or better one course from Physics 3305-3306 (5315-5316) and one course from Physics 4304-4305 (5324-5325). Students may receive graduate credit for only two of these four courses. Students can satisfy this requirement if they have taken equivalent courses previously and passed them with a grade of B or better. If taken for graduate credit, two of these courses will count as the two courses that are taken outside of the Department of Chemistry and Biochemistry, as described below in the course work for masters and doctoral candidates.

Course Work

Masters Candidates: Graduate work totaling a minimum of 30 semester credit hours beyond the Bachelor's degree are required for the M.S. in chemistry for any specialization. These graduate credit hours must be distributed so that there are at least:

- 18 graduate level lecture course hours (six courses)
- 4 hours in graduate seminar (CHEM 5101 and/or CHEM 5102)
- 2 hours in research (CHEM 7000), and
- 6 hours in Master's Thesis (CHEM 6000)

Of the six courses, a maximum of two can be taken outside of the Department of Chemistry and Biochemistry.

Doctoral Candidates: Graduate work totaling a minimum of 72 semester credit hours beyond the Bachelor's degree are required for the Ph.D. in chemistry for any specialization. These graduate credit hours must be distributed so that there are at least:

- 24 graduate level lecture course hours (eight courses)
- 6 hours in graduate seminar (CHEM 5101 and/or CHEM 5102)
- 30 hours in research (CHEM 7000), and
- 12 hours in Doctor's Dissertation (CHEM 8000)

Of the eight courses, a maximum of two can be taken outside of the Department of Chemistry and Biochemistry. At least one of the eight courses must be in organic, inorganic, analytical, or biochemistry.

It is anticipated that most of courses taken for the chemical physics specialization will be graduate courses in physical chemistry. If a student, because of his/her research area, chooses to take graduate courses in areas other than physical chemistry, these courses will be accepted for his/her six (for the M.S.) or eight (for the Ph.D.) courses. Chemical physics students will be allowed to substitute departmental physics or mathematics seminar courses for some of the Departmental Chemistry and Biochemistry seminars.

Advisory Committee

The Advisory committee for doctoral students must be a minimum of three members, which includes the Research Advisor. The Advisory committee for Masters students must be a minimum of two members, which includes the Research Advisor. One member of the committee (either doctoral or masters) must be a faculty member in Physics.

C. Checklist for the M.S. Degree in Chemistry

Requirement	Deadline	Date Completed
1) Completion of Diagnostic Requirements	end of second long semester	_____
2) Choose Research Advisor	beginning of second long semester	_____
Choose at least one other faculty member for advisory committee	end of second long semester	_____
3) Fill out, obtain signatures on, and submit the form "Program for the Master's Degree and Admission to Candidacy" to the Graduate School	beginning of second long semester	_____
4) Complete literature seminar to division (Graduate Advising Assistant must receive signed "Report of Literature Research Seminar" form)	end of the fourth long semester	_____
5) Complete six graduate-level lecture courses of which at least five must be CHEM.	whenever completed	_____
Also complete 4 credits of CHEM 5101 and/or 5102	whenever completed	_____
6) Complete at least 2 credit hours of CHEM 7000 and 6 credit hours of CHEM 6000	departmental requirements assure that you will have extra credit hours to spare	_____
7) Complete research project as supervised by your Research Advisor, write up your results in a thesis which follows Graduate School guidelines, undergo a final oral examination with your advisory committee, and submit the requisite number of corrected copies of your thesis to the Graduate School according to the deadlines set by it each semester.	whenever completed	_____

All forms can be found on the Departmental website
www.depts.ttu.edu/chemistry under "Current Graduate Students"

D. Checklist for the Ph.D. Degree in Chemistry

Requirement	Deadline	Date Completed
1) Completion of Diagnostic Requirements	end of second long semester	_____
2) Choose Research Advisor	beginning of second long semester	_____
3) Choose at least two other faculty members for advisory committee	end of second long semester	_____
4) Fill out, obtain signatures on, and submit the form "Program for the Doctoral Degree" to the Graduate School	beginning of second calendar year of enrollment	_____
5) Complete Research Examination (Graduate Advising Assistant must receive completed, signed "Report of Research Examination" form)	by end of second calendar year of enrollment	_____
6) Successfully complete six Cumulative Examinations	first three exams by the end of fourth long semester,	_____
all six exams by the end of sixth long semester	_____	
7) Admission into candidacy degree	Graduate Advisor will submit your name	_____
8) Complete two approved literature seminars in your division (Graduate Advising Assistant must receive a completed, signed "Report of Literature Seminar" form for each seminar presented)	1st by end of 4th long semester	_____ 1st
	2nd by end of third academic year	_____ 2nd
9) Complete Research Proposal (Graduate Advising Assistant must receive a completed, signed "Report of Research Proposal" form)	submit RP no later than end of 7th long semester;	_____ (submitted)
	defend RP no later than end of 8th long semester (Inorganic students submit & defend in long semester following RE)	_____ (defended)

- | | | | |
|-----|---|---|-------|
| 10) | Complete at least eight graduate level lecture courses of which at least five must be CHEM courses.
Also complete 6 credits of CHEM 5101 and/or CHEM 5102. | whenever completed | _____ |
| | | whenever completed | _____ |
| 11) | Complete 30 credit hours of CHEM 7000 and 12 credit hours of CHEM 8000 | departmental registration requirements assure completion of this with extra credit hours to spare | _____ |
| 12) | Complete research project, write up results in a dissertation which follows Graduate School guidelines, pass final oral examination | within 4 years of date for admission into candidacy | _____ |

All forms can be found on the Departmental website
www.depts.ttu.edu/chemistry under “Current Graduate Students”

E. Sample of Completed “Program for the Master’s Degree” Form

Anything on the degree plan can be changed after it is filed;
forms to make changes are in Room 109.

The department only awards M.S. degrees in Chemistry.

Use the department address as “current address”

List the 6 lecture courses you have taken or will take for your degree, including any approved transfer courses.

Committee should have at least 2 members.

Thesis title must be included.

For special topics courses, give the semester(s) that you took (or will take) the course(s).

F. Sample of Completed “Program for the Doctoral Degree” Form

Anything on the degree plan can be changed after it is filed;
forms to make changes are in Room 109.

Use the department address as “current address”

The department only awards Ph.D. degrees in Chemistry.

List the 8 lecture courses you have taken or will take for your degree, including any approved transfer courses.

List your first year (2 long semesters & summer) as the residence year
(24 total credits)

Committee should have at least 3 members

Dissertation title must be included

For special topics courses, give the semester(s) that you took (or will take) the course(s)