

Status: PENDING

**PROGRAM REQUEST**  
Chemical Physics

Last Updated: Myers, Dena Elizabeth  
08/10/2011

<b>Fiscal Unit/Academic Org</b>	Physics - D0684
<b>Administering College/Academic Group</b>	Mathematical And Physical Sci
<b>Co-administering College/Academic Group</b>	
<b>Semester Conversion Designation</b>	Converted with minimal changes to program goals and/or curricular requirements (e.g., sub-plan/specialization name changes, changes in electives and/or prerequisites, minimal changes in overall structure of program, minimal or no changes in program goals or content)
<b>Current Program/Plan Name</b>	Chemical Physics
<b>Proposed Program/Plan Name</b>	Chemical Physics
<b>Program/Plan Code Abbreviation</b>	CHEMPHY-PH
<b>Current Degree Title</b>	Doctor of Philosophy

**Credit Hour Explanation**

Program credit hour requirements		A) Number of credit hours in current program (Quarter credit hours)	B) Calculated result for 2/3rds of current (Semester credit hours)	C) Number of credit hours required for proposed program (Semester credit hours)	D) Change in credit hours
Total minimum credit hours required for completion of program		120	80.0	80	0.0
Required credit hours offered by the unit	Minimum				
	Maximum				
Required credit hours offered outside of the unit	Minimum				
	Maximum				
Required prerequisite credit hours not included above	Minimum				
	Maximum				

**Program Learning Goals**

Note: these are required for all undergraduate degree programs and majors now, and will be required for all graduate and professional degree programs in 2012. Nonetheless, all programs are encouraged to complete these now.

**Program Learning Goals**                      •

**Assessment**

Assessment plan includes student learning goals, how those goals are evaluated, and how the information collected is used to improve student learning. An assessment plan is required for undergraduate majors and degrees. Graduate and professional degree programs are encouraged to complete this now, but will not be required to do so until 2012.

**Is this a degree program (undergraduate, graduate, or professional) or major proposal?** Yes

**Does the degree program or major have an assessment plan on file with the university Office of Academic Affairs?** No

**Program Specializations/Sub-Plans**

If you do not specify a program specialization/sub-plan it will be assumed you are submitting this program for all program specializations/sub-plans.

**Pre-Major**

**Does this Program have a Pre-Major?** No

**Attachments**

- chemphys transition to semesters-phd.pdf  
*(Program Proposal. Owner: Lafyatis, Gregory Paul)*
- chemphys transition to semesters-phd final revised a.pdf  
*(Program Proposal. Owner: Lafyatis, Gregory Paul)*
- Chemical Physics PhD cover letter.doc: NMS Division of Arts and Sciences cover letter  
*(Letter from the College to OAA. Owner: Andereck, Claude David)*

**Comments**

- The attached file contains all of the required components in the requested order *(by Lafyatis, Gregory Paul on 07/10/2011 07:54 PM)*

**Workflow Information**

Status	User(s)	Date/Time	Step
Submitted	Lafyatis, Gregory Paul	07/10/2011 07:55 PM	Submitted for Approval
Approved	Hughes, Richard E	07/13/2011 02:51 PM	Unit Approval
Revision Requested	Andereck, Claude David	07/22/2011 03:25 PM	College Approval
Submitted	Lafyatis, Gregory Paul	07/27/2011 02:29 PM	Submitted for Approval
Approved	Hughes, Richard E	08/04/2011 12:46 PM	Unit Approval
Approved	Andereck, Claude David	08/09/2011 11:29 AM	College Approval
Approved	Myers, Dena Elizabeth	08/10/2011 08:36 AM	GradSchool Approval
Pending Approval	Cameron, Erin Marie Soave, Melissa A	08/10/2011 08:36 AM	CAA Approval



College of Arts and Sciences

---

186 University Hall  
230 North Oval Mall  
Columbus, OH 43210

Phone (614) 292-8908  
Fax (614) 247-7498

August 9, 2011

Dena Myers  
Graduate School  
250 University Hall  
230 North Oval Mall  
Campus

Dear Dena:

It is a pleasure to forward to you for your consideration the proposal for the interdisciplinary doctoral program in Chemical Physics. The program is a relatively straightforward conversion from its quarter version.

Beyond my own review of the documents, the proposal has been discussed by colleagues from other NMS units at meetings on July 22, 2011. Feedback from these discussions has been incorporated in the proposal.

If you have any questions, I would be happy to address them.

Sincerely,

A handwritten signature in black ink, appearing to read "David Andereck".

David Andereck  
Professor of Physics  
Associate Dean of Natural and Mathematical Sciences, College of Arts and Sciences



*Chemical Physics*  
<http://chemphys.chemistry.ohio-state.edu/chemphys>

120 West 18th Avenue  
Columbus, OH 43210-1173

Phone 614-292-2569  
FAX 614-292-1948  
[chemphys@chemphys.chemistry.ohio-state.edu](mailto:chemphys@chemphys.chemistry.ohio-state.edu)

July 5, 2011

TO: Office of Academic Affairs  
FROM: Terry A. Miller, Chair, Chemical Physics Program  
RE: Semester Program Proposal for Chemical Physics Doctoral Program

Chemical Physics has the following programs which will be converted from quarters to semesters:

- 1) The Graduate Chemical Physics Masters
- 2) The Graduate Chemical Physics PhD

The subject of this proposal is the Chemical Physics PhD program; the other program is addressed in a separate proposal.

The Chemical Physics Graduate Studies Committee has worked extensively to produce this proposal, describing the conversion of our current Graduate PhD program from the quarter system to the semester system.

The contents of this proposal have been discussed at length by the Graduate Studies Committee and were unanimously approved June 22.

The proposal was circulated to the entire Chemical Physics faculty with a request for comment or objections. Only one objection was received concerning format issues, which has been resolved. As Chair of the Chemical Physics Graduate Studies Committee, I strongly endorse this proposal.

### Rationale for Changes to the Ph.D. Program from quarters to semesters

Overall, the goals and requirements are essentially unchanged. With minimal exceptions detailed below, the required courses for a Chemical Physics Ph.D. are offered by either the Physics or Chemistry Departments. Each department has supplied a detailed mapping of the quarter to semester conversion. The Chemical Physics program has followed this map to offer nearly equivalent core and elective course requirements under quarters and semesters. The tables below summarize this mapping.

<u>Core Areas</u>	<u>Courses</u>			
	<u>Chemistry</u> <u>Quarters</u>	<u>Chemistry</u> <u>Semesters</u>	<u>Physics</u> <u>Quarters</u>	<u>Physics</u> <u>Semesters</u>
1) Quantum Mechanics	861, 862, 863	6510,6540, 7520	827,828,829, 830	7501,7502, 7503
2) Statistical Mechanics/ Thermodynamics//Kinetics	880, (775 or 876)	6520,6530, 7550	846,847	7601, 7602
3) Spectroscopy	866	7530		* (I)
4) Safety Seminar (to be completed in first year)	685	6781(1)		

\* Depending on topic Physics 880.20 → Physics 8804.1 may satisfy this requirement

<u>Elective Areas</u>	<u>Courses</u>			
	<u>Chemistry</u> <u>Quarters</u>	<u>Chemistry</u> <u>Semesters</u>	<u>Physics</u> <u>Quarters</u>	<u>Physics</u> <u>Semesters</u>
Optics	-	7570(1.5-3)	657	3470
Classical Mechanics	-		821	7601
Kinetics	876	7540		-
Electricity and Magnetism	-		834,835	7401
Condensed Matter Physics	-	7580(1.5-3)	780.06	8806.1
Atomic Physics/ Spectroscopy			780.04	8804.1
Analytical Spectroscopy	823(S)	7140		-

Electrochemistry	821(A)	7120		-
Advanced Topics	-	6550,7570	880.0X	880X.X
Special Topics of Current Interest	996 (I)	8599(1.5-3), 8699(1.5-3)	880.20	6810(4),6820(4)
Mathematics	Appropriate math courses at the 500 level (→4000 level) or above, e.g., Math 601(A), 602(W) (→ Math 4512,4551,4552,4557,4568) or Physics 730,731 (→ Physics 7701)			

Semester courses are all 3 credit hours unless otherwise indicated

Chemical Physics of course offers Doctoral research (CP8999), Masters research, and non-degree research (CP7998) under semesters which map trivially from their counterparts under quarter. Chemical Physics also offers the Frontiers in Spectroscopy course featuring (usually) outside speakers presenting 3 days of lectures on specific topics. Under quarters this course offers 5 speakers with interspersed reading weeks. Under semesters it (CP8880) will be a half semester course offering 4 weeks of lectures plus 3 reading period weeks.

### CHEMICAL PHYSICS SEMESTER COURSES

Semster Course Number	Course Title	Semester Credits	Quarter Equivalent course
CP8880	Frontiers in Spectroscopy	1.5-3	880
CP7998	Research	arranged	
CP7999	Master's Research	arranged	
CP8999	Doctoral Research	arranged	999

## **CHEMICAL PHYSICS PH.D. PROGRAM UNDER SEMESTERS**

### **I. General Information**

The program for a Ph.D. degree leads to mastery at a high level of the fundamental principles in the area defined by the overlap of the traditional chemistry and physics disciplines. The graduate student in Chemical Physics who seeks the Ph.D. degree is expected to expend the major effort on a research problem which culminates in a dissertation. To reach this goal the candidate will conduct independent research under the guidance of a preceptor, prepare and present a dissertation on the study, and demonstrate that it adds significant new knowledge to an area of Chemical Physics. The course requirements are designed to prepare the student for this major challenge of graduate education.

#### **Candidacy Examination:**

The Candidacy Examination is described below.

#### **Dissertation and Final Oral Examination:**

The candidate must submit a satisfactory dissertation and pass a Final Oral Examination in order to qualify for the Ph.D. The Final Oral Examination is described below.

#### **Graduate School:**

The student must fulfill all of the Graduate School requirements. The current requirements and the order in which they must be fulfilled are listed in the Graduate School Handbook.

#### **Foreign Language:**

All international students who are not citizens of countries in which English is the official language are required to be certified in spoken English prior to the end of the second semester of study, not including Summer Term, by the department (Chemistry or Physics) wherein they hold a TA appointment. In addition, the Graduate School requires that English XXXX (a writing course) or its equivalent be completed within one year of entering graduate school.

### **II. Preceptor Selection**

The selection of a research advisor is a major step in a student's program and a formal system of interviews has been developed. To initiate the procedure, the student will obtain a preceptor selection form and designate a minimum of 5 chemical physics faculty members (at least one member each of the Chemistry and Physics Department) that he/she wishes to interview. Students are encouraged to interview as many chemical physics faculty members as they feel may provide research programs of interest. Students entering the program fall semester must submit to the Chairman of the Graduate Studies Committee their preceptor preference list on the last Friday of classes of autumn semester or at the latest the Friday of the 10th week of spring semester. For students entering at other times, this must be done no later than the Friday of the 10th week of their

second semester at The Ohio State University.

### III. Doctoral Program

The requirements specific to the Chemical Physics program are as follows:

**A. Course Requirements for Ph.D. Candidates.** The purpose of coursework in the Ph.D. program is to prepare the student to take the General Examinations for the Ph.D. (written and oral) and to undertake work on a significant original investigation in chemical physics which culminates in the doctoral dissertation.

To this end the student will be required to demonstrate proficiency in a number of specific subject areas. The normal method of demonstrating proficiency is to successfully complete a prescribed set of courses. However, in exceptional cases, the Graduate Studies Committee has the discretion to accept other evidence of the student's proficiency.

The course requirements may be divided into two categories: i) core requirements and ii) elective requirements. Each student must take at least 5 full semester-equivalent courses (15 credit hours) in the core areas. These must include at least one semester-equivalent course (3 credit hours) in each of the three areas. The core areas are:

<u>Area</u>	<u>Suggested Course</u>	
	<u>Chemistry</u>	<u>Physics</u>
1) Quantum Mechanics	6510(Au-1), 6540(Au-2), 7520(Sp)	7501(Au), 7502(Sp), 7503(Au)
2) Statistical Mechanics/ Thermodynamics/Kinetics	6520(Au-1), 6530(Au-2), 7550(Sp), 7540 (every other year)	7601(Au), 7602(Sp)
3) Spectroscopy	7530 (every other year)	* (I)

\* Depending on topic 8804.XX may satisfy this requirement

If the student does chemical research, the Safety Seminar, Chem 7681, must be taken.

(Letters in parenthesis indicates semester normally offered: (Au)=autumn; (Sp)=spring; 1, 2 indicates half-semester courses. All full semester courses are 3 credit hour courses; ½ semester courses are 1.5 credit hour courses)

To fulfill the core requirement in each area the student may take the appropriate courses in either department (but not both). These courses will normally be taken during the student's first year of enrollment (except for Physics 7503).

In addition, the student must also demonstrate proficiency in several electives exemplified by the following:

<u>Area</u>	<u>Courses</u>	
	<u>Chemistry</u>	<u>Physics</u>
Frontiers in Spectroscopy	ChemPhys 8880(1.5-3)	
Laser and Optics	7580(1.5-3)	3470



Kinetics	7540	-
Electricity and Magnetism	-	7401
Condensed Matter Physics	7590(1.5-3)	8806.1
Atomic Physics/Spectroscopy		8804.1
Analytic Spectroscopy	7140	-
Electrochemistry	7120	-
Advanced Topics	6550, 7570	880X.X
Special Topics of Current Interest	8599(1.5-3), 8699(1.5-3)	6810(4), 6820(4)
Mathematics	Appropriate math courses at the 4000 level or above, e.g., Math 4512, 4551, 4552, 4557, 4568, Phys 7701	

All courses are 3 credit hour courses unless otherwise indicated

With advisor's permission, other courses may satisfy the elective requirement.

Overall the student must complete the equivalent of 9 credit hours of these elective requirements, with at least one of these being completed within the first year. Credit in the core areas in excess of 5 semester courses may be applied to fulfill up to 2 of the 3 course elective credit requirements. However, for the Chemical Physics degree, a student must accumulate a total of at least 6 credit hours in each of the Chemistry and the Physics Departments. ChemPhys8880-Frontiers in Spectroscopy, taken for a letter grade, will count as one elective.

Chemical Physics also offers research courses as follows:

<u>Research</u>	<u>Course</u>	<u>Hours</u>
Non-Degree Research	ChemPhys7998	By Arrangement
Master's Research	ChemPhys7999	By Arrangement
Doctoral Research	ChemPhys8999	By Arrangement Nominally 3 credit hours/quarter

In summary, degree program will consist of at least 15 credit hours of core courses, at least 9 hours of elective courses with research taking up the balance to a minimum 80 credit hours, total.

**Colloquia and Seminars** – Colloquia and special seminars in both the Chemistry and Physics Departments provide an important opportunity to the faculty and students in the Chemical Physics Program to be introduced to research programs underway at OSU as well as to hear reports from scientists from throughout the U.S. and other parts of the world. For students who have selected an area in which to do their research, or are in the process of making such a choice, attendance at the

special seminars in that area provides an important means of becoming acquainted with the frontiers of the field. All students are strongly advised to attend the special seminars in their chosen research area. For example, Chem8895 provides course credit for the Physical Chemistry Seminar.

**B. Other Requirements.** The graduate degree program in Chemical Physics has several options:

- I Terminal M.S. degree
- II M.S. degree followed by Ph.D.
- III Ph.D. degree, not preceded by the M.S. degree

The choice among these programs will be determined on the basis of the student's academic record and his/her performance on the Integrated Oral Examination (IOE) as described below.

1. The **IOE** is given on an individual basis, but will normally be taken at the end of spring semester or the beginning of the summer term of the student's first year. At this point, the student should have completed most of the course requirements listed above. The IOE shall be administered by 3 Chemical Physics faculty members appointed by the Graduate Studies Chairperson and will test the depth and integration of understanding of the student's knowledge in the core Chemical Physics areas as indicated above and in selected other areas of the student's specialization. The examination shall be oral. In the case of an overall ambiguous performance, the committee can require a second, written examination.

2. **Candidacy Examination.** The examination for admission to Ph. D. candidacy, consisting of a written and an oral portion, is also given on an individual basis. The written portion is in the form of a research proposition on a topic in the general area of the student's research interests but different from the thesis topic already being pursued by the student. The topic is selected by the student but must be approved by his advisor. For students permitted to proceed directly toward the Ph.D. (on the basis of the IOE and coursework evaluation), the selection and approval of the proposal topic should be completed *not later than the autumn semester of the third year*; for students taking the M.S. first, it is to be done *within the semester following completion of the M.S. degree. The Ph. D. candidacy exam must be taken by the end of the third year.*

a) The **written portion** of the candidacy examination will consist of a well-documented research proposal that includes a critical review of the subject matter which is pertinent to the candidate's proposed research problem. The minimum objective will be for the student to use this opportunity to demonstrate a thorough understanding of the project and its relationship to other areas of Chemical Physics. This document normally shall consist of not more than about 30 typewritten, double-spaced pages including all references, figures, tables, etc.

The student's advisor will be responsible for initiating and coordinating the written examination. He/she will submit the approved topic of the proposal to the Graduate Committee Chairperson, who will approve an evaluation committee of four faculty members. The committee will include the advisor plus three chemical physics faculty members, at least one member each of the Chemistry and Physics Department. The student

will then have six weeks to prepare and submit his proposal to the committee. During this time, he will be expected to work independently on the proposal, without consulting any member of the committee, including his advisor. Each member of the evaluation committee (except the advisor) will submit a written critique of the proposal to the student (and send a copy to the advisor) within approximately two weeks after receiving the proposal. The student will then be given an opportunity to modify his proposal and return it to the committee, as required. If the proposal is basically satisfactory, requiring modest revision, the student will be allowed two weeks following its receipt for preparation of the revised proposal; for major revision, three weeks will be allowed. Presentation of a final proposal, which is judged satisfactory by the examining committee, will constitute passage of the written portion of the examination.

b) The **oral portion** of the examination should be scheduled by the student and his advisor through the Graduate School. The Graduate School form is due to the Graduate School 2 weeks prior to the oral exam. The committee should include the three Chemical Physics faculty members (in addition to the advisor) who evaluated the written proposal (at least one member each of the Chemistry and Physics Department). The content of the oral examination will be directed principally toward the proposal itself and the actual research program planned or in progress by the student but some general chemical physics questions may also be directed to the student. Since most of the more general background material will be available in the written proposal, the student should plan to present a brief, informal (approximately 5 minutes) summary of the proposal and then be prepared to answer questions from the committee related to the proposal, to his own research program, and to chemical physics more generally. Satisfactory performance will result in admission to candidacy for the Ph.D. degree. Failure will result in a second attempt not later than the second semester following. [NOTE: the Grad School is not providing the outside reader but they are still requiring 4 grad faculty members for the oral exam]

3. **Dissertation.** The principal requirement for the Ph.D. degree is the accomplishment of independent research. Details concerning the Ph.D. dissertation and its oral defense are given in the Graduate School Handbook.

**Sample Plan**

**Year 1 (total Hours: 29)**

<b>Autumn</b>	<b>Spring</b>	<b>Summer</b>
Chem 6510/6540* (3)	Chem 7520 (3)	ChemPhys 7998 (8)
Physics 7601 (3)	Physics 7602 (3)	
Physics 7701 (3)	Physics 7401 (3)	IOE→Masters or Ph. D
Chem 8895 (1)	Chem 8895 (1)	Preceptor selection
Chem 6781 (1)		

**Year 2 (total Hours: 35)**

<b>Autumn</b>	<b>Spring</b>	<b>Summer</b>
Chem 7530 (3)	ChemPhys 8880 (3)	ChemPhys 7998 (8)
Chem 7570 (3)	ChemPhys 7998 (8)	Candidacy Exam
ChemPhys 7998 (5)	ChemPhys 8880 (3)	
Chem 8895 (1)	Chem 8895 (1)	

**Year 3 till completion (total Hours: 9/year)**

<b>Autumn</b>	<b>Spring</b>	<b>Summer</b>
ChemPhys 8999 (3)	ChemPhys 8999 (3)	ChemPhys 8999 (3)

\* Chem 6510 and 6540 are sequential half semester courses.

**A minimum of 80 hours, total is required for the Ph. D degree.**

## Chemical Physics Graduate Ph.D. program under quarters

### I. INTRODUCTION

The present course and other requirements for a Ph.D. degree in Chemical Physics are outlined in this section. The graduate student in Chemical Physics who seeks the Ph.D. degree is expected to expend the major effort on a research problem which culminates in a dissertation. To reach this goal the candidate will conduct independent research under the guidance of a preceptor, prepare and present a dissertation on the study, and demonstrate that it adds significant new knowledge to an area of Chemical Physics. The course requirements are designed to prepare the student for this major challenge of graduate education.

### II. PRECEPTOR SELECTION

The selection of a research advisor is a major step in a student's program and a formal system of interviews has been developed. To initiate the procedure, the student will obtain a preceptor selection form and designate a minimum of 5 chemical physics faculty members (at least one member each of the Chemistry and Physics Department) that he/she wishes to interview. Students are encouraged to interview as many chemical physics faculty members as they feel may provide research programs of interest. Students entering the program fall quarter may submit to the Chairman of the Graduate Studies Committee their preceptor preference list on the last Friday of classes of fall or winter quarter or at the latest the Friday of the 5th week of spring quarter. For students entering at other times, this must be done no later than the Friday of the 5th week of their third quarter at The Ohio State University.

### III. DOCTORAL PROGRAM

The requirements specific to the Chemical Physics program are as follows:

**A. Course Requirements for Ph.D. Candidates.** The purpose of coursework in the Ph.D. program is to prepare the student to take the General Examinations for the Ph.D. (written and oral) and to undertake work on a significant original investigation in chemical physics which culminates in the doctoral dissertation.

To this end the student will be required to demonstrate proficiency in a number of specific subject areas. The normal method of demonstrating proficiency is to successfully complete a prescribed set of courses. However, in exceptional cases, the Graduate Studies Committee has the discretion to accept other evidence of the student's proficiency.

The course requirements may be divided into two categories: i) core requirements and ii) elective requirements. Each student must satisfy each of the following three core requirements for a total minimum of 6 courses. The core areas are:

<u>Area</u>		<u>Suggested Course</u>	
		<u>Chemistry</u>	<u>Physics</u>
1)	Quantum Mechanics	861(A), 862(W), 863(S)	827(A), 828(W), 829(S), 830(A)
2)	Statistical Mechanics/ Thermodynamics/Kinetics	880(S), (775(A) or 876(W))	846(W), 847(S)
3)	Spectroscopy	866(S odd years)	* (I)
4)	Safety Seminar (to be completed in first year)	685 (W)	

\* Depending on topic 880.20 may satisfy this requirement

(Letter in parenthesis indicates quarter normally offered: (A)=Autumn; (W)=Winter; (S)=Spring; (I)=Irregular)

To fulfill the core requirement in each area the student may take the appropriate courses in either department (but not both). These courses will normally be taken during the student's first year of enrollment (except for Physics 830).

In addition, the student must also demonstrate proficiency in several electives in at least two areas exemplified by the following:

<u>Area</u>		<u>Suggested Course</u>	
		<u>Chemistry</u>	<u>Physics</u>
Optics		-	657(S)
Classical Mechanics		-	821(A)
Kinetics		876(W)	-
Electricity and Magnetism		-	834(A), 835(W)
Condensed Matter Physics		-	780.06(S)
Atomic Physics/Spectroscopy			780.04((A) also Astron 823)
Analytic Spectroscopy		823(S)	-
Electrochemistry		821(A)	-
Advanced Topics		-	880.0X (I)
Special Topics of Current Interest		996 (I)	880.20 (I)
Mathematics		Appropriate math courses at the 500 level or above, e.g., Math 601(A), 602(W), Phys 730(Su), 731(W)	

Overall the student must complete the equivalent of 4 courses of these elective requirements, with at least half of these being completed within the first year. Credit in the core areas in excess of 6 courses may be applied to fulfill up to 2 courses of the 4 courses elective credit requirements. However, for the Chemical Physics degree, a student must normally accumulate a total of at least 3 courses from the core and elective courses in each of the Chemistry and the Physics Departments. (ChemPhys880(W)-Frontiers in Spectroscopy taken for a grade will count as an elective.)

**B. Other Requirements.** The graduate degree program in Chemical Physics has several options:

- I Terminal M.S. degree
- II M.S. degree followed by Ph.D.
- III Ph.D. degree, not preceded by the M.S. degree

The choice among these programs will be determined on the basis of the student's academic record and his/her performance on the Integrated Oral Examination (IOE) as described below.

1. The **IOE** is given on an individual basis, but will normally be taken at the end of Spring Quarter or the beginning of Summer Quarter of the student's first year. At this point, the student should have completed most of the course requirements listed above. The IOE shall be administered by 3 Chemical Physics faculty members appointed by the Graduate Studies Chairperson and will test the depth and integration of understanding of the student's knowledge in the core Chemical Physics areas as indicated above and in selected other areas of the student's specialization. The examination shall be oral. In the case of an overall ambiguous performance, the committee can require a second, written examination.

2. **General Examination.** The examination for admission to Ph. D. candidacy, consisting of a written and an oral portion, is also given on an individual basis. The written portion is in the form of a research proposition on a topic in the general area of the student's research interests but different from the thesis topic already being pursued by the student. The topic is selected by the student but must be approved by his advisor. For students permitted to proceed directly toward the Ph.D. (on the basis of the IOE and coursework evaluation), the selection and approval of the proposal topic should be completed *not later than the autumn quarter of the third year*; for students taking the M.S. first, it is to be done *within the quarter following completion of the M.S. degree*.

a) The **written portion** of the general examination will consist of a well-documented research proposal that includes a critical review of the subject matter which is pertinent to the candidate's proposed research problem. The minimum objective will be for the student to use this opportunity to demonstrate a thorough understanding of the project and its relationship to other areas of Chemical Physics. This document normally shall consist of not more than about 30 typewritten, double-spaced pages including all references, figures, tables, etc.

The student's advisor will be responsible for initiating and coordinating the written examination. He/she will submit the approved topic of the proposal to the Graduate Committee Chairperson, who will approve an evaluation committee of four faculty members. The committee will include the advisor plus three chemical physics faculty members, at least one member each of the Chemistry and Physics Department. The student will then have six weeks to prepare and submit his proposal to the committee. During this time, he will be expected to work independently on the proposal, without consulting any member of the committee, including his advisor. Each member of the evaluation committee (except the advisor) will submit a written critique of the proposal to the student (and send a

[Type text]

[Type text]

[Type text]

copy to the advisor) within approximately two weeks after receiving the proposal. The student will then be given an opportunity to modify his proposal and return it to the committee, as required. If the proposal is basically satisfactory, requiring modest revision, the student will be allowed two weeks following its receipt for preparation of the revised proposal; for major revision, three weeks will be allowed. Presentation of a final proposal, which is judged satisfactory by the examining committee, will constitute passage of the written portion of the examination.

b) The **oral portion** of the examination should be scheduled by the student and his advisor through the Graduate School. The Graduate School form is due to the Graduate School 2 weeks prior to the oral exam. The committee should include the three Chemical Physics faculty members (other than the advisor) who evaluated the written proposal (at least one member each of the Chemistry and Physics Department). The content of the oral examination will be directed principally toward the proposal itself and the actual research program planned or in progress by the student but some general chemical physics questions may also be directed to the student. Since most of the more general background material will be available in the written proposal, the student should plan to present a brief, informal (approximately 5 minutes) summary of the proposal and then be prepared to answer questions from the committee related to the proposal, to his own research program, and to chemical physics more generally. Satisfactory performance will result in admission to candidacy for the Ph.D. degree. Failure will result in a second attempt not later than the second quarter following. [NOTE: the Grad School is not providing the outside reader but they are still requiring 4 grad faculty members for the oral exam]

3. **Dissertation.** The principal requirement for the Ph.D. degree is the accomplishment of independent research. Details concerning the Ph.D. dissertation and its oral defense are given in the Graduate School Handbook.



## Chemical Physics Ph.D. Transition Policy

**Students who began their degree under quarters will not be penalized as the university moves to semesters, either in terms of progress towards their degree or their expected timing of graduation. The Chemical Physics Graduate Studies Chair is the advisor for all Ph.D. students upon entry to the program, and remains the students' advisor until they join research groups and prepare for the Candidacy Exam (typically in the second year). At this point the student's research advisor also becomes his/her academic advisor. This support structure will continue under semesters.**

The transition plan for the Ph.D. degree details how students who have completed portions of their required coursework under quarters be able to fulfill their coursework requirements under semesters. Nearly all Chemical Physics Ph.D. students take the core-course multi-quarter sequences during a single academic year, in which case a one-year sequence under quarters will be counted as the corresponding one-year sequence under semesters. However, if a student has taken only one or two quarters of a sequence, then the student will take the second semester of the sequence. If the student has only taken one quarter, individual study will be provided to ensure that he/she is ready to take the second semester. The elective courses are all one-semester courses and they will be substituted on a one-to-one basis for quarter courses to satisfy the elective requirements.

### Sample Plan

#### Year 1 (Quarters)

Autumn	Winter	Spring	Summer
Chem 861	Chem 862	Chem 863	Physics 816
Physics 834	Physics 835	Physics 836	
Physics 821	Physics 846	Physics 847	IOE
	ChemPhys 880		

#### Year 2 (total Hours: 35)

Autumn	Spring	Summer
Chem 7530 (3)	ChemPhys 8880 (3)	ChemPhys 7998 (8)
Chem 7570 (3)	ChemPhys 7998 (8)	Candidacy Exam
ChemPhys 7998 (5)	ChemPhys 8880 (3)	
Chem 8895 (1)	Chem 8895 (1)	

#### Year 3 till completion (total Hours: 9/year)

Autumn	Spring	Summer
ChemPhys 8999 (3)	ChemPhys 8999 (3)	ChemPhys 8999 (3)