Qualifying Examination Guidelines, 2012-13
Department of Chemistry, Rice University

The purpose of the qualifying examination is to establish the extent to which the student has achieved intellectual independence and has demonstrated the research accomplishments appropriate to become a Ph.D. candidate. The examination consists of (1) a written proposal which summarizes research achievements and describes future goals and (2) a public research seminar immediately followed by a closed oral defense in front of a faculty committee.

The written document must be submitted and defended before the end of the fourth semester of residence. In addition to the written and oral exam, the student must also request a letter of recommendation from his / her advisor and ensure that it is sent to all the members of the exam committee. This letter is due at the same time as the written document.

Criteria: The student is evaluated on his / her ability to demonstrate:

1. a mastery of relevant background material, recent literature, and chemical concepts relevant to the described work
2. a clear research plan and understanding of the reasons why the research is being pursued at both a strategic level and day-to-day practical level that is sufficient and realistic for a 5-year Ph.D. (i.e., within the next 3 years)
3. a track record of concrete, scientifically rigorous research achievement
4. the ability to make a clear, concise presentation of scientific information and to verbally answer questions from the committee related to the presented research and to general, fundamental chemical concepts.

Written Document:

The written document is a combination of a research summary and research proposal. The ideal examination document should convey to the reader (1) that the student has identified a scientific problem or subdiscipline for study and has become an expert in this field, (2) that a careful research plan, appropriate for a single graduate career, has been developed that will create significant new scientific knowledge, and (3) that significant progress has already been made such that it appears likely that the student will complete the work necessary for the Ph.D. degree in an appropriate time frame.

Deadlines: Regardless of the student’s oral presentation date, all students defending in the Spring semester are required to submit their written proposal by 5 PM on Monday March 4th (the first day after spring break). Students defending outside of the Spring semester must turn in their proposal at least one week before the scheduled exam date. The text should be received both in electronic and hardcopy by all members of the exam committee. It is the responsibility of the student to make sure the committee has received the document on time. Failure to turn in the written document on time will result in failure of the exam (see below).

Length: The entire document, excluding Supporting Information and References, shall be 3500–7000 words. Supporting information and references may be of any appropriate length and do not count against the above word total. Documents that violate length restrictions will not be accepted.
Format: The document should be prepared in the *J. Am. Chem. Soc.* Template for Articles, which is accessible at [http://pubs.acs.org/page/jacsat/submission/jacsat_templates.html](http://pubs.acs.org/page/jacsat/submission/jacsat_templates.html). Note that there is a word limit rather than a page limit. It’s important to develop expertise with templates, but the close spacing and small font makes it difficult to write comments. Please be willing to generate a version double-spaced in 12-point font on request.

Figures: Figures should be incorporated into the text as near as reasonable to the place where they are first mentioned. IMPORTANT: Figures must be properly referenced (“taken from ...”, “adapted from ...”). Figures not referenced will be assumed to be the sole creative work of the student.

Organization:

**Abstract:** Concise (250 word maximum) summary of proposal goals and justifications.

**Introduction and Background Literature:** Broadly, what are you trying to do and why is it important? What is already known about this topic? What researchers are currently leading the field? What are the major problems or gaps in knowledge in this field? What has your chosen lab already done in this area?

**Specific Aims:** Exactly what are you trying to do? Each of the 2-5 aims should be described concisely in 1-3 sentences.

**Timeline:** Describe the timeline in which the above Aims are expected to be accomplished (can be a graph).

**Research Accomplishments:** Since coming to Rice, what have you (not other people in your lab) accomplished related to this goal? If you have already published or have a manuscript in review, you should indicate that here and what your specific contribution to that work has been. This section should be written as a logical summary of experiments and their ramifications. Key figures, graphs or images which help summarize this work are useful. However, detailed experimental procedures and data should be included in the Supporting Information section sufficient to prove any claims described here. In some circumstances you may have done a significant amount of work on a different project that has not worked out or is not related to the current proposal. Because one goal of the qualifying exam is to assess research achievement, it may be appropriate to discuss work on such projects here, describing the concrete results that led to significantly altering research goals.

**Experimental Strategy:** Specifically, what experiments will be performed to address the Specific Aims? If synthesis is required, are the steps reasonable? What is the mechanism? If an analytical technique is used, how does it work? Can it accomplish what is proposed? Is the instrument available at Rice? Does the order of the experiments make sense? Are there alternative routes to accomplishing your goals if your primary approach fails?

**Expected Outcomes:** Assuming success in the experiments outlined in Experimental Strategy, what will the consequences of your work be? What will you have accomplished?

**References (no word limit):** These should be in a modified *J. Am. Chem. Soc.* format which includes the title of the article for example (please note that journal names should be properly abbreviated, e.g.: *J. Am. Chem. Soc.*, not *Journal of the American Chemical Society*):

Your references should be almost entirely from the primary literature. References to outstanding reviews or textbooks may be appropriate for broad, well known or old concepts. The internet is not typically acceptable. Avoid Wikipedia. **Improper referencing may be construed as plagiarism and result in failure of the qualifying examination and/or expulsion.** The Rice Honor Code, as always, is in effect for this examination.

**Supporting Information (no word limit):** This should include detailed JACS-style experimental procedures for all experiments described both in your Experimental Strategy and in your Research Accomplishments. Any data necessary to prove the results mentioned in Research Accomplishments should be included here. Portions of this section can be taken directly from any manuscripts already written by the student (but still must be properly referenced).

Written documents which do not follow the guidelines described above may be returned for revision before the oral examination takes place or result in failure of the examination (see below).

**Oral Defense:**

The student will present his or her work as a public seminar using a professional-quality presentation. These will be scheduled as part of CHEM 600. The student is responsible for the technical aspects of the presentation (for example the working of the projector and interface with the computer). The presentation should last 25-30 minutes and will be followed by questions from the general audience. Following the public presentation and questioning, the closed portion of the defense will commence with only the members of the student’s committee. The examination may include (but is not limited to): clarification of a point or a request to discuss a point in more detail to ascertain whether the student understands in detail the concepts being presented; speculative questions to force the student to consider new ideas or alternative approaches and to think on his/her feet; and questions addressing fundamental chemical concepts relevant to the described work. The student will be scored independently by each committee member on four questions (see below) from 1–5 with a 5 being the best possible score.

**Possible Outcomes:**

The exam committee has the following options after having reviewed the student’s written and oral proposal and advisor’s letter of recommendation. The decision will typically be made by the committee immediately following the examination, but always within 72 hours.

1) **Pass.** If the average score on each of the four questions is 3 or above, and the committee feels that no revisions, corrections or addendums are needed, the student passes. Nothing further is needed from the student.

2) **Incomplete.** The student neither passes nor fails the qualifying exam. An incomplete denotes a strong performance exhibiting solid achievement, but with one or more areas in which the student's progress towards the thesis could be facilitated by doing something more. A written revision / addition is probably expected. Additional experimental work may also be requested. *The committee chair will describe in writing exactly what is required of the student and the timeline for its completion.* Please see “Exam Revisions” below.
3) **Fail.** The student fails the qualifying exam. This is typically the result of multiple major flaws in scientific reasoning and / or a significant deficiency in research progress. The committee believes that advancement to candidacy is not appropriate in this case, and the student is generally not permitted to retake the exam. The student’s research advisor may petition the full department to allow the student to defend a master’s thesis if s/he believes this is warranted. If the master’s thesis is successfully defended the student may be promoted to Ph.D. candidacy.

**Exam Revisions:**

Within one week of the oral examination, the committee chair will prepare a written analysis of the student’s exam performance, and will provide a copy of this analysis to the student, his/her advisor, and the chair of chemistry graduate studies. If the student scores an incomplete on the examination, this document will clearly indicate what is being asked of the student and provide concrete deadlines for the tasks requested. When corrections or additions to the written document are requested, the student should provide an itemized commentary describing the changes made in response to each point raised by the committee. If the committee has asked for an in person defense of the revision, public or private, any written documents must be turned in one week before the established meeting date. The committee will inform the student if revisions are sufficient within two weeks of receipt of that document. The committee may score the revision as a Pass, Incomplete or Fail. If the student passes, nothing further is needed. If the student is given an incomplete the student’s research advisor may choose to allow the student to defend a master’s thesis is s/he believes this is warranted. If not, the student must leave the chemistry program. If the committee scores the revision as a fail the student’s research advisor may petition the full department to allow the student to defend a master’s thesis. If the master’s thesis is successfully defended the student may be promoted to Ph.D. candidacy.

**Questions and Scoring:**

The committee member will evaluate the student’s performance in each category on a 1-5 scale as below.

5 - Performance quality (not necessarily quantity) consistent with that of a very good PhD defense.  
4 - Performance quality (not necessarily quantity) would be adequate, but not exceptional, at a PhD defense.  
3 - Performance is that expected for a Ph.D. candidate. Achievement/knowledge is beyond that expected of a first-year graduate student or undergrad (i.e. in terms of accomplishments, significantly more work is presented than that expected of an undergrad during a school year or REU session).  
2 - First-year graduate student level knowledge/achievement  
1 - Clear deficiencies

To pass each category, students must average a 3 from their committee members. A mean below 3 in any category equates to not passing the qualifying exam. Only that deficient category need be readdressed to pass a second effort. A low score in the research progress section may indicate the presenter should go back to the lab for several months before a re-examination.
1. Mastery of Scientific Concepts:

( ) Did the student demonstrate a mastery of relevant background material, recent literature, and chemical concepts relevant to the described work?

Comments:

2. Research Progress:

( ) Has the student demonstrated a track record of concrete, scientifically rigorous research achievement? To pass this category, a student must present results that are well supported by rigorous data appropriate for someone who has completed a quarter or more of the expected time to the Ph.D. degree. In most chemical disciplines, this would require a substantial progress towards a publishable manuscript, such as proving or disproving a hypothesis, establishing an appropriate mass of sufficiently interesting facts, or developing an instrument, method, or approach with unambiguous value.

Comments:
3. Proposed Work:

(   ) Did the student present—through both written and oral communication—a well thought out and scientifically significant proposal for future work, and did the student present a sensible research plan to carry out this plan?

Comments:

4. Presentation/Communication:

(   ) Did the student able make a clear, concise presentation of scientific information (written and oral) and to answer questions from the committee? The written document should be to the standards of a submission to a peer reviewed journal such as J. Am. Chem. Soc. The oral presentation should be of the quality necessary for a national meeting such as the ACS.

Comments: