

Candidacy Examination Guidelines for Chemistry and Biochemistry Ph.D. Students

The following document provides guidelines for preparing a candidacy proposal and instructions for the oral examination before your candidacy committee. Make sure your candidacy committee has been approved before beginning the candidacy process. Committee nomination forms and instructions can be found in the Departmental Graduate Office.

Candidacy Examination Guidelines for Chemistry and Biochemistry Ph.D. Students

The candidacy exam is designed to help you develop the critical written and oral skills necessary to become a successful Ph.D. scientist. The exam also enables your faculty advisory committee to assess your research progress and potential. The Ph.D. candidacy exam consists of two parts, a written document and an oral defense. The document consists of a discussion of results obtained to date and a proposal for future research. The oral exam involves a brief presentation of your ongoing and proposed research, followed by questions from your committee. These questions will focus on your research project, but may also include general questions designed to gauge your proficiency in a related areas.

The major objectives for the candidacy exam are: 1) to determine whether you can communicate to your committee that your research is important and you understand the objectives and implications; 2) to determine whether you have chosen a research plan that is likely to return results in a reasonable time; and 3) to determine whether you have the background and understanding necessary to carry out the proposed research.

To be advanced to candidacy for the chemistry and biochemistry Ph.D., you must:

- Prepare a document ("the candidacy paper"), in your own words, that describes progress and plans for doctoral research.
- Undergo an oral examination, in which you defend the proposed doctoral research and you demonstrate adequate preparation to conduct the proposed research.

The students advisor will set the date for the candidacy exam. However, the candidacy exam must be completed within the first month of the student's 5th semester of study.

Instructions for the candidacy paper. The following sections are to be included in the candidacy paper but do not have to appear in the order listed below.

1. Content Guidelines. The paper must include:

A. **Cover Page** that contains:

- Title of the Proposed Research
- Candidate's Name
- Abstract of Proposed Research (200 word limit)
- Date and Location of Oral Examination
- A list of all previous academic degrees including the awarding institutions and dates.
- A signed certification line acknowledging adherence the University's honor pledge.

A sample title page is given at the end of this document.

B. **Introduction** that:

- States the specific aims and significance of the proposed research
- Provides a context for the proposed research by providing important background information, key references, and introduces new terminology and/or equations.

Note: The Introduction should not be a comprehensive literature survey, but should only provide the essential background for the project.

C. **A Research Plan** that includes:

- A presentation of key experiments and/or computations to be executed
- A description of the specific system(s) to be investigated
- A description of specialized apparatus or methods necessary for the proposed research
- A plan for the interpretation of results

D. **Preliminary Results** Describes the current status of the research project.

Varies with field, but includes:

- A summary of experiments or computations that have been conducted to date.
- The status of any new research apparatus, protocols, or codes that you have developed.
- Figures and/or tables that summarize important findings.

E. **Conclusion**. This includes:

- A summary of any key research results obtained to date.
- A summary of the proposed research and its feasibility.

- An expected timeline for the proposed research.

F. **Supplemental Information**— This section should describe protocols for experiments and/or computations that led to preliminary results described in Part C. Includes synthetic methods, materials preparation, characterization methods and other physical methods used. See the journal web sites listed in section 4 for proper formats.

This section should specifically include:

- Descriptions of experiments in sufficient detail that another Ph.D. student could repeat your experiments.
- All new materials should be adequately characterized. For any new compounds, you should provide the data (NMR, MS, etc.) that you used to characterize that compound. For known compounds, you should supply a reference to where it has been previously characterized, along with the key data that allowed you to verify that you had successfully prepared the known material (melting point, NMR, etc.).

G. **References.**

References should be formatted according to the guidelines of the journal that you are using as guide to write the candidacy exam (see section 4 below for more details). You are strongly encouraged to format references with Endnote or similar software. The reference library that you construct in Endnote will facilitate writing future research publications and your Ph.D. dissertation.

2. *Length Guidelines.*

- The body of the candidacy paper (Sections B-E) must not exceed 20 pages, double-spaced.
- There is no length restriction for Sections F-G.

3. *Submission Guidelines.*

- A copy of the written candidacy document must be supplied to each member of the examination committee at least 10 days prior to the scheduled examination.

4. *Style Guidelines.* The paper should follow the formatting guidelines used in a reputable journal in the chosen area, such as the *Journal of the American Chemical Society* (ACS format), the *Journal of Chemical Physics* (AIP format) or the *Journal of Molecular Biology*. Consult with your advisor for the appropriate journal selection. You will find it helpful to use papers from the chosen journal as a model for your paper. Details on formatting can be found in the journal and at:

<http://pubs.acs.org/instruct/jacsat.pdf> (Guidelines for authors page for ACS journals, including JACS, Biochemistry, Analytical Chemistry, and J. Phys. Chem.)

<http://www.aip.org/pubservs/style/4thed/toc.html> (Style Manual for AIP journals, including the Journal of Chemical Physics, Physical Reviews)

<http://www.academicpress.com/www/journal/mb/mbifa.htm> - style (Journal of Molecular Biology)

Note: Style guidelines include format specifications for double-spaced typing (typical, 12 point Times, Helvetica or similar), 1" margins, figures and captions, tables and references.

5. *Integrity Guidelines.*

- While preparing the candidacy paper, you are strongly encouraged to discuss the document's content and structure with your advisor and other knowledgeable individuals. The actual writing of the candidacy paper, however, must be done by you alone.
- You are strongly encouraged to ask your advisor and other knowledgeable individuals to proof-read and critique your document prior to submission to your examination committee. However, any modifications to the candidacy paper must be written by you alone.

Guidelines for the oral examination:

1. *Overview of Research.*

You should present a short (5-20 minute) overview of your research, using approximately 4-8 overhead transparencies. The student should consult with their advisor for appropriate presentation content and length. The overview should include:

- i. Introduction to the Research Problem
- ii. Motivation for the Proposed Research
- iii. Key Results or Progress
- iv. Future Research Plans.

2. *The Oral Examination.*

Following your presentation, your committee will ask you questions about the paper and any general issues or concepts that relate to your project. Your committee will ask you questions about what you have already done and what you plan to do. You are expected to demonstrate a sound grasp of both the practical and theoretical aspects of your research project. It is important that you demonstrate to your committee that you understand why you are involved in your specific research and how you plan to successfully carry out your research.

Note: As a preparation for the examination, you should review your field of chemistry at the advanced undergraduate and graduate level so that you can demonstrate adequate preparation for doctoral research.

Note: You may also be asked general questions on work from other labs that is related to your project. Read the relevant literature for preparation.

3. The research advisor's role during the oral exam.

Your research advisor has neither voice nor vote in the candidacy exam, but your advisor will be present to provide information when requested from the candidacy chair.

4. The candidacy chair.

The chair of the candidacy committee will be a member of the committee nominated by the research advisor and appointed by the Associate Chair for Graduate Studies. The student's research advisor cannot serve as the candidacy chair. It is the candidacy chair's responsibility to run the examination, moderate discussion and questioning, assure fairness, and act as an advocate for the student.

5. Feedback.

You may or may not receive written comments on the candidacy paper from the members of the candidacy committee. However, you are strongly encouraged to meet with your advisor and the other committee members after the oral exam to get feedback regarding the paper and the defense.

Soft Chemical Synthesis of New Transition Metal Pnictide Materials

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Abstract

Background information is presented describing the importance of transition metal pnictide materials in regards to synthesis and properties as well as a description of pertinent soft chemical methods. Preliminary results involving anion metathesis reactions between $ZrNCl$ and A_2S ($A = Na, K, Rb$) to give two new zirconium nitride sulfide polymorphs are presented. $ZrNCl$ reacts with A_2S at $800^\circ C/48hr/in\ vacuo$ yielding a - Zr_2N_2S (P-3m1; $a = 3.605(1)$, $c = 6.421(3)$ Å) with the expected La_2O_2S structure. Above $850^\circ C$, b - Zr_2N_2S (P63mmc; $a = 3.602(1)$, $c = 12.871(1)$ Å) is formed which differs from the a form by an $a/2$ shift of the Zr_2N_2 layers. $ZrNCl$ reacts with excess A_2S at $400-1000^\circ C$ giving an alkali sulfide excess phase $A_2xZr_2N_2S_{1+x}$ (for $x = 0.5$, R-3m; $a = 3.6359(1)$, $c =$

29.4820(6) Å) where the alkali ions reside in octahedral holes between the S...S van der Waals gap. A hygroscopic alkali chloride excess phase $A_xZr_2N_2SCl_x$ (R-3m; $a \sim 3.6$ Å, $c \sim 28.4$ Å (Na), 28.9 Å (K) 30.5 Å (Rb) is obtained when $ZrNCl$ reacts with stoichiometric or excess amounts of A_2S , where alkali ions reside between the S/Cl layers and the c lattice parameters are alkali dependant. Proposed research plans are provided including further exploration of anion metathesis to give organic/inorganic hybrids and mixed layer pnictide/oxide materials.

**Oral Examination — Tuesday, September 24, 2002 — Room 3103 B.S.
Chemistry — Penn State Erie, The Behrend College, Dec. 1999**

I adhere to the University of Maryland honor pledge in its entirety.