

Qualifying Exam Guidelines

For Students in the Department of Chemistry

List of Revisions:

March 2022, March 2018, November 2015, April 2009, March 2003

Overview

Timing

PhD students must complete the qualifying exam **within 12 months** of starting their graduate program. Most students will therefore take the exam in **April of their first year** of study; this leaves enough time for a second attempt in August if the first one is unsuccessful.

MSc students who are transferring to the PhD program will take the qualifying exam as part of the transfer process. MSc students are eligible to transfer to the PhD program **in their second year** of study.

Format

There are three components to the qualifying exam: a **report**, a **presentation**, and a **question period**.

Report	Presentation	Question Period
<ul style="list-style-type: none"> • A research proposal for your PhD thesis • Describes your proposed research and summarizes progress to date • 2,500 - 5,000 words total (not including references) 	<ul style="list-style-type: none"> • A presentation that describes your proposed research and summarizes progress to date • Open to everyone, but the primary audience is your examining committee • 25 - 30 min 	<ul style="list-style-type: none"> • Two rounds of questions • Questions typically relate to your proposed work and/or chemistry fundamentals • Approx. 60 - 120 min

Figure 1. Components of the qualifying examination.

Writing the Report

Deadlines

At least 60 days before the exam, the graduate program coordinator will e-mail you an approximate deadline for your report. Your exam date is then finalized, and your report is due **two weeks before your exam**. As soon as your exam has been scheduled, the graduate program coordinator will let you know both the date and time for your exam and the exact due date of your report.

Although your report should be **written in your own words**, your supervisor can help you clarify the main goals of your work, organize your thoughts, and point you toward key literature. Your supervisor can provide constructive feedback on your report. Talk to your supervisor early and often about your qualifying exam!

Length and Format

The report should be **2500 – 5000 words** in total, not counting references, tables, figures, schemes, or equations. It should adhere to the following general formatting guidelines:

- Main text should be in 12 point, Times New Roman font and double spaced.
- Pages should be 8 ½” × 11” (letter size) with minimum margins of ¾”.
- All pages should be numbered in the bottom-right corner.
- Citations and references should be in *Journal of the American Chemical Society* format; references should include titles.
- Use the following headlines:
Introduction, Research Goals, Experimental Plan, Initial Results, Appendix (optional),
References

Introduction

Introduce your topic and its importance. What is known about your topic? What are the unanswered questions or unmet challenges? How have other researchers approached similar problems? Be sure to cite and discuss the relevant literature.

Introductions vary in length, but a typical introduction might fall in the range of **750 – 2000 words**. Ultimately, your committee wants to see that you have done the background reading on your topic, that you understand the field, and that you can place your own work into context.

Research Goals

Clearly and concisely state the overall (long-term) goals of your PhD research and describe shorter-term objectives. For each project that you propose, consider framing it in terms of a **research question** and a **hypothesis**:

“Project 1. Old-fashioned vs. Jam-filled Doughnuts. In this project, I will determine whether chemistry students prefer old-fashioned or jam-filled doughnuts. My hypothesis is that there will be a preference for jam-filled doughnuts.”

In this example, there is a question and hypothesis and it is clear what the research is trying to achieve.

Experimental Plan

What experiments will you do to carry out your project? How will you test your hypothesis? Your committee is not so concerned with small details, but they do want to see a clear plan. Think about a flow chart for your project – what are the key experiments you need to do, and what order will you do them in?

Initial Results

Hopefully you will have at least started your work and have some preliminary data to share. What experiments have you done, what were the results, and what is their significance? What will you do next?

If you have lengthy experimental details to report (e.g., synthetic procedures and characterization data for new compounds), put them in an appendix rather than including them in the main text.

Presentation

At the start of the exam, you will give a **25 – 30 min presentation** summarizing your research proposal and initial results.

Your presentation should introduce your research topic, communicate your research goals (including research questions and hypotheses), and briefly describe your experimental plan and initial results. You won't have time to go through everything in detail but remember that your committee has already read your report. Summarize, using carefully selected examples to highlight your points.

Your presentation is open to the entire department, but your primary audience will be your examining committee.

Question Period

Two rounds of questions follow immediately after the presentation. Each member of your examining committee is given the opportunity to ask questions, followed by other faculty and students who may be present. The first round is open to everyone, after which students in the audience are asked to leave; only your committee and faculty are present in round two. The length of the question period is variable, but **typically runs 60 – 120 min.**

Examining Committee

The composition of your examining committee will depend on whether you are a PhD student or a MSc student transferring to the PhD program. In both cases, it consists of your regular advisory committee (AC) plus 2-3 extra examiners.

PhD Students	MSc → PhD Transfers
<ul style="list-style-type: none"> • AC Member 1 • Cognate Member • Examiner 1 • Examiner 2 • Supervisor 	<ul style="list-style-type: none"> • AC Member 1 • Examiner 1 • Examiner 2 • Examiner 3 • Supervisor

Figure 2. Composition of the examining committee for the qualifying exam.

Your committee will also have a chair who will oversee the running of the exam; it may be one of the extra examiners, or an additional committee member may be added to serve as the chair. Neither AC members nor your supervisor should be the chair.

Question Topics

The purpose of the qualifying exam is to establish that you have a clearly defined research project, a good understanding of that project, and enough chemistry knowledge to complete the project in a timely way. As such, you can expect questions to be related to your project, but to also test chemistry fundamentals. Consider some examples:

- For the reaction on slide 5, do you expect ΔH to be positive or negative? ΔS ? How does that relate to ΔG ? Is the reaction spontaneous or non-spontaneous?
- You plan to do a lot of FT-IR. How does a FT-IR spectrometer work?
- In Scheme 3, you propose to do a Sandmeyer reaction. Please draw the reaction mechanism.
- Compound 7 is an octahedral metal complex. What d -orbital splitting you would predict for this compound?

In all these examples, the questions may be related to your work, but they probe fundamental concepts of physical, analytical, organic, and inorganic chemistry.

Evaluation

Exam Components

There are three distinct components of the exam: the **report**, **presentation**, and **question period**. Each is evaluated separately as either pass or fail. To pass the exam, all three components must be deemed satisfactory.

Decision Making

All faculty will be invited to submit written comments on the report to the chair of the examining committee; comments should be received prior to the presentation. At the end of the question period, the examining committee will meet to determine the outcome. A report on this meeting (prepared by the chair of the examining committee) will be circulated to both the committee and the student by the graduate program coordinator.

Possible Outcomes

- **Pass.** The committee believes that all components of the exam were satisfactory.
- **Deferred decision.** A student may be asked to correct a **limited number of specific deficiencies** in at most **one exam component**. The final decision is deferred while the student makes the necessary corrections. The exam is generally resumed **within two weeks**, at which time a final decision is reached.
- **Fail.** The committee believes that there were **significant deficiencies** in one or more exam components.

For PhD students: A failed examination may be repeated once, with the permission of the Dean of the CGPS (which is almost always granted). A second failure will result in the student being required to discontinue from the program. This failure may be appealed to the PhD Committee of the CGPS on substantive or procedural grounds.

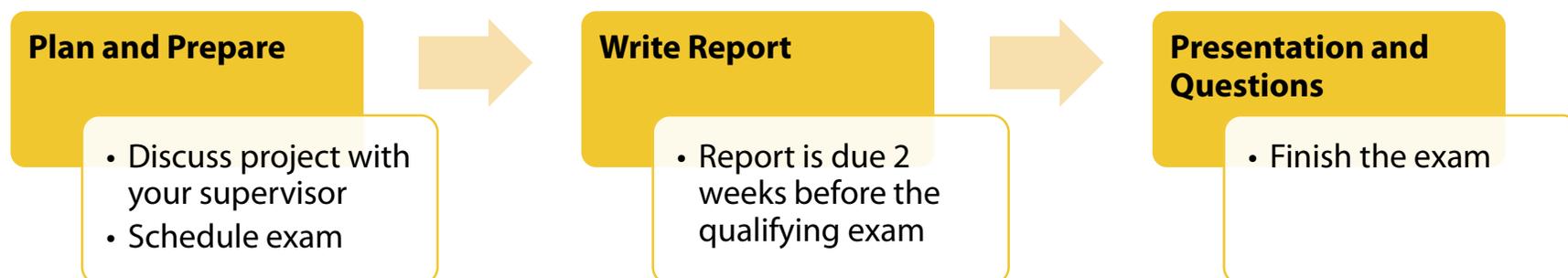
For MSc → PhD transfers: A failed examination may not be repeated. The student would need to first complete the MSc program and then submit a new application to the PhD program.

Qualifying Exam – Quick Reference

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Timelines



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MSc → PhD transfers should complete the qualifying exam **in the second year** of their program.