# Thesis Guidelines

*For Students in the Department of Chemistry*

*List of Revisions:*

*March 2023, 2018*

# Overview

## Timing

There are three main stages in writing your thesis: (i) seeking permission to write; (ii) writing and submitting; and (iii) revising the thesis after your defence.

| Permission to Write | Writing and Submitting | Revisions |
|---|---|---|
| • Typically sought after your departmental seminar and once the majority of your experimental work is complete<br>• Your advisory committee (AC) has up to **2 weeks** to approve | • Write a thesis!<br>• Once you submit, your AC has up to **2 weeks** to approve it for release to CGPS<br>• CGPS then requires the thesis a minimum of **2 weeks** (MSc) / **5 weeks** (PhD) before a defence can be scheduled | • After your defence, the examining committee may request revisions<br>• Most commonly, these can be completed within **2 weeks**<br>• Your program is complete once a revised thesis has been uploaded to HARVEST |

**Figure 1.** The three stages of writing and submitting your thesis.

In a hurry to graduate? The whole approval / scheduling / revision process could take as long as **11 weeks** (2 + 2 + 5 + 2)! Plan ahead and seek permission to write as soon as you are ready.

# Permission to Write

## When to Seek Permission to Write

You should seek permission to write from your advisory committee after your departmental seminar (for PhD students) and once you've completed the majority of your experimental work. If you're in the final year of your program, talk to your supervisor about the best time to apply. Remember that it can take up to two weeks for your AC to approve your request, so don't leave it until the last minute!

To apply for permission to write, e-mail the graduate program coordinator (chem.grad.program@usask.ca) with the following:

- ❑ Title and abstract

  Choice of traditional vs. manuscript-style thesis (choose *one*):

  - ❑ Traditional thesis
  - ❑ Manuscript-style thesis

- ❑ Thesis outline
- ❑ A completed version of this checklist (found on the last page of this document)

Additionally, for manuscript-style theses:

- ❑ A list of manuscripts that will be included in the thesis
- ❑ A description of your contribution to the research and writing of each manuscript

## Title

The title of your thesis. The best titles are short, specific, and descriptive.

## Abstract

The abstract should clearly and succinctly identify the purpose of the research, the methods used, the results obtained, and their significance. Your abstract should conform to CGPS policies on length. As of Jan. 2023, the maximum length of the abstract was 350 words.

## Traditional vs. Manuscript Style

One important decision that you'll need to make is whether you plan to write a *traditional* or a *manuscript-style* thesis. Your choice needs to be approved by your advisory committee, so make the decision in close consultation with your supervisor.

**Traditional.** In a traditional thesis, the *Introduction*, *Methods*, *Results and Discussion*, *Conclusions*, and *References* sections are typically presented in separate chapters. You may have lots of results spanning multiple projects and multiple papers, but they share common *Introduction*, *Methods*, *Conclusions*, and *References* chapters.

**Manuscript-style.** In a manuscript-style thesis, each body chapter is presented as a self-contained manuscript, complete with its own separate *Introduction*, *Methods*, *Results and Discussion*, *Conclusions*, and *References* sections. These body chapters will likely be very similar (although not identical) to your published (or soon-to-be published) papers. The individual manuscripts are then tied together into a

cohesive document by way of an overarching *Introduction* chapter and a final *Conclusions* chapter, as well as by short transition sections at the start and/or end of each manuscript.

| Traditional | Manuscript-Style |
|---|---|
| • Ch. 1 - Introduction | • Ch. 1 - Introduction |
| • Ch. 2 - Methods | • Ch. 2 - Manuscript 1 |
| • Ch. 3 - Results & Discussion | • Ch. 3 - Manuscript 2 |
| • Ch. 4 - Conclusions | • Ch. 4 - Manuscript 3 |
| • Ch. 5 - References | • Ch. 5 - Conclusions |

**Figure 2.** Comparison of a traditional vs. manuscript-style thesis.

## Thesis Outline

You should include a detailed outline of your thesis. In addition to chapter titles and high-level section headings, you should include a short description (1-2 sentences) of what will be discussed in each section and/or chapter. Make the outline detailed enough that your AC can tell what background material will be covered, the purpose and objectives of your research, what results will be included, where your experimental and/or theoretical methods will be described, and how the work fits together as a cohesive thesis.

Having a good outline can help a lot with the writing process. Discuss the outline with your supervisor and make sure that it is both detailed and complete.

## List of Manuscripts (for a manuscript-style thesis)

If you are planning to write a manuscript-style thesis, include the full citation of each paper to be included. Be sure to include co-authors, the title, and the journal, year, volume, and page range. If the work has not yet been published, indicate the publication status (in revision, submitted, or in preparation).

**Which manuscripts can I include in my thesis?**

For a manuscript to be included in your thesis, you need to have made a **significant and substantial contribution** to the work. Papers where you performed only a limited number of experiments or were only peripherally involved in the data analysis should not be included. If you have any questions about whether to include a particular manuscript, talk to your supervisor.

## Contributions to Research and Writing (for a manuscript-style thesis)

For each manuscript in your list, briefly describe your role (and that of your co-authors) in carrying out the research and writing the manuscript.

Pumpkinhead, P.; Unicorn, S. L.; Xavier, C.; Doughnut preferences in chemistry students at mid-sized Canadian universities: old-fashioned vs. jam-filled. *J. Can. Doughnut,* **2023**, *11*, 1257-1261.

*In this paper, I was responsible for carrying out all the experimental work and theoretical modeling, except for the density functional theory calculations (which were performed by Dr. Spark L. Unicorn). I wrote the first draft of the manuscript, which was revised by Prof. Charles Xavier prior to submission.*

The co-authors of your manuscripts must agree with your description of the research contributions. It is your responsibility to come to an agreement with your co-authors before requesting permission to write.

## Writing the Thesis

Once your request for permission to write has been granted, it's time to start writing your thesis! The first thing you should do is read through the CGPS guidelines on thesis writing; these describe the various sections that are required in a thesis, as well as specific formatting requirements (https://cgps.usask.ca/onboarding/thesis-roadmap/drafting.php).

In general, there is a lot of flexibility in the style and format of a thesis. You should talk with your supervisor about their preferences, past practice in your research group, and the norms in your field.

## Writing a Traditional Thesis

A traditional thesis follows a fairly standard format, typically consisting of one or more *Introduction* chapters, a description of the experimental or theoretical *Methods*, your *Results and Discussion*, *Conclusions*, and *References*. Optionally, an *Appendix* may be used for supplementary data. The number of chapters, their titles, and their order within your thesis may be different what is described here, but the same basic components will be present in every thesis.

### Introduction

Your introduction serves three main purposes: (i) reviewing the relevant literature; (ii) teaching the reader about specialized topics or techniques relevant to the thesis; and, (iii) stating the overall goals and objectives of the thesis.

### Methods

Your thesis must include a complete description of your experimental and/or theoretical methods; the description should be detailed enough to allow another researcher to reproduce your results.

### Results and Discussion

This is the place to discuss your hard-earned research results! If you are including multiple different projects, you might find it helpful to organize them into either separate chapters or distinct sections within the same chapter.

### Conclusions

Think back to the overall goals and objectives from your *Introduction*. Did you meet those objectives? What are your overall conclusions? Many years have passed since you first started your project; how has the field evolved since then? How did your work contribute to that evolution? What is the outlook for your field – where is it going, and what are the next big challenges? Finally, consider future work; what would be the next logical progression for your project?

### References

This is your list of references. Be sure to check that your citations are both complete and formatted consistently. As an alternative to putting all of your references into a single *References* chapter, you can have a reference list at the end of each chapter, with the references in each chapter being numbered separately. Whichever approach you choose, be consistent – do not mix the two styles.

### Appendix

In general, all of the data for your thesis should be included in the relevant *Results and Discussion* or *Methods* sections. But occasionally, you may find yourself with pages upon pages of raw data. Although the data needs to be reported, it is not discussed in the thesis and would detract from its readability if it were included in the main text. In this case, talk to your supervisor about whether you should include an Appendix and how to format it.

## Writing a Manuscript-Style Thesis

In a manuscript-style thesis, each body chapter is written in the style of a journal article, with its own *Introduction*, *Methods*, *Results and Discussion*, *Conclusions*, and *References* sections. If your research has already been published, then the body chapters will likely be very similar to your published papers; however, they will still need to be modified to fit into your thesis. You will also need to write separate *Introduction* and *Conclusions* chapters. The suggestions below, as well as the specific guidelines from CGPS regarding manuscript-style theses (https://cgps.usask.ca/onboarding/blueprint/sub/manuscript-style-theses-and-dissertations.php), will help you effectively write in manuscript style.

### Introduction

A manuscript-style thesis requires a separate *Introduction* chapter. As with a traditional thesis, the introduction serves three main purposes: (i) reviewing the relevant literature; (ii) teaching the reader about specialized topics or techniques relevant to the thesis; and, (iii) stating the overall goals and objectives of the thesis. Pay particular attention to the description of your overall goals and objectives! *You need to show how each of your manuscripts is connected to the common goals of your thesis;* link them together by common themes and show how they are all part of a cohesive thesis, not just a bunch of papers.

### Body Chapters

**Citation.** At the start of each body chapter (immediately after the chapter number and title), you should include a complete citation for the manuscript, including recognition of the copyright holder. If the work has not yet been published, include the publication status (in revision, submitted, or in preparation).

> Reprinted with permission from Pumpkinhead, P.; Unicorn, S. L.; Xavier, C.; Doughnut preferences in chemistry students at mid-sized Canadian universities: old-fashioned vs. jam-filled. *J. Can. Doughnut,* **2023***, 11*, 1257-1261. Copyright 2023 Canadian Doughnut Society.

**Copyright.** If your work has been previously published, you likely transferred the copyright to the publisher as part of the publishing process. You will need to secure copyright permission to include the work in your thesis. For most journals, this is relatively easy; typically there is a "*Rights and Permissions*" button on the website for each article that explains the process.

**Co-authorship Statement.** Following the citation, you should include a co-authorship statement that describes your contributions (and those of your co-authors) to the work and the writing of the manuscript. You should have already written these statements as part of your request for *Permission to Write.*

> *In this paper, I was responsible for carrying out all the experimental work and theoretical modeling, except for the density functional theory calculations (which were performed by Dr. Spark L. Unicorn). I wrote the first draft of the manuscript, which was revised by Prof. Charles Xavier prior to submission.*

**Transition.** A typical manuscript starts with its own introduction; this would make for an abrupt transition from the rest of the thesis. You will need to write a short transition section (1-2 paragraphs) that introduces the manuscript and shows its connection to the rest of the thesis.

> *This thesis explores the taste preferences of chemistry graduate students, with an emphasis on baked goods. The previous chapter examined the question of whether students preferred chocolate chip or oatmeal raisin cookies; however, previous work has shown that doughnuts are often a preferred snack. In this chapter, I aim to answer the question of whether students prefer old-fashioned or jam-filled doughnuts …*

**Manuscript.** The transition section is followed by the main text of your manuscript; however, you will need to adapt your manuscript somewhat to make it suitable for your thesis. In particular, you will need to address the following issues:

- The manuscript should match the formatting (font, line spacing, page numbers) of the rest of the thesis.
- Figures, tables, schemes and charts should all be renumbered for the thesis (e.g., Figure 2 might become Figure 3.2); each figure number in your thesis should be unique.
- Compound numbers should be similarly renumbered; every compound number should be unique.
- Figures should be redrawn such that they have consistent formatting (fonts, line widths, sizing) throughout the thesis.
- Supporting (or Supplementary) Information from your manuscript should be incorporated into the main text of your thesis chapter; this may require the additional text to better explain or discuss the data. Any data not included in the main text should be included as an *Appendix*.

### Conclusions

*This is not just a summary of your conclusions from each manuscript*! You should not just restate your earlier conclusions. Instead, think about the bigger picture; how do the individual chapters relate to each other, and how do they relate to the research field as a whole?

Think back to the overall goals and objectives from your *Introduction*. Did you meet those objectives? What are your overall conclusions? Now that you've finished the study, is your analytical method / synthetic methodology / target molecule / etc. as promising as you'd first hoped, or does it have significant drawbacks or limitations?

Place your work in context. Your *Introduction* might have dealt with the state of the field when you started your project, but many years have since passed. How has the field evolved since then? How did each of your manuscripts contribute to that evolution? What is the outlook for your field – where is it going, and what are the next big challenges? Finally, consider future work; what would be the next logical progression for your project?

### References

You may give each chapter its own self-contained *References* section, or you may have one common *References* chapter for the entire manuscript. Both are acceptable, but do not mix the two approaches.

## Revising

After your defence, your external examiner and/or the other committee members may suggest revisions to your thesis. Often, committee members will provide you with an annotated copy of your thesis with their suggestions. Discuss the proposed changes with your supervisor and revise your thesis in light of your committee's suggestions. Typically, your supervisor is the last person to sign off on your thesis; have your supervisor approve the revisions and notify the graduate program coordinator (chem.grad.program@usask.ca). You will then receive a link for you to upload your revised thesis to HARVEST, the USask institutional repository. Once the upload is done, your graduate program is officially complete.

Outcomes other than Recommendation 1 or 2 will have different processes. Check with your supervisor whether any additional steps are required as part of the revision process.

# Thesis Guidelines – Quick Reference and Checklist

## Checklist

- ❑ Title and abstract

  Choice of traditional vs. manuscript-style thesis (choose *one*):

  - ❑ Traditional thesis
  - ❑ Manuscript-style thesis

- ❑ Thesis outline
- ❑ A completed version of this checklist (found on the last page of this document)

Additionally, for manuscript-style theses:

- ❑ A list of manuscripts that will be included in the thesis
- ❑ A description of your contribution to the research and writing of each manuscript

## Timelines

### Request Permission to Write

- Submit application to Graduate Program Coordinator
- Takes up to **2 weeks** for approval

### Write and Submit Thesis

- Submit thesis to Graduate Program Coordinator
- AC has up to **2 weeks** to approve it for defence
- Once approved, it is sent to CGPS

### Schedule Defence

- CGPS needs to have the thesis for a **minimum of either 2 weeks (MSc) or 5 weeks (PhD)** before a defence can be scheduled

### Revise and Upload Thesis

- After the defence, make necessary revisions
- Upload to institutional repository (HARVEST)

*It can take anywhere from 5 – 11 weeks to go from seeking permission to write to uploading final revisions. Plan ahead and schedule carefully!*