

## CHEMISTRY SECOND-YEAR EXAMINATION REQUIREMENTS

All students in the Chemistry Ph.D. Program are required to pass a 2<sup>nd</sup>-Year Examination to remain in Good Academic Standing. This exam evaluates **your current research competency** and ensures you are on track with a project. The outcome is not recorded on your transcript.

### **Exam Components** (see subsequent pages for detailed guidelines)

- Research Summary Written Report: summary of your research project
- Literature Review: review a current research paper and suggest future directions
- Oral exam covering both Research Summary and Lit Review components
- Review your Individual Development Plan (IDP) with your committee

### **Possible Outcomes**

- Pass: proceed with research
- Conditional pass: committee identified areas of concern and specific tasks to complete
- Retake: repeat exam before end of spring quarter – only one retake attempt is permitted

### **Evaluation Criteria**

- Demonstrate knowledge/skills appropriate for your subfield of chemistry and your project
- Formulate research questions, explain broader significance, describe alternative plans
- Clear written/oral presentation and ability to answer questions
- This exam is an assessment of whether you are on track to eventually complete a Ph.D. project. To pass this exam, you need to be able to describe a well-defined project that you have started or plan to start in the next year. You need to have accomplished some type of graduate research (whether on that project or not) to demonstrate research proficiency. Obtaining publishable results is not required.
- See detailed evaluation rubric attached (last page)

### **Exam Process**

- This exam should be completed by the end of **winter quarter of your 2<sup>nd</sup> year**. This deadline ensures that you have time to satisfy any conditions or retake the exam by the end of spring quarter.
- Your exam committee will include three faculty who must be members of the Chemistry department. Your advisor does not serve on the exam committee.

### **Oral Exam Format**

- At the oral portion you will present both your Research Summary and Lit Review. The only people in the room during the exam will be you and your committee.
- The total time for the exam, including talks and questions, is **2 hours**. Please plan accordingly.
- Research Summary: 60 minutes total (~30 minute presentation, ~30 minutes for questions)
- Lit Review: 30 minutes total (~10 minute presentation, ~20 minutes for questions)
- IDP review: 5-10 min at end of exam. See below for guidelines.
- At the end of the exam, you will be asked to leave the room so the committee can discuss whether you have met the evaluation criteria. Your committee will also discuss a short performance assessment provided by your advisor and your graded coursework record. The committee will complete a "Second-Year Exam Progress Report" to record the exam outcome and provide detailed written feedback.

### **Questions? Contact:**

- Jesse Zalatan [zalatan@uw.edu](mailto:zalatan@uw.edu), Ph.D. Training Committee Chair
- Christine Gormley [chmgprog@uw.edu](mailto:chmgprog@uw.edu), Graduate Program Coordinator

### Preparing for the Exam

- Enroll in CHEM 581 in each quarter of your 2<sup>nd</sup> year until you complete the exam. If you pass in winter quarter, you do not need to enroll in CHEM 581 for spring quarter.
- Attend the info session led by the Ph.D. Training Committee and the GPC in Oct/Nov for a discussion about preparing for the exam.
- Consult your research advisor, other faculty, and other graduate students for feedback on research plans and your literature review topic. Your advisor should not edit your written documents. You are encouraged to get editing help from other graduate students and/or from resources like the UW Writing Center ([www.lib.washington.edu/ougl/owrc](http://www.lib.washington.edu/ougl/owrc)).
- For the oral presentation, any combination of slides or a chalk talk is allowed. See detailed guidelines below.
- Complete an individual development plan (IDP) and review with your research advisor in autumn quarter of your 2<sup>nd</sup> year. It is your responsibility to complete your component of the IDP and schedule a meeting with your advisor to review both the advisee and advisor sections. Your IDP is incomplete if you have not reviewed it with your advisor before the exam.

### Exam Materials

- Your written Research Summary and Literature Review should be delivered to the committee at least **one week before the oral exam**. Include the exam date/time/location on the first page.
- Ask your committee members if they would prefer to receive a hard copy. Electronic copies are usually sufficient.

### Procedure following a Conditional Pass or Retake evaluation

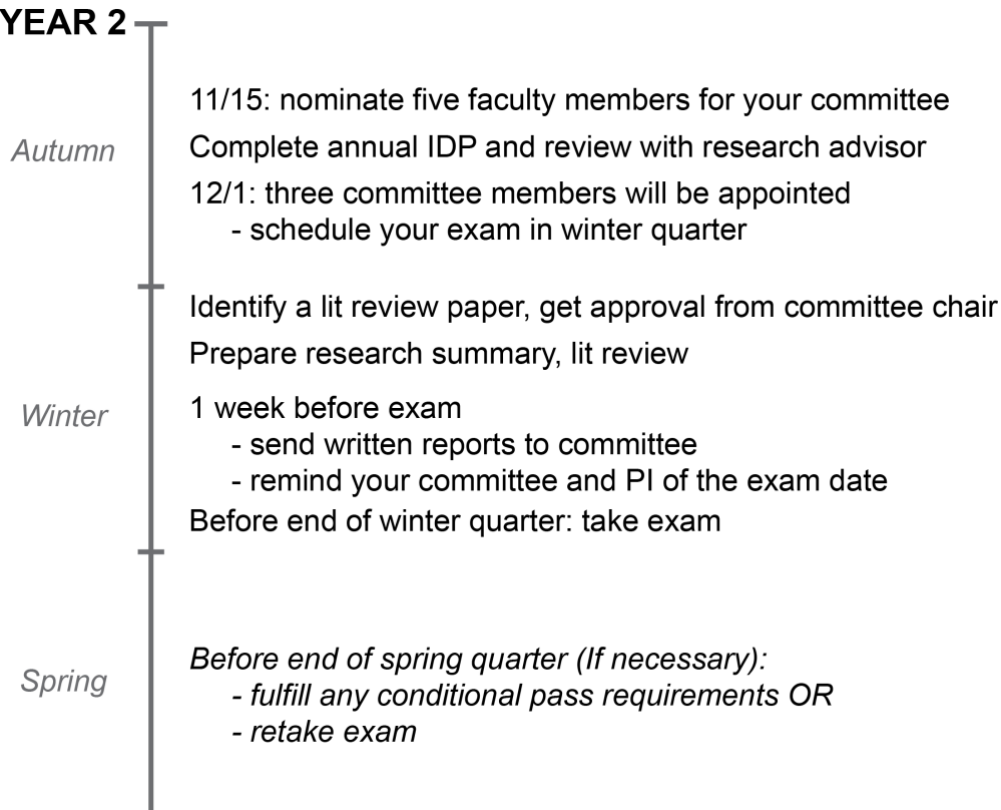
- **Conditional Pass** indicates that the student has met most expectations, but the committee has identified one or more areas that require immediate attention and that can be corrected independently. Your committee may ask you to review any topic related to your exam. You may be asked to provide a write-up or meet briefly with one or more members of your committee. A conditional pass is a common occurrence, and the department's expectation is that students will quickly convert a conditional pass to a pass.
- **Retake** indicates that there are major deficiencies that must be reevaluated in an exam format. You will need to retake your exam before the end of the spring quarter. Your committee will specify which portions of the exam need to be retaken. You may elect to have your advisor join the original committee for the retaken exam.
- If you do not pass the 2<sup>nd</sup> year exam by the end of winter quarter, and have not received an approved extension from the Graduate Education Committee, you will be placed on Academic Probation for spring quarter. Students who receive a Conditional Pass and are on track to resolve any outstanding issues in the spring quarter will typically receive an extension. Refer to policies outlined here:  
<https://chem.washington.edu/doctoral-degree-elements-good-academic-standing>

### Scheduling the Exam

- The Graduate Program Coordinator (GPC) will contact you in **autumn quarter** to ask you to nominate five Chemistry department faculty members to serve on your committee. Committee members are typically but not always from your division. Nominate committee members that can understand your work and give constructive feedback. You do not need to consult with prospective committee members before submitting your nomination form.
- The three members of your committee will be appointed by the Ph.D. Training Committee.
- The Chair of the exam committee will be appointed by the Ph.D. Training Committee. The Chair is responsible for enforcing time limits and recording the results of the exam on the "*Second-Year Exam Progress Report*" (with input from the rest of the committee). Please list your full committee and identify the Chair on the first page of your written research summary.

- Consult your research advisor to discuss an appropriate time to take the exam. Some students may be well-positioned to take the exam as soon as possible in winter quarter, while others may benefit from a bit more time to prepare.
- Identify a paper for your literature review (see guidelines pg 5). **The committee chair must approve your selection.**
- Coordinate with your committee to find a mutually agreeable time, date, and place for the exam. The exam will require a single **two-hour time slot**. Use a web-based scheduling tool to find a time (when2meet/whenisgood are preferred over doodle poll, you should provide a 1-2 week window of available times).
- It is your responsibility to reserve a room or set up a virtual meeting and communicate the time/date/location by email to your committee and the GPC. You should also let your PI know the date of your exam as soon as it is scheduled.
- Remind your PI that they will need to write a summary of your progress and send it to the GPC one week before your exam. Your PI will need advance notice to prepare this document.
- It is a good idea to remind your committee members a day or so before the exam.
- All three committee members must attend the exam. If any member is not present, the exam must be rescheduled unless a suitable replacement can be assigned by the GPC.
- The Chemistry department expects that exams will take place in person, but recognizes that situations like inclement weather, illness, and faculty travel may necessitate virtual or hybrid exams. The committee chair must approve any virtual/hybrid exam formats.
- If the exam is virtual or hybrid, you must have a means to display handwritten material during the exam. A writing tablet or a camera positioned next to a whiteboard is preferred. If necessary, you can also write on paper and hold it up to a camera. Please ensure that you obtain and test any necessary supplies before the exam starts.
- Prior to the exam, the GPC will send an electronic version of the 2<sup>nd</sup>-Year Examination Progress Report form to your committee chair. The chair will complete the form and the GPC will collect signatures electronically. You and your advisor will receive a copy of the signed report.

## YEAR 2



## **Guidelines for the Research Summary**

### **Written Research Summary**

The written summary should describe your research progress and immediate future plans. Format your summary similar to a published paper. You should have an abstract (250 words), introduction, results, discussion, figures, and references (1500-2500 words; about 5 pages in 11-12 pt font not counting figures/refs). Results and discussion can be separate or combined. A detailed methods section is not necessary unless method development is a core component of your project (consult your advisor if you are unsure). Note that you will still be expected to answer questions about your methodology in the oral exam.

Writing suggestions:

- Before you begin writing, think about the key 1-2 sentence conclusion that a reader should remember after reading your summary.
- Each paragraph should start with a topic sentence that logically transitions from the previous paragraph and sets up the point of the current paragraph.
- Each paragraph should end with a concluding remark that allows a logical transition to the next point.
- Avoid giving a long list of background details. Make sure the introduction quickly focuses on the question/goal, and then provides the relevant background to establish the importance of this question/goal.

Useful resources:

- Gopen, G. D.; Swan, J. A. The Science of Scientific Writing. *American Scientist* **1990**. <https://www.americanscientist.org/blog/the-long-view/the-science-of-scientific-writing>
- Whitesides, G. M. Whitesides' group: writing a paper. *Advanced Materials* **2004**, 16 (15), 1375–1377 DOI: [10.1002/adma.200400767](https://doi.org/10.1002/adma.200400767).
- So you're writing a paper. *Nat. Methods* **2017**, 14 (12), 1115–1115 DOI: [10.1038/nmeth.4532](https://doi.org/10.1038/nmeth.4532).
- ACS Guide to Scholarly Communication. <https://doi.org/10.1021/acsguide>

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### **Oral Research Presentation**

Prepare a presentation that describes your research progress and immediate future plans. You can use slides or a chalkboard/whiteboard. Aim for a 30 minute presentation. The exam allocates ~60 minutes for the research presentation (~30 minute presentation, ~30 minutes for questions). You should expect questions during your presentation. You are advised to prepare a 30 minute presentation so that you will be able to complete the entire presentation, with questions, in a total of 60 minutes.

Suggested talk structure:

1. Broad perspective – what are the big questions/goals? Why should the general public care about your research? This perspective should be field-spanning and understandable to non-scientists.
2. What is the focused question/goal for your work? (get here quickly)
3. (optional) Show an outline (and come back to outline slide as you proceed)
4. What are the studies you have done or will do to address this question?
5. Describe the individual studies & results
6. Interpret the results, describe conclusions, next question (loop back to #4)
7. Summarize conclusions and immediate future plans
8. Acknowledgments – thank any coauthors, coworkers, collaborators, and funders

## **Guidelines for the Literature Review**

### **Written Review**

The Literature Review is a 2 page (single spaced, 11-12 pt font, not counting references) summary of a recent paper of your choice. The primary goal of this part of the exam are for the student to (a) demonstrate the ability to think creatively and independently on a topic distinct from their own research, and (b) demonstrate the ability to engage in a high-level scholarly discussion about a topic at the forefront of current research.

You will select a self-contained research article (not a review) in an area of chemistry adjacent to your primary field of study. Your choice of paper does not need to be from a different division of research (Analytical/Inorganic/Organic/Physical). The divisional categories are sufficiently broad that you can find appropriate papers within your category that are distinct from your research. The selected papers must have been published within 10 years of your exam date.

**Your chosen paper must be approved by your exam committee chair.** You are encouraged to identify 3 papers to choose from. You can consult with your advisor to help identify an appropriate paper based on the significance of the work and whether the topic is a worthwhile area for you to review.

Your written review should include the following:

- Paper citation: Include a link, confirm that link works before sending pdf to the committee.
- Review (~1-1.5 pages): A concise summary of the work (1 paragraph) that clearly states the question/goal, the results, and the conclusions. The paragraph should end with a 1-2 sentence critical evaluation of the paper. After the summary paragraph, elaborate in detail on your evaluation. Act as if you are a manuscript referee for the journal. Which conclusions do you think are supported by the data/results and which ones (if any) do you think are not supported? For any areas of concern that you identify, evaluate whether these issues could affect or alter the central conclusions of the paper. If you suggest additional experiments, explain how they could change the interpretation or conclusions. Your critique can take the form of a bullet point or numbered list, or be presented in paragraph form. Consider the following points:
  - Significance to the given field of chemistry or science in general
  - Adequacy of experimental or theoretical approach
  - Logic (note any logical errors, jumps, stretches, etc.)
  - Data quality and presentation
  - Literature references (are they adequate?)
- Future Directions ( $\leq 0.5$  pages): Identify outstanding questions and propose experiments to address one or more of these questions. The future directions should move beyond the scope of the paper and should not focus on minor details or gaps in the original work.
- Citations (optional): It may be appropriate to cite other papers from the literature. Any references cited do not count towards the 2 page limit.

Your review should be written for a technical audience, but you should provide sufficient detail so that someone who has not carefully read the paper can understand the paper's claims and your critique. Focus on the scientific content of the paper. You should not focus on grammar or writing style. It is expected that you will need to read many of the references cited in your paper, and you may want to use search tools like SciFinder, PubMed, Google Scholar, or Web of Science (cited search tool) to obtain more background on the topic.

An important part of this exercise is to write concisely and focus on the most critical points. Use your judgement to decide what to prioritize. If there is additional content that you feel is critical but cannot fit in the 2 page written report or the 10 minute oral presentation (see details below), you are encouraged to prepare backup slides for discussion.

## **Oral Presentation of Literature Review**

Prepare a presentation that describes your chosen paper and your critique. Aim for a concise 10 minute presentation. The presentation should typically be no more than 5 slides of content. Follow the talk structure guidelines for the Research Presentation (see page 4). Your first slide should provide a general introduction to explain the context of the paper. The exam allocates ~30 minutes for the literature review presentation (~10 minute presentation, ~20 minutes for questions). You should expect questions during your presentation. You are advised to prepare a 10 minute presentation so that you will be able to complete the entire presentation, with questions, in a total of 30 minutes.

During your presentation, your committee will ask you to justify your critique and may ask for further details about the science contained in the reviewed article. Depending on the length of the paper, you may have shown some but not all of the figures in your 5 slides. You should include each of the figures contained in the paper as supplementary backup slides for discussion. Supplemental figures from the paper may also be useful. You can also include backup slides for any additional points that might be useful for discussion but did not fit in the 10 minute presentation.

For your proposed future experiments, you should explain what are the possible outcomes and what alternative approaches you could use if your experiment is unsuccessful.

### Useful resources for literature reviews/critiques:

- Annesley, T. M. Now you be the judge. *Clin. Chem.* **2012**, 58 (11), 1520–1526 DOI: [10.1373/clinchem.2012.195529](https://doi.org/10.1373/clinchem.2012.195529)
  - Sweedler, J. V. Writing a review. *Anal. Chem.* **2014**, 86 (21), 10503 DOI: [10.1021/ac503793u](https://doi.org/10.1021/ac503793u)
  - Ploegh, H. End the wasteful tyranny of reviewer experiments. *Nature* **2011**, 472 (7344), 391 DOI: [10.1038/472391a](https://doi.org/10.1038/472391a)
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## **Guidelines for IDP Review During Exam**

You must review your IDP with your advisor before your 2<sup>nd</sup> year exam. You do not need to provide your IDP to the committee in advance or during the exam.

At the end of the closed session of the exam, present two summary “IDP Review” slides with the following information:

Slide 1: Progress towards degree

- 1) Date of IDP review meeting with your advisor
- 2) Planned timeline to general exam, including what needs to be accomplished

Slide 2: Professional development

- 1) Current post-graduation plans (does not need to be fully developed)
- 2) Describe any professional opportunities (such as conferences, technical learning, teaching or mentoring experience, fellowships, outreach activities, or participation in courses, workshops, or training programs either within or outside of UW) that you think will benefit you in the next year (ok to copy directly from your IDP).
- 3) Are there any areas where your Exam Committee can help you achieve your goals (pre- or post-graduation)?

If desired, you can display any additional sections of your IDP to request further feedback from your committee. You are not expected to disclose any personal information that may have arisen in your IDP discussion with your advisor.

At the end of the exam, the committee will complete a "Second-Year Exam Progress Report" to record the exam outcome and provide written detailed feedback. The committee will use the evaluation rubric below to determine the exam outcome.

**Evaluation Rubric** – indicate Y/N in each box below

**Y** – Meets/Exceeds Expectations; **N** – Does Not Meet Expectations

<b>A student should demonstrate the following</b>	<b>In-Field Research</b>	<b>Literature Review</b>
Progress on thesis research: i. Formulate testable hypotheses or design metrics ii. Plan and conduct independent research		<b>N/A</b>
Motivation for research i. Describe the novelty/originality of the research ii. Discuss literature cited in written and oral presentations iii. Explain methods/rationale of scientific approach and how it addresses the broader questions/goals iv. Interpret results (do this even if experiment/approach failed) v. Identify shortcomings and alternative considerations vi. Plan for immediate follow-up experiments (in-field) or proposed future directions (literature review)		
Written documents i. Explain testable hypotheses or design metrics ii. Summarize outcome(s) of research iii. Use clear logical transitions between ideas iv. Concisely discuss relevant literature precedent(s)/context		

*"PASS" requires "Y" in all categories. The decision between "CONDITIONAL PASS" and "RETAKE" is at the discretion of the committee. A "CONDITIONAL PASS" typically means that your committee has identified a deficiency that they feel you can correct independently. Any number of "N" evaluations can result in a "RETAKE".*

**Individual Development Plan reviewed and discussed with student:** \_\_\_\_\_

**EXAM OUTCOME**    \_\_\_\_\_ **PASS**                    \_\_\_\_\_ **CONDITIONAL PASS\***                    \_\_\_\_\_ **RETAKE\*\***

\* Must be completed no later than by the end of the Spring Quarter to remain in Good Academic Standing

\*\* Retake must take place by the end of the Spring Quarter to remain in Good Academic Standing