

# **Ph.D. Qualifying Exam Procedures**

## **Climate and Space Sciences and Engineering (CLaSP)**

### **(Updated January 2020)**

The CLaSP Ph.D. qualifying exam includes a research-based written report and an oral presentation, followed by an oral exam. The primary objective is to assess the examinee's potential to conduct doctoral-level research, likelihood of successfully completing a Ph.D., and ability to become an independent researcher. Passing the qualifying exam is one of multiple prerequisites for achieving Ph.D. candidacy, as specified in the Graduate Handbook. In order to take the qualifying exam, the student must be in [good academic standing, as defined by the Rackham Graduate School](#). Procedures for the qualifying exam are described below. Appropriate accommodations can be made for an examinee with a documented learning disability (Section 7).

#### **1. Scope of the exam**

The exam will focus primarily on the research that the examinee has conducted by the time they take the exam in their second year. After entering the Ph.D. program, the examinee is expected to carry out research under the supervision of their advisor(s). The intensity of this research generally increases during the summer and fall following the students' first academic year. Expectations for the exam are therefore commensurate with the level of research that can be reasonably expected to have occurred within this time period. The written component of the exam is a report, manuscript, or proposal prepared by the student (Section 4). During the oral exam following the presentation, students will be asked knowledge-based questions closely related to their research project, and also questions on fundamental topics relevant to their research and covered in their graduate coursework (section 5).

#### **2. Timing of the exam**

Students will take the exam during their second academic year. Recognizing that students will be at different levels of preparedness and will have different time constraints throughout the year, three periods are offered for taking the exam: September, January, and May. The student must notify the Graduate Coordinator and Qualifying Exam Committee chair of their intent to take the exam at least one month prior to the exam month (i.e., by August 1 for a September exam, December 1 for a January exam, and April 1 for a May exam). The Graduate Coordinator will then work with the Qualifying Exam Committee to schedule the exam based on faculty availability and the committee composition requirements described below. Retake exams may occur in any subsequent exam period and must occur by May of the student's third academic year.

#### **3. Exam committee members**

Guidelines for the exam committee composition are:

- (1) The committee will consist of three members selected by the Qualifying Exam Committee. Two of these members should have some familiarity with the examinee's area of research, while the third member may have less familiarity and is included to probe breadth of knowledge and context.
- (2) The examinee's advisor is required to sit in on the exam but will not question the student or contribute to the rubric scoring.
- (3) The committee chair must be a member of the Qualifying Exam Committee. This will help ensure that exams are administered consistently.
- (4) Committee members may be teaching faculty, research faculty, or research scientists, but may not be post-docs. All committee members should have primary appointments within the department.
- (5) In the case of a retake exam, the committee should have no overlapping members with the original exam, i.e., the committee should be entirely new.

During the exam, the roles of the advisor are to (1) answer any questions that other committee members might have directly for the advisor, especially clarification questions; and (2) observe the exam and provide feedback in the deliberation after the exam. The advisor does not contribute to the rubric scoring that determines the exam outcome (Section 6). The advisor should not actively question the examinee during the exam. Should the advisor wish to comment on questions asked by the committee members, such comments should be deferred to the deliberation.

#### **4. Written report**

The written report is due two weeks before the oral exam date. The examinee should submit the written report electronically to their committee members.

In the written report, the examinee is expected to demonstrate their (1) ability to formulate tractable scientific questions and frame the importance of their questions for the research community, (2) research progress made to date, and (3) scientific writing skills. The report should describe research progress made by the examinee, and to the extent possible, focus on preliminary results. The report may also describe research objectives for future work, i.e., as would be described in a proposal with preliminary results. If the student has prepared a lead-author manuscript (either published, submitted, or in an advanced state of preparation) describing work that they have done at U-M for their Ph.D. research, they may submit this manuscript for their written report.

It is assumed that the examinee and their advisor will have discussed the research to a considerable extent. Discussions with advisors and colleagues on the general outline of the report are allowable, but the student must be the primary author of the document. To assist the committee with their evaluation, the student and advisor must submit a jointly-signed statement describing all contributions to the written report. The statement must clearly identify the extent to which the writing and research were prepared independently by the student, and also explain co-author contributions to manuscripts and/or the extent of reviews that were provided by the advisor and peers. Non-native English speakers can seek help with English editing and proofreading from the staff in the English Language Institute

(or similar English editing units) of the university, though such help must be documented in the statement of contributions.

The written report should contain a title, abstract, introduction (providing context and relevant literature review), results/discussion/analysis, conclusions, references, and if applicable, figures, tables, and associated captions or headings. Excluding references and figures/tables, the body of the report should be 6-10 single-spaced pages. Page restrictions do not apply when lead-author manuscripts are provided as the written report. The report should adopt a style requirement used in a mainstream journal, e.g. as specified in the AGU, AMS or IEEE journal author style guides. This will give the examinee a chance to gain familiarity with the discipline-specific formats of scientific writing.

## **5. Procedures of the exam**

The oral exam is expected to be 2 hours long.

(1) Before the exam starts, the exam committee members will hold a brief discussion on their impression of the written report and will review the examinee's transcript. An evaluation rubric (appended) will be given to each committee member for notetaking and used as input to a consensus evaluation.

(2) The examinee will start with a ~2-minute self-introduction, describing their background and research project.

(3) The examinee will give an uninterrupted 20-30 minute presentation about their research described in the written report. The chair can stop the examinee if the presentation is over 30 minutes. Except for questions pertaining to clarification, no other questions should be asked during the presentation. This is intended to allow the examinee to present their entire talk coherently without questions that may stray from the student's main presentation.

(4) After the presentation, the committee members will ask questions about material from the presentation, specifics in the written report, and fundamental knowledge from coursework that is relevant to the examinee's research and contained in the skillset sheets provided for the exam. Skillset sheets will be provided for all CLIMATE and SPACE courses that the student has completed (and for which skillsets exist).

## **6. Evaluation and outcome of the exam**

After the examination, the chair will ask the examinee to leave the room. Each committee member will complete their own evaluation rubric. The chair will then lead a deliberation that results in the completion of a consensus evaluation rubric and decision on the outcome of the exam. The four possible outcomes of the exam are:

- (1) **Pass:** The student advances to candidacy after meeting all other department requirements for candidacy, as specified in the Graduate Handbook.

- (2) **Conditional Pass:** The student may pass the exam and advance to candidacy after specified conditions are met.
- (3) **Fail with retake:** The student has the option to retake the exam at a later date with a new committee.
- (4) **Fail with no retake:** The student does not advance to candidacy and cannot re-take the exam.

Scoring on the consensus evaluation rubric will determine whether the student passes or fails the exam, as follows:

- **Score greater than or equal to 36:** Pass (1), or Conditional Pass (2):
- **Score less than 36:** Fail with retake (3), or Fail without retake (4):

The committee will decide between outcomes (1) and (2), or between outcomes (3) and (4) based on the exam performance and a holistic evaluation of the examinee's progress and potential to become an independent researcher. The examinee's advisor may provide input during the deliberation, but the exam outcome is determined by the three committee members. If the committee cannot reach a unanimous consensus, the committee will vote, and the outcome will be based on the majority opinion.

The committee will notify the examinee about the outcome immediately at the conclusion of the exam and committee discussion. The chair of the committee will prepare an electronic consensus evaluation and will submit this to the Qualifying Exam Chair and Graduate Coordinator immediately after the exam (ideally), or no later than 1 week after the exam. The Qualifying Exam Chair will then integrate this feedback into a formal notification email. For outcomes (2-4), the committee should provide sufficient justification for their decision in the evaluation. Any conditions that are imposed as part of outcome (2) must be approved by the Qualifying Exam Committee. The examination committee should also keep in mind that the intent of any imposed conditions must be to provide useful and relevant education to the student. In the event of outcome (4), the student may appeal the decision as described in the Graduate Handbook.

## **7. Students with disabilities**

The University of Michigan is committed to providing equal opportunity for participation in all programs, services and activities. Request for accommodations by persons with disabilities may be made by contacting the Services for Students with Disabilities (SSD) Office located at G664 Haven Hall. The SSD phone number is 734-763-3000. Once your eligibility for an accommodation has been determined you will be issued a verified individual services accommodation (VISA) form. Please present this form to the Qualifying Exam Committee Chair prior to scheduling the exam.

## Rubric for Qualifying Exam

SA = Strongly Agree, A = Agree, N = Neutral, D = Disagree, SD = Strongly Disagree

<b>WRITTEN EXAM EVALUATION</b>	SA	A	N	D	SD
<b>Introduction:</b> Identifies a research objective or question. Motivates the research objective or question using relevant literature. Summarizes and synthesizes the relevant literature to identify critical research gaps.	5	4	3	2	1
<b>Methods and Research:</b> Clearly describes the approach to address the research objective/question. Explains why the approach (including data analysis, model or instrument development, and/or theory) represents an advance or is an appropriate method to address the research question.	5	4	3	2	1
<b>Presentation:</b> Illustrates research with figures, tables, and/or appropriate visualization. Figures include axis labels, units, and legends in readable fonts. Text provides clear explanation of all figures and their relevance to the research objective.	5	4	3	2	1
<b>Overall:</b> Structure includes individually labeled sections that are logically presented. Report is free of typographical and grammatical errors and is generally readable.	5	4	3	2	1

<b>ORAL EXAM EVALUATION</b>	SA	A	N	D	SD
<b>Research Motivation:</b> Defines one or more research objectives or questions. Explains the state of current knowledge associated with the research area. Explains how their research builds upon or challenges existing knowledge.	5	4	3	2	1
<b>Research Conduct and Methodology:</b> Describes their research approach and justifies why it is appropriate to address the research objective/question. Can draw, explain, and defend inferences from data, models, theory, or experiments.	5	4	3	2	1
<b>Research Outcomes:</b> Draws conclusions from preliminary or advanced work. Describes preliminary next steps in their research project. Identifies or explains limitations associated with their work.	5	4	3	2	1
<b>Communication:</b> Provides a logical presentation. Clearly communicates their research to experts and non-experts in the field.	5	4	3	2	1
<b>Synthesis of Course Material and Foundational Knowledge in their Field:</b> Can discuss detailed fundamental concepts from their coursework, including use and manipulation of relevant equations, and relate them to their research objective/question.	5	4	3	2	1

TOTAL SCORE: \_\_\_\_\_

≥36 = Pass, or Conditional Pass

<36 = Fail with retake, or Fail without retake

Comments for the student, including notable strengths, weaknesses, and suggestions to address any deficiencies identified above: