

The Physics Graduate Qualifying Exam

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1 Introduction

The Physics Department has adopted a policy for written qualifying examinations, to be given in August and January of each year. The exam is to cover four major subject areas at the undergraduate level:

1. Classical Mechanics
2. Electricity and Magnetism
3. Statistical and Thermal Physics
4. Quantum Mechanics

The exam policy that has already been approved is incorporated herein by reference. This document sets forth the committee's philosophy for the format, content, and grading of the qualifying exam. We require that graduate students demonstrate competence in Physics at the undergraduate level by passing this exam. Hence, educators would describe it as a *summative* assessment. Nevertheless, the qualifying exam policy allows multiple attempts, as well as passing by subject area. Therefore, the exam also presents an opportunity for *formative* assessment, which entails clear and useful feedback to aid students in reaching the desired Physics competency level.

2 Format

The exam will be held in four 3.5-hour sessions, one per subject area, over the course of two days. Disability accommodations will be provided for students who require them, consistent with MSU policy. Students are strongly encouraged to attempt each subject area that they have not yet passed. Our aim is to allow ample time and provide an opportunity for undisturbed concentration. Students are expected to arrive on time, but may leave whenever they are finished. We will request a location that is spacious, well lit, quiet, with restrooms nearby, and preferably in a building that is not connected to the Barnard Hall complex.

3 Content

Three problems will be posed in each subject area. All problems will be at the upper division undergraduate level, similar to questions that might be encountered in an undergraduate setting. Problems will emphasize core concepts of the subject area. Calculations are important, but are not intended to be long or tedious. Because we want to maximize the opportunity for formative

assessment, we encourage students to attempt all three problems in each subject area. We also encourage students to verify their answers carefully.

A topic list for each subject area will be made available to the students well in advance of the exam. The topic list indicates the emphasis of the examination. However, it should be understood that knowledge in physics is cumulative and connected. For example, a simple mechanical concept like force balance might be necessary to complete a problem in Electricity and Magnetism. In addition to the topics listed for each subject area, certain overarching concepts such as conservation laws and symmetry are broadly essential to success in physics, and especially on this exam.

4 Grading

The exam is passed by subject area. Each problem is worth a maximum of 10 points. To pass the subject area, two of the three problems must receive a score of 8 or higher, and the lowest score out of three problems will be discarded. External factors will not be considered.

Student responses are expected to be clearly written and justified. It is not possible to give partial credit when answers appear without any work or when the work is illegible to the grader.

Each student's exam shall be clearly labeled with a unique alphanumeric identifier on all pages. This facilitates anonymous grading and ensures that each student's work is kept together. The exams will be scanned to facilitate grading simultaneously and for archival purposes.

Two faculty members will grade each problem independently. They will then confer to reconcile their scores and comments. While we will not publish a detailed grading scheme, our general philosophy is to reward demonstrated conceptual understanding and minimize deductions for unimportant mistakes (e.g., transcription errors).

No less than 14 days after the last examination date, the exam takers shall receive the results of the exam including their scores, pass/fail status in each attempted subject area, and copies of their exam papers with each problem clearly scored and marked. In view of our goal to provide a formative assessment, the graders will strive to provide clear feedback. Research advisors will be informed of their students' pass/fail status in each subject area. Solutions will be released in the same timeframe. Exam grades are at the sole discretion of the committee.

Requests for regrades will be considered, but must include clear written justification, and must be submitted to the Department (not directly to the exam committee) within one week after the exam has been graded and returned to the student. The Department will transmit the request anonymously to the committee using the aforementioned alphanumeric identifier rather than student name. Procedures for evaluating regrade requests are at the committee's discretion.