

# Ph.D. in Physics

## Requirements

PHSX 594	Seminar (01 -Teaching Seminar)	1
PHSX 594	Seminar (15 -Research Introduction Seminar)	1
PHSX 501	Advanced Classical Mechanics	3
PHSX 506 & PHSX 507	Quantum Mechanics I and Quantum Mechanics II	6
PHSX 519 & PHSX 520	Electromagnetic Theory I and Electromagnetic Theory II	6
PHSX 535	Statistical Mechanics	3
PHSX 566 & PHSX 567	Mathematical Physics I and Mathematical Physics II	6
Electives		14

## Thesis (an acceptable thesis is required)

Doctoral Thesis (PHSX 690); minimum of 20 credits is required in addition to the courses listed above	20
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## Examinations

A written comprehensive examination and an oral comprehensive examination are required. A final oral examination is also required, covering the thesis and related areas.

<b>Total Credits</b>	<b>60</b>
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## Electives Requirements

All elective courses must be approved by the student's Graduate Committee and the Physics Department Head. This approval will ensure that the electives represent a coherent block of study of substantial relevance to Physics. The following limitations normally apply to Elective Courses which may be listed on the Graduate Program for the M.S. or Ph.D. degree in Physics:

1. No more than half of the Elective credits in the above Course Requirements may be at the 400 level in a student's Graduate Program for any graduate degree in Physics. The remaining Elective credits must be at the 500 level.
2. The Electives will include courses in Physics and minor or supporting fields. At least half of the elective credits must be in Physics.
3. PHSX 461, PHSX 490R, PHSX 492, PHSX 494, PHSX 589, PHSX 590, PHSX 689, and PHSX 690 cannot be used as Electives in any Physics Graduate Program.
4. PHSX 592 is allowed as an Elective to a maximum of 3 credits for an M.S. Program and 6 credits for a Ph.D. Program.
5. No more than 2 credits of non-required seminar courses are applicable as Electives in any Physics Graduate Program.

## Comprehensive Examination

The Ph.D. Comprehensive Examination is a written exam. In addition, there is a Ph.D. Candidacy Examination, taken after passing the Ph.D. Comprehensive Examination. These are considered separate examinations, and each must be passed separately.

Details concerning the Physics Ph.D. Comprehensive Examination and Physics Ph.D. Candidacy Examination can be found at:

<http://www.physics.montana.edu/grad/>

**Additional requirements:** No more than 4 pass/fail credits can be included in any Physics Graduate Program. Only 10 course-work credits must be taken beyond a MS en route or continuing MS toward the PhD.

**Required Examinations:** Qualifying and Comprehensive Examinations are required. A Final oral defense of the thesis is also required. For details, see the Physics graduate manual that is accessible from the Physics Department Home page <https://physics.montana.edu/>.

**Qualifying exam:** The Qualifying exam assesses proficiency in Physics at the undergraduate level and preparedness for graduate study and PhD-level research. The Qualifying Exam consists of problems drawn from upper-level undergraduate course work in four subject areas: quantum mechanics, electricity and magnetism, classical mechanics, and statistical mechanics and thermodynamics. The Qualifying Exam is given twice a year, once in August and once in January. Students first take the Qualifying Exam at the beginning of their first year and are required to pass by January of their second year. To pass the Qualifying Exam at the PhD level, a student must receive a passing grade in each of the four subjects. Students can pass individual subjects on different attempts and culminate a complete pass in up to four attempts. Entering students are highly encouraged to study for the exam the summer before entering, with the goal of passing all four subjects in their first two attempts and starting their research work in the Spring/Summer of their first year of graduate school.

**Comprehensive Exam:** The Comprehensive/Candidacy Exam for Ph.D. degree-seeking graduate students is a written and oral exam that requires the student to present and defend a thesis research plan to their Ph.D. committee.