

Physics Major

Program Requirements

- **Total units required:** 42-44

Required Introductory Courses

Majors in physics are required to complete a series of introductory courses. They may take either:

| Code | Title | Units |
|--------------|-----------------------|-------|
| Physics 191 | Physics I | 3 |
| Physics 191L | Physics I Laboratory | 1 |
| Physics 192 | Physics II | 3 |
| Physics 192L | Physics II Laboratory | 1 |

or (recommended for majors):

| Code | Title | Units |
|--------------|------------------------------|-------|
| Physics 193 | Focused Physics I | 4 |
| Physics 193L | Focused Physics I Laboratory | 1 |
| Physics 194 | Focused Physics II | 4 |
| Physics 194L | Physics II Laboratory | 1 |

Required Courses

In addition, **majors in physics are required to complete the following courses:**

| Code | Title | Units |
|--------------------|---------------------------------|-----------|
| Physics 217 | Introduction to Quantum Physics | 3 |
| Physics 322 | Physical Measurement Laboratory | 3 |
| Physics 411 | Mechanics | 3 |
| Physics 421 | Electricity and Magnetism | 3 |
| Total Units | | 12 |

They must also complete **one additional upper-level laboratory course**, chosen from the following:

| Code | Title | Units |
|-------------|---------------------------------------|-------|
| Physics 316 | Optics and Wave Physics Laboratory | 3 |
| Physics 321 | Electronics Laboratory | 3 |
| Physics 360 | Biophysics Laboratory | 3 |
| Physics 427 | Introduction to Computational Physics | 3 |
| Physics 435 | Nuclear and Radiochemistry Lab | 3 |

Upper-level courses: Majors are required to complete a minimum of 21 units of advanced courses (300 level or higher) in Physics, excluding Physics 341, Physics 342, Physics 441, Physics 442, Physics 499 and Physics 500. These 21 units may include courses listed above and may also include *one* upper level engineering class chosen from the following:

| Code | Title | Units |
|-----------|--|-------|
| ESE 351 | Signals and Systems | 3 |
| ESE 429 | Basic Principles of Quantum Optics and Quantum Information | 3 |
| ESE 436 | Semiconductor Devices | 3 |
| ESE 438 | Applied Optics | 3 |
| ESE 441 | Control Systems | 3 |
| ESE 482 | Digital Signal Processing | 3 |
| ESE 531 | Nano and Micro Photonics | 3 |
| ESE 532 | Introduction to Nano-Photonic Devices | 3 |
| ESE 582 | Fundamentals and Applications of Modern Optical Imaging | 3 |
| MEMS 3410 | Fluid Mechanics | 3 |

Students must receive letter grades for these advanced courses, and the course must be completed with a grade of at least a C-.

Math courses required for the physics major:

| Code | Title | Units |
|--------------------|------------------------|-----------|
| Math 131 | Calculus I | 3 |
| Math 132 | Calculus II | 3 |
| Math 217 | Differential Equations | 3 |
| Math 233 | Calculus III | 3 |
| Total Units | | 12 |

Students who have completed Math 203 Honors Mathematics I and Math 204 Honors Mathematics II will have fulfilled the requirement for Math 131 Calculus I, Math 132 Calculus II, and Math 233 Calculus III.

Math courses recommended for the physics major:

- Math 308 Mathematics for the Physical Sciences **or** ESE 318 Engineering Mathematics A (We recommend that this course precede Physics 421 Electricity and Magnetism.)
- Math 309 Matrix Algebra (We recommend that this course precede Physics 474 Introduction to Particle Physics.)
- Physics 501 Theoretical Physics/Math 501C Theoretical Physics and Physics 502 Methods of Theoretical Physics II/Math 502C Methods of Theoretical Physics II also are recommended.

Science-breadth requirement: Majors must select three of the following courses to satisfy the science-breadth requirement. One of the three courses must be Chem 103 Advanced Placement Chemistry I, Chem 104 Advanced Placement Chemistry II, Chem 105 Principles of General Chemistry I, Chem 106 Principles of General Chemistry II, Chem 111A General Chemistry I, Chem 112A General Chemistry II, Chem 401 Physical Chemistry I or Chem 402 Physical Chemistry II.

| Code | Title | Units |
|-----------|------------------------------------|-------|
| Biol 2960 | Principles of Biology I | 4 |
| Biol 2970 | Principles of Biology II | 4 |
| Chem 103 | Advanced Placement Chemistry I | 3 |
| Chem 104 | Advanced Placement Chemistry II | 3 |
| Chem 105 | Principles of General Chemistry I | 3 |
| Chem 106 | Principles of General Chemistry II | 3 |

| | | |
|-----------|---|---|
| Chem 111A | General Chemistry I | 3 |
| Chem 112A | General Chemistry II | 3 |
| Chem 151 | General Chemistry Laboratory I | 2 |
| Chem 152 | General Chemistry Laboratory II | 2 |
| Chem 401 | Physical Chemistry I | 3 |
| Chem 402 | Physical Chemistry II | 3 |
| Chem 445 | Instrumental Methods: Physical Chemistry | 3 |
| CSE 131 | Introduction to Computer Science | 3 |
| CSE 132 | Introduction to Computer Engineering | 3 |
| CSE 247 | Data Structures and Algorithms | 3 |
| EEPS 202 | Introduction to Earth, Environmental, and Planetary Science | 3 |

Students who have received credit for Chem 103 Advanced Placement Chemistry I and Chem 104 Advanced Placement Chemistry II can use them toward the science-breadth requirement.

Additional Information

Senior Honors

Students are encouraged to work toward Latin honors (i.e., cum laude, magna cum laude, and summa cum laude). To qualify, students must meet the academic requirements of the College and successfully complete a suitable project under the supervision of a faculty member in the department. The project, whether experimental or theoretical, should demonstrate the student's capacity for independent work. Honors candidates must apply to the Undergraduate Studies Committee no later than the first day of classes of their senior year. The application should include a description of the proposed project, co-signed by the supervising professor. A written report of the completed work must be submitted to the committee by a March deadline. By enrolling in Physics 499, students may earn up to 6 units of credit for the honors project.

The physics department also offers physics majors the possibility to earn departmental distinctions. These distinctions require the same grade point average cutoffs as Latin honors but are calculated exclusively from the grades in physics courses (i.e., all courses with the prefix L31). Three levels of distinction are offered: 1) highest distinction; 2) high distinction; and 3) distinction. The highest and high distinctions require at least one semester of undergraduate research and a senior thesis describing the results; these distinctions are limited to the top 15% (highest distinction) and the top 15% to 50% (high distinction) of the physics majors in their senior year as ranked by their GPA in the physics courses. Students who meet the GPA cutoff but who do not undertake undergraduate research and a senior thesis may only receive the third level of distinction.

Transfer Credit and Study Abroad

Students may transfer up to 9 credits of advanced course work (300+ level) to satisfy major requirements by taking comparable physics courses at another institution. Prior approval by the department is needed. Online or other distance learning courses are not eligible for transfer credit.

Website: <http://physics.wustl.edu>