

## Physics

<http://www.pacificu.edu/as/physics>

Physics is fundamental to science, engineering and the technology industry. From black holes to quarks, solar systems to atoms, tornados to blood flow, physics describes the underlying forces and structure of nature. The physics program incorporates both the theoretical and practical aspects of physics, using innovative teaching methods with an emphasis on active classroom experiences. Students at Pacific take Physics for a variety of reasons including the desire to major or minor in physics, fulfill the core science requirement, prepare for a health professions career, or prepare for an engineering-related career. Each of these students has a distinct path that they should follow as described below.

### A. Students not majoring in science who wish to fulfill their science requirement:

#### One-semester courses:

The courses below are designed for students interested in physics or astronomy but who are not interested in a full-year course. These courses all require basic high school math skills, such as simple algebra. These courses have no lab component.

SCI 170 Astronomy  
SCI 180 Introduction to Cosmology  
PHY 110 Physics of Everyday Phenomena  
PHY 160 Energy and the Environment

#### Year-Long Introductory Sequences in Physics:

PHY 202 & 204 (Introductory Physics) are the algebra-based physics courses. The format of these courses is three lecture periods, and one three-hour lab each week. These courses include inquiry-based activities such as peer instruction, interactive lecture demonstrations, and tutorials. **Students must have taken Math 125 (Pre-Calculus) or the equivalent.**

PHY 232 & 242 (Workshop Physics) are the calculus-based physics courses. These courses are taught in an inquiry-based format where students spend three 2-hour periods during the week in the lab. There is very little lecture and students spend most of their time experimenting, collecting data, and analyzing data. **Students must be taking or have taken Math 226 (Calculus) or the equivalent.**

The same topics are generally covered in both sequences. Workshop Physics (PHY 232 & 242) covers slightly fewer topics but in greater depth and at a higher mathematical level than PHY 202 & 204. Neither course sequence assumes a student has taken physics in high school.

## **B. Physics Major**

The physics program is divided into a core set of courses along with a number of emphases that the students can choose that best match their personal goals.

**IMPORTANT:** Students must consult with a physics faculty member before selecting an emphasis. Currently, the available emphases are:

### **Traditional Physics**

Meant for students interested in pursuing a career in physics, applied physics, or engineering; or continuing on to graduate study in physics, engineering, or another professional field.

### **Health Professions**

Meant for students interested in pursuing a career in a health profession.

### **Environmental Science**

Meant for students interested in pursuing graduate study in environmental engineering or alternative energy.

### **Engineering Physics**

Designed for students who are interested in pursuing further work in a specialty via a joint B.S. or B.S./M.S. program in engineering or other technical fields, such as a dual degree 3-2 Engineering program.

Additional information on the course sequence is shown in the tables below.

## **C. Physics Minor**

The physics minor provides a strong foundation for quantitative problem solving and signifies that a student has a general understanding of modern physics. The minor can be completed as follows: Either intro sequence (232/242 or 202/204), PHY 322 (Modern Physics), PHY 332 (Waves & Optics), and 8-credits of upper-division electives.

## **D. Students pursuing a career in health professions**

Pre-Physical Therapy, Pre-Optometry, Pre-Pharmacy, Pre-Medical and any other pre-health students can take either of the year-long introductory sequences in (A).

Students are encouraged to check prerequisites for their intended program as some programs require a calculus-based physics course (i.e. PHY 232 & 242).

## **E. Students pursuing a career in engineering**

First-year courses are identical to those of the physics major. Students enrolled in MATH 226 or with credit for Calculus I should take PHY 232 in their first year.

Students interested in engineering should take SCI 190 (Engineering Passport) as early as possible. This is a one-credit seminar that provides an introduction into the fields of engineering and the required training.

Students interested in the 3-2 engineering program should meet with a physics faculty member to plan their course schedule in order to meet the necessary requirements within three years.

## Physics Course Sequence

Many 300- and 400-level physics courses are offered only in alternating years. The two sequences below apply to different cohorts of students depending on when they plan to start the course sequence. For example, students who start in Fall 2017 as first-year students in PHY 232 (or 202) would follow the top table for their course planning. Courses shown in grey are offered in the indicated year, but are listed in black under the recommended year. Generally, the 400-level classes should be taken in year 3 or 4. The major can be completed in three years by taking the alternating courses at the earliest possible time.

The physics **minor** can be fulfilled by the bold courses plus eight elective credits.

Cycle A: (e.g. Year 1 = 2017-18)

Year 1	Year 2	Year 3	Year 4
<b>PHY 232 &amp; 242</b> or <b>PHY 202 &amp; 204</b>	<b>PHY 332 (Waves)</b> PHY 410 (Classical) PHY 460 (E&M)	<b>PHY 322 (Modern)</b> PHY 420 (Quantum)	PHY 410 (Classical) PHY 460 (E&M)
<b>MATH 226 &amp; 227</b>	Elective(s): PHY 384 (Thermo)	Elective(s): PHY 325 (Topics) PHY 364 (Electronics)	Elective(s): PHY 384 (Thermo)
PHY 311-312 (Relativity)	PHY 377-378 (Statics)	PHY 311-312 (Relativity)	PHY 470 (Adv. Analysis) PHY 491-493 (Capstone)

Cycle B: (e.g. Year 1 = 2018-19)

Year 1	Year 2	Year 3	Year 4
<b>PHY 232 &amp; 242</b> or <b>PHY 202 &amp; 204</b>	<b>PHY 322 (Modern)</b> PHY 420 (Quantum)	<b>PHY 332 (Waves)</b> PHY 410 (Classical) PHY 460 (E&M)	PHY 420 (Quantum)
<b>MATH 226 &amp; 227</b>	Elective(s): PHY 325 (Topics) PHY 364 (Electronics)	Elective(s): PHY 384 (Thermo)	Elective(s): PHY 325 (Topics) PHY 364 (Electronics)
PHY 377-378 (Statics)	PHY 311-312 (Relativity)	PHY 377-378 (Statics)	PHY 470 (Adv. Analysis) PHY 491-493 (Capstone)

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## Physics Core

All physics majors need to take the following core set of physics courses regardless of their chosen emphasis:

PHY 232-242 General (Workshop) Physics I-II

**or**

PHY 202-204 Introductory Physics I-II

PHY 322 Modern Physics with Health Applications

PHY 332 Waves and Optics

PHY 470 Advanced Analysis in Physics

PHY 491-493 Physics Capstone I-II

Math 226-228 Calculus I-III

CHEM 220-230 General Chemistry I-II

**or**

CS 150-250 Intro to Computer Programming

**or**

CHEM 220 General Chemistry I

**and**

CS 150 Intro to Computer Programming

## Physics Emphases

In addition to the core physics courses listed to the left, physics majors need to take the following courses to complete the major:

### Traditional Physics Emphasis

PHY 410 Classical Mechanics

PHY 420 Quantum Mechanics

PHY 460 Electric and Magnetic Fields

8 credits of 300-400-level electives

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### Environmental Science Emphasis

PHY 410 Classical Mechanics

**or**

PHY 420 Quantum Mechanics

**or**

PHY 460 Electric and Magnetic Fields

PHY 300-400-level elective

PHY 384 Thermodynamics and Statistical Mechanics

Env 200 Intro to Environmental Science

Env 330 Ecosystems and Ecological Design

ENV 300-400-level elective

### Health Professions Emphasis

PHY 410 Classical Mechanics

**or**

PHY 420 Quantum Mechanics

**or**

PHY 460 Electric and Magnetic Fields

2 PHY 300-400 level electives

2 approved 300-400 level electives from BIO, CHEM, or EXIP

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### Engineering Physics Emphasis

PHY 410 Classical Mechanics

**or**

PHY 420 Quantum Mechanics

**or**

PHY 460 Electric and Magnetic Fields

Omit PHY 470 Advanced Analysis in Physics

A minimum of 24 semester credits in engineering courses in an approved engineering program at another institution will transfer back to Pacific University and count towards the completion of the physics degree. Department-approved coursework taken at the engineering institution along with an approved public presentation will satisfy the requirements for the Senior Capstone. Of the courses used to satisfy the major, at least 28 CR must be at the 300 or 400 level, or equivalent, with at least 4 of these credits at the 400-level, or equivalent.