

# PHYSICS, BA

**Degree:** Bachelor of Arts (BA)  
**Major:** Physics

## Program Overview

The mission of the Bachelor of Arts degree in Physics is to provide an education in fundamental areas of physics, including classical mechanics, electromagnetism, quantum mechanics, thermal physics/statistical mechanics, and laboratory, data analysis and computational skills, while offering maximum flexibility to pursue other interests. Compared to the BS degree, there are 27 fewer required credit hours of physics courses, including 3 fewer advanced laboratory courses. This makes the BA degree particularly attractive to students who wish to combine a study of physics with the pursuit of other interests or customize their physics degree with courses of their own choosing. Such students often complete a second major in the arts, humanities or social sciences and they may apply to a professional program in medicine, law or business after completing their BA. Understanding the scientific enterprise can be crucial in business, finance, medicine, law, the media, literature, the arts, general education, government, and any number of other pursuits.

The required physics courses provide exposure to a broad range of physical phenomena as well as training in the scientific method, techniques of problem solving, data analysis, quantitative approaches to physical problems, and experimental procedures. Although less intense than the BS program, the BA program can, with a judicious choice of electives, provide an excellent preparation for graduate study in physics. At the same time, a reduced requirement for technical courses in the physics BA program provides an opportunity to explore other disciplines in depth.

The first year is very similar for BA and BS students, the only differences being that the BA student has a wider choice of non-physics science electives and may choose to take the introductory physics and math courses designed for life science students. BA majors who choose to do their capstone through the Department of Physics have worked on a wide variety of topics with mentors from departments across campus and even off-campus.

## Learning Outcomes

- Students will be able to demonstrate proficiency in classical mechanics, electromagnetism, quantum mechanics, thermal physics/statistical mechanics and other topics needed for a career in physics.
- Students will be able to carry out experiments, take measurements and analyze data to support or refute a scientific hypothesis.
- Students will be able to demonstrate proficiency in the methods of scientific inquiry, including critical thinking and problem-solving, and be able to formulate and solve quantitative problems using computational and analytical methods.
- Students will be able to demonstrate proficiency in communicating scientific concepts and results orally and in writing in styles appropriate to proposals, reports and formal publications.
- Students will be able to demonstrate their understanding of professional standards and ethics.

## Teacher Licensure

Case Western Reserve University offers licensure programs in music education and art education as degree programs in each of those departments. Additionally, CWRU's Teacher Education Program offers a licensure track for students who wish to pursue a teaching career in their content area in grades 7-12 Adolescent to Young Adult. Licensure areas are: English Language Arts (English major), Integrated Social Studies (history major), Integrated Mathematics (math major), Life Science (biology major), Physical Science (chemistry major), or Physical Science (physics major). A Multi-Age license in grades PreK-12 is available in French, Spanish or Latin. Students must fulfill the degree requirements for their primary major and declare Teacher Education as a second major. The Teacher Education major consists of 36 hours in education, including a student teaching semester. The program places students in mentored teaching situations at every stage of their training, capitalizing on the relationships the university has built with area schools.

For the subject area requirements for teacher licensure, please visit the program page for Teacher Education, BA.

## Undergraduate Policies

For undergraduate policies and procedures, please review the Undergraduate Academics section of the General Bulletin.

## Accelerated Master's Programs

Undergraduate students may participate in accelerated programs toward graduate or professional degrees. For more information and details of the policies and procedures related to accelerated studies, please visit the Undergraduate Academics section of the General Bulletin.

## Program Requirements

Students seeking to complete this major and degree program must meet the general requirements for bachelor's degrees and the Unified General Education Requirements. Students completing this program as a secondary major while completing another undergraduate degree program do not need to satisfy the school-specific requirements associated with this major.

Code	Title	Hours
<b>Required Courses:</b>		
PHYS 221	Introduction to Modern Physics	3
PHYS 301	Advanced Laboratory Physics I	3
PHYS 303	Advanced Laboratory Physics Seminar	1
PHYS 310	Classical Mechanics	3
PHYS 313	Thermodynamics and Statistical Mechanics	3
PHYS 324	Electricity and Magnetism I	3
PHYS 331	Introduction to Quantum Mechanics I	3
ENGR 131	Elementary Computer Programming	3
or CSDS 132	Programming in Java	
MATH 121	Calculus for Science and Engineering I	4
or MATH 125	Math and Calculus Applications for Life, Managerial, and Social Sci I	
MATH 223	Calculus for Science and Engineering III	3
or MATH 227	Calculus III	
MATH 224	Elementary Differential Equations	3
PHYS 351	Senior Physics Project	4
PHYS 352	Senior Physics Project Seminar	2

Intro Science Elective I	3
Intro Science Elective II	3
<i>Choose one of the following:</i>	4
PHYS 115    Introductory Physics I	
PHYS 121    General Physics I - Mechanics	
PHYS 123    Physics and Frontiers I - Mechanics	
<i>Choose one of the following:</i>	4
PHYS 116    Introductory Physics II	
PHYS 122    General Physics II - Electricity and Magnetism	
PHYS 124    Physics and Frontiers II - Electricity and Magnetism	
<i>Choose one of the following:</i>	4
MATH 122    Calculus for Science and Engineering II	
MATH 124    Calculus II	
MATH 126    Math and Calculus Applications for Life, Managerial, and Social Sci II	

Code	Title	Hours
<b>Intro Science Elective Sequences <sup>a</sup></b>		<b>6-8</b>
ASTR 221 & ASTR 222	Stars and Planets and Galaxies and Cosmology	
CHEM 105 & CHEM 106	Principles of Chemistry I and Principles of Chemistry II	
CHEM 111 & ENGR 145	Principles of Chemistry for Engineers and Chemistry of Materials	
BIOL 214 & BIOL 215	Genes, Evolution and Ecology and Cells and Proteins	
EEPS 101 & EEPS 110	The Earth and Planets and Physical Geology	
EEPS 115 & EEPS 117	Introduction to Oceanography and Weather and Climate	

<sup>a</sup> Students can choose another two course sequence totaling 6 or more credit hours in a quantitative science (other than physics), with approval of the physics undergraduate program committee.

## Sample Plan of Study

<b>First Year</b>		
<b>Fall</b>		<b>Hours</b>
PHYS 121    General Physics I - Mechanics or PHYS 123    or Physics and Frontiers I - Mechanics		4
MATH 121    Calculus for Science and Engineering I		4
PHYS 166    Physics Today and Tomorrow		1
Academic Inquiry Seminar, Breadth, or Elective course <sup>a</sup>		3
Intro Science Elective I		3
<b>Hours</b>		<b>15</b>
<b>Spring</b>		
MATH 122    Calculus for Science and Engineering II		4
PHYS 122    General Physics II - Electricity and Magnetism or PHYS 124    or Physics and Frontiers II - Electricity and Magnetism		4
ENGR 131    Elementary Computer Programming		3
Academic Inquiry Seminar, Breadth, or Elective course <sup>a</sup>		3

Intro Science Elective II		3
Hours		17
Second Year		
Fall		
PHYS 221	Introduction to Modern Physics	3
MATH 223	Calculus for Science and Engineering III	3
Breadth, or Elective course <sup>a</sup>		3
Open Elective		3
Open Elective		3
Hours		15
Spring		
MATH 224	Elementary Differential Equations	3
PHYS 310	Classical Mechanics	3
Breadth, or Elective course <sup>a</sup>		3
Open Elective		3
Open Elective		3
Hours		15
Third Year		
Fall		
PHYS 301	Advanced Laboratory Physics I	3
PHYS 303	Advanced Laboratory Physics Seminar	1
PHYS 313	Thermodynamics and Statistical Mechanics	3
PHYS 331	Introduction to Quantum Mechanics I	3
Breadth, or Elective course <sup>a</sup>		3
Open Elective <sup>c</sup>		3
Hours		16
Spring		
PHYS 324	Electricity and Magnetism I	3
Breadth, or Elective course <sup>a</sup>		3
Open Elective		3
Open Elective		3
Open Elective		3
Hours		15
Fourth Year		
Fall		
PHYS 351	Senior Physics Project	2
PHYS 352	Senior Physics Project Seminar	1
Breadth, or Elective course <sup>a</sup>		3
Open Elective		3
Open Elective		3
Open Elective		3
Hours		15
Spring		
PHYS 351	Senior Physics Project	2
PHYS 352	Senior Physics Project Seminar	1
Breadth, or Elective course <sup>a</sup>		3
Open Elective		3
Open Elective		3
Hours		12
Total Hours		120

a Unified General Education Requirement.