**PHYSICS, BA**

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

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### 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.

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### 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.

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### 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
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| 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 or CSDS 132 | Elementary Computer Programming Programming in Java | 3 |
| MATH 121 or MATH 125 | Calculus for Science and Engineering I Math and Calculus Applications for Life, Managerial, and Social Sci I | 4 |
| MATH 223 or MATH 227 | Calculus for Science and Engineering III Calculus III | 3 |
| 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
Choose one of the following: 4
PHYS 115 Introductory Physics I
PHYS 121 General Physics I - Mechanics
PHYS 123 Physics and Frontiers I - Mechanics
Choose one of the following: 4
PHYS 116 Introductory Physics II
PHYS 122 General Physics II - Electricity and Magnetism
PHYS 124 Physics and Frontiers II - Electricity and Magnetism
Choose one of the following: 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

Sample Plan of Study

First Year
Fall
PHYS 121 General Physics I - Mechanics 4
or PHYS 123 or Physics and Frontiers I - Mechanics
MATH 121 Calculus for Science and Engineering I 4
PHYS 166 Physics Today and Tomorrow 1
Academic Inquiry Seminar, Breadth, or Elective course a 3
Intro Science Elective I 3

Hours 15

Spring
MATH 122 Calculus for Science and Engineering II 4
PHYS 122 General Physics II - Electricity and Magnetism 4
or PHYS 124 or Physics and Frontiers II - Electricity and Magnetism
ENGR 131 Elementary Computer Programming 3
Academic Inquiry Seminar, Breadth, or Elective course a 3

Hours 15

Second Year
Fall
PHYS 221 Introduction to Modern Physics 3
MATH 223 Calculus for Science and Engineering III 3
Breadth, or Elective course a 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 a 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 a 3
Open Elective c 3

Hours 16

Spring
PHYS 324 Electricity and Magnetism I 3
Breadth, or Elective course a 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 a 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 a 3
Open Elective 3
Open Elective 3
Open Elective 3

Hours 12

Total Hours 120

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.
a Unified General Education Requirement.