PHYSICS, B.S. (SCIENCE)

Begin Campus: Any Penn State Campus

End Campus: University Park

Degree Requirements

For the Bachelor of Science degree in Physics, a minimum of 120 credits is required:

Requirement	Credits
General Education	45
Requirements for the Major	90-97
Electives	0-3

16-18 of the 45 credits for General Education are included in the Requirements for the Major. This includes: 7-9 credits of GN courses (9 credits only for Medical Physics Option); 6 credits of GQ courses; 3 credits of GWS courses.

Requirements for the Major

To graduate, a student enrolled in the major must earn a grade of C or better in each course designated by the major as a C-required course, as specified by Senate Policy 82-44 (https://senate.psu.edu/students/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/).

Common Requirements for the Major (All Options)

Code	Title	Credits
Prescribed Courses		
CHEM 111	Experimental Chemistry I	1
CHEM 112	Chemical Principles II	3
MATH 220	Matrices	2-3
Prescribed Courses: Require a grade of C or better		
CHEM 110	Chemical Principles I	3
ENGL 202C	Effective Writing: Technical Writing	3
MATH 140	Calculus With Analytic Geometry I	4
MATH 141	Calculus with Analytic Geometry II	4
PHYS 211	General Physics: Mechanics	4
PHYS 212	General Physics: Electricity and Magnetism	4
PHYS 213	General Physics: Fluids and Thermal Physics	2
PHYS 214	General Physics: Wave Motion and Quantum Physics	2
PHYS 237	Introduction to Modern Physics	3-4
PHYS 400	Intermediate Electricity and Magnetism	3-4
PHYS 410	Introduction to Quantum Mechanics I	3-4
PHYS 419	Theoretical Mechanics	3
PHYS 420	Thermal Physics	3
PHYS 444	Topics in Contemporary Physics	2
PHYS 457W	Experimental Physics	3
Additional Courses		
Select 3 credits from the following:		3
CMPSC 101	Introduction to Programming	
CMPSC 121	Introduction to Programming Techniques	
CMPSC 131	Programming and Computation I: Fundamentals	
CMPSC 200	Programming for Engineers with MATLAB	
CMPSC 201	Programming for Engineers with C++	
CMPSC 204	Introduction to Computational Sciences Programming	
Additional Courses: Require a grade of C or better		
MATH 230	Calculus and Vector Analysis	4
or MATH 231 & MATH 232	Calculus of Several Variables and Integral Vector Calculus	
MATH 251	Ordinary and Partial Differential Equations	4
or MATH 250 & MATH 252	Ordinary Differential Equations and Partial Differential Equations	
Supporting Courses and Related Areas		
Select 3 credits of 400-level MATH from departmental list		3
Requirements for the Option		
Select an option		24-27

Requirements for the Option

Computation Option (24 credits)

Code	Title	Credits
Prescribed Courses		
MATH 455	Introduction to Numerical Analysis I	3
MATH 456	Introduction to Numerical Analysis II	3
Additional Courses		
CMPSC 122	Intermediate Programming [1]	3
or CMPSC 132	Programming and Computation II: Data Structures	
Supporting Courses and Related Areas		
Select 9 credits from department list		9
Select 6 credits from the following:		6
AERSP 424	Advanced Computer Programming	
PHYS 430	Introduction to Computational Physics	
300-400-level CMPSC		
400-level MATH from departmental list		
400-level STAT		

[1] CMPSC 122 has CMPSC 121 as a prerequisite and CMPSC 132 has CMPSC 131 as a prerequisite so care should be taken when choosing the 'programming requirement' under the Common Requirements for the Major.

Electronics Option (27 credits)

Code	Title	Credits
Prescribed Courses		
EE 210	Circuits and Devices	4
Additional Courses		
Select 8 credits from the following:		8
CMPEN 270	Digital Design: Theory and Practice	
EE 310	Electronic Circuit Design I	
EE 350	Continuous-Time Linear Systems	
Supporting Courses and Related Areas		
Select 9 credits from department list, a maximum of 6 credits may be from the following:		9
PHYS 496	Independent Studies	
SC 295	Science Co-op Work Experience I	
SC 395	Science Co-op Work Experience II	

SC 495	Science Co-op Work Experience III	
Select 6 credits of EE 300- or 400-level courses		6

General Physics Option (25-26 credits)

Code	Title	Credits
Additional Courses		
PHYS 402	Electronics for Scientists	4
or PHYS 458	Intermediate Optics	
Select 6-7 credits from items A, B, and/or C: [1]		6-7
A		
PHYS 337	Introduction to Quantum Information Science and Engineering	
PHYS 406	Subatomic Physics	
PHYS 411	Introduction to Quantum Mechanics II	
PHYS 412	Solid State Physics I	
PHYS 414	Solid State Physics	
PHYS 430	Introduction to Computational Physics	
PHYS 437	Physical implementation of qubits	
PHYS 465	Network analysis of biological systems	
PHYS 472	Elements of Nuclear Physics and its Applications to Medical Imaging and Treatments	
PHYS 479	Special and General Relativity	
PHYS 496	Independent Studies	
PHYS 497	Special Topics	
B		
PHYS 402	Electronics for Scientists [2]	
or PHYS 458	Intermediate Optics	
C		
ASTRO 410	Computational Astrophysics	
ASTRO 440	Introduction to Astrophysics	
ASTRO 485	Introduction to High-Energy Astronomy	
Supporting Courses and Related Areas		
Select 12 credits from department list, with a maximum of 6 credits of the following:		12
PHYS 496	Independent Studies	
SC 295	Science Co-op Work Experience I	
SC 395	Science Co-op Work Experience II	
SC 495	Science Co-op Work Experience III	
Select 3 credits of 400-level MATH from department list		3

1 Only 3 credits of ASTRO courses may be used.
2 The course not selected above may be used.

Medical Physics Option (24-26 credits)

This option prepares students for graduate study in medical physics, medical school, or bioengineering.

Code	Title	Credits
Additional Courses		
Select course set A or B:		15-17
Set A		
BIOL 110	Biology: Basic Concepts and Biodiversity	
BIOL 230W	Biology: Molecules and Cells	
or BIOL 240W	Biology: Function and Development of Organisms	
CHEM 113	Experimental Chemistry II	
CHEM 210	Organic Chemistry I	
CHEM 212	Organic Chemistry II	
CHEM 213	Laboratory in Organic Chemistry	
Set B		
BIOL 141	Introduction to Human Physiology	
or BIOL 472	Human Physiology	
9 credits of PHYS 472 or BME at the 300- or 400-level		
Select one of the following:		
BIOL 230W	Biology: Molecules and Cells	
BMB 251	Molecular and Cell Biology I	
BME 201	Fundamentals of Cells and Molecules	
Supporting Courses and Related Options		
Select 9 credits from department list, a maximum of 6 credits may be from the following:		9
PHYS 496	Independent Studies	
SC 295	Science Co-op Work Experience I	
SC 395	Science Co-op Work Experience II	
SC 495	Science Co-op Work Experience III	

Nanotechnology/Material Science Option (24-25 credits)

Code	Title	Credits
Prescribed Courses		
PHYS 412	Solid State Physics I	3
Additional Courses		
Select course set A or B: [1]		12-13
Set A		
ESC 312	Engineering Applications of Wave, Particle, and Ensemble Concepts	
ESC 313	Introduction to Principles, Fabrication Methods, and Applications of Nanotechnology	
6 credits from ESC 400-level courses		
Set B		
MATSE 201	Introduction to Materials Science	
MATSE 402	Materials Process Kinetics	
or MATSE 436	Mechanical Properties of Materials	
MATSE 430	Materials Characterization	
MATSE 460	Introductory Laboratory in Materials	
3 credits from 400-level MATSE courses		
Supporting Courses and Related Areas		
Select 9 credits from department list, with a maximum of 6 credits from the following:		9
PHYS 496	Independent Studies	
SC 295	Science Co-op Work Experience I	
SC 395	Science Co-op Work Experience II	
SC 495	Science Co-op Work Experience III	

1 The courses in Set A help satisfy the requirements for the Nanotechnology minor.

General Education

Connecting career and curiosity, the General Education curriculum provides the opportunity for students to acquire transferable skills necessary to be successful in the future and to thrive while living in interconnected contexts. General Education aids students in developing

intellectual curiosity, a strengthened ability to think, and a deeper sense of aesthetic appreciation. These are requirements for all baccalaureate students and are often partially incorporated into the requirements of a program. For additional information, see the General Education Requirements (https://bulletins.psu.edu/undergraduate/general-education/baccalaureate-degree-general-education-program/) section of the Bulletin and consult your academic adviser.

The keystone symbol appears next to the title of any course that is designated as a General Education course. Program requirements may also satisfy General Education requirements and vary for each program.

Foundations (grade of C or better is required and Inter-Domain courses do not meet this requirement.)

- **Quantification (GQ):** 6 credits
- **Writing and Speaking (GWS):** 9 credits

Breadth in the Knowledge Domains (Inter-Domain courses do not meet this requirement.)

- **Arts (GA):** 3 credits
- **Health and Wellness (GHW):** 3 credits
- **Humanities (GH):** 3 credits
- **Social and Behavioral Sciences (GS):** 3 credits
- **Natural Sciences (GN):** 3 credits

Integrative Studies

- **Inter-Domain Courses (Inter-Domain):** 6 credits

Exploration

- **GN,** may be completed with Inter-Domain courses: 3 credits
- **GA, GH, GN, GS, Inter-Domain courses.** This may include 3 credits of World Language course work beyond the 12th credit level or the requirements for the student's degree program, whichever is higher**:** 6 credits

University Degree Requirements

First Year Engagement

All students enrolled in a college or the Division of Undergraduate Studies at University Park, and the World Campus are required to take 1 to 3 credits of the First-Year Seminar, as specified by their college First-Year Engagement Plan.

Other Penn State colleges and campuses may require the First-Year Seminar; colleges and campuses that do not require a First-Year Seminar provide students with a first-year engagement experience.

First-year baccalaureate students entering Penn State should consult their academic adviser for these requirements.

Cultures Requirement

6 credits are required and may satisfy other requirements

- United States Cultures: 3 credits
- International Cultures: 3 credits

Writing Across the Curriculum

3 credits required from the college of graduation and likely prescribed as part of major requirements.

Total Minimum Credits

A minimum of 120 degree credits must be earned for a baccalaureate degree. The requirements for some programs may exceed 120 credits. Students should consult with their college or department adviser for information on specific credit requirements.

Quality of Work

Candidates must complete the degree requirements for their major and earn at least a 2.00 grade-point average for all courses completed within their degree program.

Limitations on Source and Time for Credit Acquisition

The college dean or campus chancellor and program faculty may require up to 24 credits of course work in the major to be taken at the location or in the college or program where the degree is earned. Credit used toward degree programs may need to be earned from a particular source or within time constraints (see Senate Policy 83-80 (https://senate.psu.edu/students/policies-and-rules-for-undergraduate-students/82-00-and-83-00-degree-requirements/)). For more information, check the Suggested Academic Plan for your intended program.