Physics B.S.

General Education Foundations

Please use this link to view a list of courses that meet each GEF requirement. **(**http://registrar.wvu.edu/gef/**)**

NOTE: Some major requirements will fulfill specific GEF requirements. Please see the curriculum requirements listed below for details on which GEFs you will need to select.

Code	Title	Hours
General Education Foundations		
F1 - Composition & Rhetoric		3-6
ENGL 101 & ENGL 102	Introduction to Composition and Rhetoric and Composition, Rhetoric, and Research	
or ENGL 103	Accelerated Academic Writing	
F2A/F2B - Science & Technology		4-6
F3 - Math & Quantitative Reasoning		3-4
F4 - Society & Connections		3
F5 - Human Inquiry & the Past		3
F6 - The Arts & Creativity		3
F7 - Global Studies & Diversity		3
F8 - Focus (may be satisfied by completion of a minor, double major, or dual degree)		9
Total Hours		31-37

Please note that not all of the GEF courses are offered at all campuses. Students should consult with their advisor or academic department regarding the GEF course offerings available at their campus.

Degree Requirements

Students must complete WVU General Education Foundations requirements, Eberly Edge Program requirements, major requirements, and electives to total a minimum of 120 hours.

Departmental Requirements for the B.S. in Physics

Students may not earn both a B.A. and a B.S. in Physics. All students wishing to obtain a degree in Physics must comply with the following:

- **Calculation of the GPA in the Major:** A minimum grade point average of a 2.0 is required in all courses applied to major requirements, including the STEM Foundations and the AoE selected. If a course is repeated, all attempts will be included in the calculation of the GPA, unless the course is eligible for a D/F repeat.
- **Writing and Communication Skills Requirement:** Physics Bachelor of Science students fulfill the Writing and Communication Skills requirement by completing ENGL 101 and ENGL 102 (or ENGL 103), and two of the following **SpeakWrite Certified Courses** **TM**: PHYS 191, PHYS 341L, PHYS 376L PHYS 496, ASTR 496.
- **Area of Emphasis**: Students completing a Bachelor of Science in Physics must complete an Area of Emphasis selected from Computational Physics, Medical Physics, Professional Preparation, or Space Physics. **The Professional Preparation Area of Emphasis is the typical plan of study for a B.S. degree in physics.**
- **Course Requirement**: Physics students completing the Professional Preparation or Space Physics Areas of Emphasis are required to complete two semesters of advanced lab (PHYS 341L and PHYS 342L) . Students completing the Computational Physics Areas of Emphasis only need to complete one semester of PHYS 341L. Students completing the Physics Teaching Area of Emphasis are required to complete PHYS 376L in place of PHYS 341L.
- **Capstone Requirement**: The university requires the successful completion of a Capstone course. Students majoring in Physics must complete PHYS 496 (other options maybe available depending on AoE selected).

Curriculum Requirements

Code	Title	Hours
University Requirements		38
Eberly Edge Requirements		15

Physics Major Requirements	67
Total Hours	120

University Requirements

Code	Title	Hours
General Education Foundations (GEF) 1, 2, 3, 4, 5, 6, 7, and 8 (31-37 Credits)		
Outstanding GEF Requirements 1, 4, 5, 6, and 7		18
PHYS 191	First-Year Seminar	1
General Electives		19
Total Hours		38

Eberly Edge Program Requirements

Code	Title	Hours
EDG 1: Data and Society		3
EDG 2: Effective and Civil Communication		3
EDG 3: Ethics and Civil Responsibility		3
EDG 4: Global and Regional Perspectives		3
EDG 5: Practicing Arts & Sciences		3
EDG 6: High Impact Experience (PHYS 341L)		
Total Hours		15

Physics Major Requirements

Code	Title	Hours
STEM FOUNDATION COURSES *		**20**
MATH 155	Calculus 1	
MATH 156	Calculus 2	
MATH 251	Multivariable Calculus	
Select one pair		
BIOL 115 & 115 & BIOL 117 & BIOL 117L	Principles of Biology and Principles of Biology and Introductory Physiology and Introductory Physiology Laboratory	
CHEM 111 & 111L & CHEM 112 & CHEM 112L	Survey of General, Organic, and Biological Chemistry 1 and Survey of Chemistry 1 Laboratory and Survey of General Organic Biological Chemistry 2 and Survey of Chemistry 2 Laboratory	
CHEM 115 & 115L & CHEM 116 & CHEM 116L	Fundamentals of Chemistry 1 and Fundamentals of Chemistry 1 Laboratory and Fundamentals of Chemistry 2 and Fundamentals of Chemistry 2 Laboratory	
SUST 101 & 101L & SUST 201 & SUST 201L	Sustainable Earth and Sustainable Earth Laboratory and Earth System Science and Earth System Science Laboratory	
CORE COURSES		**31**
MATH 261	Elementary Differential Equations	
PHYS 111 & 111L & PHYS 112 & PHYS 112L	General Physics 1 and General Physics 1 Laboratory and General Physics 2 and General Physics 2 Laboratory	
PHYS 312	Oscillations and Thermal Physics	
PHYS 314	Introductory Modern Physics	
PHYS 331	Theoretical Mechanics 1	
PHYS 333	Electricity and Magnetism 1	

PHYS 451	Introductory Quantum Mechanics	
Any additional ASTR or PHYS course at the 300 level or above		
AREA OF EMPHASIS		**13**
Select one area of Emphasis		
CAPSTONE EXPERIENCE		**3**
PHYS 496	Senior Thesis	
Total Hours		67

*

STEM foundation courses are common to most STEM majors and excluded from the calculation of the percentage of upper-division course.

First Year

Fall	Hours	Spring	Hours
MATH 155 (F3)	4	ENGL 101 (F1)	3
PHYS 191	1	Science course 2 (F8 Course 1)	4
Science Course 1 (F2B)	4	MATH 156	4
EDG 1: Data and Society	3	PHYS 111 & 111L (F8 Course 2)	4
F4	3		
	15		15

Second Year

Fall	Hours	Spring	Hours
ENGL 102	3	MATH 261	4
MATH 251	4	PHYS 314	4
PHYS 112 & 112L	4	EDG 4: Global and Regional Perspectives	3
EDG 2: Effective and Civil Communication	3	F6	3
F5	3		
	17		14

Third Year

Fall	Hours	Spring	Hours
PHYS 312	3	PHYS 333	3
PHYS 331	3	ARSC 380 (EDG 5)	3
PHYS 341L (EDG 6 and AOE Course 1)	3	PHYS or ASTR Elective 1	3
EDG 3: Ethics and Civil Responsibility	3	AOE Course 2	3
F7	3	General Elective	3
	15		15

Fourth Year

Fall	Hours	Spring	Hours
PHYS 451	3	PHYS 496	3
AOE Course 3	4	General Elective	4
AOE Course 4	3	General Elective	3
General Elective	3	General Elective	3
General Elective	3		
	16		13

Total credit hours: 120

Areas of Emphasis Offered:

- Computational Physics (p. 3)
- Medical Physics (p. 5)
- Professional Preparation (p. 6)
- Space Physics (p. 7)

COMPUTATIONAL PHYSICS

Code	Title	Hours
CORE COURSES:		**10**
PHYS 301	Computational Physics	
PHYS 341L	Advanced Physics 1 Laboratory	
PHYS 342L	Advanced Physics Laboratory 2 (2 credits) *	
PHYS 461	Thermodynamics and Statistical Mechanics	
ELECTIVES:		**3**
Select one of the following courses:		
CPE 271	Introduction to Digital Logic Design	
CS 210	File and Data Structures	
CS 220	Discrete Mathematics	
CS 330	Introduction to Software Engineering	
MATH 322	Introduction to Programming and Computational Mathematics	
Total Hours		13

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Students may substitute any ASTR or PHYS courses at the 300 level or above. Only 3 credits of PHYS 490, 491, 495 may be applied to major requirements.

SUGGESTED PLAN OF STUDY

First Year

Fall	Hours	Spring	Hours
PHYS 191	1	ENGL 101 (F1)	3
F4	3	CS 111 (B.S. First Area 2)	3
CS 110 (B.S. First Area 1)	3	MATH 156 (B.S. Second Area 1; F8)	4
MATH 155 (F3)	4	PHYS 111 & 111L (B.S. Third Area 1; F2)	4
General Elective	3		
	14		14

Second Year

Fall	Hours	Spring	Hours
ENGL 102 (F1)	3	F6	3
F5	3	MATH 261	4
MATH 251 (B.S. Second Area 2)	4	PHYS 314	4
PHYS 112 & 112L (B.S. Third Area 2; F8)	4	General Elective	3
General Elective	1	General Elective	3
	15		17

Third Year

Fall	Hours	Spring	Hours
CPE 271	3	CS 210	4
PHYS 312	3	PHYS 332 (or Elective)	3
PHYS 331	3	PHYS 333	3
PHYS 341L	3	F8	3
ECAS Glo. Stu. & Div. Req. (F7)	3	General Elective	2
	15		15

Fourth Year

Fall	Hours	Spring	Hours
CS 220	3	PHYS 461	3
PHYS 301	3	PHYS 496 or CS 481	3
PHYS 334 (or Elective)	3	General Elective	3
PHYS 451	3	General Elective	3

General Elective		3 General Elective	3
		15	15

Total credit hours: 120

NOTE: Students in this AoE will need to have completed either (a) CHEM 231 (or CHEM 233 and CHEM 233L) as a prerequisite for AGBI 410 or (b) CHEM 233 and CHEM 233L as prerequisites for BIOC 339

MEDICAL PHYSICS

Code	Title	Hours
BMM 339	Introduction to Human Biochemistry	4
or AGBI 410	Introductory Biochemistry	
BIOL 115 & 115L	Principles of Biology and Principles of Biology Laboratory	4
PHYS 326	Medical Imaging Physics	3
PHYS 341L	Advanced Physics 1 Laboratory	3
Total Hours		14

SUGGESTED PLAN OF STUDY

First Year

Fall	Hours	Spring	Hours
PHYS 191	1	ENGL 101 (F1)	3
F4	3	CHEM 116 & 116L (B.S. First Area 2; F8)	4
CHEM 115 & 115L (B.S. First Area 1; F2)	4	MATH 156 (B.S. Second Area 1; F8)	4
MATH 155 (F3)	4	PHYS 111 & 111L (B.S. Third Area; F8)	4
General Elective	3		
	15		15

Second Year

Fall	Hours	Spring	Hours
ENGL 102 (F1)	3	F6	3
F5	3	F7	
MATH 251 (B.S. Second Area 2)	4	MATH 261	4
PHYS 112 & 112L (B.S. Third Area 2; F8)	4	PHYS 314	4
General Elective	1	General Elective	4
	15		15

Third Year

Fall	Hours	Spring	Hours
BIOL 115 & 115L	4	BIOL 117 & 117L	4
PHYS 312	3	PHYS 332 (or Elective)	3
PHYS 331	3	PHYS 333	3
PHYS 341L	3	General Elective	4
General Elective	3		
	16		14

Fourth Year

Fall	Hours	Spring	Hours
CHEM 233 & 233L	4	PHYS 326	3
PHYS 334 (or Elective)	3	PHYS 461	3
PHYS 451	3	PHYS 496	3

General Elective		3 General Elective	3
General Elective		2 General Elective	3
		15	15

Total credit hours: 120

PROFESSIONAL PREPARATION AREA OF EMPHASIS

Code	Title	Hours
CORE COURSES:		**10**
PHYS 332	Theoretical Mechanics 2	
or PHYS 334	Electricity and Magnetism	
PHYS 341L	Advanced Physics 1 Laboratory	
PHYS 342L	Advanced Physics Laboratory 2 (2 credits)	
PHYS 461	Thermodynamics and Statistical Mechanics	
ELECTIVES:		**3**
Select one course from the list: *		
PHYS 301	Computational Physics	
PHYS 321	Optics	
PHYS 326	Medical Imaging Physics	
PHYS 332	Theoretical Mechanics 2	
or PHYS 334	Electricity and Magnetism	
PHYS 452	Quantum Mechanics 2	
PHYS 471	Solid State Physics	
PHYS 481	Plasma Physics	
PHYS 490	Teaching Practicum	
ASTR 368	Astrophysics 2	
ASTR 467	Stellar Structure and Evolution	
ASTR 469	Observational Astronomy	
ASTR 470	General Relativity	
Total Hours		13

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No more than 6 hours combined of ASTR/PHYS 490, 491, 494, 495, or 497 may be used to fulfill major requirements (AoE and core requirements).

SUGGESTED PLAN OF STUDY

First Year

Fall	Hours	Spring	Hours
PHYS 191	1	ENGL 101 (F1)	3
F4	3	B.S. First Area 2	4
B.S. First Area 1; F2	4	MATH 156 (B.S. Second Area 1; F8)	4
MATH 155 (F3)	4	PHYS 111 (Third Area 1; F8)	4
General Elective	3		
	15		15

Second Year

Fall	Hours	Spring	Hours
ENGL 102 (F1)	3	F6	3
F5	3	MATH 261	4
MATH 251 (B.S. Second Area 2)	4	PHYS 314	4
PHYS 112 (B.S. Third Area 2; F8)	4	General Elective	1
General Elective	3	General Elective	3
	17		15

Third Year

Fall	Hours	Spring	Hours
PHYS 331	3	PHYS 332 (or Elective)	3
PHYS 341L	3	PHYS 333	3
ECAS Glob. Stu. and Div. Req. (F7)	3	Physics or Astronomy Elective 1	3
General Elective	3	General Elective	3
PHYS 312	3	General Elective	3
	15		15

Fourth Year

Fall	Hours	Spring	Hours
PHYS 334 (or Elective)	3	PHYS 461	3
PHYS 451	3	PHYS 496	3
Math Elective	3	Physics or Astronomy Elective 3	3
Physics or Astronomy Elective 2	3	General Elective	3
General Elective	3	General Elective	1
	15		13

Total credit hours: 120

SPACE PHYSICS

Code	Title	Hours
CORE COURSES:		**9**
ASTR 467	Stellar Structure and Evolution	
or PHYS 481	Plasma Physics	
PHYS 341L	Advanced Physics 1 Laboratory	
PHYS 342L	Advanced Physics Laboratory 2 (1 credit)	
PHYS 461	Thermodynamics and Statistical Mechanics	
ELECTIVES: *		**4**
PHYS 342L	Advanced Physics Laboratory 2 (1 credit)	
PHYS 301	Computational Physics	
PHYS 321	Optics	
PHYS 332	Theoretical Mechanics 2	
PHYS 334	Electricity and Magnetism	
PHYS 452	Quantum Mechanics 2	
ASTR 368	Astrophysics 2	
ASTR 469	Observational Astronomy	
ASTR 470	General Relativity	
EE 221 & 221L	Introduction to Electrical Engineering and Introduction to Electrical Engineering Laboratory	
Total Hours		13

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Only a total of 3 credits of PHYS 490, 491, 495 may count toward major requirements.

SUGGESTED PLAN OF STUDY

First Year

Fall	Hours	Spring	Hours
PHYS 191	1	ENGL 101 (F1)	3
F4	3	CS 111 & 111L (B.S. First Area 2)	4
CS 110 & 110L (B.S. First Area 1)	4	MATH 156 (F8)	4
MATH 155 (F3)	4	PHYS 111 (B.S. Third Area 1; F2)	4

General Elective		3	
		15	15

Second Year

Fall	Hours	Spring	Hours
ENGL 102 (F1)		3 F6	3
F5		3 F7	3
MATH 251 (B.S Second Area 1)		4 MATH 261	4
PHYS 112 (B.S. Third Area 2; F8)		4 PHYS 314	4
General Elective		1 General Elective	1
		15	15

Third Year

Fall	Hours	Spring	Hours
EE 221 & 221L		4 PHYS 321	3
PHYS 312		3 PHYS 332 (or General Elective)	3
PHYS 331		3 PHYS 333	3
PHYS 341L		3 General Elective	5
F8		3	
		16	14

Fourth Year

Fall	Hours	Spring	Hours
ASTR 467		3 PHYS 461	3
PHYS 334 (or General Elective)		3 PHYS 481 or ASTR 368	3
PHYS 451		3 PHYS 496	3
General Elective		3 General Elective	3
General Elective		3 General Elective	3
		15	15

Total credit hours: 120

Major Learning Outcomes

PHYSICS B.S.

Upon successful completion of the B.S. degree, **Physics** majors will demonstrate:

1. An understanding of and ability to solve basic conceptual and quantitative problems in theoretical mechanics, electricity and magnetism, quantum mechanics, and thermodynamics.
2. A range of effective strategies, both written and oral, to communicate physics theories, processes, and results.
3. An ability to develop experiments to test basic or applied research questions, to perform accurate experimental measurements, and to critically evaluate others' answers to research questions.