PHYSICS: CHEMICAL PRINCIPLES, BA

Physics and astronomy are fundamental sciences aimed at discovering the basic principles that govern our universe. Physicists study the interplay between space, time, matter, and energy. Complex behavior in nature is explained in terms of elementary relations between constituent elements and the forces that bind them, over distances ranging from subatomic to cosmic scale. Astronomy encompasses the entire physical universe beyond the earth: the solar system, stars, galaxies, galaxy clusters and superclusters, quasars, and the large-scale structure of the universe. The basic tools in physics and astronomy are mathematics and experimental investigation and observation of the world around us.

At Penn, the curriculum for undergraduate Physics majors, which includes extensive laboratory experience, is based on faculty strengths in Condensed Matter Physics, Elementary Particle Physics, and Astrophysics. Undergraduate teaching is linked to faculty research efforts in these areas, and participation by undergraduates in research is strongly encouraged.

This concentration is particularly appropriate for students planning to enter the health professions. Such students should be aware that, although not part of the concentration requirements, laboratories in general and organic chemistry and lecture and laboratory work in biology are generally required by professional schools in the health area. The concentration may also be appropriate for other students pursuing double majors in Physics and Chemistry or Biochemistry.

The minimum total course units (https://www.college.upenn.edu/credits-needed-major/) for graduation in this major is 36. Double majors may entail more course units.

Note: For Biology concentration, see Biophysics track outlined below.

For more information: http://www.physics.upenn.edu/

For information about the General Education requirements, please visit the College of Arts & Sciences Curriculum (https://www.college.upenn.edu/curriculum/) page.

Code	Title	Course Units
College General Education Requirements and Free Electives		
Foundational Approaches + Sectors[1] + Free Electives		17.5
Major Requirements		
Core Requirements		
MATH 1400	Calculus, Part I	1
MATH 1410	Calculus, Part II	1
MATH 2400	Calculus, Part III	1
MATH 2410	Calculus, Part IV	1
PHYS 1230	Principles of Physics III: Thermal Physics and Waves	1
PHYS 1250	Principles of Physics IV: Modern Physics	1.5
PHYS 3351	Analytical Mechanics	1
PHYS 3361	Electromagnetism I: Electricity and Potential Theory	1
PHYS 3362	Electromagnetism II: Magnetism, Maxwell's Equations, and Electromagnetic Waves	1
PHYS 4411	Introduction to Quantum Mechanics I	1
PHYS 0150	Principles of Physics I: Mechanics and Wave Motion	1.5
or PHYS 0170	Honors Physics I: Mechanics and Wave Motion	
PHYS 0151	Principles of Physics II: Electromagnetism and Radiation	1.5
or PHYS 0171	Honors Physics II: Electromagnetism and Radiation	
Concentration Requirements		
Select one of the following Concentrations:		5
Chemical Principles Concentration:		
CHEM 1011	Introduction to General Chemistry I	
CHEM 1021	Introduction to General Chemistry II	
CHEM 2210 & CHEM 2220	Physical Chemistry I and Physical Chemistry II	
or CHEM 241 & CHEM 242	Principles of Organic Chemistry I and Principles of Organic Chemistry II	
PHYS 4401	Thermodynamics and the Introduction to Statistical Mechanics and Kinetic Theory	
Biology Concentration: Biophysics Track Requirements:		
BIOL 1121	Introduction to Biology - The Molecular Biology of Life	
BIOL 2210	Molecular Biology and Genetics	
BIOL 2110	Molecular and Cellular Neurobiology	
BIOL 4004	Immunobiology	
PHYS 2280	Physical Models of Biological Systems	
Total Course Units		**36**

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You may count no more than one course toward both a Major and a Sector requirement. For Exceptions, check the Policy Statement (http://www.college.upenn.edu/sectors-policy/).

Honors

Applicants must have a minimum GPA of 3.3 in major-related courses.

Code	Title	Course Units
PHYS 4498	Senior Honor Thesis (Semester 1)	1
PHYS 4498	Senior Honor Thesis (Semester 2)	1
Thesis Accepted		

The degree and major requirements displayed are intended as a guide for students entering in the Fall of 2022 and later. Students should consult with their academic program regarding final certifications and requirements for graduation.