PHYSICS - B.S.

College of Arts and Sciences
Department of Physics
www.kent.edu/physics

About This Program

The Bachelor of Science in Physics program is designed for students who want to pursue a career in physics or a related field. With a rigorous curriculum that includes advanced coursework in classical mechanics, electromagnetism, quantum mechanics and more, this program provides you with the knowledge and skills needed to succeed in graduate school or the workforce. Read more...

Contact Information

- **Almut Schroeder** | aschroe2@kent.edu | 330-672-3044
- Speak with an Advisor
- Chat with an Admissions Counselor

Program Delivery

- **Delivery:**
  - In person
- **Location:**
  - Kent Campus

Admission Requirements

The university affirmatively strives to provide educational opportunities and access to students with varied backgrounds, those with special talents and adult students.

First-Year Students on the Kent Campus: First-year admission policy on the Kent Campus is selective. Admission decisions are based upon cumulative grade point average, strength of high school college preparatory curriculum and grade trends. Students not admissible to the Kent Campus may be administratively referred to one of the seven regional campuses to begin their college coursework. For more information, visit the admissions website for first-year students.

First-Year Students on the Regional Campuses: First-year admission to Kent State's campuses at Ashtabula, East Liverpool, Geauga, Salem, Stark, Trumbull and Tuscarawas, as well as the Twinsburg Academic Center, is open to anyone with a high school diploma or its equivalent. For more information on admissions, contact the Regional Campuses admissions offices.

International Students: All international students must provide proof of proficiency of the English language (unless they meet specific exceptions) through the submission of an English language proficiency test score or by completing English language classes at Kent State's English as a Second Language Center before entering their program. For more information, visit the admissions website for international students.

Former Students: Former Kent State students who have not attended another institution since Kent State and were not academically dismissed will complete the re-enrollment process through the Financial, Billing and Enrollment Center. Former students who attended another college or university since leaving Kent State must apply for admissions as a transfer or post-undergraduate student.

Transfer Students: Students who attended an educational institution after graduating from high school or earning their GED must apply as transfer students. For more information, visit the admissions website for transfer students.

Admission policies for undergraduate students may be found in the University Catalog's Academic Policies.

Students may be required to meet certain criteria to progress in their program. Any progression requirements will be listed on the program's Coursework tab

Program Requirements

Major Requirements

Code	Title	Credit Hours
Major Requirements (courses count in major GPA)		
CHEM 10060	GENERAL CHEMISTRY I (KBS)	4
CHEM 10061	GENERAL CHEMISTRY II (KBS)	4
CHEM 10062	GENERAL CHEMISTRY I LABORATORY (KBS) (KLAB)	1
CHEM 10063	GENERAL CHEMISTRY II LABORATORY (KBS) (KLAB)	1
MATH 12002	ANALYTIC GEOMETRY AND CALCULUS I (KMCR)	5
MATH 12003	ANALYTIC GEOMETRY AND CALCULUS II	5
MATH 32051	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES I	4
MATH 32052	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES II	4
PHY 12000	INTRODUCTORY PHYSICS SEMINAR (ELR)	1
PHY 23101	GENERAL UNIVERSITY PHYSICS I (KBS) (KLAB) [1]	5
PHY 23102	GENERAL UNIVERSITY PHYSICS II (KBS) (KLAB) [1]	5
PHY 30020	INTERMEDIATE PHYSICS LABORATORY (WIC) [2]	2
PHY 35101	CLASSICAL MECHANICS	4
PHY 36001	INTRODUCTORY MODERN PHYSICS	3
PHY 40020	ADVANCED PHYSICS LABORATORY (WIC) [2]	2
PHY 40092	INTERNSHIP IN PHYSICS (ELR)	2
or PHY 40096	INDIVIDUAL INVESTIGATION (ELR)	
PHY 45201	ELECTROMAGNETIC THEORY	4
Additional Requirements (courses do not count in major GPA)		
UC 10001	FLASHES 101	1
Foreign Language (see Foreign Language College Requirement below)		8
Kent Core Composition		6
Kent Core Humanities and Fine Arts (minimum one course from each) [3]		9
General Elective (total credit hours depends on earning 120 credit hours, including 39 upper-division credit hours)		1
Concentrations		
Choose from the following:		39
Applied Physics		
Biological Sciences		
Chemistry		
Computer Science		
Entrepreneurship		

Mathematical Physics	
Pre-Medicine/Pre-Osteopathy/Pre-Podiatry	
Research	
Minimum Total Credit Hours:	**120**

1 Credit is not granted for both the PHY 13001/PHY 13002 and the PHY 23101/PHY 23102 series, nor for PHY 13012.
2 A minimum C grade must be earned to fulfill the writing-intensive requirement.
3 PHIL 21001 is highly recommended to fulfill the Kent Core Humanities category for the Pre-Medicine/Pre-Osteopathy/Pre-Podiatry concentration. This course also fulfills the global diversity requirement.

Applied Physics Concentration Requirements

Code	Title	Credit Hours
Concentration Requirements (courses count in major GPA)		
CS 13001	COMPUTER SCIENCE I: PROGRAMMING AND PROBLEM SOLVING	4
or CS 13011 & CS 13012	COMPUTER SCIENCE IA: PROCEDURAL PROGRAMMING and COMPUTER SCIENCE IB: OBJECT ORIENTED PROGRAMMING	
PHY 22564	INTRODUCTION TO MATERIALS PHYSICS	3
PHY 32511	ELECTRONICS	4
PHY 36002	APPLICATIONS OF MODERN PHYSICS	3
PHY 45403	DATA ANALYSIS AND COMPUTATIONAL PHYSICS TECHNIQUES	3
PHY 45501	ELECTROMAGNETIC WAVES AND MODERN OPTICS	3
Physics (PHY) Elective [1]		3
Physics (PHY) Upper-Division Elective (30000 or 40000 level) [1]		3
Additional Requirements (courses do not count in major GPA)		
Kent Core Social Sciences (must be from two disciplines)		6
General Electives		7
Minimum Total Credit Hours:		**39**

1 Maximum 6 credit hours of PHY 40096 may be applied toward the major.

Biological Sciences Concentration Requirements

Code	Title	Credit Hours
Concentration Requirements (courses count in major GPA)		
BSCI 10110	BIOLOGICAL DIVERSITY (ELR) (KBS) (KLAB)	4
BSCI 10120	BIOLOGICAL FOUNDATIONS (ELR) (KBS) (KLAB)	4
BSCI 30140	CELL BIOLOGY	4
BSCI 30156	ELEMENTS OF GENETICS	3
BSCI 40163	EVOLUTION	3
PHY 45301	THERMAL PHYSICS	3
PHY 46101	QUANTUM MECHANICS	4
Major Upper-Division Elective [1]		3
Additional Requirements (courses do not count in major GPA)		
Kent Core Social Sciences (must be from two disciplines)		6
General Electives		5
Minimum Total Credit Hours:		**39**

1 Recommended major electives: BSCI 40158, CHEM 30481, PHY 41010, PHY 44600.

Chemistry Concentration Requirements

Code	Title	Credit Hours
Concentration Requirements (courses count in major GPA)		
CHEM 30481	ORGANIC CHEMISTRY I [1]	3
CHEM 30482	ORGANIC CHEMISTRY II [1]	3
CHEM 30105	ANALYTICAL CHEMISTRY I	3
CHEM 30107	ANALYTICAL CHEMISTRY LABORATORY I (WIC) [2]	1
CHEM 30301	INORGANIC CHEMISTRY I	3
PHY 36002	APPLICATIONS OF MODERN PHYSICS	3
PHY 45301	THERMAL PHYSICS	3
PHY 46101	QUANTUM MECHANICS	4
Physics (PHY) Electives [3]		6
Additional Requirements (courses do not count in major GPA)		
Kent Core Social Sciences (must be from two disciplines)		6
General Electives		4
Minimum Total Credit Hours:		**39**

1 Students who have already completed CHEM 30481 and CHEM 30482 may not take and apply CHEM 20482 toward the program.
2 A minimum C grade must be earned to fulfill the writing-intensive requirement.
3 Maximum 6 credit hours of PHY 40096 may be applied toward the major.

Computer Science Concentration Requirements

Code	Title	Credit Hours
Concentration Requirements (courses count in major GPA)		
CS 13001	COMPUTER SCIENCE I: PROGRAMMING AND PROBLEM SOLVING	4
or CS 13011 & CS 13012	COMPUTER SCIENCE IA: PROCEDURAL PROGRAMMING and COMPUTER SCIENCE IB: OBJECT ORIENTED PROGRAMMING	
CS 23001	COMPUTER SCIENCE II: DATA STRUCTURES AND ABSTRACTION	4
CS 23022	DISCRETE STRUCTURES FOR COMPUTER SCIENCE	3
CS 42201	NUMERICAL LINEAR ALGEBRA	3
PHY 36002	APPLICATIONS OF MODERN PHYSICS	3
PHY 46101	QUANTUM MECHANICS	4
Physics (PHY) Upper-Division Electives (30000 or 40000 level) [1]		6
Additional Requirements (courses do not count in major GPA)		
Kent Core Social Sciences (must be from two disciplines)		6
General Electives		6
Minimum Total Credit Hours:		**39**

1 Maximum 6 credit hours of PHY 40096 may be applied toward the major.

Entrepreneurship Concentration Requirements

Code	Title	Credit Hours
Concentration Requirements (courses count in major GPA)		
ACCT 23020	INTRODUCTION TO FINANCIAL ACCOUNTING	3
or ENTR 37040	ENTREPRENEURIAL TOOLS	
ECON 22060	PRINCIPLES OF MICROECONOMICS (KSS)	3
ENTR 27056	INTRODUCTION TO ENTREPRENEURSHIP	3
ENTR 27466	SPEAKER SERIES IN ENTREPRENEURSHIP	1
ENTR 37065	ENTREPRENEURIAL FINANCE	3
MKTG 25010	PRINCIPLES OF MARKETING	3
Physics (PHY) Upper-Division Electives (30000 or 40000 level) [1]		9
Additional Requirements (courses do not count in major GPA)		
Kent Core Social Sciences (must be from two disciplines)		3
General Electives [2]		11
Minimum Total Credit Hours:		**39**

1 Maximum 6 credit hours of PHY 40096 may be applied toward the major.

2 Recommended general electives: ENTR 47047 and one of the following: ENTR 37045, ENTR 37075, MKTG 35056.

Mathematical Physics Concentration Requirements

Code	Title	Credit Hours
Concentration Requirements (courses count in major GPA)		
CS 13001	COMPUTER SCIENCE I: PROGRAMMING AND PROBLEM SOLVING	4
or CS 13011 & CS 13012	COMPUTER SCIENCE IA: PROCEDURAL PROGRAMMING and COMPUTER SCIENCE IB: OBJECT ORIENTED PROGRAMMING	
PHY 36002	APPLICATIONS OF MODERN PHYSICS	3
PHY 45401	MATHEMATICAL METHODS IN PHYSICS	4
PHY 45403	DATA ANALYSIS AND COMPUTATIONAL PHYSICS TECHNIQUES	3
PHY 46101	QUANTUM MECHANICS	4
Physics (PHY) Electives [1]		9
Additional Requirements (courses do not count in major GPA)		
Kent Core Social Sciences (must be from two disciplines)		6
General Electives		6
Minimum Total Credit Hours:		**39**

1 Maximum 6 credit hours of PHY 40096 may be applied toward the major.

Pre-Medicine/Pre-Osteopathy/Pre-Podiatry Concentration Requirements

Code	Title	Credit Hours
Concentration Requirements (courses count in major GPA)		
BSCI 10120	BIOLOGICAL FOUNDATIONS (ELR) (KBS) (KLAB)	4
BSCI 30130	HUMAN PHYSIOLOGY	3
or BSCI 40430	ANIMAL PHYSIOLOGY	
BSCI 30140	CELL BIOLOGY	4
BSCI 30156	ELEMENTS OF GENETICS	3
BSCI 30171	GENERAL MICROBIOLOGY	4
CHEM 30284	INTRODUCTORY BIOLOGICAL CHEMISTRY	4
or CHEM 40245	BIOCHEMICAL FOUNDATIONS OF MEDICINE	
CHEM 30475	ORGANIC CHEMISTRY LABORATORY I (ELR)	1
CHEM 30476	ORGANIC CHEMISTRY LABORATORY II	1
CHEM 30481	ORGANIC CHEMISTRY I	3
CHEM 30482	ORGANIC CHEMISTRY II	3
PSYC 11762	GENERAL PSYCHOLOGY (DIVD) (KSS)	3
SOC 12050	INTRODUCTION TO SOCIOLOGY (DIVD) (KSS)	3
Concentration Elective, choose from the following:		3-4
BSCI 30518	VERTEBRATE ANATOMY	
BSCI 40174	IMMUNOLOGY	
BSCI 40517	MEDICAL HISTOLOGY	
PHY 41010	BIOPHOTONICS	
PHY 44600	INTRODUCTION TO BIOLOGICAL PHYSICS	
Minimum Total Credit Hours:		**39**

Research Concentration Requirements

Code	Title	Credit Hours
Concentration Requirements (courses count in major GPA)		
CS 13001	COMPUTER SCIENCE I: PROGRAMMING AND PROBLEM SOLVING	4
or CS 13011 & CS 13012	COMPUTER SCIENCE IA: PROCEDURAL PROGRAMMING and COMPUTER SCIENCE IB: OBJECT ORIENTED PROGRAMMING	
PHY 36002	APPLICATIONS OF MODERN PHYSICS	3
PHY 45301	THERMAL PHYSICS	3
PHY 45403	DATA ANALYSIS AND COMPUTATIONAL PHYSICS TECHNIQUES	3
PHY 46101	QUANTUM MECHANICS	4
Physics (PHY) Electives [1]		5
Physics (PHY) Upper-Division Electives (30000 or 40000 level) [1]		4
Additional Requirements (courses do not count in major GPA)		
Kent Core Social Sciences (must be from two disciplines)		6
General Electives		7
Minimum Total Credit Hours:		**39**

1 Maximum 6 credit hours of PHY 40096 may be applied toward the major.

Graduation Requirements

Minimum Major GPA	Minimum Overall GPA
2.000	2.000

- The following courses may not count towards the Physics major requirements: PHY 11030, PHY 21040, PHY 21041, PHY 21430 and PHY 21431.

Foreign Language College Requirement, B.S.

- Students pursuing the Bachelor of Science degree in the College of Arts and Sciences must complete 8 credit hours of foreign language.[1]
- The following programs are exempt from this requirement: The Bachelor of Science in Cybercriminology and the Bachelor of Science in Medical Laboratory Science.[2]
- Minimum Elementary I and II of the same language

[1] All students with prior foreign language experience should take the foreign language placement test to determine the appropriate level at which to start. Some students may start beyond the Elementary I level and will complete the requirement with fewer credit hours and courses. This may be accomplished by (1) passing a course beyond Elementary I through Intermediate II level; (2) receiving credit through one of the alternative credit programs offered by Kent State University; or (3) demonstrating language proficiency comparable to Elementary II of a foreign language. When students complete the requirement with fewer than 8 credit hours and two courses, they will complete remaining credit hours with general electives.

[2] The Bachelor of Science in Medical Laboratory Science exemption exists under another college policy (Three-Plus-One Programs). The Bachelor of Science in Cybercriminology exemption is due to its extensive collaboration with and contribution from the Information Technology program in the College of Applied and Technical Studies, which does not have a foreign language requirement.

Roadmaps

Applied Physics Concentration

This roadmap is a recommended semester-by-semester plan of study for this major. However, courses designated as critical (!) must be completed in the semester listed to ensure a timely graduation.

	Semester One		Credits
!	MATH 12002	ANALYTIC GEOMETRY AND CALCULUS I (KMCR)	5
!	PHY 12000	INTRODUCTORY PHYSICS SEMINAR (ELR)	1
!	PHY 23101	GENERAL UNIVERSITY PHYSICS I (KBS) (KLAB)	5
	UC 10001	FLASHES 101	1
	Kent Core Requirement		3
		Credit Hours	**15**
	Semester Two		
!	MATH 12003	ANALYTIC GEOMETRY AND CALCULUS II	5
!	PHY 23102	GENERAL UNIVERSITY PHYSICS II (KBS) (KLAB)	5
	Kent Core Requirement		3
	Kent Core Requirement		3
		Credit Hours	**16**
	Semester Three		
!	CHEM 10060	GENERAL CHEMISTRY I (KBS)	4
!	CHEM 10062	GENERAL CHEMISTRY I LABORATORY (KBS) (KLAB)	1
!	MATH 32051	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES I	4
	Foreign Language		4
	Kent Core Requirement		3
		Credit Hours	**16**
	Semester Four		
!	CHEM 10061	GENERAL CHEMISTRY II (KBS)	4
!	CHEM 10063	GENERAL CHEMISTRY II LABORATORY (KBS) (KLAB)	1
!	MATH 32052	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES II	4
!	PHY 36001	INTRODUCTORY MODERN PHYSICS	3
	Foreign Language		4
		Credit Hours	**16**
	Semester Five		
	CS 13001 or CS 13011 ***and*** CS 13012	COMPUTER SCIENCE I: PROGRAMMING AND PROBLEM SOLVING or COMPUTER SCIENCE IA: PROCEDURAL PROGRAMMING ***and*** COMPUTER SCIENCE IB: OBJECT ORIENTED PROGRAMMING	4
!	PHY 35101	CLASSICAL MECHANICS	4
!	PHY 36002	APPLICATIONS OF MODERN PHYSICS	3
!	PHY 45201	ELECTROMAGNETIC THEORY	4
		Credit Hours	**15**
	Semester Six		
!	PHY 22564	INTRODUCTION TO MATERIALS PHYSICS	3
!	PHY 30020	INTERMEDIATE PHYSICS LABORATORY (WIC)	2
!	PHY 45403	DATA ANALYSIS AND COMPUTATIONAL PHYSICS TECHNIQUES	3
	Physics (PHY) Elective		3
	Kent Core Requirement		3
		Credit Hours	**14**
	Semester Seven		
!	PHY 32511	ELECTRONICS	4
!	PHY 40092 or PHY 40096	INTERNSHIP IN PHYSICS (ELR) or INDIVIDUAL INVESTIGATION (ELR)	2
	Kent Core Requirement		3
	Kent Core Requirement		3
	General Elective		3
		Credit Hours	**15**
	Semester Eight		
!	PHY 40020	ADVANCED PHYSICS LABORATORY (WIC)	2
!	PHY 45501	ELECTROMAGNETIC WAVES AND MODERN OPTICS	3
	Physics (PHY) Upper-Division Elective (30000 or 40000 level)		3
	General Electives		5
		Credit Hours	**13**
		Minimum Total Credit Hours:	**120**

Biological Sciences Concentration

This roadmap is a recommended semester-by-semester plan of study for this major. However, courses designated as critical (!) must be completed in the semester listed to ensure a timely graduation.

	Semester One		Credits
!	CHEM 10060	GENERAL CHEMISTRY I (KBS)	4
!	CHEM 10062	GENERAL CHEMISTRY I LABORATORY (KBS) (KLAB)	1
!	MATH 12002	ANALYTIC GEOMETRY AND CALCULUS I (KMCR)	5
!	PHY 12000	INTRODUCTORY PHYSICS SEMINAR (ELR)	1
	UC 10001	FLASHES 101	1
	Kent Core Requirement		3
		Credit Hours	**15**
	Semester Two		
!	CHEM 10061	GENERAL CHEMISTRY II (KBS)	4
!	CHEM 10063	GENERAL CHEMISTRY II LABORATORY (KBS) (KLAB)	1
!	MATH 12003	ANALYTIC GEOMETRY AND CALCULUS II	5
!	PHY 23101	GENERAL UNIVERSITY PHYSICS I (KBS) (KLAB)	5
		Credit Hours	**15**

	Semester Three		
!	BSCI 10110	BIOLOGICAL DIVERSITY (ELR) (KBS) (KLAB)	4
!	MATH 32051	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES I	4
!	PHY 23102	GENERAL UNIVERSITY PHYSICS II (KBS) (KLAB)	5
	Kent Core Requirement		3
		Credit Hours	**16**
	Semester Four		
!	BSCI 10120	BIOLOGICAL FOUNDATIONS (ELR) (KBS) (KLAB)	4
!	MATH 32052	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES II	4
!	PHY 36001	INTRODUCTORY MODERN PHYSICS	3
	Kent Core Requirement		3
		Credit Hours	**14**
	Semester Five		
!	BSCI 30156	ELEMENTS OF GENETICS	3
!	PHY 35101	CLASSICAL MECHANICS	4
	Major Elective		3
	Foreign Language		4
		Credit Hours	**14**
	Semester Six		
!	BSCI 30140	CELL BIOLOGY	4
!	PHY 30020	INTERMEDIATE PHYSICS LABORATORY (WIC)	2
	Foreign Language		4
	Kent Core Requirement		3
	Kent Core Requirement		3
		Credit Hours	**16**
	Semester Seven		
!	BSCI 40163	EVOLUTION	3
!	PHY 40092 or PHY 40096	INTERNSHIP IN PHYSICS (ELR) or INDIVIDUAL INVESTIGATION (ELR)	2
!	PHY 45201	ELECTROMAGNETIC THEORY	4
	Kent Core Requirement		3
	Kent Core Requirement		3
		Credit Hours	**15**
	Semester Eight		
!	PHY 40020	ADVANCED PHYSICS LABORATORY (WIC)	2
!	PHY 45301	THERMAL PHYSICS	3
	PHY 46101	QUANTUM MECHANICS	4
	General Electives		6
		Credit Hours	**15**
		Minimum Total Credit Hours:	**120**

Chemistry Concentration

This roadmap is a recommended semester-by-semester plan of study for this major. However, courses designated as critical (!) must be completed in the semester listed to ensure a timely graduation.

	Semester One		**Credits**
!	CHEM 10060	GENERAL CHEMISTRY I (KBS)	4
!	CHEM 10062	GENERAL CHEMISTRY I LABORATORY (KBS) (KLAB)	1
!	MATH 12002	ANALYTIC GEOMETRY AND CALCULUS I (KMCR)	5
!	PHY 12000	INTRODUCTORY PHYSICS SEMINAR (ELR)	1
	UC 10001	FLASHES 101	1
	Kent Core Requirement		3
		Credit Hours	**15**
	Semester Two		
!	CHEM 10061	GENERAL CHEMISTRY II (KBS)	4
!	CHEM 10063	GENERAL CHEMISTRY II LABORATORY (KBS) (KLAB)	1
!	MATH 12003	ANALYTIC GEOMETRY AND CALCULUS II	5
!	PHY 23101	GENERAL UNIVERSITY PHYSICS I (KBS) (KLAB)	5
		Credit Hours	**15**
	Semester Three		
	CHEM 30481	ORGANIC CHEMISTRY I	3
!	MATH 32051	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES I	4
!	PHY 23102	GENERAL UNIVERSITY PHYSICS II (KBS) (KLAB)	5
	Kent Core Requirement		3
		Credit Hours	**15**
	Semester Four		
	CHEM 30482	ORGANIC CHEMISTRY II	3
!	MATH 32052	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES II	4
!	PHY 36001	INTRODUCTORY MODERN PHYSICS	3
	Kent Core Requirement		3
	General Elective		2
		Credit Hours	**15**
	Semester Five		
!	PHY 35101	CLASSICAL MECHANICS	4
!	PHY 36002	APPLICATIONS OF MODERN PHYSICS	3
	Foreign Language		4
	Kent Core Requirement		3
		Credit Hours	**14**
	Semester Six		
!	CHEM 30301	INORGANIC CHEMISTRY I	3
!	PHY 30020	INTERMEDIATE PHYSICS LABORATORY (WIC)	2
!	PHY 45301	THERMAL PHYSICS	3
	PHY 46101	QUANTUM MECHANICS	4
	Foreign Language		4
		Credit Hours	**16**
	Semester Seven		
!	CHEM 30105	ANALYTICAL CHEMISTRY I	3
!	CHEM 30107	ANALYTICAL CHEMISTRY LABORATORY I (WIC)	1
!	PHY 40092 or PHY 40096	INTERNSHIP IN PHYSICS (ELR) or INDIVIDUAL INVESTIGATION (ELR)	2
!	PHY 45201	ELECTROMAGNETIC THEORY	4
	Kent Core Requirement		3
	Kent Core Requirement		3
		Credit Hours	**16**
	Semester Eight		
!	PHY 40020	ADVANCED PHYSICS LABORATORY (WIC)	2
	Physics (PHY) Electives		6
	Kent Core Requirement		3
	General Elective		3
		Credit Hours	**14**
		Minimum Total Credit Hours:	**120**

Computer Science Concentration

This roadmap is a recommended semester-by-semester plan of study for this major. However, courses designated as critical (!) must be completed in the semester listed to ensure a timely graduation.

	Semester One		Credits
!	MATH 12002	ANALYTIC GEOMETRY AND CALCULUS I (KMCR)	5
!	PHY 12000	INTRODUCTORY PHYSICS SEMINAR (ELR)	1
	UC 10001	FLASHES 101	1
	Kent Core Requirement		3
	Kent Core Requirement		3
	General Elective		3
		Credit Hours	**16**
	Semester Two		
	CS 13001 or CS 13011 ***and*** CS 13012	COMPUTER SCIENCE I: PROGRAMMING AND PROBLEM SOLVING or COMPUTER SCIENCE IA: PROCEDURAL PROGRAMMING ***and*** COMPUTER SCIENCE IB: OBJECT ORIENTED PROGRAMMING	4
!	MATH 12003	ANALYTIC GEOMETRY AND CALCULUS II	5
!	PHY 23101	GENERAL UNIVERSITY PHYSICS I (KBS) (KLAB)	5
		Credit Hours	**14**
	Semester Three		
!	CS 23022	DISCRETE STRUCTURES FOR COMPUTER SCIENCE	3
!	MATH 32051	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES I	4
!	PHY 23102	GENERAL UNIVERSITY PHYSICS II (KBS) (KLAB)	5
	Foreign Language		4
		Credit Hours	**16**
	Semester Four		
!	MATH 32052	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES II	4
!	PHY 36001	INTRODUCTORY MODERN PHYSICS	3
	Foreign Language		4
	Kent Core Requirement		3
		Credit Hours	**14**
	Semester Five		
!	PHY 30020	INTERMEDIATE PHYSICS LABORATORY (WIC)	2
!	PHY 35101	CLASSICAL MECHANICS	4
!	PHY 36002	APPLICATIONS OF MODERN PHYSICS	3
!	PHY 45201	ELECTROMAGNETIC THEORY	4
	Kent Core Requirement		3
		Credit Hours	**16**
	Semester Six		
!	CS 23001	COMPUTER SCIENCE II: DATA STRUCTURES AND ABSTRACTION	4
	PHY 46101	QUANTUM MECHANICS	4
	Physics (PHY) Upper-Division Elective (30000 or 40000 level)		3
	Kent Core Requirement		3
		Credit Hours	**14**
	Semester Seven		
!	CHEM 10060	GENERAL CHEMISTRY I (KBS)	4
!	CHEM 10062	GENERAL CHEMISTRY I LABORATORY (KBS) (KLAB)	1
!	CS 42201	NUMERICAL LINEAR ALGEBRA	3
!	PHY 40020	ADVANCED PHYSICS LABORATORY (WIC)	2
!	PHY 40092 or PHY 40096	INTERNSHIP IN PHYSICS (ELR) or INDIVIDUAL INVESTIGATION (ELR)	2
	Kent Core Requirement		3
		Credit Hours	**15**
	Semester Eight		
!	CHEM 10061	GENERAL CHEMISTRY II (KBS)	4
!	CHEM 10063	GENERAL CHEMISTRY II LABORATORY (KBS) (KLAB)	1
	Physics (PHY) Upper-Division Elective (30000 or 40000 level)		3
	Kent Core Requirement		3
	General Electives		4
		Credit Hours	**15**
		Minimum Total Credit Hours:	**120**

Entrepreneurship Concentration

This roadmap is a recommended semester-by-semester plan of study for this major. However, courses designated as critical (!) must be completed in the semester listed to ensure a timely graduation.

	Semester One		Credits
!	CHEM 10060	GENERAL CHEMISTRY I (KBS)	4
!	CHEM 10062	GENERAL CHEMISTRY I LABORATORY (KBS) (KLAB)	1
!	MATH 12002	ANALYTIC GEOMETRY AND CALCULUS I (KMCR)	5
!	PHY 12000	INTRODUCTORY PHYSICS SEMINAR (ELR)	1
	UC 10001	FLASHES 101	1
	Kent Core Requirement		3
		Credit Hours	**15**
	Semester Two		
!	CHEM 10061	GENERAL CHEMISTRY II (KBS)	4
!	CHEM 10063	GENERAL CHEMISTRY II LABORATORY (KBS) (KLAB)	1
!	MATH 12003	ANALYTIC GEOMETRY AND CALCULUS II	5
!	PHY 23101	GENERAL UNIVERSITY PHYSICS I (KBS) (KLAB)	5
		Credit Hours	**15**
	Semester Three		
!	ECON 22060	PRINCIPLES OF MICROECONOMICS (KSS)	3
!	ENTR 27056	INTRODUCTION TO ENTREPRENEURSHIP	3
!	MATH 32051	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES I	4
!	PHY 23102	GENERAL UNIVERSITY PHYSICS II (KBS) (KLAB)	5
		Credit Hours	**15**
	Semester Four		
!	MATH 32052	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES II	4
!	PHY 36001	INTRODUCTORY MODERN PHYSICS	3
	Kent Core Requirement		3
	Kent Core Requirement		3
	General Elective		3
		Credit Hours	**16**
	Semester Five		
	ACCT 23020 or ENTR 37040	INTRODUCTION TO FINANCIAL ACCOUNTING or ENTREPRENEURIAL TOOLS	3
!	PHY 35101	CLASSICAL MECHANICS	4
	PHY 45201	ELECTROMAGNETIC THEORY	4
	Foreign Language		4
		Credit Hours	**15**
	Semester Six		
	ENTR 27466	SPEAKER SERIES IN ENTREPRENEURSHIP	1
	ENTR 37065	ENTREPRENEURIAL FINANCE	3
	MKTG 25010	PRINCIPLES OF MARKETING	3

!	PHY 30020	INTERMEDIATE PHYSICS LABORATORY (WIC)	2
	Foreign Language		4
	Kent Core Requirement		3
		Credit Hours	**16**
	Semester Seven		
!	PHY 40092 or PHY 40096	INTERNSHIP IN PHYSICS (ELR) or INDIVIDUAL INVESTIGATION (ELR)	2
	Physics (PHY) Upper-Division Elective (30000 or 40000 level)		3
	Kent Core Requirement		3
	Kent Core Requirement		3
	General Elective		3
		Credit Hours	**14**
	Semester Eight		
!	PHY 40020	ADVANCED PHYSICS LABORATORY (WIC)	2
	Physics (PHY) Upper-Division Electives (30000 or 40000 level)		6
	General Electives		6
		Credit Hours	**14**
		Minimum Total Credit Hours:	**120**

Mathematical Physics Concentration

This roadmap is a recommended semester-by-semester plan of study for this major. However, courses designated as critical (!) must be completed in the semester listed to ensure a timely graduation.

	Semester One		**Credits**
!	CHEM 10060	GENERAL CHEMISTRY I (KBS)	4
!	CHEM 10062	GENERAL CHEMISTRY I LABORATORY (KBS) (KLAB)	1
!	MATH 12002	ANALYTIC GEOMETRY AND CALCULUS I (KMCR)	5
!	PHY 12000	INTRODUCTORY PHYSICS SEMINAR (ELR)	1
	UC 10001	FLASHES 101	1
	Kent Core Requirement		3
		Credit Hours	**15**
	Semester Two		
!	CHEM 10061	GENERAL CHEMISTRY II (KBS)	4
!	CHEM 10063	GENERAL CHEMISTRY II LABORATORY (KBS) (KLAB)	1
!	MATH 12003	ANALYTIC GEOMETRY AND CALCULUS II	5
!	PHY 23101	GENERAL UNIVERSITY PHYSICS I (KBS) (KLAB)	5
		Credit Hours	**15**
	Semester Three		
	CS 13001 or CS 13011 ***and*** CS 13012	COMPUTER SCIENCE I: PROGRAMMING AND PROBLEM SOLVING or COMPUTER SCIENCE IA: PROCEDURAL PROGRAMMING ***and*** COMPUTER SCIENCE IB: OBJECT ORIENTED PROGRAMMING	4
!	MATH 32051	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES I	4
!	PHY 23102	GENERAL UNIVERSITY PHYSICS II (KBS) (KLAB)	5
	General Elective		3
		Credit Hours	**16**
	Semester Four		
!	MATH 32052	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES II	4
!	PHY 36001	INTRODUCTORY MODERN PHYSICS	3
	Kent Core Requirement		3
	Kent Core Requirement		3
	General Elective		3
		Credit Hours	**16**
	Semester Five		
!	PHY 35101	CLASSICAL MECHANICS	4
!	PHY 36002	APPLICATIONS OF MODERN PHYSICS	3
!	PHY 45201	ELECTROMAGNETIC THEORY	4
	Foreign Language		4
		Credit Hours	**15**
	Semester Six		
!	PHY 30020	INTERMEDIATE PHYSICS LABORATORY (WIC)	2
!	PHY 45403	DATA ANALYSIS AND COMPUTATIONAL PHYSICS TECHNIQUES	3
	PHY 46101	QUANTUM MECHANICS	4
	Foreign Language		4
		Credit Hours	**13**
	Semester Seven		
!	PHY 40092 or PHY 40096	INTERNSHIP IN PHYSICS (ELR) or INDIVIDUAL INVESTIGATION (ELR)	2
!	PHY 45401	MATHEMATICAL METHODS IN PHYSICS	4
	Physics (PHY) Elective		3
	Kent Core Requirement		3
	Kent Core Requirement		3
		Credit Hours	**15**
	Semester Eight		
!	PHY 40020	ADVANCED PHYSICS LABORATORY (WIC)	2
	Physics (PHY) Electives		6
	Kent Core Requirement		3
	Kent Core Requirement		3
	General Elective		1
		Credit Hours	**15**
		Minimum Total Credit Hours:	**120**

Pre-Medicine/Pre-Osteopathy/Pre-Podiatry Concentration

This roadmap is a recommended semester-by-semester plan of study for this major. However, courses designated as critical (!) must be completed in the semester listed to ensure a timely graduation.

	Semester One		**Credits**
!	CHEM 10060	GENERAL CHEMISTRY I (KBS)	4
!	CHEM 10062	GENERAL CHEMISTRY I LABORATORY (KBS) (KLAB)	1
!	MATH 12002	ANALYTIC GEOMETRY AND CALCULUS I (KMCR)	5
!	PHY 12000	INTRODUCTORY PHYSICS SEMINAR (ELR)	1
!	PHY 23101	GENERAL UNIVERSITY PHYSICS I (KBS) (KLAB)	5
	UC 10001	FLASHES 101	1
		Credit Hours	**17**
	Semester Two		
!	CHEM 10061	GENERAL CHEMISTRY II (KBS)	4
!	CHEM 10063	GENERAL CHEMISTRY II LABORATORY (KBS) (KLAB)	1
!	MATH 12003	ANALYTIC GEOMETRY AND CALCULUS II	5
!	PHY 23102	GENERAL UNIVERSITY PHYSICS II (KBS) (KLAB)	5
		Credit Hours	**15**
	Semester Three		
!	BSCI 10120	BIOLOGICAL FOUNDATIONS (ELR) (KBS) (KLAB)	4
!	CHEM 30475	ORGANIC CHEMISTRY LABORATORY I (ELR)	1

!	CHEM 30481	ORGANIC CHEMISTRY I	3
!	MATH 32051	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES I	4
	PSYC 11762	GENERAL PSYCHOLOGY (DIVD) (KSS)	3
		Credit Hours	**15**
	Semester Four		
!	BSCI 30140	CELL BIOLOGY	4
!	CHEM 30476	ORGANIC CHEMISTRY LABORATORY II	1
!	CHEM 30482	ORGANIC CHEMISTRY II	3
!	MATH 32052	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES II	4
!	PHY 36001	INTRODUCTORY MODERN PHYSICS	3
		Credit Hours	**15**
	Semester Five		
!	BSCI 30130 or BSCI 40430	HUMAN PHYSIOLOGY or ANIMAL PHYSIOLOGY	3
!	BSCI 30156	ELEMENTS OF GENETICS	3
!	PHY 35101	CLASSICAL MECHANICS	4
	SOC 12050	INTRODUCTION TO SOCIOLOGY (DIVD) (KSS)	3
	Concentration Elective or Kent Core Requirement		3
		Credit Hours	**16**
	Semester Six		
!	BSCI 30171	GENERAL MICROBIOLOGY	4
!	CHEM 30284 or CHEM 40245	INTRODUCTORY BIOLOGICAL CHEMISTRY or BIOCHEMICAL FOUNDATIONS OF MEDICINE	4
!	PHY 30020	INTERMEDIATE PHYSICS LABORATORY (WIC)	2
	Concentration Elective or Kent Core Requirement		3
	Kent Core Requirement		3
		Credit Hours	**16**
	Semester Seven		
!	PHY 40092 or PHY 40096	INTERNSHIP IN PHYSICS (ELR) or INDIVIDUAL INVESTIGATION (ELR)	2
!	PHY 45201	ELECTROMAGNETIC THEORY	4
	Foreign Language		4
	Kent Core Requirement		3
		Credit Hours	**13**
	Semester Eight		
!	PHY 40020	ADVANCED PHYSICS LABORATORY (WIC)	2
	Foreign Language		4
	Kent Core Requirement		3
	Kent Core Requirement		3
	General Elective		1
		Credit Hours	**13**
		Minimum Total Credit Hours:	**120**

Research Concentration

This roadmap is a recommended semester-by-semester plan of study for this major. However, courses designated as critical (!) must be completed in the semester listed to ensure a timely graduation.

	Semester One		**Credits**
!	MATH 12002	ANALYTIC GEOMETRY AND CALCULUS I (KMCR)	5
!	PHY 12000	INTRODUCTORY PHYSICS SEMINAR (ELR)	1
!	PHY 23101	GENERAL UNIVERSITY PHYSICS I (KBS) (KLAB)	5
	UC 10001	FLASHES 101	1
	Kent Core Requirement		3
		Credit Hours	**15**
	Semester Two		
!	MATH 12003	ANALYTIC GEOMETRY AND CALCULUS II	5
!	PHY 23102	GENERAL UNIVERSITY PHYSICS II (KBS) (KLAB)	5
	Kent Core Requirement		3
	Kent Core Requirement		3
		Credit Hours	**16**
	Semester Three		
!	CHEM 10060	GENERAL CHEMISTRY I (KBS)	4
!	CHEM 10062	GENERAL CHEMISTRY I LABORATORY (KBS) (KLAB)	1
!	MATH 32051	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES I	4
	Foreign Language		4
	Kent Core Requirement		3
		Credit Hours	**16**
	Semester Four		
!	CHEM 10061	GENERAL CHEMISTRY II (KBS)	4
!	CHEM 10063	GENERAL CHEMISTRY II LABORATORY (KBS) (KLAB)	1
!	MATH 32052	MATHEMATICAL METHODS IN THE PHYSICAL SCIENCES II	4
!	PHY 36001	INTRODUCTORY MODERN PHYSICS	3
	Foreign Language		4
		Credit Hours	**16**
	Semester Five		
	CS 13001 or CS 13011 ***and*** CS 13012	COMPUTER SCIENCE I: PROGRAMMING AND PROBLEM SOLVING or COMPUTER SCIENCE IA: PROCEDURAL PROGRAMMING ***and*** COMPUTER SCIENCE IB: OBJECT ORIENTED PROGRAMMING	4
!	PHY 35101	CLASSICAL MECHANICS	4
!	PHY 36002	APPLICATIONS OF MODERN PHYSICS	3
!	PHY 45201	ELECTROMAGNETIC THEORY	4
		Credit Hours	**15**
	Semester Six		
!	PHY 30020	INTERMEDIATE PHYSICS LABORATORY (WIC)	2
!	PHY 45301	THERMAL PHYSICS	3
!	PHY 45403	DATA ANALYSIS AND COMPUTATIONAL PHYSICS TECHNIQUES	3
!	PHY 46101	QUANTUM MECHANICS	4
	Physics (PHY) Elective		3
		Credit Hours	**15**
	Semester Seven		
!	PHY 40092 or PHY 40096	INTERNSHIP IN PHYSICS (ELR) or INDIVIDUAL INVESTIGATION (ELR)	2
	Physics (PHY) Elective		2
	Kent Core Requirement		3
	Kent Core Requirement		3
	General Elective		3
		Credit Hours	**13**
	Semester Eight		
!	PHY 40020	ADVANCED PHYSICS LABORATORY (WIC)	2
	Physics (PHY) Upper-Division Electives (30000 or 40000 level)		4
	Kent Core Requirement		3

General Electives	5
Credit Hours	**14**
Minimum Total Credit Hours:	**120**

University Requirements

All students in a bachelor's degree program at Kent State University must complete the following university requirements for graduation.

NOTE: University requirements may be fulfilled in this program by specific course requirements. Please see Program Requirements for details.

Flashes 101 (UC 10001)	1 credit hour
Course is not required for students with 30+ transfer credits (excluding College Credit Plus) or age 21+ at time of admission.	
Diversity Domestic/Global (DIVD/DIVG)	2 courses
Students must successfully complete one domestic and one global course, of which one must be from the Kent Core.	
Experiential Learning Requirement (ELR)	varies
Students must successfully complete one course or approved experience.	
Kent Core (see table below)	36-37 credit hours
Writing-Intensive Course (WIC)	1 course
Students must earn a minimum C grade in the course.	
Upper-Division Requirement	39 credit hours
Students must successfully complete 39 upper-division (numbered 30000 to 49999) credit hours to graduate.	
Total Credit Hour Requirement	120 credit hours

Kent Core Requirements

Kent Core Composition (KCMP)	6
Kent Core Mathematics and Critical Reasoning (KMCR)	3
Kent Core Humanities and Fine Arts (KHUM/KFA) (min one course each)	9
Kent Core Social Sciences (KSS) (must be from two disciplines)	6
Kent Core Basic Sciences (KBS/KLAB) (must include one laboratory)	6-7
Kent Core Additional (KADL)	6
Total Credit Hours:	**36-37**

Program Learning Outcomes

Graduates of this program will be able to:

1. Demonstrate technical and cognitive skills important in a good physicist, including the following:
   a. Think critically and analytically.
   b. Define a problem and how to solve problems.
   c. Understand advanced mathematics (e.g., calculus and differential equations) and computer skills.
   d. Use, design and even build lab equipment.
2. Demonstrate the traits important in a good scientist, namely, hard working, creative, meticulous, persistence, tenacious and self confidence.
3. Communicate results of their work to peers, to their instructors or supervisors, to various target groups within the physics community and to people outside the discipline.

Program Policies

Foreign Language Requirements

In general, students may elect any foreign language taught through the Department of Modern and Classical Language Studies. However, certain majors, concentrations and minors require specific languages or limit the languages from which students may choose. In addition, students who plan to pursue graduate study may need particular languages for that study. In such cases, students should seek the advice of the appropriate department before selecting a language.

Progress Toward Fulfillment

College of Arts and Sciences students are encouraged to begin meeting the foreign language requirement as early as possible in their program to ensure timely degree completion.

Mandatory Outcomes Assessment

In addition to the other General Requirements of the college, candidates for an undergraduate degree in the College of Arts and Sciences are required, as a condition of graduation, to participate in an outcomes assessment. These outcomes assessments are conducted by each undergraduate degree program in the College of Arts and Sciences.

Full Description

The Bachelor of Science degree in Physics is a professionally oriented program that serves as preparation either for graduate work in physics or for entrance into positions in a variety of industries or government service.

The Physics major comprises the following concentrations:

- The **Applied Physics** concentration prepares students for immediate entry into careers in industry. Course requirements include electronics, introduction to computer programming, and data analysis and computational physics techniques. While rooted in the basic principles of physics, this program is optimized for students concerned with the application of physics in practical devices and systems.
- The **Biological Sciences** concentration is interdisciplinary and for students with a strong interest in both physics and biology, who may wish to prepare for graduate study in biophysics or for work in a biotechnology company.
- The **Chemistry** concentration is interdisciplinary and designed for students with a strong interest in both physics and chemistry, who may wish to prepare for graduate study in chemical physics or for work in a high-technology materials-related research and development laboratory.
- The **Computer Science** concentration is interdisciplinary and provides a foundation in physics while emphasizing the use of computer software in scientific applications. Graduates are prepared for computer-related careers that require an understanding of the underlying science as well as knowledge of relevant computer applications.
- The **Entrepreneurship** concentration is interdisciplinary and designed to prepare physics majors for various aspects of starting or managing a scientific business.

- The **Mathematical Physics** concentration is interdisciplinary and provides students with a strong understanding of applied physical theory, its applications and the underlying mathematics. This training, valuable for start-up positions with a number of industries, may also serve as preparation for graduate work in either physics or mathematics.
- The **Pre-Medicine/Pre-Osteopathy/Pre-Podiatry** concentration is interdisciplinary and designed to prepare physics majors for further study leading to careers in medicine.
- The **Research** concentration prepares majors for further study at the graduate level. This program trains students in logical thinking and problem solving using both analytical and computational methods. It also furnishes students with a comprehensive understanding of the basic laws and principles that govern the physical world. Academic assessment and GRE scores keep the program up-to-date via curricular revisions. This program is a popular stepping stone to graduate degrees not only in physics, but also in engineering, astronomy/astrophysics and materials science.