




# Physical Science

## | American River College

If you wish to pursue a career in physics or a related field, ARC's Physics program offers you a strong foundation. Through this program, you have a number of course options to fulfill a GE requirement and/or needed physics coursework required for your major. You will be required to take some course work in physics if you major in, for example, biology, chemistry, many pre-health fields, engineering, mathematics, or computer science.

</academics/arc-program-road-maps>

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## Associate Degrees

### A.S. in General Science

This program provides a broad study in the fields of biological and physical sciences in preparation for transfer to a four-year program and continuation of studies in upper division science courses.

#### Degree Requirements

COURSE CODE	COURSE TITLE	UNITS
A minimum of 18 units from the following:		18 <sup>1</sup>
<b>Physical Science Courses</b>		
ASTR 300	Introduction to Astronomy (3)	
ASTR 310	The Solar System (3)	
ASTR 320	Stars, Galaxies, and Cosmology (3)	
ASTR 330	Introduction to Astrobiology (3)	
ASTR 400	Astronomy Laboratory (1)	
ASTR 481	Honors Astronomy: Stars, Galaxies, and Cosmology (4)	
ASTR 495	Independent Studies in Astronomy (1 - 3)	
ASTR 499	Experimental Offering in Astronomy (0.5 - 4)	
CHEM 305	Introduction to Chemistry (5)	
CHEM 306	Introduction to Organic and Biological Chemistry (5)	
CHEM 309	Integrated General, Organic, and Biological Chemistry (5)	
CHEM 310	Chemical Calculations (4)	
CHEM 400	General Chemistry I (5)	
CHEM 401	General Chemistry II (5)	

COURSE CODE	COURSE TITLE	UNITS
CHEM 420	Organic Chemistry I (5)	
CHEM 421	Organic Chemistry II (5)	
CHEM 423	Organic Chemistry - Short Survey (5)	
CHEM 495	Independent Studies in Chemistry (1 - 3)	
CHEM 499	Experimental Offering in Chemistry (0.5 - 4)	
GEOG 300	Physical Geography: Exploring Earth's Environmental Systems (3)	
GEOG 301	Physical Geography Laboratory (1)	
GEOG 305	Global Climate Change (3)	
GEOG 306	Weather and Climate (3)	
GEOG 307	Environmental Hazards and Natural Disasters (3)	
GEOG 308	Introduction to Oceanography (3)	
GEOG 309	Introduction to Oceanography Lab (1)	
GEOG 391	Field Studies in Geography: Mountain Landscapes (1 - 4)	
GEOG 392	Field Studies in Geography: Coastal Landscapes (1 - 4)	
GEOG 393	Field Studies in Geography: Arid Landscapes (1 - 4)	
GEOG 394	Field Studies in Geography: Volcanic Landscapes (1 - 4)	
GEOG 495	Independent Studies in Geography (1 - 3)	
GEOG 499	Experimental Offering in Geography (0.5 - 4)	
GEOL 300	Physical Geology (3)	
GEOL 301	Physical Geology Laboratory (1)	
GEOL 305	Earth Science (3)	
GEOL 306	Earth Science Laboratory (1)	
GEOL 310	Historical Geology (3)	
GEOL 311	Historical Geology Laboratory (1)	
GEOL 320	Global Climate Change (3)	
GEOL 325	Environmental Hazards and Natural Disasters (3)	
GEOL 330	Introduction to Oceanography (3)	
GEOL 331	Introduction to Oceanography Lab (1)	
GEOL 345	Geology of California (3)	
GEOL 390	Field Studies in Geology (1 - 4)	
GEOL 495	Independent Studies in Geology (1 - 3)	
GEOL 499	Experimental Offering in Geology (0.5 - 4)	
PHYS 310	Conceptual Physics (3)	
PHYS 311	Basic Physics (3)	
PHYS 312	Conceptual Physics Laboratory (1)	
PHYS 350	General Physics (4)	
PHYS 360	General Physics (4)	
PHYS 410	Mechanics of Solids and Fluids (5)	
PHYS 421	Electricity and Magnetism (4)	

COURSE CODE	COURSE TITLE	UNITS
PHYS 431	Heat, Waves, Light and Modern Physics (4)	
PHYS 495	Independent Studies in Physics (1 - 3)	
PHYS 499	Experimental Offering in Physics (0.5 - 4)	
PS 300	Introduction to Physical Science (3)	
PS 301	Physical Science Laboratory (1)	
PS 495	Independent Studies in Physical Science (1 - 3)	
PS 499	Experimental Offering in Physical Science (0.5 - 4)	
<b>Biological Science Courses</b>		
ANTH 300	Biological Anthropology (3)	
ANTH 301	Biological Anthropology Laboratory (1)	
ANTH 303	Introduction to Forensic Anthropology (3)	
ANTH 370	Primatology (3)	
ANTH 372	Primatology Field Studies (2)	
ANTH 480	Honors Biological Anthropology (3)	
ANTH 495	Independent Studies in Anthropology (1 - 3)	
ANTH 499	Experimental Offering in Anthropology (0.5 - 4)	
BIOL 300	The Foundations of Biology (3)	
BIOL 301	Evolution (3)	
BIOL 303	Survey of Biology (4)	
BIOL 305	Natural History (4)	
BIOL 310	General Biology (4)	
BIOL 322	Ethnobotany (3)	
BIOL 332	Introduction to Ornithology (4)	
BIOL 342	The New Plagues: New and Ancient Infectious Diseases Threatening World Health (3)	
BIOL 352	Conservation Biology (3)	
BIOL 370	Marine Biology (4)	
BIOL 375	Marine Ecology (3)	
BIOL 390	Natural History Field Study (0.5 - 4)	
BIOL 400	Principles of Biology (5)	
BIOL 410	Principles of Botany (5)	
BIOL 415	Introduction to Biology: Biodiversity, Evolution, and Ecology (5)	
BIOL 420	Principles of Zoology (5)	
BIOL 430	Anatomy and Physiology (5)	
BIOL 431	Anatomy and Physiology (5)	
BIOL 440	General Microbiology (4)	
BIOL 442	General Microbiology and Public Health (5)	
BIOL 482	Honors Marine Biology (4)	
BIOL 495	Independent Studies in Biology (1 - 3)	
BIOL 499	Experimental Offering in Biology (0.5 - 4)	

COURSE CODE	COURSE TITLE	UNITS
BIOT 301	Biotechnology and Human Health (3)	
BIOT 305	Introduction to Bioinformatics (1)	
BIOT 307	Biotechnology and Society (2)	
BIOT 311	Biotechnology Laboratory Methods - Molecular Techniques (2)	
BIOT 312	Biotechnology Laboratory Methods - Microbial and Cell Culture Techniques (2)	
BIOT 499	Experimental Offering in Biology (0.5 - 4)	
NATR 300	Introduction to Natural Resource Conservation and Policy (4)	
NATR 302	Introduction to Wildlife Biology (4)	
NATR 303	Energy and Sustainability (3)	
NATR 304	The Forest Environment (3)	
NATR 305	Fisheries Ecology and Management (4)	
NATR 306	Introduction to Rangeland Ecology and Management (3)	
NATR 307	Principles of Sustainability (4)	
NATR 310	Study Design and Field Methods (4)	
NATR 320	Principles of Ecology (4)	
NATR 322	Environmental Restoration (2)	
NATR 324	Field Studies: Birds and Plants of the High Sierra (1.5)	
NATR 330	Native Trees and Shrubs of California (4)	
NATR 332	Wildflowers of California (3)	
NATR 346	Water Resources and Conservation (3)	
NATR 495	Independent Studies in Natural Resources (1 - 3)	
NATR 499	Experimental Offering in Natural Resources (0.5 - 4)	
PSYC 310	Biological Psychology (3)	
PSYC 311	Biological Psychology Laboratory (1)	
PSYC 495	Independent Studies in Psychology (1 - 3)	
PSYC 499	Experimental Offering in Psychology (0.5 - 4)	
Total Units:		18

<sup>1</sup>must be transfer-level and must include one laboratory course in a physical science and one laboratory course in a biological science

*The General Science Associate in Science (A.S.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.*

## Student Learning Outcomes

Upon completion of this program, the student will be able to:

- evaluate new and accepted ideas about the natural universe using scientific methods.
- analyze a wide variety of natural phenomena using basic definitions and fundamental theories of biological or physical sciences.
- apply appropriate quantitative and qualitative methods to interpret and analyze pertinent data.
- outline the basic concepts and fundamental theories of a natural science.
- articulate orally and/or in writing the importance of continuous examination and modification of accepted ideas as a fundamental element in the

progress of science.

- discuss ethical components of scientific decision making and apply personal and social values within the process of decision making in scientific endeavors.

## A.S. in Physical Science/Mathematics

This degree provides a broad study in the fields of physical science and mathematics. It is a good foundation for transfer to a four-year program in science, technology, engineering, or mathematics (STEM).

### Degree Requirements

COURSE CODE	COURSE TITLE	UNITS
A minimum of 18 units from the following:		18
ASTR 300	Introduction to Astronomy (3)	
ASTR 310	The Solar System (3)	
ASTR 320	Stars, Galaxies, and Cosmology (3)	
ASTR 330	Introduction to Astrobiology (3)	
ASTR 400	Astronomy Laboratory (1)	
ASTR 481	Honors Astronomy: Stars, Galaxies, and Cosmology (4)	
ASTR 495	Independent Studies in Astronomy (1 - 3)	
ASTR 499	Experimental Offering in Astronomy (0.5 - 4)	
CHEM 305	Introduction to Chemistry (5)	
CHEM 306	Introduction to Organic and Biological Chemistry (5)	
CHEM 309	Integrated General, Organic, and Biological Chemistry (5)	
CHEM 310	Chemical Calculations (4)	
CHEM 400	General Chemistry I (5)	
CHEM 401	General Chemistry II (5)	
CHEM 420	Organic Chemistry I (5)	
CHEM 421	Organic Chemistry II (5)	
CHEM 423	Organic Chemistry - Short Survey (5)	
CHEM 495	Independent Studies in Chemistry (1 - 3)	
CHEM 499	Experimental Offering in Chemistry (0.5 - 4)	
ENGR 300	Introduction to Engineering (1)	
ENGR 310	Engineering Survey Measurements (4)	
ENGR 312	Engineering Graphics (3)	
ENGR 401	Introduction to Electrical Circuits and Devices (4)	
ENGR 413	Properties of Materials (4.5)	
ENGR 420	Statics (3)	
ENGR 495	Independent Studies in Engineering (1 - 3)	
ENGR 499	Experimental Offering in Engineering (0.5 - 4)	
GEOG 300	Physical Geography: Exploring Earth's Environmental Systems (3)	
GEOG 301	Physical Geography Laboratory (1)	

COURSE CODE	COURSE TITLE	UNITS
GEOG 305	Global Climate Change (3)	
GEOG 306	Weather and Climate (3)	
GEOG 307	Environmental Hazards and Natural Disasters (3)	
GEOG 308	Introduction to Oceanography (3)	
GEOG 309	Introduction to Oceanography Lab (1)	
GEOG 391	Field Studies in Geography: Mountain Landscapes (1 - 4)	
GEOG 392	Field Studies in Geography: Coastal Landscapes (1 - 4)	
GEOG 393	Field Studies in Geography: Arid Landscapes (1 - 4)	
GEOG 394	Field Studies in Geography: Volcanic Landscapes (1 - 4)	
GEOG 495	Independent Studies in Geography (1 - 3)	
GEOG 499	Experimental Offering in Geography (0.5 - 4)	
GEOL 300	Physical Geology (3)	
GEOL 301	Physical Geology Laboratory (1)	
GEOL 305	Earth Science (3)	
GEOL 306	Earth Science Laboratory (1)	
GEOL 310	Historical Geology (3)	
GEOL 311	Historical Geology Laboratory (1)	
GEOL 320	Global Climate Change (3)	
GEOL 325	Environmental Hazards and Natural Disasters (3)	
GEOL 330	Introduction to Oceanography (3)	
GEOL 331	Introduction to Oceanography Lab (1)	
GEOL 345	Geology of California (3)	
GEOL 390	Field Studies in Geology (1 - 4)	
GEOL 495	Independent Studies in Geology (1 - 3)	
GEOL 499	Experimental Offering in Geology (0.5 - 4)	
MATH 300	Introduction to Mathematical Ideas (3)	
MATH 310	Mathematical Discovery (3)	
MATH 311	Mathematical Concepts for Elementary School Teachers - Number Systems (3)	
MATH 320	Symbolic Logic (3)	
MATH 325	Problem-Solving (3)	
MATH 330	Trigonometry (3)	
MATH 336	College Algebra (5)	
MATH 340	Calculus for Business and Economics (3)	
MATH 342	Modern Business Mathematics (3)	
MATH 355	Calculus for Biology and Medicine I (4)	
MATH 356	Calculus for Biology and Medicine II (4)	
MATH 370	Pre-Calculus Mathematics (5)	
MATH 372	College Algebra for Calculus (4)	
MATH 373	Trigonometry for Calculus (4)	

COURSE CODE	COURSE TITLE	UNITS
MATH 400	Calculus I (5)	
MATH 401	Calculus II (5)	
MATH 402	Calculus III (5)	
MATH 410	Introduction to Linear Algebra (3)	
MATH 420	Differential Equations (4)	
MATH 480	Honors Seminar in Mathematics (1)	
MATH 495	Independent Studies in Mathematics (1 - 3)	
MATH 499	Experimental Offering in Mathematics (0.5 - 4)	
PHYS 310	Conceptual Physics (3)	
PHYS 311	Basic Physics (3)	
PHYS 312	Conceptual Physics Laboratory (1)	
PHYS 350	General Physics (4)	
PHYS 360	General Physics (4)	
PHYS 410	Mechanics of Solids and Fluids (5)	
PHYS 421	Electricity and Magnetism (4)	
PHYS 431	Heat, Waves, Light and Modern Physics (4)	
PHYS 495	Independent Studies in Physics (1 - 3)	
PHYS 499	Experimental Offering in Physics (0.5 - 4)	
PS 300	Introduction to Physical Science (3)	
PS 301	Physical Science Laboratory (1)	
PS 495	Independent Studies in Physical Science (1 - 3)	
PS 499	Experimental Offering in Physical Science (0.5 - 4)	
STAT 300	Introduction to Probability and Statistics (4)	
STAT 305	Statway, Part II (6)	
STAT 495	Independent Studies in Statistics (1 - 3)	
STAT 499	Experimental Offering in Statistics (0.5 - 4)	
Total Units:		18

*The Physical Science/Mathematics Associate in Science (A.S.) degree may be obtained by completion of the required program, plus general education requirements, plus sufficient electives to meet a 60-unit total. See ARC graduation requirements.*

## Student Learning Outcomes

Upon completion of this program, the student will be able to:

- recognize and utilize correctly the terminology of math, statistics, and/or science.
- analyze and interpret data, charts, and graphs using quantitative and qualitative methods.
- recognize and construct valid arguments using deductive and inductive reasoning.
- evaluate new and accepted ideas about the natural universe using testable methodology.

# Physical Science (PS)

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## PS 495 Independent Studies in Physical Science

Units:	1 - 3
Hours:	54 - 162 hours LAB
Prerequisite:	None.
Transferable:	CSU

Independent Study is an opportunity for the student to extend classroom experience in this subject, while working independently of a formal classroom situation. Independent study is an extension of work offered in a specific class in the college catalog. To be eligible for independent study, students must have completed the basic regular catalog course at American River College. They must also discuss the study with a professor in this subject and secure approval. Only one independent study for each catalog course will be allowed.

## Faculty

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