

BA IN PHYSICS (TEACHER PREPARATION)

Units required for Major: 86-87

Total units required for BA: 120

Program Description

The Science Subject Matter Program (SSMP), with emphases in Biological Sciences, Chemistry, and Physics, leads to a BA degree in the area of emphasis. It also meets the latest California Commission on Teacher Credentialing (CCTC) subject-matter requirement to enter a teaching credential program in California. In order to obtain a California K-12 Teaching Credential, a program of professional education preparation (a teaching credential program) is required in addition to completing the SSMP. Completing the SSMP and teaching credential program allows graduates to teach all four sciences (biology, chemistry, geoscience, and physics) at the general/integrated 7th-12th grade science level, in addition to the student's area of concentration at the advanced high school level. A typical credential might read, for example, SCIENCE: Chemistry.

Physics is the most fundamental science and underlies our understanding of nearly all areas of science and technology. In a broad sense, physics is concerned with the study of energy, space, and matter, and with the interactions between matter and the laws that govern these interactions. More specifically, physicists study mechanics, heat, light, electric and magnetic fields, gravitation, relativity, atomic and nuclear physics, and condensed matter physics.

The BA degree is recommended for students who are interested in teaching Physics in high school or who want a liberal arts education with an emphasis in Physics. Physics majors are encouraged to take additional mathematics and to develop skills in the use of computers.

Currently there is a serious need in public school education for well-educated science teachers. Physics majors who have an interest in teaching should see the credential advisor in the Department (Dr. Vera Margoniner) to plan an academic program and to explore ways to get involved in teaching-related activities such as tutoring, grading, and working in the schools.

Currently there is a great need for K-12 teachers educated in science. Changes in State Board of Education Standards and increasing interest in Biological Sciences have created significant demands for students with this credential. Biological Sciences majors who have an interest in teaching should contact one of the credential advisors in the Biological Sciences Department, Melanie Loo.

Note:

- It is also possible to obtain admission to the Professional Education Program by passing a series of subject-matter examinations specified by the CTC in lieu of this Science Subject Matter Program. For information about this option contact the Teacher Preparation Program Office, Eureka Hall 216, (916) 278-6403.
- Due to policy changes from the California Commission on Teacher Credentialing and the federal No Child Left Behind mandate, the Science Subject Matter program was under review at the time of this catalog printing and is subject to revision. As a result it is important to consult a credential advisor for current details.

Minimum Grade Requirement

A grade of at least a "C-" in all required Science Subject Matter Program courses is necessary in order to meet subject matter requirements for admission to a teaching credential program. If a grade of "C-" is not achieved in all SSMP courses, then the current CTC approved subject matter exam must be successfully passed in order to be eligible for admission to a teaching credential program (the current exam is the CSET, tests I, II, and III).

Note: It is recommended that all coursework for the SSMP be completed before starting the Teacher Education Program. At least 15 units of the coursework or equivalent work experience must be current, i.e., completed within the past six years.

Program Requirements

Code	Title	Units
Required Lower Division Courses (58 Units)		
ASTR 4A or ASTR 4B or ASTR 4C	Introduction to the Solar System Introduction to Stars, Galaxies, and Cosmology Introduction to Astrobiology	3
ASTR 6	Astronomical Observation Laboratory	1
BIO 1	Biodiversity, Evolution and Ecology ¹	5
BIO 2	Cells, Molecules and Genes	5
CHEM 1A	General Chemistry I	5
CHEM 1B	General Chemistry II	5
ENVS 10	Introduction to Environmental Science	3
GEOL 10	Physical Geology	3
GEOL 10L	Physical Geology Lab	1
MATH 30	Calculus I ¹	4
MATH 31	Calculus II ¹	4
MATH 32	Calculus III	4
MATH 45	Differential Equations for Science and Engineering	3
PHYS 11A	General Physics: Mechanics ¹	4
PHYS 11B	General Physics: Heat, Light, Sound, Modern Physics	4
PHYS 11C	General Physics: Electricity and Magnetism	4
Required Upper Division Courses (22-23 Units)		
PHYS 105	Mathematical Methods in Physics	3
PHYS 106	Introduction to Modern Physics	3
PHYS 110	Classical Mechanics	3
PHYS 115	Electronics and Instrumentation	4
PHYS 124	Thermodynamics and Statistical Mechanics	3
PHYS 135	Electricity And Magnetism	3
PHYS 175	Advanced Physics Laboratory	2
PHYS 191	Senior Project	1 - 2
Elective Upper Division Requirements (6 Units)		
Select 6 units of upper-division coursework chosen in consultation with physics advisor ²		6
Physics Colloquium Attendance		
Fulfill a minimum attendance requirement ³		
Total Units		86-87

¹ Course also satisfies General Education (GE)/Graduation Requirement.

² See list below for a list of Department approved electives.

³ Majors must fulfill a minimum attendance requirement at Department Colloquia. Students should consult with the Department for details.

Elective List

Code	Title	Units
PHYS 115	Electronics and Instrumentation ⁴	4
PHYS 116	Advanced Electronics and Instrumentation	3
PHYS 130	Acoustics	3
PHYS 136	Electrodynamics of Waves, Radiation, and Materials	3
PHYS 142	Applied Solid State Physics	3
PHYS 145	Optics ⁴	3
PHYS 150	Quantum Mechanics	3
PHYS 151	Advanced Modern Physics	3
PHYS 156	Classical and Statistical Mechanics	3
PHYS 162	Scientific Computing: Basic Methods	3
PHYS 163	Scientific Computing: Modeling, Simulation, and Visualization	3
PHYS 195	Teaching Internship	1 - 2
PHYS 196 Series		
PHYS 197	Laboratory Teaching Assistant	1 - 2
PHYS 199	Special Problems	1 - 3
ASTR 150	Dark Matter and Dark Energy	3
MATH 105B	Advanced Mathematics for Science and Engineering II	4

⁴ If not used to satisfy other requirement of the degree (Example: PHYS 115 or PHYS 145 are required for the Bachelor of Science. If both are taken, one will count as an elective).

General Education Requirements ¹

Code	Title	Units
Area A: Basic Subjects (9 Units)		
A1	Oral Communication	3
A2	Written Communication	3
A3	Critical Thinking ³	3
Area B: Physical Universe and Its Life Forms (3 Units)		
B1	Physical Science ²	0
B2	Life Forms ²	0
B3	Lab (Note: Lab experience to be taken with one of the following: B1, B2 or B5) ²	0
B4	Math Concepts ²	0
B5	Additional Course (Any B to reach 12 units) - Take upper-division course to complete Area & upper division requirements.	3
Area C: Arts and Humanities (12 Units)		
C1	Arts	3
C2	Humanities	3
C1/C2	Area C Course	3
C1/C2	Area C Course - Take upper-division course to complete Area & upper division requirements.	3
Area D: The Individual and Society (9 Units)		

Area D Course	3
Area D Course	3
Area D Course - Take upper-division course to complete Area & upper division requirements.	3
Area E: Understanding Personal Development (3 Units)	
Area E Course	3
Area F: Ethnic Studies (3 Units)	
Area F Course	3
Total Units	39

¹ To help you complete your degree in a timely manner and not take more units than absolutely necessary, there are ways to use single courses to meet more than one requirement (overlap). For further information, please visit the General Education page (<https://catalog.csus.edu/colleges/academic-affairs/general-education/>).

Note: There is no way to list all possible overlaps so please consult with a professional advisor. The Academic Advising Center can be visited online (<http://www.csus.edu/acad/>), by phone (916) 278-1000, or email (advising@csus.edu).

² Required in Major; also satisfies GE.

³ Department recommends PHYS 30 to meet Area A3.

Graduation Requirements ¹

Code	Title	Units
Graduation Requirements (required by CSU) (9 Units)		
	American Institutions: U.S. History	3
	American Institutions: U.S. Constitution & CA Government	3
	Writing Intensive (WI)	3
Graduation Requirements (required by Sacramento State) (12 Units)		
	English Composition II	3
	Race and Ethnicity in American Society (RE)	3
	Foreign Language Proficiency Requirement ²	6

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² If not satisfied before entering Sacramento State, it may be satisfied in General Education Area C2 (Humanities). "C- or better required." The alternative methods for satisfying the Foreign Language Proficiency Requirement are described here: <https://www.csus.edu/college/arts-letters/world-languages-literatures/foreign-language-requirement.html> (<https://www.csus.edu/college/arts-letters/world-languages-literatures/foreign-language-requirement.html>)

The following roadmaps are sample planning resources. Please consult your academic advisor and Academic Catalog for graduation requirements as you develop your individualized academic plan.

Physics (Teacher Preparation), BA: 4-Year Roadmap

Course	Title	Units
Year 1		
First Semester		
MATH 30	Calculus I	4
GE Area 1C - Oral Communication ²		3
GE Area 3A - Arts ²		3
GE Area 4 - Social & Behavioral Sciences ²		3
GR American Institutions (US History) ²		3
Units		16
Second Semester		
ASTR 4A or ASTR 4B or ASTR 4C	Introduction to the Solar System ³ or Introduction to Stars, Galaxies, and Cosmology or Introduction to Astrobiology	3
MATH 31	Calculus II	4
PHYS 11A	General Physics: Mechanics	4
GE Area 1A - English Composition ²		3
GE Area 3B - Humanities ²		3
Units		17
Year 2		
First Semester		
BIO 1	Biodiversity, Evolution and Ecology	5
MATH 32	Calculus III	4
PHYS 11C	General Physics: Electricity and Magnetism	4
GE Area 1B - Critical Thinking ²		3
Units		16
Second Semester		
ENGL 20	College Composition II	3
MATH 45	Differential Equations for Science and Engineering	3
PHYS 11B	General Physics: Heat, Light, Sound, Modern Physics	4
GE Area 6 - Ethnic Studies ²		3
GR American Institutions (GOVT) ²		3
Units		16
Year 3		
First Semester		
ENVS 10	Introduction to Environmental Science	3
PHYS 105	Mathematical Methods in Physics	3
PHYS 106	Introduction to Modern Physics	3
PHYS 115	Electronics and Instrumentation	4
Foreign Language Semester 1 ²		4
Units		17
Second Semester		
GEOL 10	Physical Geology	3
GEOL 10L	Physical Geology Lab	1
PHYS 110	Classical Mechanics	3
Upper Division GE Area 3 - Arts or Humanities + Writing Intensive ²		3
Foreign Language Semester 2 ²		4
Units		14
Year 4		
First Semester		
ASTR 6	Astronomical Observation Laboratory	1
BIO 2	Cells, Molecules and Genes	5

CHEM 1A	General Chemistry I	5
PHYS 191	Senior Project	1 - 2
Physics Elective ³		3
Upper Division GE Area 5 or 2 - Science or Mathematical Concepts/Quantitative Reasoning ²		3
Units		18-19
Second Semester		
CHEM 1B	General Chemistry II	5
PHYS 135	Electricity And Magnetism	3
PHYS 175	Advanced Physics Laboratory	2
PHYS 191	Senior Project	1 - 2
Physics Elective ³		3
Upper Division GE Area 4 - Social & Behavioral Sciences ²		3
Units		17-18
Total Units		131-133

Physics (Teacher Preparation), BA: 2-Year Roadmap

Course	Title	Units
Year 1		
First Semester		
PHYS 105	Mathematical Methods in Physics	3
PHYS 106	Introduction to Modern Physics	3
PHYS 115	Electronics and Instrumentation	4
Foreign Language Semester 1 ²		4
Units		14
Second Semester		
PHYS 110	Classical Mechanics	3
PHYS 124	Thermodynamics and Statistical Mechanics	3
PHYS 135	Electricity And Magnetism	3
Physics Elective ³		3
Foreign Language Semester 2 ²		4
Units		16
Year 2		
First Semester		
PHYS 191	Senior Project	1 - 2
Physics Elective ³		3
Upper Division GE Area 3 - Arts or Humanities + Writing Intensive ²		3
GR American Institutions (US History) ²		3
Upper Division Elective		3
Elective of Choice		3
Units		16-17
Second Semester		
PHYS 175	Advanced Physics Laboratory	2
PHYS 191	Senior Project	1 - 2
Upper Division GE Area 4 - Social & Behavioral Sciences ²		3
Upper Division GE Area 5 or 2 - Science or Mathematical Concepts/Quantitative Reasoning ²		3
GR American Institutions (GOVT) ²		3
Elective of Choice		3
Units		15-16
Total Units		61-63

¹. Any course not completed in the first semester should be taken in the second or a later semester.

². Please see General Education/Graduation Requirement **course options** (https://www.csus.edu/academic-affairs/curriculum-%20workflow/_internal/_documents/program-road-maps/als_2yr/art_transfer-%20roadmap-2024-25.pdf).

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³. Please see an academic advisor for elective options.

Career Options: Physicists, Astronomers, Atmospheric and Space Scientists, Nuclear Technicians, Data Scientists, Computer Programmers, Software Developers