

## PHYSICS

### Natural and Applied Sciences Division

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<http://www.cabrillo.edu/programs>



Associate Degree  
for Transfer  
*A Degree with a Guarantee.™*

### Physics A.S.-T Transfer Degree

Physics is the study of our natural surroundings, from the tiniest elementary particle to the entire universe. Physics provides a broad range of knowledge and powerful skills which are useful in practically every discipline. The program at Cabrillo emphasizes topics that affect our everyday lives: forces, motion, gravity, waves, sound, electricity, magnetism, light, and heat. The excitement of atoms, nuclei, relativity, and the cosmos is also included.

A physics major degree generally transfers to a four-year institution to complete a bachelor's degree. Physics graduates at the bachelor's level are qualified for a variety of technical positions with government or industry, and they are also well prepared to enter a graduate program in any other science or in engineering. Physics majors are welcomed into professional programs such as law, business, or medicine. Teaching at the high school or two-year college level is an option if a master's degree is obtained. A physicist generally obtains the Ph.D. Degree, which may lead to experimental or theoretical research and/or teaching at the university level or basic research in government or industry.

Cabrillo offers options for degrees in Physics. The first option listed below is an Associate in Science in Physics for Transfer (A.S.-T), which is intended for students who plan to complete a bachelor's degree in a similar major at a CSU campus. Students completing these degrees are guaranteed admission to the CSU system, but not to a particular campus or major.

See Associate Degree for Transfer information in the Cabrillo College *Catalog*. The following is required for all A.A.-T or A.S.-T degrees:

- Completion of 60 CSU-transferable semester units.
- Minimum grade-point average (GPA) of at least 2.0 in all CSU-transferable coursework. While a minimum of 2.0 is required for admission, some majors may require a higher GPA.
- Completion of a minimum of 18 semester units in the major with a letter grade of "C" or better.
- Certified completion of the California State University General Education- Breadth pattern (CSU GE Breadth) or the Intersegmental General Education Transfer Curriculum (IGETC) pattern.

### Learning Outcomes

The Cabrillo College Core Competencies (with an emphasis in the study of Physics):

1. Communication: Reading, Writing, Listening, Speaking, and/or Conversing

2. Critical Thinking and Information Competency: Analysis, Computation, Research, Problem Solving
3. Global Awareness: An appreciation of Scientific Processes, Global Systems and Civics, and Artistic Variety
4. Personal Responsibility and Professional Development: Self-Management and Self-Awareness, Social and Physical Wellness, Workplace Skills

### IGETC (for CSU) General Education Requirements 37 - 39 Units

PHYS 4A	Physics for Scientists and Engineers I .....	5
PHYS 4B	*Physics for Scientists and Engineers II .....	5
PHYS 4C	**Physics for Scientists and Engineers III .....	5
MATH 5A	Analytic Geometry and Calculus I .....	5
MATH 5B	Analytic Geometry and Calculus II .....	5
MATH 5C	Analytic Geometry and Calculus III .....	5

**Total Units** **60**

\*Fall only; \*\*Spring only

### Physics A. S. Degree

#### Learning Outcomes

The Cabrillo College Core Competencies (with an emphasis in the study of Physics):

1. Communication: Reading, Writing, Listening, Speaking, and/or Conversing
2. Critical Thinking and Information Competency: Analysis, Computation, Research, Problem Solving
3. Global Awareness: An appreciation of Scientific Processes, Global Systems and Civics, and Artistic Variety
4. Personal Responsibility and Professional Development: Self-Management and Self-Awareness, Social and Physical Wellness, Workplace Skills

#### Model Program for Physics

This Associate Degree requires 60 units appropriate to your educational goal, to include general education and at least 30 units in a major. Courses should be selected to meet the lower-division major preparation requirements at your intended transfer university - these specific requirements can be found at [www.assist.org](http://www.assist.org) for 4-year public institutions in California. Please see a counselor for advisement to ensure you are taking the best possible courses given your goal.

The department presents the following suggested Model Program for this major. The courses listed below may or may not be appropriate depending on your specific goal. Please see a counselor for advisement for transfer to any 4-year institution.

### A. S. General Education 21 Units

<b>Core Courses (39 units)</b>		
MATH 5A	Analytic Geometry and Calculus I .....	5
MATH 5B	Analytic Geometry and Calculus II .....	5
MATH 5C	Analytic Geometry and Calculus III .....	5
MATH 6	Introduction to Linear Algebra .....	3
MATH 7	Introduction to Differential Equations .....	3
PHYS 4A	Physics for Scientists and Engineers I .....	5
PHYS 4B	**Physics for Scientists and Engineers II .....	5
PHYS 4C	*Physics for Scientists and Engineers III .....	5
PHYS 4D	***Modern Physics .....	3

**Total Units** **60**

\*Spring only; \*\*Fall only; \*\*\*Fall, even years only

## Physics Courses

### PHYS 2A General Physics I

4 units; 3 hours Lecture, 4 hours Laboratory

Prerequisite: MATH 4 or MATH 2 and MATH 3 or equivalent knowledge.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers mechanics, heat and waves primarily for life science students. Fall semester only. Some of the class hours for this course may be scheduled as To Be Arranged (TBA). See the *Schedule of Classes* for the details about this course offering.

*Transfer Credit:* Transfers to CSU; UC, with limits: PHYS 2A, 2B and 4A, 4B, 4C combined: maximum credit-one series. Deduct credit for duplication of topics. C-ID: PHYS 105, PHYS 2A + PHYS 2B = C-ID PHYS 100S

### PHYS 2B General Physics II

4 units; 3 hours Lecture, 4 hours Laboratory

Prerequisite: PHYS 2A.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers electromagnetism, optics, relativity, and the atom primarily for life science students. Spring semester only. Some of the class hours for this course may be scheduled as To Be Arranged (TBA). See the *Schedule of Classes* for the details about this course offering.

*Transfer Credit:* Transfers to CSU; UC, with limits: PHYS 2A, 2B and 4A, 4B, 4C combined: maximum credit-one series. Deduct credit for duplication of topics. C-ID: PHYS 110, PHYS 2A + PHYS 2B = C-ID PHYS 100S

### PHYS 4A Physics for Scientists and Engineers I

5 units; 4 hours Lecture, 4 hours Laboratory

Prerequisite: PHYS 11 or a "B" or better in high school physics and MATH 5A.

Recommended Preparation: Completion of or concurrent enrollment in MATH 5B; Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers classical mechanics, fluids, and waves for scientists and engineers. This is the first course in the calculus-based physics sequence. Some of the class hours for this course may be scheduled as To Be Arranged (TBA). See the *Schedule of Classes* for the details about this course offering.

*Transfer Credit:* Transfers to CSU; UC, with limits: PHYS 2A, 2B, and 4A, 4B, 4C combined: maximum credit- one series. Deduct credit for duplication of topics. C-ID: PHYS 205, PHYS 4A + PHYS 4B + PHYS 4C = C-ID PHYS 200S

### PHYS 4B Physics for Scientists and Engineers II

5 units; 4 hours Lecture, 4 hours Laboratory

Prerequisite: PHYS 4A and MATH 5B.

Recommended Preparation: Completion of or concurrent enrollment in MATH 5C; Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers electricity and magnetism for scientists and engineers. This is the second course in the calculus-based physics sequence. Students enrolled in the Honors Transfer Program may count this course towards the Honors Scholar designation with an Honors Contract. Fall semester only. Some of the class hours for this course may be scheduled as To Be Arranged (TBA). See the *Schedule of Classes* for the details about this course offering.

*Transfer Credit:* Transfers to CSU; UC, with limits: PHYS 2A, 2B, and 4A, 4B, 4C combined: maximum credit- one series. Deduct credit for duplication of topics. C-ID: PHYS 210, PHYS 4A + PHYS 4B + PHYS 4C = C-ID PHYS 200S

### PHYS 4C Physics for Scientists and Engineers III

5 units; 4 hours Lecture, 4 hours Laboratory

Prerequisite: PHYS 4A and MATH 5B.

Recommended Preparation: Completion of or concurrent enrollment in MATH 5C; Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers thermodynamics, optics, and introduction to modern physics for scientists and engineers. This is the third course in the calculus-based physics sequence. Students enrolled in the Honors Transfer Program may count this course towards the Honors Scholar designation with an Honors Contract. Spring semester only. Some of the class hours for this course may be scheduled as To Be Arranged (TBA). See the *Schedule of Classes* for the details about this course offering.

*Transfer Credit:* Transfers to CSU; UC, with limits: PHYS 2A, 2B, and 4A, 4B, 4C combined: maximum credit- one series. Deduct credit for duplication of topics. C-ID: PHYS 215, PHYS 4A + PHYS 4B + PHYS 4C = C-ID PHYS 200S

### PHYS 4D Modern Physics

3 units; 3 hours Lecture

Prerequisite: PHYS 4C.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers relativity, quantum mechanics, and nuclear physics for scientists and engineers. Fall semester only, even years.

*Transfer Credit:* Transfers to CSU; UC.

### PHYS 10 Introduction to Physics

3 units; 3 hours Lecture

Prerequisite: MATH 154.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers conceptual topics in physics for the non-science major (PHYS 10L lab optional).

*Transfer Credit:* Transfers to CSU; UC, with limits: PHYS 10, 10L, 11 & 12 combined: maximum credit-4 units. No credit for PHYS 10/10L, 11 or 12 if taken after 2A or 4A.

**PHYS 10L Introduction to Physics Lab**

1 unit; 3 hours Laboratory

Prerequisite: PHYS 10 or concurrent enrollment.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Presents a hands-on exploration of topics in physics for the non-science major.

*Transfer Credit:* Transfers to CSU; UC, with limits: PHYS 10, 10L, 11 & 12 combined: maximum credit-4 units. No credit for PHYS 10 /10L, 11 or 12 if taken after 2A or 4A.

**PHYS 11 Elementary Physics**

4 units; 3 hours Lecture, 4 hours Laboratory

Prerequisite: MATH 4 or MATH 2 and MATH 3 or equivalent knowledge.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Prepares students for the PHYS 4 sequence by introducing classical mechanics, thermodynamics, electromagnetism, atoms and nuclei. Some of the class hours for this course may be scheduled as To Be Arranged (TBA). See the *Schedule of Classes* for the details about this course offering.

*Transfer Credit:* Transfers to CSU; UC, with limits: PHYS 10, 10L, 11 & 12 combined: maximum credit-4 units. No credit for PHYS 10/10L, 11 or 12 if taken after 2A or 4A.

**PHYS 12 Conceptual Modern Physics**

3 units; 3 hours Lecture

Prerequisite: MATH 154.

Recommended Preparation: Eligibility for ENGL 100 or ESL 100 and READ 100.

Repeatability: May be taken a total of 1 time.

Covers conceptual topics in modern physics for the non-science major.

*Transfer Credit:* Transfers to CSU; UC, with limits: PHYS 10, 10L, 11 & 12 combined: maximum credit-4 units. No credit for PHYS 10/10L, 11 or 12 if taken after 2A or 4A.