

Physics

Degrees

Associate in Arts/Science Degree, Physics

Associate in Science Degree (AS-T):
Physics for Transfer

Program Description

Physics is the foundation discipline which must be incorporated into the education of anyone preparing for a career in engineering or science. It is equally true for the non-scientist having the responsibility to make meaningful decisions in society—the citizen in politics, the business person or social scientist who deals with problems of a society strongly linked to technology based on application of physical principles. A truly educated person preparing for life in the 21st century can hardly afford not to be aware of the statements of contemporary physics.

The Physics Department, in addition to offering courses for the major, provides a support service in offering Physics courses satisfying the needs of other disciplines.

There is a three-semester, calculus-based sequence (PHYS 121, 122, 123) for the student in Engineering, Physics and other physical sciences. The department also offers the Excellence in Mathematics, Sciences and Engineering (EMSE) workshop program (PHYS 121W, 122W, and 123W) to assist students in calculus-based Physics courses.

For the Biological Sciences student, both a two-semester trigonometry-level Physics sequence (PHYS 105 and 106) and a two-semester calculus-level Physics sequence (PHYS 110 and 111) are offered.

PHYS 102 satisfies the needs of those requiring an introduction to physics prior to entering the Engineering/Physics sequence.

For those fulfilling a General Education science requirement, a one-semester general survey Physics course (PHYS 101 and 101L) is offered.

To satisfy the needs of the Liberal Studies major, the Physics Department offers a non-mathematical one-semester Physical Science course (Physical Science 103) which covers the physical basis of a number of disciplines—Physics, Chemistry, Astronomy, Geology and Meteorology.

The department offers an AS-T Degree in Physics for Transfer. This degree provides the foundational knowledge in physics to students who want to earn a Baccalaureate Degree in Physics. This degree is in compliance with the Student Transfer Achievement Reform Act {Senate Bill 1440, now codified in

California Education Code Sections 66746-66749} and guarantees admission to a California State University (CSU) campus for any community college student who completes an “associate degree for transfer,” a newly established variation of the associate degrees traditionally offered at a California community college. Upon completion of the transfer associate degree, the student is eligible for transfer with junior standing into the California State University (CSU) system. Students will be given priority consideration when applying to a particular program that is similar to the student’s community college area of emphasis. For more information on transfer degrees, visit www.sb1440.org.

Student Learning Outcomes

1. Demonstrate proficiency, both conceptually and mathematically with calculus, in solving static and dynamic mechanical problems involving both solids and fluids.
2. Demonstrate proficiency, both conceptually and mathematically with calculus, in solving mechanical wave problems.
3. Demonstrate proficiency, both conceptually and mathematically with calculus, in solving thermodynamic problems.
4. Demonstrate proficiency, both conceptually and mathematically with calculus, in solving electric, magnetic and electromagnetic problems.
5. Demonstrate proficiency, both conceptually and mathematically with calculus, in solving ray and wave optics problems.
6. Demonstrate proficiency, both conceptually and mathematically with calculus, in solving modern physics problems.
7. Demonstrate proficiency in construction and assembly of experimental apparatuses; conduct and analyze measurements of physical phenomena; assess experimental uncertainty; make meaningful comparisons between experiment and theory; and interpret results.

Faculty and Offices

Michael Young, *Chair* (PS-119, ext. 2697)

Nick Arnold (PS-118, ext. 4253)

Doug Folsom (PS-115, ext. 4305)

Don Ion, *Laboratory Technician* (PS-120, ext. 2312)

TBD, *Dean*

Department information is also available on the Internet at <http://science.sbcc.edu/physics/> and www.sbcc.edu/physics.

AA/AS Degree: Physics**Department Requirements (50-51 units)**

CHEM 155 — General Chemistry I	5
CHEM 156 — General Chemistry II	5
MATH 150 — Calculus with Analytic Geometry I.....	5
MATH 160 — Calculus with Analytic Geometry II.....	5
MATH 200 — Multivariable Calculus	4
MATH 210 — Linear Algebra.....	4
MATH 220 — Differential Equations	4
PHYS 121 — Mechanics of Solids and Fluids.....	5
PHYS 122 — Electricity and Magnetism	5
PHYS 123 — Heat, Light and Modern Physics	5

Plus one of the following

CS 120 — Java Programming.....	3
CS 105 — Theory and Practice I <i>or</i>	3
CS 107 — Computer Architecture and Organization <i>or</i> ...	3
CS 137 — C Programming.....	3
CS 140 — Object-Oriented Programming Using C++	4

College Requirements

For complete information, see “Graduation Requirements” in the *Catalog* Index.

Planning a Program of Study

Students should work with Santa Barbara City College’s counseling staff in planning semester-by-semester programs of study. Important conditions to be met by students majoring in the Physical Sciences include:

1. The number of units taken each semester is a matter of personal choice. Students who work full-time should take a reduced course load.
2. Many required courses are in sequences—which must be taken in the prescribed order (e.g. MATH 150, 160, 200/210 and 220), hence schedule courses in the major first and schedule IGETC courses second. See www.assist.org for help.
3. Some courses are prerequisites for courses in the sequences (e.g., MATH 150 is a prerequisite for PHYS 121).
4. PHYS 122 is only taught in the Fall Semester and PHYS 123 is only taught in the Spring Semester.
5. PHYS 123 may be taken before PHYS 122.

6. PHYS 121 should be taken with MATH 160 and PHYS 122/123 should be taken with MATH 200/210/220 else there may be a scheduling time conflict.

Some sequences are especially important for the sciences. The sciences do require reading, writing and mathematical skills. Science textbooks are typically at a grade 13-14 reading level. Students deficient in such skills have a unique opportunity at Santa Barbara City College to quickly and efficiently reach the levels required in the majors programs through the following sequences:

English Sequence

1. Passing score on placement exam (to) ENG 110 (to) 111; *or*
2. English Skills (to) ENG 100 (to) 110 (to) 111.

Mathematics Sequence

1. MATH 100 (to) 111 (to) 137 (to) 138 (to) 150, 160, 200/210, 220; *or*
2. High school algebra and trigonometry, plus passing score on placement exam (to) MATH 150, 160, 200/210, 220.

Special Note: If you have not been tested for appropriate course placement in respect to the aforementioned sequences, contact the Counseling Center for up-to-date pre-enrollment testing schedule information. You should make sure that you have the necessary skills for each class taken—in order to succeed and/or progress in your chosen major.

Chemistry Sequence

CHEM 101 or high school chemistry (to) 155 (to) 156.

Physics Sequence

PHYS 102 or high school physics with trigonometry (to) 121 (to) 122 or 123 (to) 123 or 122. *Note:* PHYS 123 may be taken before PHYS 122. PHYS 102 and 121 are offered every semester, but PHYS 122 and 123 are only offered once a year.

Preparation for Transfer

Course requirements for transfer vary depending upon the college or university a student wishes to attend. Therefore, it is *most important* for a student to consult with his/her counselor, departmental adviser and www.assist.org before planning an academic program for transfer.

Requirements for AS-T Degree—**Physics for Transfer**

Physics covers a wide range of topics. The major is designed to give students exposure to basic information in the discipline and provide the opportunity to focus on the areas that best suit their individual needs. Students should consult with a departmental adviser and/or counselor when choosing both controlled and general electives in order to develop a program of study that is best suited to their specific needs. For example, requirements for the Baccalaureate Degree in Physics vary from one institution to another. It is, therefore, essential to become familiar with the requirements of the institution a student plans to attend.

The Associate in Science Degree in Physics for Transfer will provide the foundational knowledge to students who want to earn a Baccalaureate Degree in Physics at any of the CSU campuses (see www.assist.org for transfer to UC/CSU).

Degree Requirements

Complete 60 CSU-transferable units including general education, major requirements and CSU-transferable electives as follows:

I. General Education*Complete the following pattern*

- Intersegmental General Education Transfer Curriculum "IGETC" for CSU (37 semester units)

II. Major

Complete 29 units as outlined below with a "C" or better in each course. Pass/No Pass grading is not permitted in a course within a student's major area of study. The courses completed for the major may also be used to fulfill general education areas on the IGETC.

MATH 150* — Calculus with Analytic Geometry I	5
MATH 160* — Calculus with Analytic Geometry II	5
MATH 200* — Multivariable Calculus.....	4
PHYS 121* — Mechanics of Solids and Fluids	5
PHYS 122* — Electricity and Magnetism.....	5
PHYS 123* — Heat, Light and Modern Physics.....	5

*These courses fulfill an IGETC requirement. Visit www.assist.org or <http://articulation.sbccc.edu> for a complete list of IGETC requirements.

III. CSU Transferable Electives

Complete as many units as needed to reach a total of 60 CSU-transferable units (for a list of SBCC-transferable courses to CSU, visit www.assist.org).

Additional Graduation Requirements for AS-T in Physics:

- Maintain a cumulative CSU-transferable GPA of 2.0.
- Residency Requirements: Candidates for an Associate Degree are expected to complete 15 semester units in residence at SBCC. Candidates for an Associate Degree are also expected to complete at least 20% of the department major requirements in residence at SBCC.

Honors and Awards*Outstanding Student Award*

The Physics Department selects one student each year as Outstanding Student. The selection is made by faculty in the department. Selections are based solely on academic excellence and no applications by students are required.

Joseph P. Cosand Award

The Joseph P. Cosand Award is granted to a student who has demonstrated excellence in at least two of the Physical Sciences and in Mathematics. Annually, the Physics, Chemistry and Geology faculty nominate outstanding candidates for this prestigious award. Selection is determined by a consensus of the three physical science departments, with the concurrence of the Mathematics Department.

Physical Science Courses**PHSC 103 — The Physical Universe****(4) — CSU, UC***

Skills Advisories: MATH 1 and eligibility for ENG 100

Hours: 108 (54 lecture, 54 lab)

Conceptual non-mathematical introduction to the physical sciences. Topics of current interest from astronomy, physics, chemistry, geology, weather and the environment. Practical illustrations taken from art, music, sports, the home. Recommended for all non-science majors. Satisfies General Education laboratory science requirement. (**UC Transfer Limit: no credit for PHSC 103 if taken after a college level course in astronomy, chemistry, geology or physics*)

PHSC 107 — Nanoscience in Society**(4) — CSU, UC***Skills Advisories: Proficiency in MATH 100 and**Eligibility for ENG 110 or 110GB or 110H**Hours: 108 (54 lecture, 54 lab)*

Interdisciplinary physical sciences course that uses the fundamental principles of science to examine nanoscience, nanotechnology, and the societal impact of these emerging technologies on our lives and environment. Topics of interest include development and global sustainability, nanotechnology and personal responsibility, developing a green future, the pros and cons of emerging nanotechnologies, and energy.

Physics Courses**PHYS 101 — Conceptual Physics****(3) — CSU, UC****Skills Advisories: Eligibility for ENG 100 and**proficiency in MATH 1**Hours: 54 lecture*

Concept-oriented non-mathematical course in general physics. Topics include motion, heat, sound, light, electricity and modern physics. Special emphasis on everyday experience, with practical illustrations taken from art, music, sports, the home. (*UC Transfer Limit: PHYS 101, 101L and 102 combined: maximum credit, 4 units; no credit for PHYS 101 or 102 if taken after 105; PHYS 101 and 101H combined: maximum credit, one course)

PHYS 101L — Conceptual Physics Lab**(1) — CSU, UC****Corequisites: PHYS 101**Skills Advisories: MATH 100 and Eligibility for ENG 110 or 110H**Hours: 54 lab*

Concept-oriented laboratory in general physics. Topics include motion, heat, sound, light, electricity and modern physics. Special emphasis on everyday experience, with practical illustrations taken from art, music, sports, the home. (*UC Transfer Limit: PHYS 101, 101L and 102 combined: maximum credit, 4 units)

PHYS 102 — Introductory Physics for Science Majors**(4) — CSU, UC****Skills Advisories: Eligibility for ENG 110 or 110H;**proficiency in MATH 104 or 107 or 111**Hours: 108 (54 lecture, 54 lab)*

Introductory course, with quantitative applications and problem-solving introduced where appropriate, for students majoring in the physical sciences. Topics include meaning of physical law, vectors, Newton's Laws of Motion (classical physics), work and energy, waves, electricity, magnetism, light, atomic and nuclear physics. Satisfies General Education laboratory science requirement. Also satisfies Physics prerequisite for PHYS 121. (*UC Transfer Limit: PHYS 101, 101L and 102 combined: maximum credit, 4 units; no credit for PHYS 101, or 102 if taken after 105)

PHYS 105 — General Physics**(4) — CSU, UC****Prerequisites: MATH 120**Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 108 (54 lecture, 54 lab)*

Statics and dynamics of particles and rigid bodies. Newton's Laws of Motion, conservation principles, rotational motion, simple harmonic motion, wave motion, heat and sound, introduction to hydrostatics and hydrodynamics. (*UC Transfer Limit; PHYS 105 and 106 or 110 and 111 or 121, 122 and 123 combined: maximum credit, one series)

PHYS 106 — General Physics**(4) — CSU, UC****Prerequisites: PHYS 105 and MATH 107 or 111**Skills Advisories: Eligibility for ENG 110 or 110H;**proficiency in MATH 120**Hours: 108 (54 lecture, 54 lab)*

Electricity, magnetism, optics, relativity, atomic and nuclear physics. (*UC Transfer Limit; PHYS 105 and 106 or 110 and 111 or 121, 122 and 123 combined: maximum credit, one series)

PHYS 110 — Introductory Physics**(4) — CSU, UC****Prerequisites: MATH 130 or 150**Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 108 (54 lecture, 54 lab)*

Statics and dynamics of particles and rigid bodies, Newton's Laws of Motion, conservation principles, rotational motion, simple harmonic motion, wave motion, heat and sound, introduction to hydrostatics and hydrodynamics. (Appropriate for life science majors requiring calculus-level physics.) (*UC Transfer Limit; PHYS 105 and 106 or 110 and 111 or 121, 122 and 123 combined: maximum credit, one series)

PHYS 111 — Introductory Physics**(4) — CSU, UC****Prerequisites: PHYS 110 and MATH 130 or 150**Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 108 (54 lecture, 54 lab)*

Electricity, magnetism, optics, relativity, atomic and nuclear physics. (Appropriate for life science majors requiring calculus-level physics.) (*UC Transfer Limit; PHYS 105 and 106 or 110 and 111 or 121, 122 and 123 combined: maximum credit, one series)

PHYS 121 — Mechanics of Solids and Fluids**(5) — CSU, UC****Prerequisites: PHYS 102 with a minimum grade of "C" or trigonometry based High School Physics with a minimum grade of "C" and MATH 150**Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 126 (72 lecture, 54 lab)*

For Engineering and Physical Science students. Statics and dynamics of particles and rigid bodies, Newton's Laws of Motion, conservation principles, rotational motion, introduction to hydrostatics and hydrodynamics. (*UC Transfer Limit; PHYS 105 and 106 or 110 and 111 or 121, 122 and 123 combined: maximum credit, one series)

PHYS 121W — Workshop For Physics 121**(1)***Corequisites: PHYS 121 (concurrent)**Hours: 54 lab*

Excellence in Mathematics, Science and Engineering (EMSE) supplementary problem-solving workshop designed for PHYS 121.

PHYS 122 — Electricity and Magnetism**(5) — CSU, UC****Prerequisites: PHYS 121 and MATH 160 with a minimum grade of "C"**Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 126 (72 lecture, 54 lab)*

For Engineering and Physical Science students. Electro-statics, Coulomb's Law, Gauss' Law, capacitors and dielectrics, DC circuits, Ohm's Law, magnetism and electromagnetism, Ampere's Law, Faraday's Law, alternating current theory, electrical oscillators, electromagnetic radiation and electromagnetic waves. (*UC Transfer Limit; PHYS 105 and 106 or 110 and 111 or 121, 122 and 123 combined: maximum credit, one series)

PHYS 122W — Workshop for Physics 122**(1)***Corequisites: PHYS 122 (concurrent)**Hours: 54 lab*

Excellence in Mathematics, Science and Engineering (EMSE) supplementary problem-solving workshop designed for PHYS 122.

PHYS 123 — Heat, Light and Modern Physics**(5) — CSU, UC****Prerequisites: PHYS 121 with a "C" or better and MATH 160**Skills Advisories: Eligibility for ENG 110 or 110H**Hours: 126 (72 lecture, 54 lab)*

For Engineering and Physical Science students. Mechanical waves, thermodynamic processes and systems, kinetic theory, light and modern physics. (*UC Transfer Limit; PHYS 105 and 106 or 110 and 111 or 121, 122 and 123 combined: maximum credit, one series)

PHYS 123W — Workshop for Physics 123**(1)***Corequisites: PHYS 123 (concurrent)**Hours: 54 lab*

Excellence in Mathematics, Science and Engineering (EMSE) supplementary problem-solving workshop designed for PHYS 123.