

Physics

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.

Student Learning Outcomes

1. Demonstrate proficiency, both conceptually and mathematically with calculus, in solving mechanical 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)

Doug Folsom, *Supervising Laboratory Technician* (PS-121, ext. 2505)

Don Ion (PS-120, ext. 2312)

Department information is also available on the Internet at www.sbcc.edu/physics.

Degrees Awarded

Associate in Arts/Science Degree, Physics

A.A./A.S. 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 131 — Assembly Language Programming.....	4
CS 135 — Programming Fundamentals.....	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.

Other important sequences include:

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. *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.

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.

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

Skills Advisories: MATH 1 and Eligibility for ENG 110 or 110H

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**PHYS 101 — Conceptual Physics****(3) — CSU, UC***

Skills Advisories: MATH 100 and Eligibility for ENG 110 or 110H

PHYS 101 and 101L taken concurrently satisfy the General Education laboratory science requirement.

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, 101H, 101L and 102 combined: maximum credit, 4 units; no credit for PHYS 101, 101H 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, 101H, 101L and 102 combined: maximum credit, 4 units)

PHYS 101H — Conceptual Physics, Honors**(4) — CSU, UC***

Skills Advisories: MATH 107 and Eligibility for ENG 110 or 110H

Limitation on Enrollment: Acceptance into the Honors Program.

Hours: 54 lecture

Conceptual, non-mathematical course in classical and modern physics. Topics include motion, heat, sound, light, electricity and magnetism, relativity and quantum theory. Both the history and development of the central ideas are considered. Laboratory projects and an appropriate field trip are for reinforcement of the ideas covered in the lecture. (*UC Transfer Limit: PHYS 101, 101H, 101L and 102 combined: maximum credit, 4 units; no credit for PHYS 101, 101H or 102 if taken after 105; 101 and 101H combined: maximum credit, one course)

PHYS 102 — Introductory Physics for Science Majors

(4) — CSU, UC*

Skills Advisories: Eligibility for ENG 110 or 110H or 110GB; 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, 101H, 101L and 102 combined: maximum credit, 4 units; no credit for PHYS 101, 101H or 102 if taken after 105*)

PHYS 104/PHIL 204 — History and Philosophy of the Great Ideas of Physics

(3) — CSU, UC

Skills Advisories: MATH 100 and Eligibility for ENG 110 or 110H
Hours: 54 lecture

History and development of physical ideas from the early Greeks through the eras of Copernicus, Galileo and Newton to the contemporary ideas of relativity and quantum theory. Non-mathematical. Appropriate for those in philosophy, liberal arts and the humanities. Satisfies SBCC Humanities General Education requirement.

PHYS 105 — General Physics

(4) — CSU, UC*

Prerequisites: MATH 107 or 111
Skills Advisories: Eligibility for ENG 110 or 110H or 110GB; proficiency in MATH 120
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 combined with PHYS 110 and 111 or 121, 122 and 123: 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 or 110GB; 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 combined with PHYS 110 and 111 or 121, 122 and 123: maximum credit, one series*)

PHYS 110 — Introductory Physics

(4) — CSU, UC*

Prerequisites: MATH 130 or 150
Skills Advisories: Eligibility for ENG 110 or 110H or 110GB
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 combined with PHYS 110 and 111 or 121, 122 and 123: 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 or 110GB
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 combined with PHYS 110 and 111 or 121, 122 and 123: 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 or 110GB
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 combined with PHYS 110 and 111 or 121, 122 and 123: 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 or 110GB
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 combined with PHYS 110 and 111 or 121, 122 and 123: 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 or 110GB
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 combined with PHYS 110 and 111 or 121, 122 and 123: 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.

PHYS 199 — Physics Lab: EMSE (1)

Hours: 54 lab

Excellence in Mathematics, Science and Engineering (EMSE) supplementary problem-solving workshop designed for PHYS 121, 122 or 123. Graded Pass/No Pass.

PHYS 299 — Independent Study in Physics (1-4) — CSU

*Limitation on Enrollment: Completion of a minimum of 12 units at SBCC, with a 2.5 GPA, and a minimum of 6 units, with a 3.0 GPA within the department
Hours: 48-192 lab*

For complete information, see "Independent Study" in the Catalog Index. (*UC Transfer Limit: computed as Independent Study; see counselor)