PHSC R170: CONCEPTS IN PHYSICAL SCIENCE

Originator
jwmiller

College
Oxnard College

Discipline (CB01A)
PHSC - Physical Science

Course Number (CB01B)
R170

Course Title (CB02)
Concepts in Physical Science

Banner/Short Title
Concepts in Physical Science

Credit Type
Credit

Start Term
Fall 2023

Catalog Course Description
This introductory course focuses on principles, laws, and concepts in physics, chemistry, and earth and space science. Students model scientific reasoning and experimentation processes: questioning, forming hypotheses, testing hypotheses experimentally, and performing analysis and additional questioning that lead to further experimentation. Lab activities are closely sequenced with the lecture topics, which include measurements and data analysis; fundamentals of classical mechanics; sources and transformations of energy; thermodynamics; waves; electricity and magnetism; light; atomic and nuclear theory; the periodic table; reactions; solutions; fundamentals of organic chemistry; geological processes, with a brief study of rocks and minerals; and the history and structure of the Earth, solar system, and universe. The course incorporates current knowledge of science teaching and concept development. It is aimed at current and prospective teachers, or anyone desiring to acquire basic literacy in physical science.

Taxonomy of Programs (TOP) Code (CB03)
1901.00 - Physical Sciences, General

Course Credit Status (CB04)
D (Credit - Degree Applicable)

Course Transfer Status (CB05) (select one only)
A (Transferable to both UC and CSU)

Course Basic Skills Status (CB08)
N - The Course is Not a Basic Skills Course

SAM Priority Code (CB09)
E - Non-Occupational

Course Cooperative Work Experience Education Status (CB10)
N - Is Not Part of a Cooperative Work Experience Education Program

Course Classification Status (CB11)
Y - Credit Course

Educational Assistance Class Instruction (Approved Special Class) (CB13)
N - The Course is Not an Approved Special Class

Course Prior to Transfer Level (CB21)
Y - Not Applicable

Course Noncredit Category (CB22)
Y - Credit Course

Funding Agency Category (CB23)
Y - Not Applicable (Funding Not Used)

Course Program Status (CB24)
1 - Program Applicable

General Education Status (CB25)
Y - Not Applicable

Support Course Status (CB26)
N - Course is not a support course

Field trips
Will not be required

Grading method
(L) Letter Graded

Does this course require an instructional materials fee?
No

Repeatable for Credit
No

Is this course part of a family?
No

Units and Hours

Carnegie Unit Override
No

In-Class

Lecture
Minimum Contact/In-Class Lecture Hours
52.5
Maximum Contact/In-Class Lecture Hours
52.5

Activity

Laboratory
Minimum Contact/In-Class Laboratory Hours
52.5
Maximum Contact/In-Class Laboratory Hours
52.5

Total in-Class

Total in-Class
Total Minimum Contact/In-Class Hours
105

Total Maximum Contact/In-Class Hours
105

Outside-of-Class

Internship/Cooperative Work Experience

Paid

Unpaid

Total Outside-of-Class

Total Outside-of-Class
Minimum Outside-of-Class Hours
105
Maximum Outside-of-Class Hours
105

Total Student Learning

Total Student Learning
Total Minimum Student Learning Hours
210
Total Maximum Student Learning Hours
210

Minimum Units (CB07)
4
Maximum Units (CB06)
4

Prerequisites
Course taught at the level of intermediate algebra or placement as determined by the college's multiple measures assessment process

Entrance Skills

Entrance Skills
Students are required to have an understanding of algebra and various techniques used in solving mathematically based problems that arise throughout the course.

Requisite Justification

Requisite Type
Prerequisite

Requisite
Course taught at the level of intermediate algebra or placement as determined by the college's multiple measures assessment process

Requisite Description
Course not in a sequence

Level of Scrutiny/Justification
Content review

Student Learning Outcomes (CSLOs)

	Upon satisfactory completion of the course, students will be able to:
1	The student will be able to determine the velocity of an object under the action of constant forces.
2	The student will be able to properly identify the elements composing a given compound.
3	The student will be able to properly identify the different types of rocks (sedimentary, igneous, and metamorphic).

Course Objectives

	Upon satisfactory completion of the course, students will be able to:
1	Describe the states of matter and associate phase changes.
2	Classify matter as elements, compounds, mixtures and describe properties of each.
3	Describe basic atomic structure including the fundamental particles and electron energy levels.
4	Explain the history and structure of the periodic table.
5	Explain and describe different ways atoms combine to form compounds.
6	Describe the motion of objects as related through the concepts of position, displacement, speed, velocity and acceleration.
7	Use Newton's Laws to predict and explain the motion of an object.
8	Discuss the type of energy present in a system and use conservation of energy to solve problems.
9	Explain the requirements for a complete circuit in terms of a model of electric charge.
10	Describe color perception based on the wave nature of light and its interactions.

Course Content

Lecture/Course Content

Lecture topics:

1. The scientific method—what is science?
   a. Initial inquiry
   b. Formulation of questions or hypotheses
   c. Planning, setting up, and carrying out experiments
   d. Experimental methodology and proper recording of data
   e. Effective data presentation, with focus on graphing
   f. Analysis, interpretation, and evaluation of results
   g. Constructing concepts and models (thinking like a scientist)
   h. Sensors: types, uses, and limitations
2. SI measurements (the metric system)
   a. Mass
   b. Length, area, and volume
   c. Time
   d. Electrical units
   e. Temperature units
3. Basic ideas and concepts of physics
   a. Motion (speed; velocity; acceleration; gravity)
   b. Forces (vectors; unbalanced forces; Newton's laws; gravity; centripetal forces; orbital motion)
   c. Energy (forms; transformations; work; power; simple machines)
   d. Energy sources, including future sources
   e. Heat and temperature (thermodynamic laws; specific heat; thermal expansion; heat transfer; theory of gases; heat engines)
   f. Waves (sound; wave types; musical instruments; resonance; speed of sound; Mach number; Doppler effect; seismic waves; echoes)
   g. Electricity and magnetism (static charges; current; Coulomb's law; electric fields; Ohm's law; power and household energy; magnetism; electrical devices)
   h. Light (properties; color; reflection; refraction; lenses and mirrors; diffraction; polarization; the human eye; fiber optics; wave vs. particle aspects)
   i. Atomic physics (history; Bohr atom; energy quanta; electron structure; energy transitions; atomic spectra, including applications such as chromatography and the cosmological red shift)
4. Basic ideas and concepts of chemistry

a. Periodic Table (families and series of elements; classes of chemicals)
b. Reactions (valence electrons; ionic and covalent bonding; exchange, combination, decomposition, and replacement reactions; formulas; balancing chemical equations; industrial chemistry)
c. Aqueous solutions (properties of water; behavior of solutions; acids, bases, and salts; pH scale)
d. Organic chemistry (carbon chemistry; alkanes, alkenes, and alkynes; organic derivatives and products; petroleum chemistry; biochemistry)
e. Nuclear reactions (radioactivity; measuring radiation; reactors; thermonuclear weapons; nuclear medicine)

5. Basic ideas and concepts of earth and space science
   a. The universe (cosmology; galaxies; the Big Bang; special relativity; the possibility of non-Earth life)
   b. The solar system (origin; planets, moons, meteors, and comets)
   c. Earth in space (motions in space; seasons; eclipses; tides)
   d. Rocks and minerals (rock formations and types; ores and mining)
   e. Building Earth's surface (plate tectonics; Earth's interior; crustal plates; continental drift; faulting; earthquakes; volcanism)
   f. Shaping Earth's surface (fossils; rock dating; development of life; ice ages)
   g. Geologic time (Eons, eras, and epochs; gradualism and catastrophism)

Laboratory or Activity Content

Laboratory topics:

1. Graphing and data analysis
2. Measuring motion
3. Rotational equilibrium
4. Specific heat
5. Speed of sound
6. Electrical circuits
7. Reflection and refraction of light
8. Archimedes' principle
9. Making hydrogen gas
10. Metal replacement reactions
11. Measurement of pH
12. Phases of the moon
13. Constellations and planets
14. Rock and mineral identification
15. Density of granite and basalt

Methods of Evaluation

Which of these methods will students use to demonstrate proficiency in the subject matter of this course? (Check all that apply):

Written expression
Problem solving exercises

Methods of Evaluation may include, but are not limited to, the following typical classroom assessment techniques/required assignments (check as many as are deemed appropriate):

Computational homework
Laboratory activities
Laboratory reports
Objective exams
Oral presentations
Quizzes
Essays
Problem-Solving Assignments

Instructional Methodology

Specify the methods of instruction that may be employed in this course

Audio-visual presentations
Computer-aided presentations
Distance Education
Instructor-guided interpretation and analysis
Laboratory activities
Lecture
Small group activities

Describe specific examples of the methods the instructor will use:

1. Audio Visual Presentation: The instructor may use videos and PowerPoint like presentations to deliver course content.
2. Computer aided presentation: The instructor may employ the computer to aid in the presentation of course materials which would include simulations of specific phenomena such as electric fields and how the molecules in a gas behave.
3. Demonstrations: The instructor will demonstrate physical principals by employing equipment and other items such as catapults, oscillators, balls, and force tables. For instance, when studying projectile motion, launching a ball out of a catapult would be used so that students see the parabolic trajectory of the ball as well as other notions regarding projectile motion.
4. Distance Education (Lecture): When applicable, recordings of lectures will be used to convey subject matter. Also, the use of discussion boards and virtual meeting will be used to allow students to ask questions regarding the course and its material.
5. Distance Education (Lab): Laboratory activities, as noted below, will take place in a virtual setting. The experiments will be tailored to utilize computer simulations, prerecorded data acquisition, live online meetings, and message boards where questions can be asked and answered.
6. Laboratory activities: Each week the students will preform an laboratory experiment investigating certain aspects of a system that has been discussed in lecture. These experiments will direct the students such that the intricacies of a given system are explored and compared to theoretical expectations. For instance, in the projectile motion lab students will launch a projectile and make measurements of displacements and time intervals to determine the initial velocity of the system. Results are then compared to the theory covered in class regarding projectile motion.
7. Small group activities (Lab): The students will work in small groups while preforming the experiments where applicable.
8. Instructor guided analysis: The instructor will work through physics problems during lecture that investigate a given system in which the students will follow along, answering questions posed by the instructor. This will also serve as a forum for students to ask particular questions regarding the logic and methods employed to come to certain conclusions regarding said problem/system.
9. Lecture: The instructor will deliver the course subject matter via in person lectures to the students. For example, a lecture on Newton's Laws of Motion.
10. Small group activities: These may be employed in the form of group quizzes where students work together in small groups to solve some physics problems regarding current material.

Representative Course Assignments

Writing Assignments

1. Weekly laboratory reports, which may include raw data, computations, graphs, and a conclusion based upon an analysis of the experimental data
2. Answers to short essay questions that may appear in the conceptual portion of the homework assignments that directly address the topics under study. For example; explain the difference between covalent and ionic bonds.
3. Preparation of written supporting materials, such as lecture notes (if needed) for oral group presentation

Critical Thinking Assignments

1. Answering a wide array of homework, quiz, and exam questions requiring the analysis of a given physical system or circumstance in order to come to the correct conclusion and/or answer regarding the question and/or desired outcome. For instance; Driving down the road at a constant rate of 20 m/s, you see that a large tree branch is breaking off of a tree. The tree is 35 m away from the front of your car and the branch is 15 m high relative to your car as it begins to fall. Your car has a length of 3.0 m can accelerate at a rate of 2.5 m/s^2 or slow down at a rate of 5 m/s^2. To avoid being hit by or hitting the branch, should you speed up, slow down, or continue at a constant rate? Justify your answer.

Reading Assignments

1. Approximately one chapter per week from the course textbook, addressing current topics being covered in the course; the breadth of a weekly reading might encompass topic titles such as “The Nature of Science”, “Energy Sources”, or “Properties of Atoms and the Periodic Table”
2. Instructions from the laboratory manual regarding use of the equipment and data collection and analysis requirements for each week’s laboratory or investigation.

Skills Demonstrations

None

Problem-Solving and Other Assignments (if applicable)

1. Preparation of visual aids or other materials for oral group presentation.

Outside Assignments

Representative Outside Assignments

1. Assigned reading from the textbook requiring 1.5 hour per week.
2. Assigned conceptual and problem solving based homework that further investigates and explores the notions and theories discussed throughout the course. This will generally require 4.5 hours per week.
3. Studying and preparing for quizzes and exams.

Articulation

C-ID Descriptor Number

PHYS 140

Status

Approved

Comparable Courses within the VCCCD

PHSC M01 - Principles of Physical Science
PHSC M01L - Principles of Physical Science Laboratory
PHSC V01 - Concepts in Physical Science

District General Education

A. Natural Sciences

A2. Physical Science

Approved

B. Social and Behavioral Sciences

C. Humanities

D. Language and Rationality

E. Health and Physical Education/Kinesiology

F. Ethnic Studies/Gender Studies

Course is CSU transferable

Yes

CSU Baccalaureate List effective term:

Summer 2002

CSU GE-Breadth

Area A: English Language Communication and Critical Thinking

Area B: Scientific Inquiry and Quantitative Reasoning

B1 Physical Science

Approved

B3 Laboratory Activity

Approved

Area C: Arts and Humanities

Area D: Social Sciences

Area E: Lifelong Learning and Self-Development

Area F: Ethnic Studies

CSU Graduation Requirement in U.S. History, Constitution and American Ideals:

UC TCA

UC TCA
Approved

IGETC

Area 1: English Communication

Area 2A: Mathematical Concepts & Quantitative Reasoning

Area 3: Arts and Humanities

Area 4: Social and Behavioral Sciences

Area 5: Physical and Biological Sciences

Area 5A: Physical Science
Approved

Area 5C: Laboratory Science
Approved

Area 6: Languages Other than English (LOTE)

Textbooks and Lab Manuals

Resource Type
Manual

Description
Tillery, B. (2017). *Lab Manual for Physical Science* (11th). Mcgraw Hill. New York

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Resource Type
Textbook

Description
Hewitt, Paul G., John Suchocki, and Leslie Hewitt. (2017) *Conceptual Physical Science*. (6th). Pearson, New York.

Resource Type
Other Resource Type

Description
Supplemental handouts on selected topics prepared by the instructor.

Distance Education Addendum

Definitions

Distance Education Modalities

Hybrid (1%–50% online)
Hybrid (51%–99% online)
100% online

Faculty Certifications

Faculty assigned to teach Hybrid or Fully Online sections of this course will receive training in how to satisfy the Federal and state regulations governing regular effective/substantive contact for distance education. The training will include common elements in the district-supported learning management system (LMS), online teaching methods, regular effective/substantive contact, and best practices.

Yes

Faculty assigned to teach Hybrid or Fully Online sections of this course will meet with the EAC Alternate Media Specialist to ensure that the course content meets the required Federal and state accessibility standards for access by students with disabilities. Common areas for discussion include accessibility of PDF files, images, captioning of videos, Power Point presentations, math and scientific notation, and ensuring the use of style mark-up in Word documents.

Yes

Regular Effective/Substantive Contact

Hybrid (1%–50% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class material.
Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.
Face to Face (by student request; cannot be required)	Face to face meetings can be arranged when needed.

Hybrid (51%–99% online) Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.
Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class material.
Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.
Face to Face (by student request; cannot be required)	Face to face meetings can be arranged when needed.

100% online Modality:

Method of Instruction	Document typical activities or assignments for each method of instruction
Other DE (e.g., recorded lectures)	The students will watch recorded lecture videos that go over the pertinent subject matter of the course.

Synchronous Dialog (e.g., online chat)	The students will join live, online meetings in which they will receive instruction, be reminded of all upcoming assignments/events, and be allowed to ask questions pertaining to the lecture and lab material. Recordings will be made available of all live meetings. Students may also be put into small groups to discuss a given class material.
Asynchronous Dialog (e.g., discussion board)	Students will have access to a discussion board in which they can ask questions regarding the course material.

Examinations

Hybrid (1%–50% online) Modality
On campus
Online

Hybrid (51%–99% online) Modality
On campus
Online

Primary Minimum Qualification
PHYSICAL SCIENCES

Additional Minimum Qualifications

Minimum Qualifications
Chemistry
Earth Science
Physics/Astronomy

Review and Approval Dates

Department Chair
05/02/2023

Dean
05/08/2023

Technical Review
05/10/2023

Curriculum Committee
05/10/2023

DTRW-I
MM/DD/YYYY

Curriculum Committee
MM/DD/YYYY

Board
MM/DD/YYYY

CCCCO
MM/DD/YYYY

Control Number
CCC000190029

DOE/accreditation approval date
MM/DD/YYYY