

# PHYS 0010L - BASIC CONCEPTS IN PHYSICS LABORATORY

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## Catalog Description

Formerly known as PHYS 11

Prerequisite: Completion with grade of "C" or better or concurrent enrollment in PHYS 10

Advisory: Eligibility for ENGL 11 strongly recommended

Hours: 54 laboratory

Description: An optional laboratory course taken in conjunction with PHYS 10. Integrates abstract concepts from PHYS 10 into concrete applications through experimentation. Topics include the SI system of measurement; motion; fluids and properties of matter; thermodynamics; waves; sound; electricity and magnetism; and light and optics. (CSU, UC-with unit limitation)

## Course Student Learning Outcomes

- CSLO #1: Use appropriate lab equipment to achieve successful measurements associated with motion, electric charges, thermodynamics and waves.
- CSLO #2: Use appropriate software and numerical calculations to perform data analysis on measurements associated with the motion of macroscopic objects, electric charges, waves and heat.
- CSLO #3: Communicate experimental results in written and oral form.
- CSLO #4: Integrate theoretical constructs of Newtonian mechanics, electricity and magnetism, thermodynamics, and waves from Physics 10 into concrete applications via experimental methodology.

## Effective Term

Fall 2022

## Course Type

Credit - Degree-applicable

## Contact Hours

54

## Outside of Class Hours

0

## Total Student Learning Hours

54

## Course Objectives

A thorough understanding of physics requires the student to evaluate data and synthesize ideas to solve conceptual and numerical problems. The objectives below are similar to those of our core courses but are evaluated at a level commensurate with the curriculum of the lecture course Physics 10.

1. Explain the importance of experimental evidence as one of the main byways of physics knowledge.

2. Integrate abstract concepts from Physics 10, into their concrete applications through experimentation.
3. Describe some basic instruments used in measuring and observing phenomena involving concepts in mechanics, thermodynamics, electromagnetism, and mechanical and optical waves.
4. Explain the difference between precision and accuracy.
5. Express, characterize, and communicate the effect of experimental error on measured values.
6. Manipulate data and apply quantitative techniques, such as graphing and statistical analysis.
7. Interpret the graphical representation of data.
8. Identify environmental factors that affect the integrity of experimental data or observations.
9. Evaluate the validity of experimental data.
10. Demonstrate proficiency in using computers for the collection, analysis, and graphical display of data.
11. Exhibit cooperative skills in the collection and analysis data.
12. Develop clear, cogent reporting of observations, analysis, and conclusions in a variety of formats ranging from informal discussion and oral presentations to formal laboratory papers and reports that adhere to accepted guidelines for formal presentation.

## General Education Information

- Approved College Associate Degree GE Applicability
  - AA/AS - Physical Sciences
  - AS - Physical Science Lab
- CSU GE Applicability (Recommended-requires CSU approval)
  - CSUGE - B3 Lab Activity
- Cal-GETC Applicability (Recommended - Requires External Approval)
- IGETC Applicability (Recommended-requires CSU/UC approval)
  - IGETC - 5C Laboratory Science

## Articulation Information

- CSU Transferable
- UC Transferable

## Methods of Evaluation

- Reports
  - Example: Student performance is evaluated through lab reports. For example: 1. Complete the lab report for the experiment titled Properties of Matter. 2. Complete the lab report experiment titled Size of an Atom. Formal laboratory reports are graded using a rubric on proper format, proper data analysis techniques, proper use of instrumentation, correct interpretation of results, identification and assessment of sources of experimental error, and the ability to evaluate the integrity of laboratory data.

## Repeatable

No

## Methods of Instruction

- Laboratory
- Distance Learning

Lab:

1. The faculty member introduces the laboratory experiment "Energy in a Peanut" using a multimedia presentation. Detailed guidelines for the experiment are provided by the instructor with some information

omitted to encourage critical thinking. The faculty member then oversees students perform laboratory experiments based on oral and written guidelines. An important part of the laboratory experience is the proper analysis of data which includes the proper application of significant figures and the identification of factors that affect experimental results. Students are then required to write a laboratory report. (Lab Objectives 1-12). The experiments are chosen to provide students with 1) "Hands-on" experience with difficult concepts. 2) "Hands-on" experience with scientific equipment. 3) Exposure to the scientific method of investigation. 4) Problem solving skills necessary to troubleshoot experiments or experimental apparatus. 5) Experience with the communication of technical information."

#### Distance Learning

1. (In Class or Distance Learning) To introduce the "Properties of Matter" lab a short discussion is initiated by a demonstration that illustrates an effect of atmospheric pressure. The key point being that the pressure of the atmosphere is due to the weight of the air. The discussion continues (in class or online) by asking the students to estimate the weight of the air in the room. The presentation and discussion can take place in class or online via recorded synchronous lecture. The first part of the experiment involving a measurement of the weight of a volume of air is presented with emphasis on the measurements to be made and the calculations to be completed. Students are reminded of the importance of (1) comparing their result with the expected value and (2) list the sources of experimental errors and to (3) estimate their relative size. Students then go into the lab and perform the measurements and calculations. Their results are then submitted in the form of a lab report. In the online format lab kits will be provided by the college or will be made available for purchase through the bookstore to allow student to carry out their experiments at home. Formal lab reports are submitted through the college's LMS.

- Laboratory Manual for Conceptual Physics
  - Author: Hewitt and Baird
  - Publisher: Pearson
  - Publication Date: 2014
  - Text Edition: 12th
  - Classic Textbook?:
  - OER Link:
  - OER:
- PHYS 10L Lab Manual
  - Author: Randall
  - Publisher: Sierra College
  - Publication Date: 2020
  - Text Edition:
  - Classic Textbook?:
  - OER Link:
  - OER:
- Inquiry into Physics
  - Author: Vern J. Ostđiek and Donald J. Bord
  - Publisher: Cengage
  - Publication Date: 2018
  - Text Edition: 8th
  - Classic Textbook?:
  - OER Link:
  - OER:

**Other materials and-or supplies required of students that contribute to the cost of the course.**

## Typical Out of Class Assignments

### Reading Assignments

1. Read the lab handout for "Lab 2: Measuring Motion" in preparation for lab discussion.
2. Review the chapters in the Physics 10 textbook regarding properties of matter in preparation for lab discussion.

### Writing, Problem Solving or Performance

1. Complete the lab report for Lab 4: Properties of Matter.
2. Complete the pre-lab on measurements and significant figures. The diameter (D) of a cylinder is measured to be 3.20 cm and its circumference (C) 10.22 cm. The calculated value of  $\pi$  using this data would be: (recall  $\pi = C/D$ ) a. 3 b. 3.2 c. 3.19 d. 3.194 e. 0.313

## Other (Term projects, research papers, portfolios, etc.)

### Required Materials

- Conceptual Physics
  - Author: Hewitt
  - Publisher: Pearson
  - Publication Date: 2015
  - Text Edition: 12th
  - Classic Textbook?:
  - OER Link:
  - OER: