South Plains College
Common Course Syllabus: PHYS 1410
Revised 12/11/2025

Department: Science

Discipline: Physics

Course Number: PHYS 1410

Course Title: Elementary Physics

Available Formats: conventional

Campuses: Levelland

Instructor:

David Hobbs
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Course Description: Conceptual level survey of topics in physics intended for liberal arts and other non-science majors.

The course seeks to provide a basic understanding of how science works and how science connects to and influences our lives. You will gain knowledge and understanding of basic physical principles that will benefit you in everyday living, your career, and in personal decision making as a scientifically literate and technologically informed member of society. All citizens should attain an appreciation for the impact of science on society. You will have the opportunity to appreciate what is currently known about the physical world as well as get a glimpse at current research at the frontiers of human knowledge.

Prerequisite: There are no prerequisites for this course, however you will be expected both on the homework and the exams to be able to perform simple mathematical calculations. Examples of the mathematical concepts we will use in this course are scientific notation, multiplying and dividing powers of 10, converting between different metric units, rearranging and solving simple equations. It will be assumed that you are proficient in math at the level of high school algebra.

Credit: 4 **Lecture:** 3 **Lab:** 3

Textbook: *Physics Concepts & Connections, 5th Edition* by Art Hobson (Pearson, 2009).

Supplies: Scientific Calculator

This course partially satisfies a Core Curriculum Requirement:

Life and Physical Sciences Foundational Component Area (030)

Core Curriculum Objectives addressed:

- **Communications skills**—to include effective written, oral and visual communication
- **Critical thinking skills**—to include creative thinking, innovation, inquiry, and analysis, evaluation and synthesis of information
- **Empirical and quantitative competency skills**—to manipulate and analyze numerical data or observable facts resulting in informed conclusions
- **Teamwork**—to include the ability to consider different points of view and to work effectively with others to support a shared purpose or goal

Student Learning Outcomes:

Learning Outcomes - Upon successful completion of this course, students will:

1. Describe what science is, how it operates, as well as what it is not. State what distinguishes science from other forms of knowledge based on belief, intuition, personal authority, or authoritative books. Distinguish between science and pseudoscience. Cite some current examples of pseudoscience.
2. Discuss aspects of the early history of astronomy that illustrate the scientific process.
3. Compare and contrast the Greek conception of atom with the planetary and quantum models of the atom. Explain how these changes to our understanding of the atom illustrate the process of science.
4. Illustrate the explanatory power of the atomic theory of matter by discussing such examples as odors, incompressibility of solids and liquids, gas pressure, variation in temperature, etc. Provide some analogies that illustrate the smallness of atoms.
5. Distinguish between displacement, velocity, and acceleration.
6. State and use the law of inertia (Newton's 1st law). State and use Newton's 2nd law to connect forces and acceleration in simple situations. Demonstrate an understanding of force pairs (Newton's 3rd law).
7. Discuss the Newtonian synthesis and Newton's theory of gravity. Discuss the influence of the Newtonian worldview and how it differs from a pre-Newtonian worldview. Discuss limitations of Newtonian physics and the Newtonian worldview.
8. Briefly discuss how evolving energy sources have influenced human society.
9. Identify types of energy in a system and describe energy transformations occurring in various processes. Solve simple problems involving conservation of energy. Describe entropy and the one-way nature of energy transformations.
10. Discuss electric charge and the role it plays in atomic structure. Describe electric field and discuss electrical interactions in terms of electric field. Describe magnetic field and discuss interactions of magnetic fields with moving charges. Relate changing magnetic fields to induced electric fields and changing electric fields to induced magnetic fields.
11. Describe electromagnetic waves in terms of electric and magnetic fields and electromagnetic induction. Discuss the spectrum of electromagnetic waves from radio waves to x-rays.
12. Describe and calculate basic properties of waves such as frequency, wavelength, and amplitude. Compare and contrast wave motion and particle motion. Discuss wave interference and the conditions for constructive and destructive interference.
13. Contrast Galilean relativity with the correct constancy of the speed of light in special relativity. Discuss time dilation and length contraction.
14. Work with relativistic energy and momentum.
15. State the equivalence principle and provide simple illustrations of it. Connect the bending of light beams in a gravitational field to the idea of curved spacetime. Describe the measurement of gravitational waves at LIGO.
16. Site four lines of evidence for the big bang. Discuss the ideas of dark matter and dark energy.
17. Calculate the energy of a quantum of radiation from its frequency.
18. Understand how the double slit experiment demonstrates both wave and particle-like behavior of the electromagnetic field. Discuss uncertainty and nonlocality involved in the quantum behavior of the electromagnetic field in the double slit experiment.
19. Calculate the de Broglie wavelength of a matter field. Compare the double slit experiment with matter fields to the experiment with electromagnetic fields. Discuss both the wave and particle-like properties of matter fields.

20. State and reason with Heisenberg's uncertainty principle. Explain what is meant by "collapse of the wave packet".
21. Discuss the general idea of quantum entanglement and nonlocal correlations arising from it. Discuss how quantum physics is at odds with the fundamental principles of the Newtonian worldview.
22. Describe the quantum field of the electron in a hydrogen atom and relate it to the emission spectrum of hydrogen. State the Pauli Exclusion Principle and specify its implications for atomic structure.
23. Describe the basic structure of a nucleus and explain the meaning of different isotopes.
24. Explain how basic observations of the nucleus suggest properties of the strong force.
25. Recall the three basic types of radioactivity and describe some properties of each. Use radioactive half-life in simple calculations. Describe the basic principles of radioactive dating.
26. Describe what is meant by nuclear fusion and how energy is released in fusion processes. Describe what is meant by nuclear fission and how energy is released in fission processes.
27. Describe how the elements heavier than helium are created by stars. Illustrate the processes with specific nuclear reaction equations.
28. Discuss how particles arise from quantum fields.
29. Describe qualitatively the Standard Model, consisting of the electroweak force field (itself a combination of the electromagnetic and weak forces), the strong force field, and matter fields.
30. Identify some candidate hypotheses for a quantum theory of gravity.

Student Learning Outcomes Assessment: Selected questions on tests will assess how well students have met targeted student learning outcomes.

Course Evaluation: Student grades will be based on daily work, homework, five tests, and a final exam. Final grades will be assigned based on the points shown below:

Task	Points
Daily Work	20
HW	120
Tests	60
Final	30

The letter grades will be based on a fixed scale as follows:

A: 200 – 230 points B: 175 – 199 points C: 150 – 174 points D: 125 – 149 points F: < 125 points

Late Work: Late work will not be accepted.

Extra Credit: This course will not include any extra credit opportunities.

Attendance Policy: Attendance and effort are vital to success in this course. Class attendance keeps you well connected to the course and gives you opportunities to ask questions and clear up confusions. Therefore, students are expected to be in attendance for every class session. Students with excessive absences (more than 5) will be administratively dropped from the class. It is the student's responsibility to know how many absences they have accumulated.

Dropping a Course: Students may drop courses through Texan Connect, the Admissions and Records Office, or Advising and Testing Center through the late registration period.

After late registration has closed, a student must complete the online Student Initiated Drop Request to drop a course.

Students may also drop courses in person at any campus location by completing a Student Initiated Drop Form. Complete a Student Initiated Drop Form and return the signed form to the Levelland Admissions and Records Office, the Student Support Center at the Lubbock Downtown Center, the Lubbock Career and Technical Center, or Plainview Center. You must have a picture ID to complete the drop.

A mark of "W" will be given for student-initiated drops that occur prior to and through the last day to drop as indicated in the online Academic Calendar found here: https://www.southplainscollege.edu/academiccalendar/index.php.

Daily Work: Daily work consists of in-class group work/discussions and lab work. These activities are meant to be formative exercises and are graded primarily on participation. Their purpose is to help develop understanding of the concepts and principles and to prepare you for the tests. Students will earn one point for work performed during each class attended up to a maximum of 20 points. The student must be present for the entire class session to earn the point.

Homework: Do your homework! There is no substitute. Students who don't put in a good effort often struggle in the course. Homework questions will be assigned and graded online through Blackboard. You may also wish to use the "concept checks" within the chapter and the end-of-chapter exercises and problems as additional practice. Answers to the "concept checks" and the odd-numbered exercises and problems are at the end of the textbook. I anticipate you will work approximately 150 – 160 problems over the course of the semester worth one point each, up to a maximum of 120 points.

Tests: Five tests will be given during the semester. Each test will consist of 15 multiple choice questions (worth one point each) to be answered in a 45-minute time period. The lowest test will be dropped, so the maximum points available from tests is 60 points. The tests will be administered during the lab portion of the Wednesday class meeting during the weeks indicated on the course calendar. Tests will be closed book/closed notes – no note sheet or card allowed. You will need a scantron answer sheet for each test.

Make-up tests will be given only in extreme circumstances. The first missed test will be the test dropped. A second missed test can be made up only if *both* missed tests were due to serious unavoidable medical issues that were *both* properly documented – see below.

Missing a test should only be for serious unavoidable medical issues and should not be for trivial reasons. You should notify the instructor **before** the missed test, if at all possible. In any case, you must notify the instructor of the reason for missing the test within 24 hours of the test date.

Failure to make this notification means making up the test will not be allowed under any circumstances. Proper documentation must be provided before a make-up test is scheduled.

Final Exam: The final exam consists of 30 multiple choice questions (worth one point each) to be answered in a 90-minute time period. The final exam will be administered during the final exam time slot for the lecture portion of the class – see the final exam schedule posted on the SPC web pages. The final will be closed book/closed notes – no note sheet or card allowed. You will need a scantron answer sheet for the final.

Student Code of Conduct Policy: Any successful learning experience requires mutual respect on the part of the student and the instructor. Neither instructor nor student should be subject to others' behavior that is rude, disruptive, intimidating, aggressive, or demeaning**.** Student conduct that disrupts the learning process or is deemed disrespectful or threatening shall not be tolerated and may lead to disciplinary action and/or removal from class.

Syllabus Statements: For information about Artificial Intelligence, Disabilities, Non-Discrimination, Intellectual Exchange, Title IX Pregnancy Accommodations, CARE (Campus Assessment, Response, and Evaluation) Team, Campus Concealed Carry, and COVID-19, please use this link: https://www.southplainscollege.edu/syllabusstatements/.

Note: The instructor reserves the right to modify the course syllabus and policies, as well as notify students of any changes, at any point during the semester.

Calendar

Phys 1410 Spring 2026

Week	Readings	Topics
1 01/11 – 01/17	1.1-2	An invitation to science
2 01/18 – 01/24	1.3-8	Early astronomy – a case study in how science works; Pseudoscience – what science is not
3 01/25 – 01/31	2.1-8	Explanatory power of the atomic theory of matter; Example of science at work – the evolving model of the atom
4 02/01 – 02/07	3.1-5	Aristotelian views on motion; Galileo's insights – the law of inertia; Distinguishing between velocity and acceleration; **TEST 1 (Ch1-2)**
5 02/08 – 02/14	4.1-5	Newton's laws of motion
6 02/15 – 02/21	5.1-6	Newton's theory of gravitation; The Newtonian synthesis; Newtonian worldview
7 02/22 – 02/28	6.1-6 7.1-4	Energy – ability to do work; Energy transformations and conservation; Using thermal energy to do work; Entropy – the one-way nature of energy transformations; **TEST 2 (Ch3-5)**
8 03/01 – 03/07	8.1-2,5-6	Electric force and the structure of the atom; Electromagnetic fields
9 03/08 – 03/14	9.1-7	Waves versus particles – is light a wave or a particle? The electromagnetic spectrum
03/15 – 03/21		SPRING BREAK
10 03/22 – 03/28	10.1-8	Einstein's Special Relativity; **TEST 3 (Ch6-9)**
11 03/29 – 04/04	11.1-7	Einstein's Gravity: General Relativity; Cosmology
12 04/05 – 04/11	12.1-6	Quantum physics; Energy in electromagnetic fields is quantized, it comes in particular size packets or bundles; Matter also consists of quantized fields
13 04/12 – 04/18	13.1-7	Quantum uncertainty and nonlocality; Quantum entanglement; **TEST 4 (Ch10-12)**
14 04/19 – 04/25	14.1-5 15.1-5	Interactions within the nucleus; Radioactive decay; Fusion and fission
15 04/26 – 05/02	17.1-6	Quantum field theory – the universe is made of quantized fields; **TEST 5 (Ch13-15)**
16 05/03 – 05/09		**Final Exam**

This schedule may be subject to change. Any necessary changes will be announced in class and through Blackboard.