

CONCEPTS OF PHYSICS

Phys 100 Fall 2023

Instructor:	Professor David Collins
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Office Hours:	M 10:00 – 11:00am, MWF 1:00 – 2:00pm, R 11:00 – 12:00noon
Class Meetings:	MWF 11:00am – 11:50am, Houston 138
Course Website:	http://www.coloradomesa.edu/~dacollin/teaching/2023Fall/Phys100/index.html
Required Text:	Art Hobson, <i>Physics: Concepts and Connections</i> , 5th ed, Pearson Prentice Hall (2010).
Prerequisites:	Curiosity about the natural world!

Overview

Physics investigates the natural world and endeavors to provide an organized systematic description of the observed phenomena. Surprisingly, a vast range of natural phenomena can be described by applying a small collection of fundamental principles. For example, the same basic rules govern the motion of the moon around the earth or objects falling toward the surface of the earth.

This course will introduce you to some of the most profound concepts of physics. Some of the implications these, such as the fact that heat only flows freely from hot to cold objects, may seem obvious to you. Others, such as the apparent ability of a microscopic object to explore two divergent trajectories through space simultaneously, may confound your sensibilities. This course will also introduce you to the workings and tools of any scientific discipline: measurements, interpretation of data, hypotheses and theories.

The course covers the following topics:

1. Understanding the physical world via scientific inquiry: examples from planetary motion and the atomic world.
2. Classical physics: “clockwork” description of the physical world.
3. Energy: the general rules for the physical world.
4. Electric and magnetic forces: the forces responsible for much of how ordinary matter behaves.
5. Waves and light: models of light.
6. Quantum theory: the modern description of the physical world.

Prerequisites

This course does not assume any prior knowledge of physics. From time to time it will be necessary to use minimal mathematics to state and elaborate on physical concepts. It will be assumed that you are able to add, subtract, multiply and divide numbers and understand the concepts of raising a number to a power and taking a square root.

Assignments

An undergraduate student should expect to spend on this course a minimum of two hours outside the classroom for every hour in the classroom. The outside hours may vary depending on the number of credit hours or type of course. More details are available from the faculty member or department office and in CMU's Curriculum Policies and Procedures Manual.

1. **Homework:** There will be a homework assignment due approximately every week. This will be due by 5pm on the date indicated on the assignment. Homework turned in after the deadline will be subject to a penalty of at least a 5% reduction in maximum grade for each half hour increment (rounded up) that the work is late. It is in your best interests to work by yourself on the homework problems but collaboration is acceptable. You can discuss the broad outlines of problem solutions with your colleagues but must write your final solutions independently. You are also encouraged to consult me for help with homework problems.
2. **Group Exercises:** There will be structured group exercises during certain classes. Each group's response will be graded and all members of the group will receive the same grade. You must attend the class meetings in order to receive credit for these. Graded for *completeness and correctness*. Attendance is required to receive credit.

Exams and Quizzes

1. **Class Tests:** There will be two tests during class on the following days:

Test 1: September 29, 2023

Test 2: October 30, 2023

Test 3: December 4, 2023

Exams will be closed book and closed notes although you will be able to bring a formula sheet. Calculators will be allowed.

2. **Final Exam:** There will be a final exam at **10:00am on Wednesday December 13, 2023**. The final will last one hour and 50 minutes and be comprehensive and closed book. Calculators will be allowed but electronic devices that can communicate with other devices are not allowed.

Grades

Individual assignments and exams will be graded using suitable scales. In general, to get full credit (100%) for a problem your solution must be correct and well justified using physical principles. Partial credit will be given for incomplete or partly correct solutions. No credit (0%) will be given for problems not attempted, assignments not turned in or quizzes and exams missed without good reason.

The numerical grades for each component will be totaled and a final numerical grade will be computed according to the following distribution.

Homework	25%
Group Exercises	10%
Tests	30%
Final Exam	35%

The following final numerical scores will guarantee letter grades:

90%	A
80%	B
65%	C
50%	D

Policies

1. The Tutorial Learning Center (TLC) is a *free* academic service for all CMU students. Tutors are available in Houston Hall 108 on a walk-in basis for many courses. More information is available at www.coloradomesa.edu/tutoring or 248-1392.

In coordination with Educational Access Services, reasonable accommodations will be provided for qualified students with disabilities. Students must register with the EAS office to receive assistance. Please meet with the instructor the first week of class for information and/or contact Educational Access Services at eas@coloradomesa.edu or call (970) 248-1856, or in person in Houston Hall, Suite 108.

Helpful advice on student success can be found at:

http://www.coloradomesa.edu/academics/documents/StudentSuccessatCMU_WCCC.pdf

2. **Withdrawals:** There are several ways to drop this course. The deadline for dropping without penalty is **September 9, 2023**. Please consult the CMU academic calendar and catalog for more details about adding and dropping courses.

3. **Attendance:** Attendance policies are described in the CMU catalog. You are expected to attend all the class meetings and attendance will be recorded. In case of illness or other emergencies you must be able to produce the appropriate documentation. There are other circumstances under which you can be excused but you must discuss these with me in advance. If you miss a class or lab for a valid reason, turn in any assignments due before the start of the next class. Assignments turned in beyond your return to class will not be accepted.

The dates of the class exams and final exam are set at the beginning of the semester and it will be assumed that these have priority over any other events (consult me about conflicts known at the start of the semester). If you miss an exam for illness, an emergency or any other reason, you must provide documentation that justifies your absence. If the reason for your absence is satisfactory to the the instructor, he will make an accommodation for the exam that you missed; times for any make-up exams will be decided by the instructor.

4. **Academic integrity:** You are expected to present your own work in assignments, exams and quizzes. Fabrication of data, plagiarism, and copying from anyone else, particularly in closed book exams, are serious violation of academic norms. CMU has extensive policies on these matters and penalties for infringement can be severe. For more details, consult the academic integrity policies in the CMU catalog.

You are prohibited from using sources which provide solutions to homework assignment or exam problems. Websites which allow students to solicit solutions for homework problems will be monitored regularly for solutions to problems that have been written and produced by the course instructor or any other CMU faculty. Students who are discovered to have submitted any assignment or exam problem to any such service or have used any such service to obtain or view solutions to any assignment or exam problem will receive zero credit for that entire assignment and the instructor will submit a Report of Academic Dishonesty with the Office of Academic Affairs. Additional penalties may be levied in such cases.

Student Learning Outcomes (Course)

A student who has taken this course will demonstrate the ability to:

1. Use basic physical concepts and laws to analyze and predict outcomes of physical scenarios.
2. Translate between verbal and mathematical descriptions of physical situations and apply elementary mathematical reasoning to analyze these situations.
3. Analyze physical processes graphically.
4. Distinguish between and relate various linear kinematic and dynamic quantities.
5. Apply Newton's First, Second and Third Laws to analyze the dynamics of physical situations.
6. Apply the concepts of energy and its conservation to analyze physical situations.

Student Learning Outcomes (Essential Learning)

This course is a critical component of CMU's Essential Learning Curriculum and a CMU Degree. In addition to knowledge in the course content area, this class will provide specific learning opportunities in the following areas:

1. Demonstrate investigative and analytical thinking skills to solve problems.
2. Select and use appropriate information in an academic project.
3. Demonstrate quantitative literacy.

Guaranteed Transfer

The Colorado Commission on Higher Education has approved PHYS 100 for inclusion in the Guaranteed Transfer (GT) Pathways program in the GTSC2 category. For transferring students, successful completion with a minimum C- grade guarantees transfer and application of credit in this GT Pathways category. For more information on the GT Pathways program, go to <http://higherred.colorado.gov/Academics/Transfers/gtPathways/curriculum.html>.

Content Criteria

This course should provide students with the opportunity to/Students should be able to:

- a) Develop foundational knowledge in specific field(s) of science.
- b) Develop an understanding of the nature and process of science.
- c) Demonstrate the ability to use scientific methodologies.
- d) Examine quantitative approaches to study natural phenomena.

GT Pathways Student Learning Outcomes

Inquiry and Analysis Competency

Students should be able to:

1. Select or Develop a Design Process
 - a) Select or develop elements of the methodology or theoretical framework to solve problems in a given discipline.
2. Analyze or Interpret Evidence
 - a) Examine evidence to identify patterns, differences, similarities, limitations, and/or implications related to the focus.
 - b) Utilize multiple representations to interpret the data.
3. Draw Conclusions
 - a) State a conclusion based on findings.

Quantitative Literacy Competency

Students should be able to:

1. Interpret Information
 - a) Explain information presented in mathematical forms (e.g., equations, graphs, diagrams, tables, words).
2. Represent information
 - a) Convert information into and between various mathematical forms (e.g., equations, graphs, diagrams, tables, words).

Schedule

The following schedule is tentative, except for the dates of the class exams.

Week	Dates	Topic
1	8/21 – 8/25	Scientific inquiry, solar system (Ch 1).
2	8/28 – 9/1	Solar system (Ch 1).
3	9/4 – 9/8	Atoms and molecules, measurements and units (Ch 2.2, 2.4).
4	9/11 – 9/15	Describing motion, force and acceleration, Newton's laws (Ch 4).
5	9/18 – 9/22	Newton's laws, gravitation (Ch 4, 5).
6	9/25 – 9/29	Gravitation, review, Test I .
7	10/2 – 10/6	Energy (Ch 6).
8	10/9 – 10/11	Energy, efficiency (Ch 6, 7.2).
8	10/13	Fall break (no classes).
9	10/16 – 10/20	Electric forces (Ch 8).
10	10/23 – 10/28	Electric forces, review, (Ch 8).
11	10/30 – 11/3	Test II , waves, light (Ch 9).
12	11/6 – 11/10	Light, quantum light (Ch 9, Ch 12.1 – 12.3).
13	11/13 – 11/17	Quantum phenomena (Ch 13).
14	11/20 – 11/24	Thanksgiving (no classes).
15	11/27 – 12/1	Quantum phenomena, review (Ch 13).
16	12/4 – 12/8	Test III , final review.