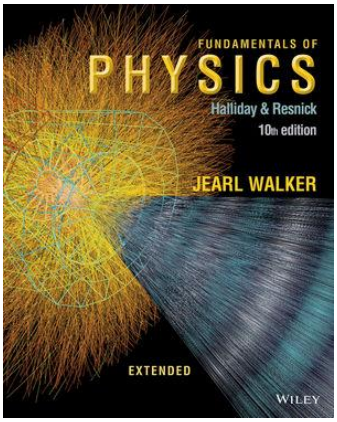
PHYS 140-1 Mechanics, Heat and Sound Spring, 2020
Instructor: Dr. Cattell Office: W4-33



PHYS 140 is the first course of the standard calculus-based Physics sequence required for Engineering and the physical sciences. Calculus I is a prerequisite for this course.

Text: *Fundamentals of Physics* (tenth edition) by Halliday, Resnick and Walker. Published by John Wiley & Sons, Inc. *Notes:* You should have the tenth edition in order to do the homework problems. The Extended Edition is recommended but not required.

Outline

Chapter 1 Measurement
Sections 1-1 to 1-3

Chapter 2 Motion Along a Straight Line
Sections 2-1 to 2-6

Chapter 3 Vectors
Sections 3-1 to 3-3

Chapter 4 Motion in Two and Three Dimensions
Sections 4-1 to 4-7

Chapter 5 Force and Motion—I
Sections 5-1 to 5-3

Chapter 6 Force and Motion—II
Sections 6-1 to 6-3

Chapter 7 Kinetic Energy and Work
Sections 7-1 to 7-6

Chapter 8 Potential Energy and Conservation of Energy
Sections 8-1 to 8-5

Chapter 9 Center of Mass and Linear Momentum
Sections 9-1 to 9-9

Chapter 10 Rotation
Sections 10-1 to 10-8

Chapter 11 Rolling, Torque and Angular Momentum
Sections 11-4 to 11-9

Chapter 12 Equilibrium and Elasticity
Sections 12-1 to 12-3

Chapter 13 Gravitation
Sections 13-1 to 13-8

Chapter 14 Fluids
Sections 14-1 to 14-7

Chapter 15 Oscillations
Sections 15-1 to 15-6

Chapter 16 Waves - I
Sections 16-1 to 16-7

Chapter 17 Waves – II
Sections 17-1 to 17-8

Chapter 18 Temperature, Heat and the First Law of Thermodynamics
Sections 18-1 to 18-6

Chapter 19 The Kinetic Theory of Gases*
Sections 19-1, 19-2, 19-4, 19-7, 19-8, 19-9

Chapter 20 Entropy and the Second Law of Thermodynamics*
Sections 20-1 to 20-4

*As time permits.

Resources

1. Library References
   a. *Physics* by Cutnell and Johnson; Wiley
   b. *University Physics* by Sears, Zemansky and Young; Addison-Wesley

2. Computer Resources in WileyPLUS
   a. The complete text of *Fundamentals of Physics* from Wiley.
   b. Tutorial solutions of some of the exercises in *Fundamentals of Physics.*
   c. *Student Solutions Manual*. Solutions are available to homework problems after the due date.

Rev. 4/29/20

PHYS 140-1 Mechanics, Heat and Sound Spring, 2020
Instructor: Dr. Cattell Office: W4-33

Tests

Tests given in this course:

1. Five hour tests during the semester. The first hour test is on Friday, January 31, 2020.
   (See the homework assignments for the dates of the remaining tests.)

2. A comprehensive final exam at the end of the semester.

Determination of Grade

Homework 10%

Lab Reports 20%

Tests 45%

Final 25%

If you take all the hour tests, your lowest hour test grade will be dropped. At the end of the course you will have a course average calculated from the averages of your homework, lab reports and hour test grades and your grade on the final (with the weights shown above). Your course average will be a number between 0 and 100. If your laboratory average is at least 60% the following scale determines the letter grade you receive for the course:

90-100 A

80-89 B

70-79 C

60-69 D

Below 60 F

If your laboratory average is less than 60% you will receive an F regardless of your overall course average.

Homework

The only way to learn a subject is to practice it yourself. It is therefore important that you do the homework and turn it in. Your test scores will reflect how well you learned the material assigned for homework. (Note that homework and tests together account for 55% of your final grade.)

Laboratory Sessions

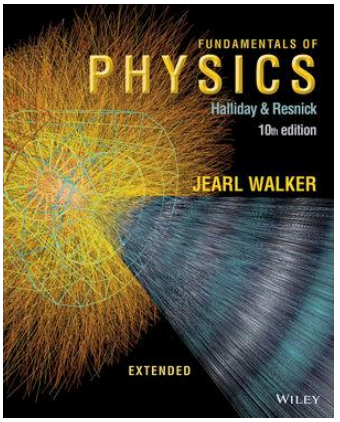
You should be scheduled for a two-hour laboratory session, which meets once a week. You are required to have Volume I of the Physics Laboratory Instructions, which is available in the Community College of Philadelphia Bookstore.

Attendance

Class attendance will be taken. It is important that you do not miss class unnecessarily. If you miss two consecutive weeks of class the instructor may initiate an official "drop" form for you and send it to the Registrar who will inform you and change the permanent record accordingly.

Final date to drop courses without penalty of an F grade:
Monday, April 13, 2020.

PHYS 140-1 Homework **Spring, 2020**
Text: *Fundamentals of Physics* by Halliday, Resnick and Walker, tenth edition Dr. Cattell



Homework is to be done through Wiley PLUS. WileyPLUS for this course can be accessed at www.wileyplus.com/class/743577 or through your instructor's web page. You must first register for WileyPLUS using the instructions that came in the package with your textbook and lab manuals. See your instructor if you have questions or need help. The problem numbers given below are for your reference and practice before you submit your answers through WileyPLUS. (*Note:* The problems will be the same but numerical values may be different when you use WileyPLUS.)

Homework should be done through WileyPLUS by the date specified below. ***Homework is due by 11:00 PM on the indicated due date.*** You will not be able to work on the assignment after this time.

Chapter 1 Measurement
1, 5, 7, 10, 15, 20, 21, 23, 27, 30

Chapter 2 Motion Along a Straight Line
5, 9, 13, 17, 20, 22, 23, 27, 33, 39, 41, 45, 47, 51, 55, 60, 61, 63, 69

Chapter 3 Vectors
5, 9, 11, 15, 19, 32, 34, 41, 51

Homework for Chapters 1, 2 and 3 is due on Friday, January 31. Test 1 is on January 31.

Chapter 4 Motion in Two and Three Dimensions
3, 5, 7, 13, 17, 23, 29, 35, 39, 43, 58, 67, 69, 75, 79

Chapter 5 Force and Motion—I
2, 4, 13, 17, 31, 34, 39, 45, 51, 55, 57

Chapter 6 Force and Motion—II
7, 9, 11, 15, 19, 23, 29, 31, 33, 41, 47, 51, 57

Homework for Chapters 4, 5 and 6 is due on Friday, February 14. Test 2 is on February 14.

Chapter 7 Kinetic Energy and Work
1, 5, 7, 11, 15, 17, 19, 25, 26, 31, 34, 43

Chapter 8 Potential Energy and Conservation of Energy
2, 3, 11, 13, 23, 26, 27, 37, 39, 40, 45, 55, 57

Chapter 9 Center of Mass and Linear Momentum
1, 5, 6, 7, 13, 17, 19, 21, 27, 29, 37, 39, 47, 51, 61, 75

Homework for Chapters 7, 8 and 9 is due on Friday, March 13. Test 3 is on March 13.

PHYS 140-1 Homework **Spring, 2020**
Text: *Fundamentals of Physics* by Halliday, Resnick and Walker, tenth edition Dr. Cattell

Chapter 10 Rotation
5, 9, 13, 21, 23, 28, 33, 41, 45, 47, 51, 53, 59, 60

Chapter 11 Rolling, Torque, and Angular Momentum
19, 29, 31, 33, 39, 43, 45, 66, 67

Chapter 12 Equilibrium and Elasticity
1, 5, 11, 15, 17, 21, 23, 25, 29, 31, 37, 47

Homework for Chapters 10, 11 and 12 is due on Wednesday, April 15. Test 4 is on April 15.

Chapter 13 Gravitation
1, 7, 13, 17, 21, 25, 26, 33, 37, 41, 43, 52, 61, 69

Chapter 14 Fluids
Questions 2, 3, 5, 6, 7; Problems 1, 5, 17, 21, 26, 28, 31, 33, 35, 39, 51, 59, 67

Chapter 15 Oscillations
5, 9, 14, 26, 31, 33, 37, 39, 47, 49

Homework for Chapters 13, 14 and 15 is due on Friday, May 1. Test 5 is on May 1.

Chapter 16 Waves—I
5, 7, 11, 17, 19, 29, 31, 35, 43, 47

Chapter 17 Waves—II
4, 7, 11, 19, 25, 29, 40, 41, 52, 55, 56

Chapter 18 Temperature, Heat, and the First Law of Thermodynamics
2, 7, 8, 9, 19, 24, 27, 31, 37, 41, 43, 45

Homework for Chapters 16, 17 and 18 is due on Thursday, May 7
The Final Examination will be given during the week of Monday, May 4, 2020.

PHYS 140 Laboratory Schedule

Spring, 2020

M	R	Experiment
1/13/20	1/16/20	Significant Figures
1/20/20		MLK Holiday – College Closed
1/27/20	1/23/20	M-1 Measurement of Length and Mass
2/3/20	1/30/20	M-6 Introduction to Rectilinear Motion and Motion Detector
2/10/20	2/6/20	M-2 Force Vectors
2/17/20	2/13/20	M-5 Gravity: Free Fall
2/24/20	2/20/20	M-7 Newton's Laws of Motion
3/2/20	3/6/20	Spring Break – College closed
3/9/20	2/27/20	M-8 Simple Machines and Work
3/30/20	3/12/20	M-9B Conservation of Energy and Momentum
4/6/20	4/2/20	M-4N Moments in Static Systems
4/13/20	4/9/20	H-2B Boyle's Law (with Computer Analysis)
4/20/20	4/16/20	VWS-1 Simple Harmonic Motion and VWS-2 The Simple Pendulum
4/27/20	4/23/20	VWS-4 Velocity of Sound in Air
5/4/20	4/30/20	H-1 Specific Heat (as demonstration)

All the above laboratory sessions meet in room W4-23.

Make-up labs may be scheduled during the semester. To schedule a make-up lab, see Mr. Walton or a laboratory assistant in W4-23B. You are permitted no more than two make-up labs.

Experiment M-9B, Conservation of Energy and Momentum, cannot be made up.

Calculus Formulas and Techniques you should know for PHYS 140

You should be able to find all the following in your Calculus text.

Derivatives

You should know the power rule, product rule, and quotient rule.

You should know the derivatives of all six trigonometric functions.

You should know the derivatives of $\arcsin(x)$, $\arccos(x)$ and $\arctan(x)$.

You should know the chain rule and how to do implicit differentiation.

You should know how to calculate differentials.

Integrals

You should also know the following techniques of integration:

Power rule for integration.

Integration by substitution.

Student Learning Outcomes for Physics 140

1. Demonstrate an understanding of the scientific method as it applies to the determination of the physical laws of the universe.

2. Identify a scientific problem and state it in a way that makes it amenable to the scientific method.

3. Use appropriate mathematical methods in the solution of basic to moderately advanced word problems in mechanics, heat and sound.

4. Use laboratory equipment to test basic physical theories.

5. Demonstrate the ability to acquire and organize experimental data.

6. Communicate technical information using written and graphical presentations.

Policy for Missed Tests and Repeated Work

The following policy applies to hour tests given during the semester.

All Tests Taken

If you take all the tests, your lowest test grade is discarded when determining your average at the end of the semester.

One Test Missed

If you miss one test, you are not allowed to make it up. (This policy is followed *regardless of the reasons* you missed the test.) Instead, the grade of the missed test is counted as the lowest grade and discarded as stated above. All remaining test grades are counted in the average.

More Tests Missed

If you miss more than one test, the first test you missed is handled as stated above under "One Test Missed" and the rest that you missed are counted as zeros and are not dropped. (Again, this policy is followed *regardless of the reasons* you missed the tests.)

Remarks

You should always be aware of the test schedule. You will always be told in advance when you are going to have a test.

If you had a grade of at least 70 in the last test you took[1] in the course and you know in advance that you will not be able to take the next test at its scheduled time (due to work, a doctor's appointment, etc.) let the instructor know *before* the time of the next test. The instructor may let you take the test at an alternate time. If you do not take the test at the alternate time, the instructor will either drop the test or count the test as a zero according to the policy given above. *You may make up only one test. The test must be made up by the due date of the following homework assignment. If the College is closed on this deadline the make up test must be taken on the first following weekday the College is open.*

Repeated Work

Tests once taken cannot be repeated, including the Final. Work resubmitted after the due date will not be accepted; only work submitted by the due date will count as part of your grade.

[1]If you are requesting an alternate time for the *first* test you have to take the second test at its regularly scheduled time and obtain a grade of at least 70.

COMMUNITY COLLEGE OF PHILADELPHIA
DEPARTMENT OF PHYSICS
POLICY CONCERNING
ACADEMIC DISHONESTY

American higher education and science have an old and strong tradition of honesty. There is no room in academia or science for cheating or any other type of academic dishonesty. Many of the nation's universities and colleges rely on an honor system concerning examinations; to be found cheating during an examination is the basis for immediate expulsion.

Cheating may be defined as (a) looking at another student's examination paper, (b) asking another student for any type of help during an examination, (c) bringing notes of any type not allowed by the instructor to an examination, (d) presenting work done by another as your own (plagiarism), (e) falsification of information including laboratory data, (f) lying, (g) making notes during an examination on scrap paper to give to another student, (h) stealing an examination, (i) asking another person for help on take-home examinations, (j) writing notes on desk tops, (k) passing calculators that contain information to another student, (1) changing answers on an examination after it has been turned in, and (m) having another student take an examination for you. Any of these violations constitutes a highly serious offense which will ultimately result in some type of disciplinary action.

Persons properly trained in science, perhaps more so than the general public, find scientific and academic cheating highly offensive. How can one trust the laboratory data or scientific findings of a person known to cheat? Will this person make an honest scientist or engineer? Does this person or his personal work have any integrity? One single instance of cheating can cast doubt on everything that person does, and it can follow one for a lifetime.

Students caught cheating will find that it may result in (a) a grade of zero on the test or assignment, (b) removal from the course, (c) your name being reported to the Office of Academic Affairs, with the recommendation that you be expelled from the college. If you are not expelled, all your present and subsequent professors will be notified of your academic dishonesty. Last, you will never receive any letter of recommendation from any Community College of Philadelphia Physics Department faculty member.

Now think it over, is cheating worth the risk of having the above happen to you? If you think these things won't happen, you are sadly mistaken. You will find out the hard way. The great majority of students are honest, and cheating is not usually a problem. We apologize to those of you who work honestly that we have found it necessary to write this statement because of a few who are dishonest.

The above is based on the Community College of Philadelphia Department of Chemistry Policy Concerning Academic Dishonesty dated September 1994.

Are You Overloaded?

A common problem among college students is overloading – trying to handle more work than is possible. If you work at a job or have other time-consuming responsibilities while attending college it is important that you do not take on excess course work. The following describes a simple formula you can use to determine if you are overloaded.

Study Time – You must allow yourself ample study time for the courses that you take. This includes time for homework assignments. As a rule of thumb multiply the number of credit hours that you take by 2. This gives the *minimum* number of hours per week you should spend studying.

Time in Class – You must allow for the time you spend at the College attending courses. This is the number of hours you are present in class (and in lab) per week.

Hours Working – You must allow for the time you spend at work and the time you spend for other *regularly-scheduled* responsibilities that do not allow you to do college work. Add together the number of hours you spend on all these activities per week.

Add together your Study Time, Time in Class and Hours Working. This total **should not exceed 60 hours per week**. If the total exceed 60 hours per week, your course work will suffer and your grades will meet neither your expectations nor your ability.

Example 1 A student works part-time 15 hours per week and is taking 12 credits. The time she spends in class and lab amounts to 15 hours per week.

Study Time:	$2 \times 12 = 24$ hours/week
Time in Class:	15
Subtotal:	39 hours/week
Hours Working:	15
Total:	54 hours/week

This student is not overloaded.

Example 2 A student works part-time 25 hours per week. He also spends one hour every weeknight helping an elderly relative with housework. He is taking 10 credits and spends 12 hours per week in class and lab.

Study Time:	$2 \times 10 = 20$ hours/week
Time in Class:	12
Subtotal:	32 hours/week
Hours Working:	30
Total:	62 hours/week

This student is overloaded and needs to either: 1) reduce his hours working or 2) reduce the number of credits he is taking, whichever is appropriate for his situation.

Dr. David F. Cattell, Spring 2020

Office: W4-33

Office Hours: 12:30 PM to 1:30 PM Mondays, Wednesdays and Fridays
12:00 PM to 1:30 PM Tuesdays and Thursdays.

Office Telephone: (215) 751-8417
Fax: (215) 496-6059

Internet email: dcattell@ccp.edu

Dr. Cattell's Web page: http://faculty.ccp.edu/faculty/dcattell/

Students who are registered with the Center on Disability must inform the instructor by the end of the first week of classes if special accommodations are requested.

To Students Receiving Title IV Financial Aid Funds

Effective Fall 2000, students who receive Title IV financial aid funds and who withdraw from ALL their classes before completion of 60% of the term, i.e., the 10th week (or its equivalent for summer terms) may be required to return all or a portion of their financial aid award. If it is determined that funds must be returned to the financial aid programs, students must make satisfactory payment arrangements within 45 days of notification or they become ineligible for further financial aid funding.

College Catalog

The College catalog is available online. It contains, among other things, the current College calendar, information on tuition and fees, information on academic programs, admissions information, financial aid information, College notices, student policies, information on educational programs and course descriptions.

For the current College catalog see

http://www.ccp.edu/site/academic/college_catalog.php

Telephone Numbers

Main Switchboard: 751-8000
Academic Advising: 751-8893
Student Activities: 751-8210
Bookstore: 751-8150
Security: 751-8111

Declaration of Receipt of the Physics 140-1 Course Syllabus
Spring, 2020

I, the undersigned student, attest that I received the following documents from the course instructor, Dr. David F. Cattell, for section 001 of the Physics 140 course, Mechanics, Heat and Sound, at Community College of Philadelphia for the Spring 2020 semester:

- Course outline titled "Mechanics, Heat and Sound" which includes an explanation of the grading procedure for the course.
- A copy of the homework assignments which indicates when assignments are due, how they are to be submitted and the dates of hour tests.
- A copy of the laboratory schedule which shows the titles, days and dates of scheduled labs.
- A document titled "Calculus Formulas and Techniques you should know for PHYS 140" which gives calculus topics the student should be familiar with for the course.
- A document titled "Student Learning Outcomes for Physics 140" which summarizes learning objectives for the course.
- A document titled "Policy for Missed Tests and Repeated Work" which includes a description of the procedure that will be followed if a student misses a test or resubmits work after the due date.
- A document titled "Community College of Philadelphia Department of Physics Policy Concerning Academic Dishonesty" which includes a definition of cheating and a description of the procedure that will be followed if a student is caught cheating.
- A document titled "Are You Overloaded?" which cautions against overloading and provides a formula for a student to determine if he or she is overloaded.
- A document titled "Dr. David F. Cattell, Spring 2020" which gives the course instructor's Website URL, email address, fax number, office telephone number, office location and office hours for this semester.

I also attest that I understand the contents of these documents and agree to abide by any policies they describe.

Name (printed) _____ Signature _____

ID Number _____ Email _____ Date _____

Declaration of Receipt of the Physics 140-1 Course Syllabus
Spring, 2020

I, the undersigned student, attest that I received the following documents from the course instructor, Dr. David F. Cattell, for section 001 of the Physics 140 course, Mechanics, Heat and Sound, at Community College of Philadelphia for the Spring 2020 semester:

- Course outline titled "Mechanics, Heat and Sound" which includes an explanation of the grading procedure for the course.
- A copy of the homework assignments which indicates when assignments are due, how they are to be submitted and the dates of hour tests.
- A copy of the laboratory schedule which shows the titles, days and dates of scheduled labs.
- A document titled "Calculus Formulas and Techniques you should know for PHYS 140" which gives calculus topics the student should be familiar with for the course.
- A document titled "Student Learning Outcomes for Physics 140" which summarizes learning objectives for the course.
- A document titled "Policy for Missed Tests and Repeated Work" which includes a description of the procedure that will be followed if a student misses a test or resubmits work after the due date.
- A document titled "Community College of Philadelphia Department of Physics Policy Concerning Academic Dishonesty" which includes a definition of cheating and a description of the procedure that will be followed if a student is caught cheating.
- A document titled "Are You Overloaded?" which cautions against overloading and provides a formula for a student to determine if he or she is overloaded.
- A document titled "Dr. David F. Cattell, Spring 2020" which gives the course instructor's Website URL, email address, fax number, office telephone number, office location and office hours for this semester.

I also attest that I understand the contents of these documents and agree to abide by any policies they describe.

Name (printed) _____ Signature _____

ID Number _____ Email _____ Date _____