

**WEST CHESTER UNIVERSITY OF PENNSYLVANIA**

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***ELEMENTS OF PHYSICAL SCIENCE—PHY 100-09—FALL, 2017***  
***MWF 11:00-11:50 am, Schmucker Science North Rm. 192 (SSN 192)***

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***Instructor: Dr. David E. Chyba***

***Office: Merion 103 / Tel. (610) 436-2827 / e-Mail: [dchyba@wcupa.edu](mailto:dchyba@wcupa.edu)***

***—My office is to the right of the elevators in the Merion Hall lobby—***  
***—I share the office with Dr. William Sawyer—***

<b><u>Office Hours</u></b> (starting 2 <sup>nd</sup> week):	<b>Monday: 3:30 pm–4:30 pm</b>
	<b>Tuesday: 1:00 pm–3:00 pm</b>
	<b>Wednesday: 1:00 pm–3:00 pm</b>
	<b>Friday: 1:00 pm–2:00 pm</b>

***—Any student who needs to meet outside the above office hours, please make an appointment—***  
***—Occasional cancellations of office hours are likely—***

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**Texts and Other Supplies—Two books are required:**

- (1) *Newton to Einstein: The Trail of Light* (An excursion to the wave-particle duality and the Special Theory of Relativity), by Ralph Baierlein (Cambridge and New York: Cambridge University Press, 2001). ISBN-13: 978-0-5214-2323-6; ISBN-10: 0-5214-2323-6 (paper).
- (2) *Physics for Future Presidents: The Science Behind the Headlines* by Richard A. Muller (New York: W. W. Norton & Company, 2008; paperback: September, 2009). ISBN-13: 978-0-393-33711-2; ISBN-10: 0-393-33711-1 (paper).

**Additional Item(s) Needed:** A *stand-alone* “scientific” calculator with trigonometric functions. The essential feature of a scientific calculator is a provision for directly entering numbers in scientific notation (usually a key or its “2<sup>nd</sup> function” labeled “EE” or “EXP”). I recommend the Texas Instruments TI-30Xa as an inexpensive and easy-to-use calculator having the necessary basic features. (A graphing calculator is *not* necessary. However, a graphing or multi-line calculator does have the advantage of allowing you to enter, examine, and edit an entire mathematical expression prior to evaluation. Complicated expressions are easier to evaluate on such a calculator.) **Note that a calculator which is part of an iPhone, iPad, or other electronic device is *not* allowed to be used for test-taking; only a *stand-alone* calculator may be used for taking a test, quiz, or exam.**

*(cont'd)*

A straight-edge will be helpful for making drawings in homework and in lecture notes. Graph paper may be helpful for making drawings for certain homework problems. (I will provide graph paper with one assignment in which it is required.) Based on experience, I suggest getting a stapler for assignments. There may not be a stapler in the classroom for last-minute use.

**You must have a student account on the WCU computer network** so that you can access postings on the “D2L” course information system and so that you can access university e-mail on the campus intranet. E-mail from the course instructor will come to you via the university e-mail system. Registering for a course at the University entitles you to such an account. Instructions for initializing your account can be found via the WCU homepage: click the “Current Students” tab; choose “IT Help Desk”; among the list of items at the left, click on “New Student Account”. Or go to the corresponding page by entering the following address:

<http://www.wcupa.edu/infoservices/clientServices/itHelpDesk/studentAccount.aspx>

### Comments on the textbooks:

Both books listed above are required. Both are paperbound. Text (1) is the primary textbook. Text (2) is very readable. It describes the significance of physics for important contemporary government policy issues: terrorism, energy in general, nuclear energy, space exploration, and climate change. It is written for the non-scientist, and could be called “physics for informed citizens”. I will provide a format for reporting on this book near the start of the semester. The report will be due about a month before the end of the semester.

Text (2) is becoming a bit outdated, especially as regards its section on climate change. A more recent book by Muller at a similar level (*Energy for Future Presidents*) does not cover the breadth of topics found in *Physics for Future Presidents*, and so I have continued using the latter, because different students find different topics especially interesting. (More recent data related to the climate-change issue continue to overwhelmingly support the ongoing trend of global warming, and support a significant contribution from human activity to this trend.)

**Description of My Version of Physics 100:** This is an introductory one-term course emphasizing three themes. The first two themes are the nature of light and the relation of the study of light to other areas of physics. The course develops these first two themes by following “the trail of light” through the history of physics—indeed, a subsidiary aspect of the course is the history of our understanding of these themes. The “trail” begins with knowledge of the properties and behavior of light, leading to the establishment of the wave nature of light. The trail then leads through three or four major landmarks in our understanding of Nature which are treated in the course—light as an *electromagnetic* phenomenon and the reality of the *electromagnetic field*; the *wave-particle duality* of quantum mechanics; and Einstein’s *Special Theory of Relativity*. The third major theme is the relation of physics to “science literacy” and to government policy. This theme is addressed through the supplemental reading [text (2) above] and a book report on it.

The mathematics required for the course consists of basic algebra and geometry. It will be essential for the student to be able to use these skills. Correct use of a scientific calculator, especially in regard to order of operations, will also be essential. (In fact, the first homework assignment will be a review of basic algebra, calculator usage, and geometry.) A small amount of trigonometry (the sine function) will be introduced and explained for limited use.

**West Chester University General Education Goals and Student Learning Outcomes:** PHY 100 is an approved course in the WCU General Education program. This course strives to have students meet the following general education goals: (Goal #2) ability to employ quantitative concepts and mathematical methods; (Goal #3) ability to think critically and analytically. These goals are accomplished through discussion of quantitative and qualitative examples and practice problems in class and outside class, through homework assignments, and through exams. The assignments and exams also provide evaluation of student accomplishment of these goals. Goal #3 is also addressed and evaluated through written answers to both open-ended and specific questions in a report on an assigned book on the social and technological impacts of physical sciences and engineering. Overall student learning outcomes are similar, but apply to specific course topics—for example, applying physical reasoning, quantitative reasoning, and mathematical skills to the refraction of light.

**Course Calendar:** A tentative course calendar is on the last sheet of this syllabus (pp. 9–10).

**Exams:** I expect to have 3 exams during the semester, in addition to the final exam (unless we are deluged with snow!) **I will drop the lowest of the three semester exam scores, but I will include the final exam—the final exam will NOT be dropped.** The final exam will count the same as each of the two highest semester exams. (I may change this arrangement if I get far behind in the course schedule. An example of such a change would be counting the highest three of all four exams, including the final. I will announce any such change in the grading scheme as early as feasible, but at least two weeks before the end of the semester.)

Altogether, the exams will account for 60% of the course grade; each of the three exams included in the score will thus account for 20% of the course grade. Two of those three exams will be semester exams, and the third will be the final exam.

**The final exam for PHY 100-09 will be given in our classroom (SSN 192), 10:30 am–12:30 pm, Friday, December 15, 2017.** This time has been pre-set by the University. The final exam will *not* be comprehensive, and, as stated above, will count the same as the semester exams. **The final exam is required—the final exam will not be dropped.** If we cover the topics I hope to, the final will be over the material following that covered by the preceding exam. Otherwise, it may cover some of the same material as the preceding exam.

I presently expect to have exams on the Wednesdays of Class Weeks 5 and 9, and Friday of Class Week 14. As mentioned above, the “Final” will be on Wednesday of Finals Week (Class Week 16). I will provide formula sheet(s) with each exam. Ungraded “Practice Exercises” with answers will be provided in advance.

I will admit that in the past I have often slipped behind schedule and pushed back the dates for semester exams. The final exam date and time are set by the university and I am not allowed to vary that. If necessary, make-up finals can be arranged on an individual basis—for example, if a student has three finals scheduled on the same day.

**Grading:** *I plan to grade on the following basis: semester exams plus final exam, 60% of the total grade (20% for each of the two highest semester exams and 20% for the final); homework assignments, 20%; report on the supplemental reading book, 20%.*

I typically do stay with the preceding percentage weights when calculating overall course grades. I reserve the possibility of eventually varying these percentages if I think the outcome would better reflect the class’s efforts; but it is unlikely that they would change by more than 5%, if at all, and very unlikely that they would change by

more than 10%. I *may* “curve” particular exams *if* I think that is appropriate, but again, I do not normally do this. My initial plan is for all exams included in the overall average to count equally, but I may vary this if it seems appropriate. I will let you know if I consider any of the preceding class-wide changes.

Final numerical scores will be converted to letter grades according to the official scheme, but I may adjust the scheme based on how the class does and on how difficult I perceive the course to have been. I do consider whether to adjust the letter grades of students whose numerical scores are close to letter-grade boundaries, and considering factors such as unusual performance in some particular aspect of the course, major illness, etc.

**Make-up Exams:** I am willing to allow make-up of semester exams for sufficiently good reasons, such as illness or emergency. Missing the *final exam* will result in a zero for the exam unless extreme circumstances apply. ***The following rules apply to making up semester exams:***

***IMPORTANT: To limit possible abuse of the make-up exam privilege, I will REQUIRE the following:***

- ***I must be notified in person, by telephone, or by e-mail by the day after the semester exam, if you need to make up the exam at another time for any reason.***
- ***The make-up exam must normally be taken not later than six days from the exam date. Exceptions will be made only for truly serious reasons, such as extended illness, and must be explicitly granted by me.***

If you miss an exam without making it up in time and without an exemption from me, your grade for that exam will be zero.

**Regarding Homework Assignments:** Please note that the preceding percentages mean that if you do very little or no homework, you will not receive an ‘A’ or ‘A–’ for the course even if you do extremely well on the exams. If you do not do the homework, and do not do well on the exams, your final grade will necessarily be low. Aside from the direct effect of the homework on your course grade, doing the homework, thinking about it as you do it, and understanding errors in your solutions will help you avoid errors on the exams!

**University’s Statement of Excused Absences Policy for University-Sanctioned Events:** Undergraduate students participating in University-sanctioned events such as, but not limited to, the Marching Band, musical ensembles, theatre group, athletic events, forensics competition, etc., will be granted an excused absence(s) by the respective faculty members for class periods missed. Students will be granted the privilege of taking, at an alternative time to be determined by the professor, scheduled examinations or quizzes that will be missed. The professor will designate such times prior to the event. Professors can provide a fair alternative to taking the examination or quiz that will be missed. Students must submit original documentation on University letterhead signed by the activity director, coach, or adviser detailing the specifics of the event in advance. Specific requirements include the following:

1. Responsibility for meeting academic requirements rests with the student.
2. Students are expected to notify their professors as soon as they know they will be missing class due to a University-sanctioned event.

3. Students are expected to complete the work requirement for each class and turn in assignments due on days of the event prior to their due dates unless other arrangements are made with the professor.
4. If a scheduled event is postponed or canceled, the student is expected to go to class.
5. Students are not excused from classes for practice on nonevent days.

The following are specifics for the student athlete:

1. The student athlete is expected, where possible, to schedule classes on days and at hours that do not conflict with athletic schedules.
2. Athletes are not excused from classes for practice or training-room treatment on nongame days.

Recently the University presidents of the Pennsylvania State Athletic Conference (PSAC) voted to allow athletic contests and championships to be played during the PASSHE final exam period. This new development may impact administration of finals, since multiple day championships will now occur during WCU's final exam week. Under WCU's Excused Absence Policy, any athlete who is participating in an athletic event or championship must be allowed to take, without penalty, any exam or quiz that they miss due to competition or be offered a fair alternative.

**Disabilities and Special Needs:** If you have a physical disability, learning disability, test anxiety, etc., please contact the Office of Services for Students with Disabilities (OSSD) at extension 3217 and bring the resulting documentation to me to discuss how the university and I can assist you. Note that sufficient notice is needed in order to make accommodations possible.

In an effort to assist students who either receive or may believe they are entitled to receive accommodations under the Americans with Disabilities Act, and Section 504 of the Rehabilitation Act of 1973, the University has appointed a student advocate to be a contact for students who have questions regarding the provision of their accommodations or their right to accommodations. The advocate will assist any students who may have questions regarding these rights. Ms. Lynn M. Klingensmith, Director of Social Equity/Title IX Coordinator, has been designated in this role. Any students who may need assistance with their rights to accommodations should contact her at [lklingensmith@wcupa.edu](mailto:lklingensmith@wcupa.edu).

***If you are approved for an accommodation of a disability, please provide me the documentation in a timely manner. Even if you think you may not need the accommodation for this course (such as extra time for exams), please provide the documentation—it may well turn out that you need the accommodation after all! If you need to contact OSSD for the documentation, do so AS SOON AS POSSIBLE. Delaying exams or other coursework while awaiting documentation will make the work more difficult later! See my similar note below regarding tutorial help (next subsection).***

**Tutoring:** Tutoring for PHY 100 is offered by the Learning Assistance Center (LARC), 223 Lawrence Center, x2535. More information is available at: <http://www.wcupa.edu/ussss/larc/>. LARC tutoring is free of charge, but you must sign up at the beginning of the semester.

Peer tutoring may also be offered by physics majors during the semester. If offered, this will not be organized until a few weeks into the semester. I will provide information as I learn about arrangements. A few weeks into the semester you could also inquire at the Physics Library, Merion 125, where the physics major hang out.

***If you realize you need tutorial help, arrange it as soon as possible, and keep up with it. Delaying or missing tutoring appointments will lead to greater difficulty later. If you need tutoring in connection with a learning disability, see my similar note above under the “Disabilities and Special Needs” subsection.***

#### **ADDITIONAL NOTES:**

**You, Me, and the Course:** You are responsible for spending the “time on task” to do the work you need to do for this course. A teacher can encourage “active learning,” but in the last analysis, active learning must be done by the student. If thinking of the entire semester at once is burdensome, focus on the current material!

***I do NOT expect to provide “extra credit” work late in the semester. If you are tempted to hope for or rely upon “extra credit work” to pull you through, think of the current course material as your extra credit work as we go through the semester. I do understand that there may be many demands on your time, and I will try to be understanding and flexible. For grades to be meaningful as indicators of student performance, however, they must be based primarily on mastery of the course material and assignments, secondarily on effort made to achieve mastery, and, perhaps, thirdly on other factors.***

I am very willing to provide help and explanations inside and outside the classroom (see “Office Hours” in the header information on page one). Whether you are a recent high-school graduate or working on starting a second (or third!) career, I’m interested in you. Students have found me to be very helpful in one-on-one and small group situations, so walk in or make an appointment to see me if you need help.

**Electronics in the Classroom:** Please turn off all cell phones, iPods, iPads, iPhones, Kindles, laptops, etc., before class. If you are expecting to receive an emergency call, set your cell phone to vibrate mode and answer the call outside the classroom. You are not allowed to use cell phones for texting or gaming during class; these activities are distracting to your classmates and to the instructor. Repeated violations of these rules may be penalized.

Possible exceptions may include use of an electronic device as an accommodation for a disability or if a student has an e-copy of the textbook. These situations should be discussed with me on an individual basis.

**Recording in Class:** You must obtain permission from me before recording class. Video recording requires permission of your classmates as well. Any on-line posting of such recordings, or circulation of such recordings to people not enrolled in the course, is *forbidden*, unless *additional special permission* is granted.

**Academic Integrity:** It is the responsibility of each student to adhere to the University’s standards for academic integrity. Violations of academic integrity include any act that violates the rights of another student in academic work, that involves misrepresentation of your own work, or that disrupts the instruction of the course. Other violations include (but are not limited to): cheating on assignments or examinations; plagiarizing, which means copying any part of another’s work and/or using ideas of another and presenting them as one’s own without giving proper credit to the source; selling, purchasing, or exchanging of term papers; falsifying of information; and using your own work from one class to fulfill the assignment for another class without significant modification. Proof of academic misconduct can result in automatic failure and removal from this course.

For questions regarding Academic Dishonesty, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to their major department’s handbook, the *Undergraduate/Graduate*

*Course Catalogue*, the *Ram's Eye View*, or the University Web Site. Please understand that improper conduct in any of these areas will not be tolerated and may result in immediate ejection from the class.

**Intellectual Property Statement:** The instructor for this course utilizes copyrighted materials under the “Freedom and Innovation Revitalizing United States Entrepreneurship Act of 2007” (Fair Use Act). Apart from such copyrighted materials, all other intellectual property associated with this course is owned and copyright protected by the instructor, including, but not limited to, lectures, course discussions, course notes and supplementary materials posted or provided to students authored by the instructor, assessment instruments such as quizzes and exams, and Power Point presentations. No recording, copying, storage in a retrieval system, or dissemination in any form, whether electronic or other format, by any means, of the intellectual property of the instructor, either in whole or in part, is permitted without the prior written permission of the instructor. When such permission is granted, it must specify the utilization of the intellectual property and all such permissions and waivers shall terminate on the last day of finals in the semester in which this course is held.

Links and references to on-line resources provided by the instructor may lead to other sites. The instructor does not sponsor, endorse, or otherwise approve of any information appearing in those sites, nor is the instructor responsible for the availability of, or the content located on or through, external sites. Apart from materials used in accordance with the Fair Use Act, the instructor takes no responsibility for material that is otherwise offered at web sites and makes no warranty that such material does not infringe on any third party rights. However, should any of this type of material be present and this fact is brought to the attention of the instructor, they will remove references to it from course materials.

**Public Safety:** The Emergency Communications Committee recommends that the telephone number of WCU's Department of public safety be available on every course syllabus.

**WCU Department of Public Safety: (610) 436-3311.**

The University encourages students to sign up for the University's free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone (as well as via email). For more information, visit <https://www.wcupa.edu/wcualert/>.

**University Statement Regarding Title IX of the Education Amendments of 1972, Including Policy on Faculty Reporting Incidents of Sexual Assault:** West Chester University and its faculty are committed to assuring a safe and productive educational environment for all students. In order to meet this commitment and to comply with Title IX of the Education Amendments of 1972 and guidance from the Office for Civil Rights, the University requires faculty members to report incidents of sexual violence shared by students to the University's Title IX Coordinator, Ms. Lynn Klingensmith. The only exceptions to the faculty member's reporting obligation are when incidents of sexual violence are communicated by a student during a classroom discussion, in a writing assignment for a class, or as part of a University-approved research project. Faculty members are obligated to report sexual violence or any other abuse of a student who was, or is, a child (a person under 18 years of age) when the abuse allegedly occurred, to the person designated in the University protection of minors policy. **Information regarding the reporting of sexual violence and the resources that are available to victims of sexual violence** is set forth at the webpage for the Office of Social Equity, found at internet address <http://www.wcupa.edu/admin/social.equity/>.

**LGBTQA Ally Statement:** West Chester University’s Mission Statement says, in part, “*We appreciate the diversity the members of our community bring to the campus and give fair and equitable treatment to all; acts of insensitivity or discrimination against individuals based on their race, gender, ethnicity, age, sexual orientation, abilities, or religious beliefs will not be tolerated.*”

Based on West Chester University’s commitment to diversity, I believe that everyone in my classroom should feel safe. I have completed the University’s Lesbian, Gay, Bisexual, & Transgender Ally training. In becoming an ally I made the commitment to offer a safe space for *all* of my students, not just those who identify as LGBTQ. You may speak to me confidentially about issues of sexual orientation or gender identity during my office hours, but I have no professional expertise in these matters. For further advice or information, I recommend contacting Ms. Sherry Mendez, Interim Director of LGBTQA Services ([smendez@wcupa.edu](mailto:smendez@wcupa.edu), 610-436-0732), or University Counseling and Psychological Services ([wucc@wcupa.edu](mailto:wucc@wcupa.edu), 610-436-2301).



**Tentative Course Calendar:**

<b>Week No.</b>	<b>Starts on Monday,</b>	<b>Coursework, Exams, and Other Events</b>
1	Aug. 28	Monday, August 28, is the first day of classes. Introduction, syllabus. Start Chap. 1 of text—reflection; qualitative description of refraction, reversibility, “total reflection”; begin quantitative treatment of refraction (Snell’s Law). Begin assigning homework.
2	Sep. 4	<b><i>Labor Day Holiday—Monday, September 4.</i></b> Introduce sine function and inverse sine function; develop and generalize Snell’s Law. Format for report on supplemental reading handed out this week. Homework assigned. <i>Sep. 5 is the last day to enroll in a course or to drop a course.</i>
3	Sep. 11	Finish Chap. 1: Examples using generalized Snell’s Law (including finding critical angle); velocity of light; colors; “sidedness” (“polarization”). Homework assigned.
4	Sep. 18	Quick summary of Chap. 2. Begin Chap. 3 on waves. Pulses, continuous waves, periodic waves; superposition of waves; standing waves. Practice Exam I given out. Homework may be assigned.
5	Sep. 25	Finish Chap. 3 on waves: refraction as a wave phenomenon. Homework assigned. <b>Exam I on Chap. 1 on Wednesday, September 27.</b>
6	Oct. 2	Start Chap. 4 on “Interference”. Homework may be assigned.
7	Oct. 9	<b><i>Fall Break Holiday—Monday, Oct. 9 and Tuesday, Oct. 10.</i></b> Continue Chap. 4 on “Interference”. Homework may be assigned.
8	Oct. 16	Finish Chap. 4. Possibly start Chapter 5 on electricity and magnetism. Homework assigned. Practice Exam II given out.
9	Oct. 23	Start or continue Chap. 5 (“Electromagnetic Waves”). <b>Exam II on Chaps. 3, 4 on Wednesday, Oct. 25.</b> <i>Friday, Oct. 27 is the last day to withdraw from a course (‘W’ grade on transcript). It is also the last day to request pass-fail or audit status or to complete NG work.</i>
10	Oct. 30	Finish Chap. 5 on electricity, magnetism, and electromagnetic waves.
11	Nov. 6	Chap. 6—Photoelectric & Compton Effects; photon concept. Possibly begin Chapter 7 on wave-particle duality.

*(cont’d)*

Week No.	Starts on Monday,	Coursework, Exams, and Other Events
12	Nov. 13	<b>Book report may be turned in this week if desired. (Penalty after Wed., Nov. 29.)</b> Chapter 7—Wave-particle duality; possible related topic. Possibly begin Chaps. 8, 9 on the special theory of relativity. Practice Exam III given out this week or next.
13	Nov. 20	<b>Book report may be turned in this week if desired. (Penalty after Wed., Nov. 29.)</b> Special theory of relativity—topics from Chaps. 8, 9. Practice Exam III given out Monday if not given out during the preceding week. <b><i>Thanksgiving Holiday, Wed., Nov. 22–Fri., Nov. 24.</i></b>
14	Nov. 27	Special theory of relativity continued—topics from Chaps. 9–13. <b>Book Report Deadline Wednesday, Nov. 29—small penalty if turned in later.</b> <b>Exam III on Chaps. 5–7 on Fri., Dec. 1.</b>
15	Dec. 4	Special theory of relativity—topics from Chaps. 10–13. Part or all of practice final exam given out. Group work on relativity? <i>Monday, Dec. 4, is the last day for term withdrawal (withdrawal from all courses).</i>
16	Dec. 11	Monday, December 11 is the last day of classes. Conclude relativity (possibly engage in group work?); possibly review for the final. Any remaining review exercises for final exam given out and/or posted on D2L.

**Final Exam will be 10:30 am–12:30 pm, Fri., Dec. 15, in our classroom, SSN 192.**

**The final exam is required—the final exam grade will NOT be dropped.**

*The Final Exam will be on whatever we actually cover after the Exam III material (and may include some Exam III material if we don't cover much additional material due to falling behind the schedule above).*

(The University's Final Exam Period will extend from Tue Dec 12 through Sat Dec 16.)