Physics 100: Elements of Physical Science

Spring 2020

300 Years of Describing Motion: Kinematics from Galileo to Heisenberg

COURSE MEETING TIME AND PLACE:

Course Section	Meeting Time	Location
PHY 100-02	MoWeFri 10:00-10:50 am	Merion 109

INSTRUCTOR INFORMATION:

Dr. Shawn H. Pfeil
e-mail: spfeil@wcupa.edu (please include section number on subject line)
phone: (610) 430-4084
office: Schmucker Science South 229

OFFICE HOURS:

My scheduled office hours as of the first day of class are listed below. I reserve the right to adjust this schedule to reflect unforeseen circumstances.

Monday	Tuesday	Wednesday
11 am – 1 pm	1 pm – 3 pm	11 am – 12 pm

Office hours are available by appointment for students with an ongoing conflict with my scheduled hours.

COURSE DESCRIPTION:

Elements of Physical Science (PHY 100) is an approved General Education Science Distributive Course. Physics is the science concerned with describing the basic interactions between objects in the material world. This includes the description of the motion of objects, and the forces which cause this motion to change. In this physics course, which is primarily aimed at non-science majors, we will learn introductory physics with the goals of improving our analytical skills, problem solving abilities, and developing a level of scientific literacy that allows us to navigate intelligently through our technological world.

In this particular section of PHY100 we will focus on kinematics the description of the motion of an object. This narrow focus will allow us to discuss both the classical physics that describes our everyday world, and more "modern" (think modern art or midcentury modern design) physics. This course has three units:

- Classical Kinematics (The understanding of motion developed by Galileo Galilei, 1564-1642)
- Special Relativity (The understanding of motion developed by Albert Einstein, 1879-1955)
- Quantum Mechanics (The understanding of motion developed by Schrodinger, Heisenberg, and Bohr in the 1920s)

REQUIRED COURSE MATERIALS:

Required Textbook: None

Physics textbooks are expensive. To increase the accessibility of this course we will not be using an assigned textbook for homework and etc. ***Lecture slides and materials will be posted to the Desire to Learn (D2L) course management platform.***

Suggested Textbook: Conceptual Physics 12th Edition, Paul G. Hewitt

You may still want a textbook as a reference. We will be using the text by Hewitt as our primary reference for the course. It is available at campus bookstore. **Importantly the edition does not matter much if you are buying the book as a reference and study aid.** If you decide to buy a reference copy, then you may be able to find a cheap copy of an older edition online. For example, I was able to find the 10th edition used for about $8 online.

Calculator: Ti-30 or equivalent. If you have not already invested in a reasonable calculator you should for this course. You do not need anything fancy, but should have a scientific calculator equivalent to a Ti-30. These retail for less than $20. ***You will not be able to use the calculator on your phone for exams.***

GENERAL EDUCATION GOALS:

As a Science Distributive course we will address the following General Education Goals and learning objectives.

General Education Goal 1: Communicate Effectively

Students will work on effective communication by *Demonstrating comprehension of and ability to explain information and ideas accessed through reading.* I will assess our progress towards effectiveness towards this goal via a combination exams, and observation of student discussions during class polling activities.

We will work on expressing oneself effectively in common college-level written forms. But I explicitly do not mean essays. We will be working developing our ability to combine quantitative arguments and writing into coherent narratives leading to a conclusion. This particular written form which we will call the "problem set" has a long and storied tradition. *Progress will be assessed via exams, and assignments.*

General Education Goal 2: Think Critically and Analytically

Students will work on *reaching sound conclusions based on a logical analysis of evidence.* In particular we will work on using the scientific method, a method for reaching sound conclusions by analyzing evidence. We will also work on our ability to use quantitative reasoning to reach conclusions using measured quantities as evidence. Progress towards this goal will be assessed via exams, and homework.

General Education Goal 3: Employ quantitative concepts and mathematical methods

Students will work towards this general education goal by employing quantitative methods to examine a problem in the natural or physical world. That problem is the description and prediction of the motion of objects. We will employ quantitative methods, read as "doing math" to solve some problems arising from kinematics. We will also employ quantitative methods, read as "measuring numerical data," in "group experiments." Progress towards this objective will be monitored via homework and exams.

Students will also apply the basic methods and thought processes of the scientific method for natural/physical science as appropriate to the discipline of Physics. In particular, we will as a class analyze "group experiments" and demonstrations. To do this we will utilize a wide range of tools including graphical analysis. Progress towards this objective will be monitored via exams, homework, and observation of in-class experiments.

ASSESSMENT:

Your grade will be based on the following components.

Exams:

- **Three Regular Exams (45%, 3 at 15% each):** This course has three exams one for each of the units/topics covered. Each exam is written to take approximately 40 minutes and will be given in-class during the 50 minute exam period. ***Tentative exam dates are listed on the course schedule. These may shift due to snow-days etc****. I will try to give you as much advanced warning as possible about any shift in dates.*

  If you miss an exam for an excused reason (i.e a University Sanctioned Event, Illness, or other major event outside your control).
  - If you know about the event in advance, then you must let me know in advance to receive a makeup exam. For example, you have prior warning of both university athletic events and jury duty. You

must also provide me with suitable documentary evidence of the event (i.e a letter from your WCU coach or the jury duty summons.)
    - If the event does not give any prior warning. For example, you are hospitalized for a car accident or your car breaks down on the way to school. You must let me know as soon as you reasonably can. If you are in the hospital, I don't expect to hear from you until things have settled down. If your car breaks down, I expect to hear from you as soon as you have access to e-mail (maybe even while you are waiting for the tow-truck.)
    - If you miss an exam for an unexcused reason, then you will be given a zero. *You may also be given a zero if you fail to notify me in a timely fashion for what would otherwise be an excused absence.* However, you can still replace the score using the final exam (see below).

- **Final Exam (15%):** We will have a 120 minute (2 hour final) during the final period. This final exam will have three labeled sections, corresponding to the three in class exams. This means that it is cumulative.

Replacing a regular exam score:

If your final exam score for a unit in the course is higher than your regular exam score, then I will replace your regular exam score with your score on the corresponding part of the final.

> Example: ***Ima Student*** scores an 85% on exam 1, a 65% on exam 2, and a 92% on exam 3. On her final, she gets 82% on portion 1, 90% on portion 2, and 85% on portion 3.
>
> When I calculate her final grade, she would receive: 85% on exam 1, 90% on exam 2 (from her final), and 92% on exams 3. Her final exam percentage would be 85.7% the average of her scores on the three portions of the final exam.

People take different amounts of time to master the material. Although we are aiming for mastery by the time of the unit test, what matters most is that you know the material in the end. *With that said, you don't want to be in the position of needing all three components replaced. If you blow-off the regular exams you are making your final effectively worth 65%. Please don't put yourself in that position.*

Assignments (40%):

- You will be responsible for two types of assignments:
    - **<u>In and out of class (10 points each)</u>**: These are assignments we start in class, typically a worksheet, which you will be expected to finish out of class. I will post these on D2L, the course management web-portal, the same day as they are assigned. **These are always due at the next course meeting.**
    - **<u>In-class only assignments (5 points each):</u>** These are assignments that require you to perform some activity, such as an experiment in-class. ***I will grade this category out of 15 points less than the total possible.*** *This is to allow students to miss up to three days of class without being penalized for missing in-class only assignments.*

This course is graded using the standard WCU grade scale (see table at the right). Please note I round at 0.5%. For example, a 79.5% is a B- and a 79.4% is a C+.

Please consult the course catalog for a description of rare grades for special circumstances such as Z, NG, etc.

Letter	Grade Points	Percentage
A	4.000	93 - 100
A-	3.670	90 - 92
B+	3.330	87 - 89
B	3.000	83 - 86
B-	2.670	80 - 82
C+	2.330	77 - 79
C	2.000	73 - 76
C-	1.670	70 - 72
D+	1.330	67 - 69
D	1.000	63 - 66
D-	0.670	60 - 62
F	0.000	59 or lower

ELECTRONIC DEVICE POLICY:

Electronic devices may be used only in a way that is conductive to the classroom environment. Improper use of devices is a distraction to all students in the area. Here are the rules for some specific devices. Ask about any other device.

Cell Phones: Cell phones should be put away so as to not be visible to you or other students. You may not use your cell phone as a calculator in class. Your phone should certainly be set to "vibrate mode." *If your ringer goes off in class I will dance badly to your ringtone. This will be embarrassing for both of us. Please silence your phone.* ***Exception: you may be asked to use your cell phone as a timer or camera during some in-class activities. Please only bring it out if asked.***

Tablets/Laptops: If you want to use a tablet to annotate the lecture slides posted on D2L or take notes that is fine. If you want to have a copy of the slides up on your laptop that is also fine. However, looking at anything unrelated to our course in class, will result in me asking you to put the device away for the rest of the semester.

Headphones: All headphones including wireless earphones and Bluetooth headsets are strictly prohibited in class. **Headphones must be put all the way away.**

Failure to follow the electronic device policy will result in a warning, then a ban on the device in question, and then a 5 point penalty per infraction taken from your assignments score.

COURSE MANAGEMENT WEBSITE (D2L):

We will be using course management software, D2L, for this course. On D2L you will be able to access course readings and lecture slides as PDFs. I will also be using the D2L gradebook, so you can easily see your current grade in the class. Finally, I will post any changes or updates to the course schedule on D2L. **Please check D2L frequently for announcements and news.**

ATTENDANCE POLICY:

No graded component is directly associated with attendance. However, unless students have an excused absence they will not be able to make up graded course components missed.

PHYSICS TUTORING:

Physics tutoring is available through LARC (610) 436-2535. In the past peer tutoring has also been available from SPS (the Society of Physics Students). If SPS tutoring becomes available this semester I will make an announcement. **These should be considered in addition to my office hours, which are the first place you should stop for additional help.**

INTELLECTUAL PROPERTY STATEMENT:

I, the instructor, utilize copyrighted materials under the "Freedom and Innovation Revitalizing the 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 copyrighted by the instructor, including, but not limited to, lectures, course discussions, course notes, slides, assessment instruments such as exams, and supplementary materials posted or provided to students authored by the instructor. No recording, copying, storage in a retrieval system, or dissemination in any form by any means of the intellectual property of the instructor, in whole or in part, is permitted without 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 of the semester in which this course is held.

ALL OTHER ACADEMIC POLICIES

For any university wide academic policy not explicitly covered in this document, such as No Grade policies. Please consult your major advising handbook, the Undergraduate Catalog, the Ram's Eye View, or the University Website.

COURSE SCHEDULE: A tentative schedule for the course follows. Although I will endeavor to stick closely to the schedule as posted below, I reserve the right to modify it as needed over the course of the semester.

		#	Topic	Unit	Suggested Hewitt Reading
1/22	W	1	Introduction to the Course	1	NONE
1/24	F	2	Units and Unit Conversion	1	NONE
1/27	M	2	The Scientific Method an Introduction	1	p.8-17
1/29	W	3	What can we measure about motion?	1	p.23-25
1/31	F	4	Average Speed/Average Velocity	1	p.41-43
02/03	M	5	Average Speed/Velocity Part II.	1	p.41-43
02/05	W	6	Instantaneous Velocity	1	p.41-43
02/07	F	7	Acceleration	1	p.43-46
02/10	M	8	The 1D Kinematics Model	1	p.43-46
02/12	W	9	Science and Testing Models	1	p.8-17
02/14	F	10	The Scientific Method II	1	p.8-17
02/17	M	11	Free Fall – on the way down	1	p.46-50
02/19	W	12	Free-Fall on the way up	1	p.46-50
02/21	F	13	Solving Free-Fall Problems	1	p.46-50
02/24	M	11	Review for Test #1	1	See Above
02/26	W	12	**Test #1**	1	See Above
02/28	F	14	Motion is Relative: Choice of Zero	2	p.659-660
03/02	M	15	Motion is Relative: Relative Velocity	2	NONE
03/04	W	16	Galilean Relativity: What we agree on	2	NONE
03/06	F	17	Wave Basics	2	p.360-362
3/16	M	18	Einstein's Relativity: The Speed of Light	2	p.660-661
3/18	W	19	Einstein's Relativity Simultaneity	2	p.662-663

3/20	F	18	Einstein's Relativity: Time Dilation	2	p.663-667
3/23	M	19	Einstein's Relativity: Relativistic Velocity Addition	2	p.673-675
3/25	W	20	Einstein's Relativity: Length Contraction	2	p.675-677
3/27	F	21	Experimental Tests of Special Relativity	2	NONE
3/30	M		Review For Test 2		
04/01	W		**TEST # 2**		
04/03	F	21	Light Waves: Diffraction	3	p.545-548
04/06	M	22	Light Waves: Superposition and Interference	3	p.549-551
04/08	W	23	The Photoelectric Effect	3	p.583-587
04/10	F	24	Probability: Fair and loaded dice	5	NONE
04/13	M	25	Probability Distributions	5	NONE
04/15	W	26	The Double Slit Experiment with Electrons	5	p.588-592
04/17	F	26	The Uncertainty Principle and Complementarity	5	p.592-596
04/20	M	27	Describing the Motion of a Particle: Three Models	5	NONE
04/22	W	29	Review for Test #3	5	See Above
04/24	F	30	**Test #3**	5	See Above
04/27	M	31	Snow Day/Catch Up/Review	6	
04/29	W	32	**Snow Day/Catch Up/Review**	6	
05/01	F	33	Snow Day/Catch Up/Review	6	
05/04	M		**REVIEW FOR FINAL EXAM**		

Statements Common to All WCU Undergraduate Syllabi

ACADEMIC & PERSONAL 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 the automatic failure and removal from this course. For questions regarding Academic Integrity, the No-Grade Policy, Sexual Harassment, or the Student Code of Conduct, students are encouraged to refer to the Department Undergraduate Handbook, the Undergraduate Catalog, the Ram's Eye View, and the University website at www.wcupa.edu.

STUDENTS WITH DISABILITIES

If you have a disability that requires accommodations under the Americans with Disabilities Act (ADA), please present your letter of accommodations and meet with me as soon as possible so that I can support your success in an informed manner. Accommodations cannot be granted retroactively. If you would like to know more about West Chester University's Services for Students with Disabilities (OSSD), please visit them at 223 Lawrence Center. Their phone number is 610-436-2564, their fax number is 610-436-2600, their email address is ossd@wcupa.edu, and their website is at www.wcupa.edu/ussss/ossd. 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 student who may have questions regarding these rights. The Director for Equity and Compliance/Title IX Coordinator has been designated in this role. Students who need assistance with their rights to accommodations should contact them at 610-436-2433.

EXCUSED ABSENCES POLICY

Students are advised to carefully read and comply with the excused absences policy, including absences for university-sanctioned events, contained in the WCU Undergraduate Catalog. In particular, please note that the "responsibility for meeting academic requirements rests with the student," that this policy does not excuse students from completing required academic work, and that professors can require a "fair alternative" to attendance on those days that students must be absent from class in order to participate in a University-Sanctioned Event.

REPORTING INCIDENTS OF SEXUAL VIOLENCE

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. 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 Diversity, Equity, and Inclusion at https://www.wcupa.edu/_admin/diversityEquityInclusion/aboutUs.aspx.

EMERGENCY PREPAREDNESS

All students are encouraged to sign up for the University's free WCU ALERT service, which delivers official WCU emergency text messages directly to your cell phone. For more information, visit www.wcupa.edu/wcualert. To report an emergency, call the Department of Public Safety at 610-436-3311.

ELECTRONIC MAIL POLICY

It is expected that faculty, staff, and students activate and maintain regular access to University provided e-mail accounts. Official university communications, including those from your instructor, will be sent through your university e-mail account. You are responsible for accessing that mail to be sure to obtain official University communications. Failure to access will not exempt individuals from the responsibilities associated with this course.