Physics 203: Foundations of Physics
Fall 2010

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Physics 203 is the first course of our three-semester introduction to physics. In Physics 203, we will learn what is now known as classical physics, from the development of mechanics in the 1600's by Isaac Newton to the thermodynamics fully developed in the 1800's by Ludwig Boltzmann. (In 204, we will learn from Faraday and Maxwell about electromagnetism and light, while in Physics 205, we move from classical physics into modern physics and explore special relativity and quantum mechanics.) The major goals for the course are for students to:

- Develop an understanding of velocity, acceleration, and force from a physicist's perspective
- Connect these concepts to the models and equations we use to describe nature
- Understand experimentally how Newtonian physics is a better description of reality, even in this world full of friction and non-perfect objects
- Begin developing the capacity to break down a problem into solvable pieces
- Learn to acquire, analyze and draw conclusions from quantitative data, and
- Learn to explain scientific results effectively and concisely in writing.

We will use a combination of active group work, lectures, conceptual quizzes, demonstrations, homework, laboratory experiments, and laboratory reports to achieve these goals.

Lecture:	Mondays, Wednesdays, Fridays	9 - 10 am	Taylor 111
Lab:	Wednesdays, Thursdays OR Fridays	1 - 4 pm	Taylor 101

Text: *Physics for Scientists and Engineers* by Hans Ohanian and John Markert, 3rd edition

Class Website: www3.wooster.edu/physics/lehman/p203_2010.html

Exams: There will be two midterm exams, scheduled for Monday September 27 and Friday October 29. The cumulative final exam is on Tuesday, December 14 at 7:00 p.m.

Grading: Your grade is determined from the exams, lab reports, homework and quizzes by the following proportions:

Lab Reports	20 %
Homework and Quizzes	20 %
Exams (combined)	60 %

The following scale will be used to determine your final letter grade:

Outstanding (A, A-):	> 88 %
Good (B+, B, B-):	> 77 %
Adequate (C+, C, C-):	> 66 %
Minimally passing (D):	> 60%

All exams must be taken when scheduled. Only truly unavoidable conflicts will be considered for rescheduling the exams. The College sets the final exam date, and professors are not authorized to grant exceptions. Unannounced quizzes may be given and may not be made up in any case.

Physics is <u>not</u> a collection of facts but a way of thinking. No one can teach you physics. Only you can teach yourself to think.

Guiding Principles of the Course

1. People understand concepts better by seeing them in *<u>action</u>* and **thinking** about them than by hearing them explained.
2. We learn physics by working problems, not by reading about working problems. Understanding physics is a learned skill, like cooking or playing basketball. It takes time, effort, and practice.
3. People learn best by thinking about topics and discussing them with others.
4. Students learn most when they take the responsibility for what is learned.

In this course, many topics are counter-intuitive and contradict our existing ideas about how the Universe works. To overcome our misconceptions, we must confront them, figure out why our initial idea is wrong, and build a new understanding of the situation. This takes a lot of practice. Research has shown that students learn and retain the most when they make a sustained consistent effort each week, rather than cramming before exams.

To make your time and effort the most efficient, I suggest the following study procedure:

1. Read the chapter prior to class. I recommend skimming the chapter and writing down an outline of the headings to form a context for the in-class discussions.
2. Listen carefully to the lecture and take notes. Really **think** about the material while in class.
3. Start working problems, going back through the chapter to clarify points as they come up. Instead of glancing over the example problems, **work** them without looking at the answers until you're really stuck. I also suggest you try to answer the "Questions for Discussion" at the end of the chapter. If you understand these, you probably understand the significant points of the chapter.
4. **Think**! Don't just try to fit the problems into an equation or sample problem, think through the question and the physics first.

Homework Philosophy

The homework is designed to give you practice in thinking about and doing physics, so that you gain a deeper understanding of the material. I do encourage you to work together on homework problems—talking about physics and explaining your ideas is one of the best ways to learn! However, you will learn the most if you attempt the problem on your own before asking for help. And, **the solutions you hand in must be entirely your own work. You may not directly copy words or equations.** A good practice is to re-write your solution without looking at your previous notes to be sure you understand each step yourself. When you obtain outside help, you must acknowledge it ("After substituting in variables (as suggested by Hermione), I find…").

When writing your homework solutions, **being able to explain what you have learned is an essential step in the learning process**. Thus, for all homework and exams, your thought process must be clear. **Neatness counts.** When working problems, your steps should be explained using short phrases. Any sketches or graphs should be clearly labeled.

Quizzes and In-Class Questions

I assign **daily** reading quizzes using Woodle. These quizzes both encourage you to read the material and also let me know before class what material is most confusing to you.
I also will occasionally call on students at random. You will receive a √ or √+ for your answer; if you are absent, you will receive a zero.
Quizzes and in-class questions are added into your homework score, but will be worth no more than 5% of your overall grade.

Academic Integrity

Cheating on a test, quiz, homework, lab, or lab report is a serious breach of academic integrity and is grounds for an F for the entire course. Direct copying of homework is a violation of the Wooster Ethic. Other violations of the Wooster Ethic include copying from any source without proper citation, going beyond what is allowed in a group project, fabricating excuses and lying in connection with your academic work. You will be held responsible for your actions. If you are unsure as to what is permissible, always ask!

Curricular and Extra-curricular Conflicts

The College of Wooster is an academic institution and its fundamental purpose is to stimulate its students to reach the highest standard of intellectual achievement. As an academic institution with this purpose, the College expects students to give the highest priority to their academic responsibilities. When conflicts arise between academic commitments and complementary programs (including athletic, cultural, educational, and volunteer activities), students, faculty, staff, and administrators all share the responsibility of minimizing and resolving them.
As a student you have the responsibility to inform me of potential conflicts as soon as you are aware of them, and to discuss and work with me to identify alternative ways to fulfill your academic commitments.
If you know of any conflicts that will require you to miss class or lab, notify me immediately.

Academic Support from the Learning Center

The Learning Center (ext. 2595) offers services designed to help students improve their overall academic performance. Sessions are structured to promote principles of effective learning and academic management. Any student on campus may schedule sessions at the Learning Center.

The Learning Center also offers a variety of services and accommodations to students with disabilities based on appropriate documentation, nature of disability, and academic need. Any student with a documented learning disability needing academic accommodations is requested to speak with me and with Pam Rose, Director of the Learning Center (ext. 2595), as early in the semester as possible. All discussions will remain confidential.

Homework Details

The goal of the homework is for you to practice. In some ways, physics is like a sport or like playing a musical instrument. It is not enough to know intellectually how to throw a football pass or how to play arpeggios on the piano. To actually hit the receiver or make it to Carnegie Hall, you have to **practice**.

For physics, that practice is homework. Like sports or music, it is more important to try than to worry about getting it right the first time. If you already know the solution, it isn't a ***problem***, but an exercise. To encourage you to work on the challenging homework problems, I am grading *partially* on effort.

The important part of your homework is **how** you solve the problem, not the number that you get as a result. If the number were really important, it wouldn't already be in the back of the book. Consultation and collaboration with your fellow students is recommended, but the homework solutions you hand in must be your own work.

To make the homework process more effective, please follow these guidelines:

- No more than two homework problems per page.
    - This is to allow you plenty of room for corrections and room for your ideas. You don't have to use new paper; the clean side of scrap paper from the recycling bin is fine.
- Use algebra when working the problem. Although it seems to make the problem easier, substituting numbers in makes it harder to understand the physics.
- Check your answer at the end to see if it makes sense. Are the units right? Is the order of magnitude of your number plausible?
- **For full credit, your solution must be clear enough to be easily understood by the grader. Your work should be organized and in a logical order. Neatness counts.**

Homework grading scale (patterned off Thomas Moore's approach at Pomona):

5 pts: good effort with no errors (correct results and reasoning and well-explained)

4 pts: good effort but with minor errors OR fair effort (*i.e.* not well-explained) with no errors

3 pts: good effort with modest conceptual or math errors OR fair effort with minor errors

2 pts: good effort with serious errors OR fair effort with modest conceptual or math errors

1 pt: very poor effort

0 pts: no effort

Special cases: Great effort but wrong problem! 2 pts

Correct answer but no work 1 pt

Homework solution outlines will be posted on Woodle. You should use these solutions to correct your work. Seeing and understanding why you made an error is the only way to not repeat the error on an exam!

The secret to success in this course is taking the homework seriously! Work the problems AND then use the posted solutions to see where you may have made errors.

No late homework is accepted.

Homework solutions and corrections

Homework solution outlines will be posted on the website the day that they are due. Depending on whether I have written the solutions myself or not, these "solutions" may skip steps that you should not, so do not consider them a good example of what your work should look like! You should then use these solutions to correct your work.

You may resubmit your corrected homework to earn **up to 2 of the points** that you missed in the initial submission. (You cannot earn more than the initial problem value of 5 points.)

The correction scale is:

2 pts: everything is corrected

1 pt: some things were uncorrected

0 pts: major errors uncorrected

Guidelines for the corrections:

- Corrections should be worked on the original homework problem. Do not recopy the whole thing. If there is absolutely room on your original sheet, circle your error and work the new section of the problem on a separate piece of paper. And next time, be sure to leave enough room in your homework for the corrections.
- Corrections should be done in some different color ink (purple and green generally work well; red works less well because I use red).
- A correction should **indicate the error you made** and include the new steps/calculations to make the problem correct.
- You may submit corrections for up to half of the HW problems due in a given week.
- You may hand in these corrections up to one week after the original was returned to you.

Please note two key points for earning credit on the corrections:

First, you must identify your error. For example "I was confused about which time I wanted" or "I included gravity as an acceleration in x." Something like "I was confused" is not enough. The learning component of the corrections comes from identifying and correcting your error. You need to be specific, or you will not get credit for the corrections.

Second, you must work the problem in your own words and not simply copy the steps from the posted solutions. I am not giving you points for your copying skills. You should compare your work and the posted solution, then I recommend you put the solution away and work the steps to redo the problem without looking at it (except to double check steps). I will not give credit for corrections with substantial missing steps or steps identical to the solutions.

Physics 203 Preliminary Schedule Fall 2010

Week		Date	Topic	Reading
1	M	30-Aug	Course Intro	
	W	1-Sep	Units, Dimensional Analysis, Sig Figs	Ch. 1
	F	3-Sep	1D motion, average speed, velocity, acceleration	2.1-2.4
2	M	6-Sep	Constant Acceleration, freefall	2.4-7
	W	8-Sep	Vectors	Ch. 3
	F	10-Sep	Velocity, Acceleration, Projectile Motion	4.1-4
3	M	13-Sep	Circular Motion, Relative Motion	4.5, 4.6
	W	15-Sep	Forces: Newton's 1st and 2nd Laws	5.1-2
	F	17-Sep	Combinations of forces	5.3-4
4	M	20-Sep	Newton's 3rd Law, Motion with a constant force	5.5-6
	W	22-Sep	Applications: Friction, Springs	6.1, 2
	F	24-Sep	Uniform circular Motion, Fundamental Forces	6.3-4
5	M	27-Sep	**EXAM 1 Chapters 1 - 5**	
	W	29-Sep	Work: Constant and variable forces	7.1, 2
	F	1-Oct	Kinetic and Potential Energy	7.3-4
6	M	4-Oct	Conservative Forces, and potential energy	8.1-2
	W	6-Oct	Other forms of energy and power	8.3-5
	F	8-Oct	Law of Gravitation, Circular Orbits	9.1-3
7	M	11-Oct	Kepler's Laws, energy	9.4-5
	W	13-Oct	Momentum, Center of mass of a system	10.1-2
	F	15-Oct	Motion of the center of mass, energy of the system	10.3-4
8	M	18-Oct	**Fall Break**	
	W	20-Oct	Collisions: Impulse, 1D elastic collisions	11.1-2
	F	22-Oct	Inelastic collisions and 2D	11.3-4
9	M	25-Oct	Rotational Motion, Constant Angular Acceleration	12.1-3
	W	27-Oct	Kinetic energy of rotation, moment of inertia	12.5
	F	29-Oct	**EXAM 2 Chapters 6 - 11**	
10	M	1-Nov	Torque, Newton's 2nd law for rotation	13.1-2
	W	3-Nov	Angular Momentum and Conservation	13.3
	F	5-Nov	Torque and angular momentum as vectors	13.4
11	M	8-Nov	Static Equilibrium	14.1-2
	W	10-Nov	Levers, Pulleys, Elasticity	14.3-4
	F	12-Nov	Oscillations: Simple Harmonic Motion	15.1-2
12	M	15-Nov	Kinetic and Potential Energy in SHO, Pendulum	15.3-4
	W	17-Nov	Damped and Forced Oscillations	15.5
	F	19-Nov	Fluids: Density, flow, Pressure in static fluids	18.1-4
13	M	22-Nov	Archimedes Principle, Fluid dynamics, Bernoulli's equation	18.5-6
	W	24-Nov	**Thanksgiving**	
	F	26-Nov	**Thanksgiving**	
14	M	29-Nov	Thermo: Ideal Gases	Ch. 19.1-3
	W	1-Dec	Thermal Energy, Degrees of Freedom	Ch. 19.4
	F	3-Dec	Heat transfer, thermal expansion	Ch. 20.1-3
15	M	6-Dec	Specific heat	Ch. 20.4-6
	W	8-Dec	1st Law of Thermodynamics, Heat Engines	Ch. 21: 1, 2
	F	10-Dec	2nd Law of Thermodynamics, Entropy	Ch. 21: 3-4

The comprehensive final exam is on Tuesday, December 14, at 7 pm.