

PHYS121 Fundamentals of Physics I

MWF 12–12:50pm in PHY 1412

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Textbooks

The primary textbook for this course is *College Physics: A Strategic Approach*, 2nd Edition by Knight, Jones, and Field (Addison-Wesley publishers, ISBN 978-0-321-59549-2). I will not be assigning readings or required homework problems from this text, but it is invaluable for gaining a different perspective on the material that I present in class. Other perspectives can be gained online, but remember that I cannot and will not vouch for the veracity of every webpage out there. Read what you find online critically and always ask yourself if the source is trustworthy before using material found online in this course. Please note that this book is sold in two forms: a two-volume paperback and a one-volume hardback. The ISBN above is for the single volume hardback, which I recommend because you will need both volumes for the entire 121–122 sequence and the single volume version is cheaper than buying both of the paperback volumes. The book also comes in a variety of packages which bundle different supplements with the textbook. You will not need any of these supplements in this course, so I suggest avoiding the bundles to save money.

For tutorials and labs you will need *Physics 121: Tutorials and Laboratories*, Fall 2006 Edition (ISBN 978-0-470-10771-3). This is a custom book published by Wiley & Sons specifically for use in this course. Because you will be writing in this book for the tutorials, you will need a **new** copy of this book.

You will also need a RF Clicker from Turning Point Technologies. This is the campus standard clicker and thus you may already have one from previous courses. You can also use the ResponseWare software from Turning Point Technologies to turn your smartphone or laptop into a clicker (it's actually cheaper this way). Don't forget that you will need to register your clicker (be it a stand-alone unit, an app simulating one, or the web interface) in order to use it. If you are using a stand-alone clicker you will need to ensure that it is set to channel 6 for each class in order to get participation credit. If you are using an app or the web interface which simulates a clicker then you need to login to session ID Springuel121. You can learn more about clickers, including how to register it, change channels, or set your session ID, at <http://clickers.umd.edu/>.

Class Participation

You are expected to attend all classes—lectures, discussions (tutorials), and labs. Each will involve your participation, including lecture. Most of these activities will result in participation points. Taken altogether participation is a full 20% of your grade.

Lecture

Lectures will be non-traditional and you will be expected to participate. Through the use of informal discussions with your neighbors, coordinated whole class discussions, clickers, and interactive lecture demonstrations I hope to create an environment in which you can express your opinion and contribute to the direction of the course.

Clickers

When clickers are used in class, you only get participation credit (1 point) for answers which are submitted at the appropriate time by using your clicker. You get points for participation only, not for simply attending lecture. If you forget your clicker, it doesn't work, or you fail to submit an answer on time, you won't get participation credit for that question. At the same time, you are encouraged to give your best answer whenever submitting an answer via clicker, but your answers will **not** be graded for correctness. Any submitted answer will get you the participation point. In order to account for the inevitable technological failure, I will offer more opportunities to earn these participation points than is necessary to get full participation credit for the course. Participation above the necessary level will earn you extra credit.

Interactive Lecture Demonstrations (ILDs)

ILDs are worksheets which use a combination of clicker questions, small group work, and whole class discussions to go over a topic in more depth. We will be doing several of these during the course of the semester and you will get 5 points of participation credit for each one (this is on top of the points you get for any clicker questions included in the ILD). Worksheets are to be handed in at the end of class so that I can verify your participation, but will not be graded and will be returned during the next class.

Tutorial

Based on past experience with other courses and instructors, many students find tutorials to be the most valuable element in the class for learning to do exam questions and homework problems.

All discussion sessions are run as group tutorials. — The discussion sessions will be run as group activities using the tutorial worksheets in the Tutorial and Lab Manual. The tutorials have two goals:

1. to help you develop your conceptual understanding of the basic ideas underlying the physics,
2. to help you learn to think about how you know what you know.

Get problem help in the Course Center! — Since we will not be answering questions about HW in the discussion sections, we have set up a Course Center in room Toll 0208. You can come there to check other texts for ideas, to work with other students, and to ask the course center monitor (me or one of the TAs) some questions. Don't expect the monitors to show you how to do the problems, however. The problems are designed so that you learn by thinking about them, not by memorizing them or watching someone else show you how to do them. Monitors are encouraged to ask you questions first, to find out where you are coming from, and then to give you suggestions and hints for what you might try to solve them. Your colleagues are free to tell you anything, but you have to decide if they are right or wrong!

At the end of each tutorial, you will be given a short worksheet to complete at home. This worksheet is designed to review important concepts from the tutorial and/or prepare you for the next one. It is due at the beginning of your next tutorial but will not be graded. Instead, you will get 5 participation points for completing it.

Laboratory

Ya gotta do the labs! — There will be an introductory lab plus 5 two-week labs during the semester. You must complete all of these labs in order to pass this course. This is a requirement in order to meet professional school criteria.

These are non-traditional labs! — Laboratories in this class will involve both exploration and creativity. Instead of being given a long step-by-step procedure, you will be given a question in a sentence or two. You will work in groups of 4 to plan and carry out your own experiment. In a second week you will analyze and model your data mathematically using Excel (a spreadsheet).

Homework

Homework is easily the most important part of this course, both because it carries a full 20% of your grade, and because it is in doing the homework problems that I expect you to do the most learning. There won't be very many homework problems in each assignment, but you should expect every problem to be challenging, so plan ahead and don't leave it to the last minute.

Work together! — Since the problems will be difficult, it may not be easy to do them entirely on your own. You are encouraged to work together, but each member of the group must fully understand how to solve each problem on their own. (“Oh, I see.” is not good enough!) Each person must write up his or her own solution. The best way to be sure to not produce cloned solutions even when you work together is to agree on a solution, then each write up the work independently. Do not all copy from a solution you worked out together on the board. Instead, recreate the solution on your own paper and include discussion and explanations of what you have done. If two or more writeups are found to be essentially identical, both will be reported to the honor council and the grade in the course of the involved students will be subject to the outcome of their proceedings. Likewise, any solution which appears to be a close copy of a solution from a previous year will be submitted to the honor council.

Explanations are essential. — On homework (and on most exam problems) you will be expected to include explanations as to what principles you are using and how you know they are relevant. An answer which only includes equations will not get full credit.

HW is on the web. — Homework will be assigned every Friday and will be due at the beginning of class one week later. Homework will be posted on ELMS and solutions will be posted there soon after they are due. As a result, late homework will not be accepted. Homework will be substantial. (You should expect to spend between 4-6 hours each week on homework.)

All HW must be typed! — Any homework that you turn in must be typed up to ensure legibility. We can't (and won't) grade what we can't read. If you need to include an equation, use an equation editor. We find “ $x = (-b \pm \sqrt{b^2 - 4ac}) / (2a)$ ” just as hard to read as you do. “ $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ ” is much easier to read and understand (despite the smaller fonts used, though there is a limit there too). If you need to include a sketch, you may add that in by hand, but remember to make it large enough and neat enough that the grader can clearly read and understand what you are trying to depict.

New Problem = New Page — Homework grading will be spread out over the TAs and myself so that each problem is graded by the same person for the entire class. This means that we need to be able to split everyone's homework by problem. If you put more than one problem on a page, only the first one will be graded. When you start a problem give it a title (if it doesn't have one already) and state the problem in its entirety on the first page. Subsequent pages can just have the problem title and a page number on them. This way we can tell what problem you are doing, which pages belong to which problem, and what order the pages go in.

Do not staple, put your name and section on every page instead. — Homeworks are scanned immediately after they are turned in and staples jam the scanner. By scanning all the homework, we make it possible to fix things when a page or two get misplaced (something that is almost bound to happen at some point with 200 students in the class).

Since the TAs are only paid for enough time to spend about 5 minutes on each of your assignments (probably less), only one problem per week on the Friday homework will be graded in detail on a basis of 0-5 and will provide you feedback. The rest will be scanned for reasonableness and given a grade of 0 (unreasonable), 1 (somewhat reasonable), or 2 (completely reasonable). On these “lightly graded” problems, you could get full credit and still have all the problems wrong! It is essential that you read over the solutions carefully in order to understand whether you had the right idea or not.

Extra Credit

Besides participation above the required minimum, there is one other way to earn extra credit in this course. Each Friday homework assignment will have 9 problems from the textbook listed on it which you can do for extra credit: 3 relatively easy (1 point each), 3 medium (2 points each), and 3 hard (3 points each). These problems will be graded on a pass/fail basis. Either you did the problem right and get full credit, or either your explanations or work is incorrect and you get nothing. The problems must be typed (just like any other homework assignment) and must follow the format demonstrated in the example problems in your textbook. Problems which are not typed or which do not follow the correct format will not get any credit.

Regardless of how you earn them, you can earn a maximum of 100 extra credit points in this course (the equivalent of 1 full letter grade).

Exams

There will be 3 exams in this course: 2 in-class exams and the final. **All** exams are cumulative, but will concentrate most heavily on the material since the last exam. Like the homeworks, all exams will be scanned immediately after they are administered so that if one (or a piece of one) disappears in the grading process, it can be recovered.

In-Class Exams

The in-class exams will be given on a Friday (tentatively scheduled for October 7th and November 11th) and returned on Monday when we will go over the answers in class. Make-up exams will be on the following Thursday in the late-afternoon/evening (time and place TBD). Anyone may take the make-up exam. If you elect to take a make-up exam, then your final grade for the exam will be the average of your original grade and the grade that you receive on the make-up. Students who carefully consider their errors and understand what they did wrong on the first exam almost always improve. Students who don't do this and just “take another shot” and “study some more” are as likely to go down as to go up.

Missing the Exam — If you miss an exam without a valid excuse (see Attendance, below) then you will receive a 0 for that exam. You can improve this score by taking the make-up, but even a perfect score (100) when averaged with a 0 is a failing grade on the exam (50). If you have a valid excuse for missing the exam, then will not get a 0 for the original exam and your make-up exam score will be treated as your score for the exam.

Regrades — Neither the TAs, nor myself, are perfect when it comes to grading. With 200 exams to grade, we are likely to make a mistake now and then. If you think the grader misunderstood what you were saying, or failed to give you proper credit, you can submit a written (typed!) request for a regrade. This request must include a clear description of why you think you deserve more points and must be

accompanied by the original exam. **Do not write on the exam itself.** If you alter a graded exam and request a regrade I will automatically reported it to the honor committee.

Exams will consist of 5 parts worth 20 points each: 10 multiple-choice problems similar to what you would see on the MCAT (and like the Passage problems in your text book), and 4 longer problems. With the exception of the multiple-choice problems, exam problems will not be standard end-of-chapter problems. You will be expected to think, and to explain your reasoning to obtain full credit. Questions of the type found on the exams will be included in the homework problems.

Final Exam

The final exam for this class is scheduled for December 20th at 8am (the slot assigned to it by the University). It will be twice as long as an in-class exam and thus carries twice the weight. While I will lengthen the multiple choice problem section by simply doubling the number of questions, I reserve the right to use longer problems rather than simply more of them for the rest of the exam.

Grading

The components of your grade break down as follows:

Clicker questions	at least 105 at 1 point each	105
ILDs	7 at 5 points each	35
Tutorial	12 at 5 points each	60
Homework	10 at 20 points each	200
Labs	Scaled to	200
Exams	2 at 100 points each	200
Final Exam	1 at 200 points	200
Total Points		1000

While every effort will be made to keep grading consistent across all lab sections, with 8 sections and several sets of eyes doing the grading, it is nearly inevitable that some inconsistencies will creep in. As a result, at the end of the semester I will look to see if any lab sections have been graded uncharacteristically harsher than the rest, and adjust their scores if needed. Homework and exams, however, will not be adjusted, as the same person will grade a single problem for the entire class.

Extra credit adds to your point total and your final grade will be taken out of 1000 points. This final grade will not be curved.

Attendance

If you cannot attend a tutorial or lab session for a valid reason, as defined by the University attendance policy (<http://www.testudo.umd.edu/soc/atedasse.html>), then you should inform me ahead of time so that alternative arrangements can be made. Excuses after the fact must be documented. In either case, you **must** speak to me about the absence. TAs cannot excuse you from any class activity. Absences without a valid excuse will result in a 0 for any assignments missed as a result.

Honor Pledge

The University has a nationally recognized Honor Code, administered by the Student Honor Council. The Student Honor Council proposed and the University Senate approved an Honor Pledge. The University of Maryland Honor Pledge reads:

I pledge on my honor that I have not given or received any unauthorized assistance on this assignment/examination.

Unless you are specifically advised to the contrary, the Pledge statement should be handwritten and signed on the front cover of all papers, projects, or other academic assignments submitted for evaluation in this course. Students who fail to write and sign the Pledge will be asked to confer with the instructor.

For more information on the Honor Pledge visit <http://www.studenthonorcouncil.umd.edu/>.

Students with Disabilities

If you have a disability which would interfere with your performance in this course and would like to request accommodations, you must consult with Disability Support Services and obtain an Accommodation Letter from them. Once you present me with this letter, I will make every effort to follow the requested accommodations where doing so can be done without compromising the learning experience of the course.

Semester Calendar

This calendar is subject to change and is not considered to be part of the syllabus proper.

Lectures

MONDAY	WEDNESDAY	FRIDAY
Aug 29th	31st Introduction, Quantification, Scales, and Estimation	Sep 2nd Mechanism, Measurement, and Math: Dimensions and Units
5th Labor Day No Class	7th Coordinates and Graphs	9th Velocity: Average and Instantaneous
12th ILD 1— Position and Velocity Graphs: Checking for Coherence as a Mistake Avoidance Strategy	14th Velocity Graphs and Examples	16th ILD 2— Velocity and Acceleration: What if Something Violates Common Sense? Looking at it Another Way
19th How Do Things Move? Newton's Laws	21st Examples	23rd The Implications Game: Newton's 3rd Law
26th Gravity	28th Free Fall	30th Projectiles: The Second Dimension
Oct 3rd Examples	5th ILD 3— Reconciling Intuition by Looking at it Another Way: Newton's 3rd Law	7th Exam I
10th Exam I review	12th Properties of Forces: Friction and Normal force	14th ILD 4— Deriving Conservation of Momentum from N2 & N3: The Search for Coherence, pt. 1
17th Work and Energy in 1D	19th Work and Energy in 2D: Dot Product	21st Energy Conservation
24th Collisions	26th Collision Examples	28th Circular Motion, Kinematics
31st ILD 5— Circular Motion	Nov 2nd Circular Motion, Forces	4th Circular Motion, Angular Variables

MONDAY	WEDNESDAY	FRIDAY
7th 29 Torque, Cross Products	9th 30 Center of Mass	11th 31 Exam II
14th 32 Exam II review	16th 33 ILD 6— Rotational Energy	18th 34 Properties of Matter: Density and Pressure
21st 35 Buoyancy Examples	23rd 36 Universal Gravitation	25th Thanksgiving Recess No Class
28th 37 Fluid Flow	30th 38 Temperature, Specific Heat, and Change of State	Dec 2nd 39 ILD 7— Heat and Heat Flow
5th 40 The Atomic Structure of Matter: Diffusion and Brownian Motion	7th 41 Transforming Energy: The First Law	9th 42 Transforming Organization: The Second Law
12th 43 Pulling it All Together	14th	16th

Final Exam: December 20, 8–10am

Tutorials

September 7–13:

TUTORIAL 1: The meaning of speed

September 14–20:

TUTORIAL 2: Interpreting graphs and equations

September 21–27:

TUTORIAL 3: Counterintuitive ideas: Newton's third law

September 28–October 4:

TUTORIAL 4: Reconciling common sense and Newton's laws

October 5–11:

TUTORIAL 4A: Velocity and acceleration in two-dimensions

October 12–18:

TUTORIAL 5: The purpose of free-body diagrams

October 19–25:

TUTORIAL 6: Relating equations to common sense: "Oomph"

October 26–November 1:

TUTORIAL 7: Work and energy

November 2–8:

TUTORIAL 8: Common sense and equations: Torque

November 9–15:

TUTORIAL 9: Properties of matter

November 16–22:

TUTORIAL 10: Making sense of pressure in a liquid

November 28–December 1:

TUTORIAL 11: Reconciling arguments: Gases in containers

December 5–8:

TUTORIAL 12: Temperature

Labs

September 12–16:

LAB 1: Reaction time

September 19–23:

LAB 2: Grandfather clock: Part 1

September 26–30:

LAB 3: Grandfather clock: Part 2

October 3–7:

LAB 4A: Let It Roll: Part 1

October 10–14:

LAB 4B: Let It Roll: Part 2

October 17–21:

LAB 5: Endangered Creatures

October 24–28:

LAB 6: There's no such thing as a free launch: Part 1

October 31–November 4:

LAB 7: There's *still* no such thing as a free launch: Part 2

November 7–11:

LAB 8: Roller coaster of statistically likely doom: Part 1

November 14–18:

LAB 9: Roller coaster of statistically likely doom: Part 2

November 28–December 2:

LAB 10: Gravity: Part 1

December 5–9:

LAB 11: Gravity: Part 2