

Physics 131

Introduction to Physics I

Spring 2016
Dr. Toggerson

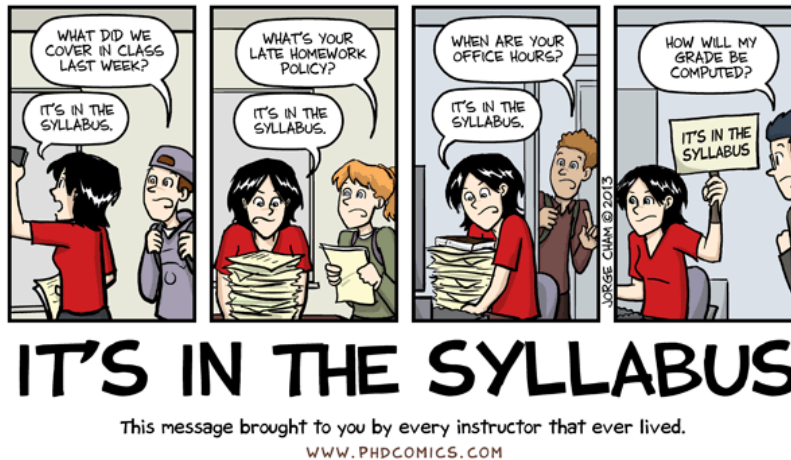


Figure 1: "Piled Higher and Deeper" by Jorge Cham. www.phdcomics.com

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OFFICE HOURS: TBA, but see note below!

CLASS SESSIONS: We meet Monday, Wednesday, and Friday. The time at which we meet is the same for all three days and specified by your section and given in the table on the top of the next page. Note, I teach all of these sections. Thus, if you email or try to meet me at these times, I am unavailable. This is a team-based learning class and you will be beholden to your team-members in your section. As such, you may not attend a different section! On SPIRES, Monday and Wednesday are listed as "lecture" and Friday is listed as "Discussion." In reality all three sessions will be essentially the same – we had to do this to make SPIRE work.

LABORATORY: Based upon some discussions that have occurred since the sign-up period, we are convinced that we can improve your laboratory experience by doing all of the lab activities within the TBL environment during regular class sessions. This will ensure that the laboratories directly correspond to what we are discussing in class (in the past they often got way out of sync). **As a consequence, you will NOT be required to attend any of your laboratory times and are free to schedule other activities during those hours.**

Section	Time
PHYS 131-02	9:25 – 10:40
PHYS 131-03	10:50 – 12:05
PHYS 131-05	2:40 – 3:55
PHYS 131-06	4:00 – 5:15

About the course

Physics 131 is the first semester in a two-semester course on introductory physics. No calculus is required for this course. However, we will assume some familiarity with algebra, and basic trigonometry. To see a full list of what we are going to learn, look at the “What are we going to learn in this class?” document available on Moodle.

The Team-Based-Learning (TBL) format of this course

Think about a previous math or physics class you have taken. I will bet it followed the format: content and simple example problems presented in lecture with more difficult problems done on your own for homework. In fact, most of my teaching evaluation comments are along the lines of, “I wish we did more examples in class.” The idea of this TBL course is that you can be exposed to content and simple examples on your own. Then, in class where you will have the support of your classmates and instructors, you will work more challenging problems. Thus, essentially all of class time is spent working in teams to learn how to *apply* the ideas you learned on your own.

Why TBL?

There are many scholarly articles which clearly indicate that learning is an active process – I cannot just put information in your heads as in the *Calvin and Hobbes* comic. Lecture is an inherently passive process. In a lecture, we sit, listen, and take notes. If you are anything like me, the main benefit of lecture is really the notes. I know that when I take a lecture-based class, most of my learning comes from doing the problems and making study materials while using my notes as a guide. The research supports this experience. I want you to be in the classroom with me and my staff when you are working on this part of the learning experience. If you would like to see some of the literature on this, a list of some of the works which have provided the theoretical basis for this class is provided on Moodle.



Figure 2: A common but incorrect perception of how people learn

Ok, so learning is active, but why the *team* part of TBL?

Again, the reason you will be working in teams is based in research. Research indicates that learning is, in addition to being inherently active, is also an inherently social activity. We have all been in the rut where we can't figure something out, but as soon as we bounce ideas off someone else, we get it. That experience is a manifestation of the social aspect of learning: being forced to articulate your ideas clearly and bouncing ideas off of others improves learning and problems solving skills. In addition, the vast majority of you are interested in the science or health fields. In these fields, the lone-genius working by themselves, an archetype which is so prevalent in our culture, no longer exists (if they ever did)! To work in the science and health fields, you need to be able to work with others on scientifically challenging tasks. I am speaking from experience on this issue, the picture below shows a *small fraction* of the 3000-person collaboration of which I was a part as a Ph.D. student.



Figure 3 A small fraction of the 3000 person ATLAS collaboration at CERN

I do recognize, however, that many of you may have had a bad experience with teamwork in a class in the past. To that end, the mottoes of this class are

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- 1) *You are beholden to your team, not to me, for your team performance.*
 - 2) *Your team cannot hurt you, your team can only help you, but your team cannot save you!*
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How this course will be structured

Teams

How big are the teams and how long will they stay together?

On the second day of class, you will be organized into teams of **five**. These teams will be heterogeneous in many dimensions and will be constructed using the iPeer software. **You will stay in the same teams for the entire semester.**

Will team performance be evaluated? (Or “How do the team’s points get distributed?” or “What if one of my teammates is a slacker?”)

Team activities will be graded, and that grade will be applied to everyone in the team, regardless of who is present. However, to make up for teammates who may not be pulling their weight, there will be a peer-evaluation system at the end of the semester. In this process you will evaluate the performance of your fellow teammates. The scores of this evaluation will be used as a multiplier for team-based grade items as described in the “How will my grade be determined?” section below. In order for you to get the feedback you need to get better as a team-member we will do practice peer-evaluations after each unit.

What if I am absent?

As stated in team motto #1, you are not beholden to me for your team performance, you are beholden to your teammates. You need to let your *team* (not me!) know when you are going to be absent and why. You and your team will have an opportunity in-class to discuss what constitutes reasonable absences, and your team is responsible for taking attendance. This attendance roster will **not** figure directly into your grade but will serve as a reference document for doing evaluations. If you are absent, I recommend finding a way to make it up to your team by taking on some other responsibility.

Units

This course will be organized into five units:

- I. Mathematical Tools and Foundational Concepts
- II. Newton’s Laws and Forces
- III. Forces and...
- IV. Conservation Laws
- V. Thermodynamics and Statistical Mechanics

Each unit will last between two and three weeks. For complete details of what we will learn in each unit, please refer to the “What are we going to learn in this class?” document on Moodle.

Within each unit, what will happen?

Before the first day of the unit: Readings

You will be assigned various materials for content delivery including but not limited to readings from the OpenStax textbook (see the section on “What do I need for this course?” below), readings from other sources, and various videos. Guides, including a list of objectives for what I want you to accomplish on your own, will also be provided. **In addition, you are encouraged to come to office hours for help understanding ideas from the reading!**

Before the first day of the unit: Homework

In addition to your reading, you will also have a homework assignment which will be due before the unit begins. **This homework is meant to help you learn and provide practice on the material before you come to class.** This is perhaps one of the biggest differences between this environment and a typical lecture-based course: the homework is due before the unit begins! If you think of a typical math/science homework assignment, there are easy problems at the beginning and harder ones at the end. This homework will only be those easy problems. **We are NOT expecting you to gain a complete mastery of all of the material – only a proficiency with the basic ideas.**

The homework will be done using the online MasteringPhysics homework system. More details on this system are provided in the “What do I need for this course?” section below. The assignments will have two parts: a learning part and an adaptive follow up. The full assignment for a unit may appear as many smaller assignments on MasteringPhysics to break things up a bit for you!

For the learning part of the homework, you will have 6 attempts to answer each question. For most questions, you will not lose any points for needing multiple attempts. For multiple choice questions however, you will lose $1/(n-1)$ points for each attempt (to prevent people from just guessing to get the correct answer!). **Don’t wait until you are almost out of attempts to get help! Give a problem 2 or 3 serious tries and then get some help from me, a TA, or one of your colleagues!** Some questions have “Hints.” If you manage to complete the problem without using the Hint, then you will get a 2% bonus! Some hints have questions buried in them. These in-Hint questions can be used to regain some points that you may have lost by using multiple attempts. Be aware, however, that not all problems will have Hints.

After the learning part of the homework is the adaptive part. For this part, MasteringPhysics will use your answers to give a set of problems that are specifically tailored to what you need to work on. You will have six attempts per question in this portion as well. However, since by this point you will have already had some practice in the learning part, there will be a 3% deduction for each attempt. Note that at this rate, even if you use all 6 attempts you are only down to an A- given the grading scale for this course! In this adaptive portion, you still get the 2% bonus for not using the Hints.

Given that the purpose of this assignment is to ensure that you are ready for class, no extensions on homework will be given – you will be given the assignments with plenty of lead time to complete them. I recommend you start early and come to office hours if you have questions! You are permitted (and in fact encouraged!) to work with other students on these assignments. Again, I encourage you to come to office hours to get help!

On the first day of the unit: RATs and fill-in some blanks

The first day of the unit will be for Readiness Assessment Twizzes (a Twiz is between a quiz and a test ☺) to make sure that you are ready and to provide me an opportunity to see where the class is at and fill-in any major gaps. A Twiz is between a test and a quiz and are closed book and notes. However, equation sheets will be provided. You will come in and take a multiple choice question exam individually, an iRAT. After you have turned in your iRAT, you will then work with your team to complete the same Twiz (a tRAT). Your total RAT grade for each unit will be the average of your iRAT and your tRAT scores. After these are complete (they will be graded the same day) we will, as a class, have a discussion on the most difficult points. *This is as close as we will come to a lecture in this class!*

If you are absent on the day of the RAT, it is *your* responsibility to contact me within **72 hours** (extensions will be granted in only EXTREME circumstances) to sign up for a makeup RAT. This RAT will be different than the one in class and your individual performance will count for 100% of your RAT score for that unit.

On the rest of the days of the unit: Application

For the rest of the days we will be working on activities to help you learn to apply the ideas that you were exposed to before the unit began. Most of these activities will be done in your teams, but some will be individual. These activities will include:

- Solving problems similar to what would be the hard problems on the homework for the unit
- Laboratory-type activities to help you connect physics to the real world and better understand data
- Constructing definitions for ideas and concept maps to help you see the big picture
- Evaluating and critiquing other teams' work. In addition to a great exercise in of itself, this will also provide you clarity on how exams will be graded.

Some of these problems will be turned in for a grade. The grade will be team-based. Everyone, present or not, will receive the same grade. **However, note that if you are absent too much or do not contribute, that will almost certainly hurt your peer-evaluation scores!**

Note, there are no challenging homework problems for you to complete for a grade on your own. If you want additional practice on more challenging problems, there will be sets of additional practice problems available online. These problems will not be graded. They are only there for you. These sets make a great way for you to test if you have a mastery of the material without your team!

In-class behavior

During class, I expect you to be participating with your team in the activity we are engaged in that day. Therefore, if I see you on Facebook etc. or doing work for another class, I will ask you to leave. In a lecture class, I don't really care what you do as you are only hurting yourself in that situation. In this environment, however, you are bringing down your entire team.

Exams

What is the point of the exams?

This is a question you may not have thought of before! Here are my goals for the exams:

- To check your grasp of the basics of the fundamental relationships in physics
- To see if you can APPLY the fundamental ideas we have learned to NEW situations
- To see what you do NOT know so I can try to correct the errors

In order to achieve these goals, the exams have two main attributes. **First, the exams will be problems you have not seen before.** I want you to be able to use the ideas and reason as a physicist – not just memorize solutions to problems you have seen. Second, the exams are hard. I cannot figure out what you don't know if I don't ask questions you cannot answer. Due to this fact, exam averages in the 60's are not uncommon (you will see this happen again in higher level courses!). However, I am not out to crush your GPA. There are plenty of other opportunities in the grading scheme to compensate.

How many exams will there be and what will they cover?

There will be two midterm exams and one final. **All exams are cumulative, but will focus on the most recent material!** Thus, the final is really just the same as another exam. The first exam will cover units I and II. The second midterm will cover through unit IV and the final will, of course, cover all of the material. A practice exam will be provided for each exam so that you can see the format before the actual exam. Each exam will have both an individual portion and a team portion.

What do we get to bring to each exam?

The exams are closed-book and closed-note. You will be permitted to bring calculator.

In alignment of my goal that exams should be more about application than memorization, an equation sheet will be provided for you. You will **NOT** be able to bring your own equation sheet. However, the equation sheet will be provided well in advance. I recommend that you use it to solve problems in class so that you can become familiar with it. The equation sheet will only have physics-related equations and data (fundamental constants etc.) on it. As budding scientists, there are certain mathematical relationships, such as the volume of a sphere, which we do expect you to have memorized. A list of these relationships will be provided so that you know.

How does the individual portion of the exam work?

The individual portions of the exams will take place outside of regular class-time at night with the days and times to-be-announced. I want this course to be as accommodating to as possible and allowing the maximum number of students to have the same class experience. As such, exams will be written to take about one hour. However, *everyone* will be given double time (2hrs total) to complete them thereby removing any need for extended time accommodations less-than or equal-to factors of two. Of course, arrangements for other accommodations such as reduced distraction environments, will be provided for those students who arrange for them through disability services. **The tentative dates for the individual exams are March 1st for Exam I and April 12th for Exam II. These are tentative. You will be notified when we finalize them. The date for the final will be announced as soon as we schedule it with the University.**

What about the team portion of the exam?

On the class-period after the exam, you will be given essentially the same exam to complete as a team (I reserve the right to make changes between the individual and the team!). This team exam provides a great opportunity for you to use the exam to learn! Your final score for each exam will be a combination of your individual and team scores. The procedure for the last exam will be determined and announced well in advance.

How should I prepare for the exams?

This is something that we will spend a bit of time on in-class. However, if you find yourself memorizing a lot of formulae, or trying to memorize the solutions to “ramp problems” and “pulley problems” then you are probably going about it the wrong way. If you have questions, I encourage you to come to my office hours and we can discuss ways for you one-on-one.

What do I need for this course?

Textbook

To keep your costs down, we will be using the OpenStax physics textbook as the basis for this course. Most of the readings will be from this book. It is available at <https://openstaxcollege.org/textbooks/college-physics> in many formats. A paper copy is available in the library as well. If you would like your own paper copy, you may order one from that same link. There may be additional readings in other places from other sources. These links will be provided to you when needed.

ABCD Voting card

In an additional effort to save you money, we will not be using clickers in this class. Instead, we will be using a piece of paper. One will be handed out to you on the first day of class. If you need a new one, a pdf will be on Moodle and you can print out a new one. **Please do not make your own.** The color scheme on these cards is chosen carefully so that I can read them from across the room. It is often difficult for me to read cards that students make.

MasteringPhysics Account

This is how I will organize the readings and other delivery materials. In addition, this is where the before-unit homework will be completed. As stated above, there will also be optional additional problems in this system. To sign up for an account, go to http://www.pearsoncustom.com/ma/umass_physics/. You only need the \$35.00 MasteringPhysics account, you do NOT need the additional eText, but are free to purchase it if you desire. The signup code for the class is MPTOGERSON93014.

Calculator

Not only will you need it for exams, but for in-class materials as well!

Optional: A camera

Access to a camera (such as on your phone) may be helpful. You will often be working as a team on the whiteboards and being able to take a picture of your work to review and annotate later may be useful. There are many good apps for taking pictures of whiteboards such as OfficeLens by Microsoft.

How is my grade computed?

If you have not read the section on the elements of the course above, please do first. This section will not make much sense otherwise!

How much is each component worth?

Individual components (61% total)		Team components (39% of total)	
Online Homework	10%	Laboratory and other in-class activities	18%
iRATs	9%	tRATs	9%
	(50% of total RAT score)		(50% of total RAT score)
Individual Exam I	14%	Team Exam I	4%
	(78% of total exam score)		(22% of total exam score)
Individual Exam II	14%	Team Exam II	4%
Individual Exam III	14%	Team Exam III	4%

Remember, your team score will be multiplied by a factor based upon your peer-evaluation at the end of the semester!

What is the grading scale?

	A	≥ 86%	A-	≥ 83%	
B+	≥ 80%	B	≥ 77%	B-	≥ 73%
C+	≥ 69%	C	≥ 65%	C-	≥ 60%
D+	≥ 55%	D	≥ 50%	F	< 50%

An 86% is guaranteed to be an A. I reserve the right (but not the responsibility) to lower this scale if needed. Such a curve is collaboration friendly (this is a *team-based* learning class after all!). I am not looking for a specific number of A's. If everyone gets above an 80%, then everyone in the class will get an A. If everyone has an 85, then everyone will get an A. **Helping and working with your fellow students will NOT hurt your grade in ANY WAY.**

What do I need to do to get an A?

This scale is developed on the assumption that an A student will have the following averages

Individual components		Team components (Multiplier of 100%)	
Online Homework	100%	In-class activities	90%
iRATs	90%	tRATs	90%
Individual Exam I	80%	Team Exam I	85%
Individual Exam II	80%	Team Exam II	85%
Individual Exam II	80%	Team Exam III	85%

Similar tables for B and C are available on Moodle.

Questions about grading

While grading so many problems and exams mistakes do of course happen. However, as a rule the number of mistakes in your favor usually balances the number of mistakes against you. If you would like a regrade please bring the assignment to me **WITHIN ONE WEEK** of the date that the assignment is returned and I will regrade the **ENTIRE** assignment. It is possible that you can end up with a lower score. Requests for regrades at the end of the semester will not be considered.

Office hours

My exact office hours will be published on Moodle soon after the start of the semester. While I will try to have a variety of times, please be aware that with 400 students it is impossible for me to pick times that work for everyone's schedule. If my office hours do not work for you, please do not hesitate to make an appointment and we can schedule another time to meet. This coming semester, however, I will not be able to meet on Thursdays. **I encourage you to come to office hours with questions on preparatory readings, before-unit online homework, studying tips, and anything else! Don't wait to come in!**

Cheating

While this is a team-based learning class, there are individual portions, in particular the iRATs and the individual exams. I should not even have to say this, but cheating will not be tolerated on these individual activities. If you are caught cheating on an exam, the minimum consequence is that you will fail the class. Furthermore it is my responsibility to report you to the Dean of Students. Also, all students are expected to abide by the student policies at https://www.umass.edu/dean_students/campus-policies

Final thoughts

I want you to be successful in this course, however for a significant portion of this class you are responsible for your own learning. Each person learns differently, if your current habits are not yielding the results you want, please come and see me. I know quite a few techniques that I have used as well as techniques used by my colleagues in undergraduate and graduate school. We can work together to find study techniques that work for you.

It is the University's goal that learning experiences be as accessible as possible. If you anticipate or experience physical or academic barriers based on disability, please let me know immediately so that we can discuss options. You are also welcome to contact Disability Services (413-545-0892) to establish reasonable accommodations. Please be aware that the accessible table and chairs in this room should remain available for students who find that standard classroom seating is not usable.

My door is always open!