Phys 174 - Fall 2017
Section 1340 - Kuo

Lectures:
Mon & Wed 6:00 - 7:40 pm - 343 Alumni Hall

Discussion Sections:
1350 - Mon 8 pm - 316 Old Engineering Hall (Brian)
1360 - Mon 8 pm - 210 Thaw Hall (Lisong)
1370 - Wed 8 pm - 210 Thaw Hall (Brian)
1380 - Wed 5 pm - 210 Thaw Hall (Lisong)
1385 - Wed 5 pm - 105 Allen Hall (Brian)

Instructor:
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TAs:
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Undergrad TAs:
Benjamin Lestourgeon BCL33@pitt.edu
Michael Shulock MAS698@pitt.edu
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Problem-solving Sessions/Office Hours:
The schedule will be posted on Courseweb.
If you need an individual meeting with any of us, just ask. Send your TA or me an email.

WHAT YOU NEED

- FlipIt Physics: I'll assign video "prelectures" and "checkpoint" questions before each lecture, so this is required. **The Course code is "pittkuo174". Once you enter the course code, enter your Pitt username (first part of your email address) as your "unique identifier."** If you don't do this, it'll be hard to assign you credit. The bookstore is selling access codes, but you can also click on "purchase" after you register for the class.

- There's no required textbook for this class, but I definitely recommend getting one. The usual book for this course is Halliday, Resnick, and Walker, *Fundamentals of Physics*, 10th edition. It's listed as "recommended" at the bookstore. If you plan on taking Phys 175 next, there is a pretty good chance that this is the book you'll use, so it might be a good investment. However, **I'll never require anything out of the textbook, so you can get an old edition to save money**.

  Feel free to use any other equivalent calculus-based physics book (some pretty standard ones are one by Giancoli and one by Tipler & Mosca). Most intro, calc-based, physics textbooks are the same: a good reference, but horrible to learn from. I've heard that the book by Cummings, Laws, Redish, and Cooney is actually an improvement on the standard textbook, but it's out of print. You might be able to find a used copy.

WHAT THIS COURSE IS ABOUT

"The whole of science is nothing more than a refinement of everyday thinking."
- Albert Einstein, 1936

This course is about forces and motion.

1) The first (and most important) thing to realize is that you already know an awful lot about pushing, pulling, hitting things, how they move or don't. I don't mean your prior physics course, if you had one. I mean stuff every 8th grader knows: that it would hurt to kick a bowling ball, that it's harder to pick up and move a couch than a stool, how far you go in 3 hours if you're driving 30 miles/hour, and so on. That's all common sense or "everyday thinking," as Einstein called it. This is really and truly the beginning of physics.

   But this is just the start, because while your common sense is important and useful, it can also be inconsistent. Here's an example: Part of common sense says that covering something keeps it *warm*, such as your hand with a mitten or a blanket. Another part says that covering something keeps it *cool*, such as your hand with an over mitt or a potholder. An idea can be really obvious in one situation, and the opposite idea can be obvious in another.

   If you wrap an ice cube in a nice, thick blanket, will it melt faster or slower than if it was unwrapped? Stop here and take 10 seconds to make a prediction. Do you see how the different common sense ideas would predict opposite results? There is obviously an answer, but it's interesting how often people make the wrong prediction. That's why this course is about **refinement of everyday thinking.** We'll practice building a "physics intuition," so we know how to decide what ideas are right and what ideas are wrong.

2) The second most important thing to realize is that this **refinement involves finding the flaws in reasoning that goes wrong**. Whatever you predicted for the ice cube, if you were thinking about it honestly based on what you know about the world, you were being sensible and intelligent. If your prediction was wrong and you want to learn, you need to study that incorrect reasoning, to figure out why it didn't work. You need to figure out what about that reasoning needs repair.

   Learning in science isn't just about acquiring information and finding the right answers. It's about building, assessing, and repairing a network of ideas. It will help to think about what an 8th grader would know, what works about it, and what needs refining. It also helps to get evidence from the physical world, from experiments and experience. It will also help to think through and argue about different lines of reasoning. It will help to be confused (temporarily), because if we can say what is confusing, we can start to untangle it.

3) The third most important thing is how useful math is for reasoning. You might think of math as separate from common sense. It's common to think of learning physics as memorizing formulas and how to use them. But math is about ideas, and it's an invaluable part of refining everyday thinking. We'll use math to express ideas precisely, and this will help us arrive at new ones.

SOME ADVICE ON HOW TO STUDY, DO WORK, AND LEARN IN THE COURSE

I think about learning any topic like going to the gym. It's important to put in effort, but it's also important to do the exercises correctly with good form. Good form makes the workout harder, but over time, you'll get much stronger. If you're doing the exercises with bad form, it doesn't matter how much effort you put in. You won't get all the benefits, and you might even get hurt!

In learning physics, trying to pick out the right equation and manipulating symbols to get the answer is bad form. Instead, try to thinking about what is going on in this system in words. Draw a picture. Write out a story for what's going to happen in this system. Then, try to describe that picture or story with math that we've learned. This is good form, and it is not quick and easy, but it will help you learn how to solve more problems in the future.

Use the problems in class and on homework to help you discover gaps and confusions in your understanding. That's the whole point. Don't shy away from confusion. *Look for it*, and try to pin down a specific question. This isn't easy, but that's why you have me and the TAs: to help you learn how to look for confusion and learn from it.

Sometimes people are afraid to admit confusion. It's easier to say the right answer and move on, but this is a short term fix. Everyone experiences confusion at times (even physics teachers!). Learning physics doesn't mean you should never be confused. It means that you should *not be afraid* of being confused. In this class, as we learn physics, we'll practice getting confused and using that confusion to make the ideas fit together better. By attacking all the confusing points in class and working them out, we'll lower the risk of getting confused later (for instance, on an exam).

Anyways, here are some particular points of advice:

1) Don't just find a way to solve a problem and move on to the next one. That's bad form. Try to articulate what you've learned from solving the problem. What ideas can be used to solve a problem in the future? Can you explain the solution to someone else in simple language (like to an intelligent 8th grader)? Don't let fancy vocabulary or math hide confusion.

2) Think about what someone like that intelligent 8th grader might ask you about what you've explained. Imagining "What questions might someone have here?" can be a great way to identify gaps in your own understanding. One benefit of working with other people is that they might actually ask you those questions.

3) Be able to explain what's wrong with reasoning that leads to wrong answers. It's often true that one line of reasoning takes you in one direction and another takes you in a different direction. It's not enough to know which direction is right; you need to be able to explain why the other direction is wrong. Again, when you work with other people, they'll help you identify other ways of thinking.

4) Come up with problems yourself. They might be new questions based on a problem you've solved: What if there is friction, what if the two cars had equal mass, whatever. That's how I come up with questions for exams: I look at problems we've solved and think of variations. Lots of times in class, students come up with variations too. Not just same problem with new numbers, but variations that need new reasoning.

WHAT HAPPENS IN THIS CLASS

Before Class
You'll watch"prelecture" videos and answer "checkpoint" questions online at flipitphysics.com (course code: pittkuo174). Typically, I'll assign them before every lecture (to be completed 15 minutes before the lecture starts). The prelecture videos are about 20 - 30 minutes long and the checkpoint questions are short checks of what you got out of the videos. You get credit just for completing the prelecture and checkpoint (you don't have to get the checkpoint questions correct). The point is to give you some initial information, stuff that you can read and listen to that I would otherwise just waste time saying in class.

Some people would rather read from a textbook than watch the videos. If you are one of these people, come speak to me about special accommodations.

During Class
Lecture is where we get down to work. This is like having a training session at the gym. There will be a lot of thinking about, answering, and talking with others about some "clicker" questions, where the whole class votes on what they think the answer is. This is where we start really tackling confusion. You don't have to get the answer right; the idea is to get you thinking about and refining your everyday thinking. You'll get a small amount of participation credit just for voting your answer.

Some students object to participation points in lectures. If you are one of these people, come speak to me about the possibility of calculating your grade only with homework, other assignments, and exams.

Discussion sections meet once a week with a TA. The idea is to have time for more extended, in-depth discussion, and collaboration. You get participation credit for attending discussion sections.

At times, in lecture or discussion sections, there might be a short written practice question that is also collected for participation credit. Again, these are meant to be practice for the kinds of written questions on the exam.

After Class
Most weeks will have a homework assignment. The homework problems in this class are different than what you might expect. It's getting repetitive at this point, but I write problems with specific goals in mind, including (1) helping you practice being confused and (2) to press for the real robust understanding that comes out of recognizing and grappling with confusion.

I don't want homework to be showing you a technique for solving a certain kind of problem and then having you practice that technique. This kind of task used to matter more, but now we have computers and they are much better at routine calculations than people can ever be. What computers don't know how to do is pick out an idea that applies to a situation and reason through how to use it. This is what you should be practicing.

On the homework, you should worry about (1) being clear and (2) being coherent about what you think the answer is. I care almost 0% whether or not you solve the homework problems correctly. I do care that the homework problems are helping you learn. For me, it's a win if you take an honest shot at a problem, get it wrong, and then learn from reading the solutions. It's not helpful if you get the right answer, but don't engage with the underlying ideas. Grading will reflect this.

If you get stuck on the homework, it's great to talk with other students, your TAs, or me. Post a question to the CourseWeb class discussion forum or look at what others have posted already. Even if you're not stuck, it's great to work with others, to check your thinking against their. Maybe there's something they've thought of that you haven't.

Although you are welcome (even encouraged!) to discuss the homework with others, your homework solutions should be your own. One way to make sure of this is, after you understand how to do the problem, to sit quietly by yourself and, with no notes, references, or help of any kind, write up the solution in your own words. You can prove to yourself that you understand it, and there will be no danger of copying something directly from someone else.

DANGER: Please don't ask anyone, or even *permit* anyone, to just tell you "how to do it." Being right on a problem is of no value if you haven't understood what you were doing. Being wrong in a thoughtful way is almost always of value.

GRADES

There are three grading categories. For each, I'll weight the points appropriately and add them up to get your total grade. I don't grade on a curve. Instead, I decide from my expectations how many points should constitute an A, B, C, etc. If everyone does well, everyone gets an A. If it turns out my expectations were unreasonable, then I may raise grades.

Participation: 25%.
This is made up of prelectures and checkpoints, clicker points in lecture, and attendance / activities in discussion section. These are designed to be "easy" points. Just show us that you're putting in the effort to learn physics.

Homework: 25%.
Sometimes students view the homework as proving to the teacher that they know the right answer. That's not the case in this class. The homework is designed to help you work through difficult ideas. The main thing we're looking for is honest, sensible effort - does what you're saying and doing make sense? One way to frame the homework is as teaching a friend from class how you're thinking about the problems. Even if the final answer is wrong, if the ideas and approach are understandable, then you'll receive at least partial credit. The right answer with no reasoning will get no points.

Exams: 50%.
This is where you show off what you've learned. We want to see that you've made genuine sense of the ideas, and that means answering questions correctly and with understanding. That's most of the exam, and I try to write questions so that memorizing without understanding won't work.

There will be 2 midterms and a final exam, which will all count equally. (During the course, I'll announce some "deals" to reward improvement).

ABSENCES AND EXCUSES

If you have a valid excuse for missing an exam or homework assignment, see me to arrange what to do about it, beforehand if at all possible. Sometimes this isn't possible, of course, but see me as soon as you can. You probably have a sense of what valid excuses are - emergencies, illnesses, jury duty - and what invalid excuses are - for example, family vacation. When I'm in doubt, I'll ask your dean. And you must see *me*, not your TA.

ACADEMIC INTEGRITY

I take academic integrity seriously. Using illegal resources on an exam is cheating. Copying or paraphrasing someone else's work, either a friend's or from the internet, is a violation. Anytime you present someone else's work as your own, or you make it look as though you did work you didn't, that's academic dishonesty. That certainly includes having someone else use your clicker in class.

The official text from Arts & Sciences below:

"Cheating/plagiarism will not be tolerated. Students suspected of violating the University of Pittsburgh Policy on Academic Integrity, from the February 1974 Senate Committee on Tenure and Academic Freedom reported to the Senate Council, will be required to participate in the outlined procedural process as initiated by the instructor. A minimum sanction of a zero score for the quiz or exam will be imposed."

ACCOMMODATIONS AND SPECIAL CIRCUMSTANCES

Please let me know right away if you need particular accommodations for a documented disability, or if there are any other special circumstances that might affect your learning and experience in the course.