

Physics 2210 General Information

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Office hours: 9:00–9:50 daily. I'll often be available in the afternoons as well, but I usually will *not* be available during the hour before our class. My full schedule is posted next to my office door. Feel free to make an appointment if you like.

Recommended texts: Knight, *Physics for Scientists and Engineers* (Addison-Wesley, 2004), or Halliday, *et al.*, *Fundamentals of Physics* (Wiley, any edition since 1990), or any similar text intended for calculus-based introductory physics. If you plan to take Physics 2220, be sure to get a version that includes chapters on quantum physics and nuclear physics.

(Which text is best? It depends on your learning style. The book by Halliday, *et al.*, takes a “just the facts” approach that’s probably more convenient for looking things up in a hurry—but it doesn’t explain every concept in detail or address all the common misconceptions. Knight’s book is better for students who like to read, but other students may find it long-winded and there are a couple of important topics that it doesn’t cover. Both books are very good overall, and there are other equally good books that you can use if you already have them. Your homework assignments will be written out in full, so you won’t need a textbook just to know what problems are being assigned.)

Required Materials: Everyone will need a scientific calculator (good ones can be purchased for as little as \$10). You will also need a ruler and protractor.

Course Outline

- 1. Describing Motion.** In physics we describe an object’s motion using precise mathematical ideas, like velocity and acceleration. This part of the course introduces these terms, postponing the question of *why* things move as they do.
- 2. Forces Cause Acceleration.** We now take up the reasons why objects move in various ways, as first given by Isaac Newton. Surprisingly, we find that *motion*, in and of itself, has no known cause: things naturally continue to move when left alone. It is the *acceleration* of an object that is caused by forces from surrounding objects. Whenever two objects interact, they exert forces on each other.
- 3. Interactions Conserve Energy and Momentum.** Often it is easier to describe motion in terms of momentum and energy instead of force and acceleration. All interactions between objects are constrained by the rules that the total momentum and energy of an isolated system never change.
- 4. Miscellaneous Applications.** Wielding the powerful tools of Newton’s laws and conservation of momentum and energy, we now study more complicated types of motion. In rotating systems we discover a third great conservation law, that of angular momentum. We also investigate oscillations, gravitational forces, and fluids.

5. **Waves.** In a continuous material (like a string or fluid), motion in one place can set up waves that travel much farther than any particle travels. Newton's laws predict that the speed of a wave is determined by the stiffness and density of the substance.
6. **Thermodynamics.** When a system contains a *large* number of particles, we don't bother to apply Newton's laws to every detail of their motions. Instead we take appropriate averages, and discover that the new concepts of "heat" and "temperature" emerge.

If I had to summarize the content of this course in one sentence, it would be this: *The universe is a mechanism.* Newton's laws give us a mechanistic explanation of motion, allowing us to predict how objects will move in the future. The metaphor of clockwork—gears and springs all moving according to plan—is often used to characterize the Newtonian view of the world. Furthermore, Newton's laws are *universal*: they apply equally well to familiar earthly objects and to the stars and planets of the heavens.

Goals of the Course

Physics is not so much a collection of facts as a *way* of looking at the world. My hope is that this course will not only teach you many of the *ideas* of physics, but will also improve your *skills* in careful thinking, problem solving, and precise communication. In this course you will gain lots of experience with qualitative explanations, rough numerical estimates, and careful quantitative problem solving. When you understand a phenomenon on all of these levels, and can describe it clearly to others, you are "thinking like a physicist" (as we like to say). Whether or not you choose to become a professional physicist, these skills will serve you well for the rest of your life.

Policies and Procedures

Class sessions will be spent on lecture, demonstrations, example problems, and discussion. *Please interrupt me with your questions at any time.* Attendance is not required but is strongly recommended. If you have a cell phone or beeper, please set it to remain silent during class.

Problem sets will be assigned once a week, as indicated on the schedule. The purpose of the problem sets is *not* to test you; rather they are an opportunity for you to practice and learn. I *strongly* encourage you to work with classmates on problem sets. In this way you can learn from each other, prevent careless errors, practice putting ideas into words, and work in an environment more like the "real world". Of course, in the end each of you will be tested individually, so it's best not to rely on classmates *too* much.

I will also make official **solutions** to the problem sets available on the course web site. You are free to consult these solutions at any time as you prepare your own. However, I recommend that you use them only to *check* your own solutions, and when you are truly stuck. In any case, all work that you turn in must be in your own handwriting.

I will not take the time to read your problem solutions in any detail. Grading will be based mostly on the amount of work completed and the apparent effort expended. It is important that you turn in full solutions, with verbal explanations wherever appropriate

(see the official solutions for examples). I will not simply count the number of correct answers.

Late homework will not be accepted. However, your homework grade will be based only on the highest 13 (out of 15) problem set scores, so you may miss two problem sets without penalty. This policy should give you enough flexibility to deal with most scheduled absences, illnesses, family emergencies, term papers, unexpected romances, and the like; exceptions will be granted only in the case of very serious illness or other long-term crisis, and then only if you contact me as soon as possible.

Quizzes will be given at the end of class on the same dates that problem sets are due. Each quiz will consist of one or more problems covering the same topics as that day's problem set. Before each quiz we will have a half-hour question-and-answer session to discuss the homework and prepare for the quiz. No make-up quizzes will be given, but again I will drop the two lowest scores in computing your final grade. All quizzes will be closed-book with no notes allowed. Calculators will sometimes be permitted for doing arithmetic, but may not be used to store any information.

We will have four **midterm tests**, given in class. Like the quizzes, they will be closed-book with calculators permitted only for doing arithmetic.

The **final exam** will be like the midterms but longer, covering all the material of the course (with an emphasis on the last three weeks). It will be given on Wednesday, April 30, at high noon.

No make-up exams will be given without *advance* permission.

Laboratory exercises will also be an integral part of this course. You should already be registered for a weekly 3-hour lab section. During these sessions you will complete 13 lab exercises plus a laboratory practical exam. You must purchase the lab manual at the WSU bookstore before your first lab session. Most lab policies are at the discretion of your lab instructor, who will grade your lab reports and then report each of your weekly lab scores to me. I will then drop the lowest score (allowing you to miss one lab without penalty) when I add up the scores and fold them into your final course grade. I will also be the one who grades the lab practical exams at the end of the semester.

Grades will be computed according to the following weights:

problems sets (highest 13)	8%
quizzes (highest 13)	13%
lab reports (highest 12)	12%
lab exam	5%
four midterms @10%	40%
final exam	22%

In deciding borderline grades I may also consider class attendance and participation. (It is your *effort* at participation that matters; how much knowledge you demonstrate makes no difference at all.)

Academic dishonesty, though rare, occasionally does occur in physics classes, so the following policies are necessary. Dishonesty on a homework assignment or quiz will result in

a zero grade for that item on the first occurrence and failure in the course thereafter. Dishonesty of any sort on a test, if clearly documented, will result in automatic failure in the course. In serious cases, evidence of dishonesty may also be presented to the appropriate hearing committee for possible further sanctions.

Special notice: Any student requiring accommodations or services due to a disability must contact Services for Students with Disabilities (SSD) in room 181 of the Student Service Center. SSD can also arrange to provide course materials (including this syllabus) in alternative formats if necessary.

Hints and Suggestions

The ideas of physics are the most fundamental and universal in science, but they are also the most abstract. It is crucial, in physics, that you learn each fundamental principle thoroughly. Fortunately, there aren't that many of them: in Newtonian mechanics the main principles are the definitions of velocity and acceleration, Newton's laws of motion, and the three basic conservation laws. Understanding these few concepts will take you much further than memorizing every equation in the textbook. In fact, rote memorization is of relatively little use in physics.

Since the ideas of physics are closely linked to each other, the material of this course will be highly sequential. It is therefore crucial that you not fall behind. If you don't understand something I say in class, ask immediately. Read the text regularly, and don't put off homework until the last minute.

Extensive research has shown that the students who do best in physics (and other subjects) are those who involve themselves *actively* in the learning process. This involvement can take many forms: jotting questions in the margins of the book; asking questions in class or in my office or by email; discussing physics with classmates; inventing your own examples; writing careful English explanations in homework assignments. Try to do things like these as often as possible!

Finally, try to enjoy the course. Although you may not particularly care how long it takes a block to slide down a frictionless inclined plane, there are sure to be other applications that do interest you. Even those sterile inclined-plane problems can be fun if you think of them as puzzles to challenge your intellect. To me, the universal principles of physics are truly awe-inspiring, and the conceptual tools that physics develops are immensely powerful. I hope that, as you learn the principles and develop the tools yourself, you will find physics to be as enjoyable, useful, and liberating as I have found it to be.

Welcome to physics!