

Success in Physics 221/222

Students committed to learning will find many possible paths to success. No path is error free, but the path best for you may not look like the same path as another student. For this reason, students should continuously assess their academic progress in courses and adjust their academic strategies accordingly.

While there is no magic formula, the following suggestions may improve your ability to succeed in physics and increase your retention of knowledge.

First things first, learning to learn. The following tips are based on suggestions listed in the PHYS 221/222 textbook¹. These tips are transferrable to any physics courses and most other courses.

- Review fundamental math concepts (algebra, geometry, and trigonometry) if needed.
 - Determine what has caused you to struggle in other problem-solving courses. These similar struggles may appear in physics if not addressed.
 - Determine how to incorporate reading before and after lectures.
 - Spend adequate amounts of time studying physics.
 - Spend time daily studying physics.
 - Stay focused by studying in distraction-free locations.
1. **Use extra study opportunities to learn with peers:** Problem solving in groups is a key influencer of long-term retention of knowledge. The PHYS 221/222 book points out that most scientists and engineers rarely work in isolation. Hence, working with peers is a critical, valuable experience. Be actively involved in class, Supplemental Instruction, the math help room, recitation, or other study group opportunities.
 2. **As soon as you struggle, determine why:** You must resolve your struggles with one concept before your struggles compound. Besides using group study opportunities to develop your ability level, also connect with your instructor or TA.
 3. **Do all homework:** Physics homework replicates what may appear on exams/quizzes. Hence, all homework is test preparation.
 4. **Embrace repetition in problem solving:** If your instructor expects you to solve 10 problems, consider this your minimum. You should work out every problem twice and do extra problems. This extra effort is the difference between testing your luck and being a good student.
 5. **Attend class:** This is like stating the obvious, but there is a lot of content in physics classes that may be presented to you for the first (and possibly only) time. If you miss class, you may never know the details of what you missed.

¹ Young, H. D., & Freedman, R. A. (2008). *Sears and Zemansky's university physics: With modern physics, 12th ed.* San Francisco: Pearson.

6. **Read ahead of lectures:** If you are frantically taking copious notes during class (or are lost) you likely are not reading enough before class. You can control your reading pace but you cannot control your instructor's lecturing. Hence, make your "first contact" with new course material be under your control by reading before class. You will find that reading ahead allows you to focus on new details in class that you might otherwise have missed.
 7. **Listen in class during presentation of examples:** Many students want to write down all examples for later reference, but are so focused on writing that they fail to hear the instructors' explanations and solution process. Your textbook has examples that you can reference later, so listen carefully during lectures and only take notes of the essential, new information.
 8. **The correct solution process is the right answer:** You can get the right final answer as a fluke, without having any idea how you did. Focus on understanding the solution process as the right answer.
 9. **Be logical and critical:** Problem solving is a process of logical steps, but to be a good problem solver requires critical thinking ability. Think. Think! THINK!
 10. **Study daily:** One hour per day every day as a minimum is better for your learning than two large study sessions per week. The minimum amount of time students should devote to physics is not the same for everyone. In fact, it's likely that you need to devote two hours per day or more to your physics course. Determine your minimum amount per day and seek to exceed this goal.
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The following tips are compiled from other sources: <https://www.lhup.edu/~dsimanek/chapman.htm>

1. **Active learning:** Try to think of applications of the material as you read it, and of problems to which the formulas apply.
2. **Summarize the material:** When you finish an assignment, plan what questions you would ask if you were making up an exam. Close the book and deliver yourself a three-minute formal lecture on the lesson, or, if you feel silly talking to yourself, write out a fifteen-minute essay on the subject. Probably you will discover that you didn't know the material as well as you thought you did—better to find it out while studying than during an exam. The importance of frequent self-recitation cannot be overemphasized. Review the day's work in the evening, the week's work on Friday, and the whole course once a month. Psychologists say that if you overlearn material (i.e., study it somewhat longer than is necessary just to understand it), you will remember it later with comparative ease. Furthermore, overlearning and review show you where you are weak and give you a chance to clear up the weak points.

3. Note-taking:

- a. You do not go to class to get a good set of notes. It is hardly worth spending several hours a week for a whole term to get information that can be bought for a few dollars in the form of a good reference book. The prime reason for your going to class is to learn something. In taking notes, keep this thought in mind. Do not overemphasize the notes to the extent that you neither see nor hear the lecture.
- b. Diagrams or formulas are the least important things to put in your notes, since they can be found afterwards in the text. The main thing to record is the explanation that accompanies them. (You will understand the explanations better if you spend some of your time studying before class.) If a diagram is labeled on the board, be sure to put down *all* of the labels. Three arrows coming from a point may mean nothing in your notes but, if they are accompanied by several sentences of explanation and by appropriate labels on the diagram, they may show the complete story of the forces acting on some point of a complicated structure such as a cantilever bridge.
- c. The explanation that accompanies the diagram is the most important part of the discussion and the student—if he takes any notes at all—should put the explanation in his notes. If the instructor goes too fast, ask him a question to slow him down; for example, “Would you state that conclusion again, please?”
- d. Whether you take copious notes during lecture, or do not take any notes during lectures (as a means to pay attention) and instead write down good notes after class is over, *it is important that you do take notes*. Psychologists say that the physical operation of writing a set of notes contributes something to the learning process, in addition to the fact that the material being written almost of necessity has to have made some mental impression. Therefore you must have at least one set of notes in your own handwriting. This set ought to serve the double purpose of being a learning aid physically, as well as helping in review. Consequently, whether or not you take notes in lecture, when the lecture is over your note work has only begun. While the material is still fresh in your mind (preferably within a few hours after lecture), go over your notes and smooth them out. Add to the explanations. Compare the lecture with the text and fill in the parts you missed. If the material still seems obscure, consult another text in the library. Pick out the important statements in the notes and the important formulas; then underline them with red pencil to facilitate your review for exams.

4. Exam Prep:

- a. Since physics is a subject where clear thinking is especially important, remember the importance of a good night's sleep.
- b. Cramming for physics may only confuse you. If you do not have time to study all the material, then discard what you think is least important and forget about it. Learn the rest of the subject well.