FAST FACTS

How to Succeed in Physics

Physics is an infamously difficult course. I consistently needed help with the material. It is not impossible though. – Brian, Electrical and computer engineering

Physics is incredibly intimidating and difficult. I used office hours and tutoring and built a strong bridge and was successful in the class. – Mridula, Chemistry major

Weekly study groups were most effective of all the support offered because it forced me to form a study routine and it allowed me to work closely with other students in small groups. – Rohan, Math major

Physics is a challenging subject ─ it's a combination of math and science that can be difficult even for the best of us. But despite its challenging nature, with a few basic tips and a little practice there's no reason you can't succeed. This handout outlines a variety of strategies that can help you improve your performance in physics classes.

Physics isn't only math; it requires conceptual understanding too!

One of the most important things to understand before embarking on a physics class is that physics requires practical knowledge of math as well as a broader conceptual understanding of physics principles. While formulas and equations are often helpful, without a conceptual understanding they can only get you so far. Typically, physics courses can be split into a handful of broad fundamental principles, under which smaller principles and equations can be organized. Make sure to take some time to think about which broad principles organize your course.

When faced with a problem to solve, think about how this specific problem relates to the overall structure of the course and the concepts being tested. It can be tempting to immediately grab your calculator and start computing. However, once you understand the conceptual material and principles behind the problem, try to solve the problem algebraically. Only after solving algebraically should you plug in numerical values. Success depends on thoroughly understanding these key concepts.

Physics builds on itself: Make sure you know the basics and don't get behind!

Like many technical subjects, physics builds on itself, and it can be hard to understand upper level physics if you don't understand the basics. When you're beginning a new course (or a new unit within a course) make sure to put in the effort to understand the simple concepts. If you don't put in the time when the material is easy, you'll be behind when it gets more difficult.

Getting behind in progressive courses can make your life twice as difficult as putting in the effort initially, so make sure you're doing a little bit of review each day so you don't get behind.

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Go to class
One of the most important steps you can take toward succeeding in a physics class is simply attending! Class is a rare time when you can have an expert explain the material to you so make sure to take advantage of this expertise. Typically, classes involve both lecture time and recitations, and both are important. In lecture, you'll be able to learn the material and get a sense of what's important to your professor (and what's likely to be on the exam!), while recitation will give you the opportunity to practice problems, apply what you learned in lecture, and ask questions.

Before class: Prepare!
Your job begins before arriving to class. Make sure that by the time you arrive in lecture you have read over previous lecture notes, printed out that day's notes in advance (if applicable), and reviewed all assignments pertinent to that class. If you've reviewed the material before you get to class, lecture will simply reinforce what you've already reviewed.

During class: Be an active learner in class
Going to class doesn't just mean being present. Take detailed notes and write down any questions you have that you can't ask in class. Review your notes within 24 hours after class to solidify the information you learned. In addition, if your professor has you answer clicker questions or solve problems during class, make sure that you are truly working through these questions so that you know where you stand with the content. Oftentimes, new material seems to make sense until you actively attempt to use it to solve a problem, so this type of interaction in lecture or recitation can be an important way to gauge your understanding.

After class: Practice, practice, practice!
Problem solving is crucial to your success in physics, and the best way to prepare is to practice. The more practice problems you complete, the better your understanding of the material. As you are solving practice problems, do as much as you can on your own, then check your work with a TA, tutor, professor, or solution manual to make sure you're approaching the problem in the correct way. Checking your work and getting feedback is crucial — you don't want to practice solving the problems incorrectly. While practicing, be sure to focus specifically on how to set up problems, since this is often one of the trickiest parts of physics problems. Think about which physics principle, law, or equation to use, and attempt to define the system and choose a reference frame if relevant. If your set-up doesn't match the solution set-up, be sure to follow up with your professor, TA, or tutor.

Don't just memorize
While you will have to memorize some equations and processes, you shouldn't be learning everything through rote memorization. Understanding the governing principles behind the equations will not only help you know when to use each equation, but will also help you remember them for long-term retention.

Your exams most likely won't have the exact same problems as the practice problems, but, they will have similar questions. Try to prepare for this by anticipating how the practice problems will be tweaked and solving these new similar problems.

For example:

- What if the masses were unequal instead of equal?
- What if the object, instead of sliding down the slope, was pushed up the slope?
- What if the surface was not frictionless?
- What if the object moved in a vertical circle instead of a horizontal circle?
- What if the electrically charged object was not spherical, but cylindrical?
- What if the object was a metal instead of an insulator?
- What if the space was filled with the dielectric instead of a vacuum?

This broadens the scope of your understanding and will help you be prepared for upcoming exams.

Don't work alone/Discuss the material
Studying with peers is perhaps one of the most effective ways to learn and process course material and concepts. Everyone has different strengths, and working in groups can be an effective way to utilize everyone's personal skills and learn from each other. However, before you opt to work in a group, be sure to check your syllabus for the academic integrity policy for the course. Some faculty welcome

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collaboration with peers, while others prefer that you only seek assistance from select individuals, including their teaching assistants.

When working in a group, be sure to maximize group study time by limiting the size of the small group (no more than six people) and setting specific goals for each meeting. After each group session, be sure to practice on your own as well, as it's important to make sure that you can solve the problems without relying on your classmates' help.

So, remember…be sure to discuss what you've learned with friends, TAs, or the professor in order to solidify what you have learned in class and make sure you have a strong understanding of the conceptual knowledge. If you're confused, make sure to clarify concepts before moving forward.

Read the textbook
Along with class time, your textbook is one of your best resources. Do your best to stay on top of assigned textbook readings and complete all readings before the lecture they are associated with. In order to make the most out of your textbook, plan sufficient time to read actively, making sure that you understand how everything you're reading relates to the broad principles of the section and that you can explain everything in your own words.

Exam Prep
Most importantly, start early ─ it may not be possible to learn all the material in one night. If you begin at least a week in advance and make sure you're completing practice problems on your own, (without looking at other people's work or the solution manual) you will be able to judge as to whether you can complete the problems without assistance. Also, remember to attend office hours with any questions that arise during your practice. Finally, complete any practice exams provided by your professor. Take these exams under test conditions (timed, without notes) to get a feel for how you will perform on test day.

Test-taking strategies
First of all, relax and try not to panic. Read the questions carefully and underline or circle important information. Think about the concepts and basic principles that are behind the question, and write down relevant equations and provided constants. Simply writing down relevant equations and constants can get you significant partial credit even if you are unsure how to solve the problem. When you reach a final answer remember to stop for a few seconds and think about whether that answer makes physical sense. If you know the answer is supposed to be less than one, and you get twenty, go back and check your work. If you can't figure out how to correct your mistake, make a note so that the grader knows that you realize your mistake and can give you partial credit. Finally, make sure you budget your time. If you're stuck on a question, move on and try the next one.

Have confidence in yourself and in what you have learned. When you know you have prepared adequately, the confidence will come naturally.

Get help when you need it!
You need help and you're not sure what to do and who to ask. If you have questions, there are a variety of sources you can go to: your professor, your TA, your peers, Supplemental Instruction (SI), Peer Tutoring, EXCEL, and the Physics Course Center. Office hours are one of the best resources you can use ─ your professor and TAs are there to help you, so make sure you use them!

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