



# ADVANCED PLACEMENT PHYSICS

## H0003A : Problem Sets

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### Overview

In some ways, the problem sets will comprise the most important part of the class. It cannot be stressed enough: ***Physics is a problem-solving science.*** Almost all research is phrased in terms of problems to be solved. In addition, all physicists would agree that the solving of problems gives the deepest and surest insight into the physics. Simply put, *if you cannot solve the problems, then you do not understand the physics.*

### Textbook Problems

Most of our problems will come from Halliday, Resnick, & Walker. You might as well learn this early: Most of the odd-numbered problems have answers printed at the back of the book. Do not come to rely too strongly on this. Firstly, I know it as well and will pick problems that remain challenging even when you know the numerical answer. Secondly, as you hopefully understand by now, the numerical answer is the least interesting part of a solution. Thirdly, sometimes attempts to "reverse engineer" a problem lead to theoretical contortions that can actively impede your understanding. Use the printed answers ... but use them with caution.

You should expect to have ten to twelve problems assigned per week. These will be collected, but not all will be graded. (The effort in grading these sorts of problems is similar to that of doing them; I would not be able to return the sets in a reasonable time if I graded them all.)

I will release my solutions to the problems when I return yours. These will include solutions to ungraded problems. You are, of course, encouraged to do a quick comparison between my solutions and your own. To save paper, I will not distribute a copy of each solution to each student. Solutions will appear on the class website ([www.GilroyPhysics.net](http://www.GilroyPhysics.net)); obviously, it would be intellectually dishonest to attempt to access these solutions before handing in the problem set.

It is always in your interest to begin work on the problems as soon as possible. They take real amounts of time to do. It is also in your interest to recopy your problems until they are neat. This is as much for you as for me, since you will want to review these problems in April when we begin to prepare for the exam. I do not insist that you recopy your work, but I do require that your work be legible and easy to follow. Some explicit requirements are listed later in this document.

### Multiple Choice Problems

One of the failings of H&R is that their problems are mostly of the free-response type. You will also require practice in the multiple-choice form, in part because your tests early in the year will consist solely of such problems.

Another useful resource is *Cracking the AP Physics B&C*, by Stephen Leduc (published by the Princeton Review), available through amazon.com (among others) at \$17.90 + shipping. In addition to many sample problems, the book includes a condensed approach tailored to the exam. Reading the *Cracking the AP Physics* book does not replace reading the textbook but you should find it a useful supplement. Consider the *Cracking the AP Physics* book to be a form of Cliff's Notes: Useful if care is taken.

Quite generously, the class of 2001 -- who were required to purchase their own copies -- donated them to the School for your use. You are welcome to take a copy home for your use. I ask, however, that you preserve them in good shape so that next year's class can benefit as well. Also, depending on enrollment this year, I cannot ensure that all students will have a free copy. We'll work out arrangements if need be.

As an aside, the *Cracking the AP Physics* book would probably serve as a good primer if you intend to take the SAT-II Physics test (which I do not recommend).

### **Rubric for Problem Set Solutions**

Each graded problem will be worth 18 points. At the end of the semester, your scores will be added together and assigned a percentile score based on the Problem Set Equivalency Table.

Each graded problem will be evaluated on the following criteria:

Diagram: (0 to 3 pts) Most problems in Physics require some sort of diagram to be truly clear. Generally, the textbook does not provide such diagrams; your ability to draw one indicates your understanding of the problem. Every problem requires a diagram. Be warned: sometimes the textbook gives a diagram but it is not complete for the solution.

Aesthetics: (0 to 3 pts) Your solution must be legible and orderly. While I do not require perfection, I do demand clarity. Your solution should not betray confusion on your part -- steps should follow logically. If you need to work something out as an aside, this should be clearly marked and put off, well, to the side.

Solution: (0 to 6 pts) Obviously, your solution of the problem matters a great deal. However, what matters most is process, with the actual numerical answer carrying less weight. Your solutions should follow accepted conventions of mathematics and physics, and obviously must utilize true physical concepts.

Clarity: (0 to 6 pts) Communication is a vital part of the scientific endeavour. If your solution is hard to follow, it has already failed a major criterion. Your ideas should be developed clearly and linearly; the grader should not have to interpret. Clarity is mostly concerned with logical clarity. Also, if you plug in numbers before stating equations, you will suffer heavily here.

**An additional penalty of 10% will be assessed to any solution submitted without a name or any solution that is submitted unstapled.**

## Format of Problem Set Solutions

Here are some points to keep in mind:

- Being consistently late with problem sets is a good way to sabotage your grade. One year, a certain student went from a 95% to a 90% based solely on his lateness.
- Clearly label both the chapter and problem number of each problem. Make sure it's easy to tell what text belongs with which solution.
- Leave a one-inch (2.54 cm) margin at the top of the page.
- Staple your pages in the upper-left corner of the page. Number problems and pages on the side opposite to where the staple goes.
- Work in whatever order you wish. Avoid setting up your paper sequentially. A lot of students like to label all their sheets and then go back and fill in solutions. This is a mistake. It's usually hard to estimate how much room a given problem will take. Pre-allocating your space leads to cramming, to messy erasures, etc. It's OK to make me flip the pages several times.
- Put your name on each page and staple your pages together. Unstapled pages will be treated like unsigned papers. Do this before arriving in class.
- Start the problem sets early. If you attempt to shoehorn all your work into one evening, you will fail to understand much of what you are doing. You very well might fail the class.
- Ask questions in class. It's acceptable to take a period aside just for questions and help. That's another reason to start early.
- Read the textbook. I've had students who come up to me in February and say that the class became much easier once they began reading the book. Don't wait until February for that revelation. If you need a more directly-beneficial reason, consider that many of the problems will be based upon sample problems in the book.
- Work together. Unlike other classes, you are expected to work together on problems. It is even acceptable that you divide problems such that one person focuses on the first, another on the second. But do not copy the work. Be warned: that's an exceedingly fine line to walk. Everyone must solve all the problems on his/her own, although you can ask each for help, tips, and hints. Learn to collaborate without copying.
- You must put each problem on its own page. Each problem past the first found on a page will be penalized at 1 point. This applies even to problems that otherwise would not be graded.
- You must work only on one side of the page. However, I don't care if you use scrap paper, as long as the side you do use is blank before you start. Also I will keep a box of scrap paper available for your use.