

PHYS 122: Mr. Covault's Comments on Taking Physics Exams

January 26, 2009

Here are some general points that I want to make regarding the first hour exam. Read these carefully tonight in the early evening while calmly sipping a cup of tea.

- Don't panic. Seriously, your attitude will have a large impact on your performance. Take any steps necessary so that you will be focused and relaxed when you come in for the exam. If you find yourself tightening up, breath deeply and slowly. Remember the first exam is only worth five percent (5%) of your grade. It's a warm-up.
- The "hour exam" will be given at **9:30 AM sharp on Friday, February 6** in Strosacker Auditorium. The exam will last 50 minutes. You will get to bring one $8\frac{1}{2} \times 11$ sheet of paper with any hand-written notes that you wish to write down on the front and back. See the Rules for Exam (Handout #08) and make sure you understand all of the rules.
- Don't spend huge amounts of time preparing your "crib sheets". Really, if you try to cram all of the textbook onto your your note sheet, you are missing the point of the course. I intend to write the exam so that the student who is quite familiar with the material will have no cause to look at any notes – except perhaps to verify a particularly central equation or concept. In my opinion, the "crib sheets" represents a *crutch*. By definition, you cannot get very far using a crutch. In other words, you may rely on your notes to get you moving if you are stuck, but you cannot rely on a two sheet of paper to help you "learn" the physics during the exam. Therefore this is my strong advice: study for this exam as if you are studying for a *closed book* exam with no cheat sheet. Decide now to commit to *memory* at least those central concepts that I have delineated in the review sheets. If you are mastered enough with the material so that you do not *need* to look up the relevant information, you will move much faster through the exam with confidence and will be much more likely to do well. This is the difference between "surface learning" and "deep learning". This is the difference between "basic competence" in the material and "mastery" over the material.
- Also remember that you will be given the values of important physical constants so you do not need to write these on your "cheat sheet". Specifically, you can assume that the material that is presented on the inside cover of your textbook will be made available to you for the exam if you need it.
- When you start studying for this exam, begin with the Cycle 1 Review Sheet (Document #05 posted). This document delineates what I consider to be the most important central concepts of the course so far. I take quite a bit of time to prepare the review sheet, so this tell you what *I* think is most important. When I write the exam, I will write it using the Review Sheets in front of me. Do not bother studying anything else until you get to the point where you feel very confident regarding the points on the review sheets.
- You will have 50 minutes. There will probably be a "short answer" problem or two that will be conceptual or may simply be a check to be sure you understand the something we have covered. Do the easy problems first and don't get hung up on them. In particular, if

you do not understand a short answer question do not waste time working on it – move on. There will also be one or two “work problems” that will be sort of like a simplified homework problem. One of these will probably be remarkably similar to one of the homework or practice problems so be sure you look at the homework solutions and understand these. Conversely, perhaps one of the problems will probably look very unfamiliar and will represent an example of me asking you to apply what you already know to a new example that we have never considered in class. Students who do well on the exam will have a comprehensive grasp of the material from the text and the lectures, and not just a quick recipe for solving problems. Students who achieve an excellent score on the exam will be those who are able to apply their understanding to unfamiliar problems. When I write an exam, I plan to ask you to *think*, not just regurgitate.

- Students often ask me how to tackle problems on the exam. My first piece of advice is always this: **Ask yourself, for this problem, what is the central physics concept?** When I design an exam question, I am not interested in having you tell me the answer. I already *know* the answer. I want you to *demonstrate* that you understand and can apply an important physics concept in this course and that you can use such an understanding to proceed towards the solution. Really, there are not so many concepts we have dealt with thus far. So for each problem stop, take a deep breath, ask yourself what the central concept of the problem is, and then *write it down* on your exam. Too many students do not do this. For example if it is clear on a problem that the problem requires you to deal with something moving in a circle, then you should write these words *on your exam sheet*: “Coulomb’s Law – E-field for a point charge: $\vec{E}_Q = \frac{kQ}{r^2}\hat{r}$ ” – or something like this. Do this *first* and do not succumb to the temptation of starting a problem by writing down equations or formulas. *Remember, for every problem we will reward students with partial credit if they correctly and clearly identify the central physics concept(s) associated with each problem. Such credit will be awarded even if the student makes no other progress toward a solution to the problem.*
- Many students make the mistake of rushing to write down formulae. *Resist this temptation!* Students are tempted to write down an equation that they think applies. Next, they try to obtain the answer by re-arranging the equation and doing algebra. Sometimes – disaster – they plug in numbers, other times, they realize later that some other equation might apply – so they try to stick this in somehow. This is a prescription for chaos. The key to solving a problem is *not* finding the correct formula. Rather, the key is to understand and apply the main physics concept. Start with the physics concept and the formulae and algebra will fall into place naturally.
- As a grader, I have no interest at all in whether you are capable of working algebra so please do not clutter your exam with all kinds of random equations. If you find yourself in a thicket of math, solving the quadratic equation or some such, then you are almost certainly off the path to the correct answer. In fact, I try to write each problem so that I can solve it *in my head* – *no calculators, almost no algebra*. Of course, I have lots of experience doing this but you can rest assured that the answer will not require intricate math manipulation. Again: **the key to solving each problem rests in your understanding and applying a central concept in physics.**

- Be clear. Be neat. If you make a mistake, please cross it out, *Please do not erase!* – it makes a huge mess on the exam. Try to organize your work so that the solution flows from the top of the page downward. If you cannot do this, at least use arrows and boxes so that I can follow the flow of your work. **The ability of the grader to clearly see the logical flow of your work is much more important than writing down the correct answer at the end.** Partial credit will be awarded for work that is moving toward the solution. However, if the grader cannot clearly see what you are up to, you will not get partial credit. Your exam will be graded objectively and fairly. However, you need to communicate clearly to the grader what you are doing. Write as neatly as you can. Draw a picture and take care. Do not write down comments that may annoy the grader, as these are grounds for taking away points.
- Show your work. You *must* explain how you got your answer with at least a few English words. **The correct answer alone, without an explanation, is worth zero points!** If you use a formula or an equation you should also say which physics concept or principle you are using. For example, if you write down $U + K = U' + K'$ then also write down the words “Conservation of Energy” so the grader knows that *you* know what this equation means. Writing down a just few words to explain your work will generally tend to clarify your thought and will help you proceed logically to an answer.
- Again, I have instructed the graders as follows: **The correct answer alone is worth zero points.** If your answer is “obvious” so that you see it with no written work, then you must *at least* write down a few words telling the grader which physics concept or principle you used to get your answer. Please put a box around your final answer. Do not fail to use proper units.
- *Please, please:* Always avoid plugging numerical values into variables until you have arrived at the final answer. This is an extremely bad habit and poor physics. Always solve physics problems in terms of symbolic variables first. Plug in numbers at the end. Many students plug numbers in too soon and this almost invariably leads to mistakes and confusion. Even if you somehow manage to get to the correct answer, the problem is messy, hard to grade, and you have no concept of how the answer depends on various terms so that there is no way to check it out. *Always* solve the problem with symbolic algebraic variables first, and *only* at the very end should you plug in numerical value with proper units. **Graders have been instructed to take away points if you plug in numbers too soon, even if you get the correct final answer.** So don't do it! Note that if you get to a correct final answer in algebraic form and you simply fail to correctly plug the numbers in, this will constitute a very minor offense with a very minor point penalty. I am much more interested in whether or not you have the correct answer in algebraic form than whether or not you can correctly plug numbers in and use your calculator. If you spending lots of time during the exam punching numbers into your calculator while other problems remain undone you are wasting your time.
- Note that there are two exceptions to the rule above about not plugging in numbers. These are as follows (1) Feel free to plug in a number if the number is “zero”. This will almost always simplify your algebra, and (2) If a problem is structured so that you derive intermediate answers, feel free to treat each intermediate result as a “given” variable. For example, if

“part (a)” to a problem asks you to determine the value of some time t , then you can treat t as a “given” in parts (b), (c) etc. – you do not need to keep track of the time in terms of the original given parameters. This will help you earn full credit for problem parts that you do correctly even when you mis-calculate a needed result on an earlier part.

- When you are done, ask yourself “Does this answer make sense?” This is where having the chance to plug numbers in at the end is useful. If I ask you to calculate the velocity of a truck and you end up with 6.51×10^{12} m/s, it should occur to you that this answer is nonsense. You’d be amazed at how students do not check for such things. So look at your answer when you are done. If it looks unreasonable, look to see where you might have gone wrong. If you at least write down words such as “This is what I calculate but I know this answer cannot be right because...” then you will please and impress the grader and you may earn additional partial credit.
- I will ensure solutions all homework and practice problems are posted by the end of the day next Monday. I urge you to look at these before the exam. To make effective use of homework and practice problem solutions as a study tool, I recommend that you *actually try to solve each problem first on your own*. Only after you have tried faithfully to solve the problem should you consult the solutions themselves. It is my belief that merely staring at the solution without trying to solve the problem first, on your own, is of no value whatsoever. Students who look at solutions without trying to solve them first often fool themselves into thinking that they understand when they do not.
- In a similar vein, beware the danger of studying solutions as the primary means of solving problems. Relying on solved problems from the text during an exam is a crutch. Do not be tempted to write down a large set of “solved” example problems on your cheat sheet. The best students solve the problem from first principles. Too many students are quick to consider a text problem that is similar to the one presented on the exam, and then they write down the solution for the text problem instead of the exam problem. Do not solve the wrong problem. The best way to solve problems is to identify the central concept and solve the problem from first principles. Do not rely on previously solved problems except as a cross check when you are done.
- Get some sleep. Seriously. This may be the one thing that you can do to improve your score. Recent rigorous and scientific studies have demonstrated categorically that sleepy people *always* underestimate the negative impact of sleepiness on their own performance. In other words when you are sleepy you always perform at a lower level than you think you are doing. Many students lose points because they did not carefully read the problem as stated. Many students lose points because they lose track of the logical flow while they are working on the problem. Sleepy people make stupid and careless mistakes. It’s a fact. Carelessness on an exam is almost invariably a result of being too sleepy. Decide here and now you *will* get a good nights sleep before the exam. This will raise your score, I guarantee it.