AP Physics Insights: Non-Content Knowledge

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AP Physics Insights Caveat: These are my personal thoughts and not in any way condoned or affiliated with ETS or whatever else. If you disagree with any of my points, please shoot me a comment or respond to the post and let me know your interpretations. I am more than willing to re-evaluate my ideas. These are simply my current conclusions based on evidence I've gathered, but I'm quite sure there's more out there I haven't seen that could lead to even better insights.

Most Important Thing

There will always be things on the AP exam that the taker feels they were never taught. The whole point of the exam is to get them to use their knowledge in scenarios never seen before. It will be a new situation, some twist on the basic ideas learned, and the goal is to figure out how to use that knowledge to make sense of this new scenario. If you are a taker, EXPECT THIS. Complaining because a teacher was unable to cover every single possible type of question that could possibly be asked is hilarious and missing the entire point of the test. If you are a teacher, expect your students to blame you for this. I haven't figured out how to avoid it.

Anyway, once you've accepted that as a fundamental part of AP Physics tests, here are a few general things about all exams that ARE good to know going in besides content.

- **Look for verbs.** Maybe even circle the verbs. That's literally the key to everythingthe questions want you do to. Action words are handy things for telling you theactions to perform. Sometimes the first word will be "draw" and then there will be forty clarification words followed by "and label it as xxxxx". Lots and lots of student miss points because they didn't clearly label what their drawing was supposed to represent. Labels need to be clear, consistent, and independent. If you're drawing two free body diagrams for two different object and label the down arrow as "mg" on both, you will not get credit unless the masses are identical, and they usually won't be for exactly this reason. If you're drawing two Gaussian surfaces, even if the drawing are correct, unless you tell me which one is 1 and which one is 2, I cannot assume you know. Because you did not tell me.
- **FOLLOW THE INSTRUCTIONS.** Once you've found those verbs, do the actions required. If it says something like 'if the velocity is zero, write "v = o" then you better write exactly what is in the quotes. If it says to draw an arrow at the dot and label it, you better do both those things. Read the entire prompt. Sometimes there are more instructions at the bottom of it. Further below I've got some more details on AP-specific vocabulary. Make sure you know what words go with which actions.

- **Write legibly.** If you cannot write with a pencil making a dark mark, write in pen. If you're worried about mistakes, bring two colors or white-out. Or erasable pen. Something that can be seen clearly. The neater your writing, the easier it is for us to score it. I have struggled to read an exam, asked my table partner, taken it to the table leader, who went to the question leader, who called in the exam leader. If none of us can figure out what those words are, you will not get the point, even if it would have been correct if we could read it. The test taker and the reader are on the same team. We're physics teachers, and we WANT students to do well. We're not looking for reasons to take points away. We're actively seeking reasons to give credit as much as possible based on the rubric we have. Work with us here.
- If **you give two answers, whichever one would earn the lower score is the one that is considered your final answer.** You cannot try the shotgun approach. I saw one question where the student wrote down literally EIGHT different numbers, and none of them were even correct. I've seen questions where students are asked something about a variable and then write down every single equation from the sheet that includes that variable. Don't do this. I saw another where a student wrote two numbers on top of each other so that both were legible, but one was ever so slightly darker. Nope, sorry, if you don't pick a final answer, we will, and it will not be to your benefit.
- **Capital and lowercase letters have meaning. So do subscripts.** Some problems will have "A" for area and "a" for a distance. There will be "M" for a big mass and "m" for a little mass. "E" for electric field or energy and "e" for the charge on an electron. "C" means Coulombs and "c" means the speed of light. Make sure you are consistent with your variable usage. There is a difference between epsilon and epsilon-naught, mu and mu-naught, v_x and v_y, m_l and m_2. The integral sign vs the integral sign with the little circle mean different things. IT MATTERS.
- **No one cares about your non-physics writing.** We are not required to read every word you write once it is clear there is no physics included. We don't read notes to us. We don't check out your drawings past glancing to see whether or not there is any physics embedded in it. We don't respond to requests to take it easy. There are always a ton of blank sheets at the end of the book Please use those instead. If you aren't going to attempt the physics, leave the damn problems blank I won't read all 50 reasons your hate your teacher. I won't read your impassioned rant about the AP system (preaching to the choir there, son). I have literally thousands of exams to read. If it ain't physics, and you ain't confessing a crime, I ain't reading it. As much as possible, avoid using the word "it" in any written passage of your test. We are not mind readers, and we cannot score points based on what we think you mean by 'it'. If it is not immediately clear, you will not get credit. Use nouns, even to the

point of it reading super stilted and weird, as long as it's clear what you are referring to at each point. Clear Communication is the key. For example, say "the torque should increase with distance from the center" and not "it gets bigger when you're farther". What does? Farther than what? From what? I recognize that I use "it" extensively in this post, but I am not looking to score exam points for clear, physics-based explanations. This is the stuff outside content that will help you on the exam. Also, you can ask me any questions if something is unclear (in fact, please do). Can't no one ask nobody nothin' about their free response answers.

Pay special attention to vocabulary. I'm going to make a dang word wall with these. "Describe" or "explain" means a different thing than "justify". Each exam description has its own specific way of describing it (AP 1 is slightly different from APC), so be sure that as a student or as a teacher you know what they are looking for. Read your exam description in general. You need to know what's going to be on your exam. For a few examples, if the question says:

- **"determine"** or **"what is"** no work needs to be shown. Just give me an answer. A "o" written with nothing else on the page will get the point if the answer is zero. Often these will be followed by **"justify"** which means you need to back it up with evidence, but sometimes you can just give an answer and everyone is happy. Units may or may not be required (always add 'em anyway, just to be safe).
- **"calculate"** means you better show every dang step. "Calculate" should start with one or more equations, solve for goal, substitute, calculate with correct units.
- **"Derive"** means you better show every dang step, too. The answer should start with one or more equations and end with one final equation relating two things. You cannot simply give the right half of your derivation without telling the reader what it is equal to. And this question usually comes along with "in terms of [variable list] and fundamental constants". If you have things in your derivation that are not in the list and not fundamental constants (g, pi, e, μ_o, 2, etc), then take another look and figure out how the things you have are related to the things they ask for.

  "using XXX Law" then you better copy that law down from the equation sheet verbatim, including every subscript, integral sign, little circles on the integral signs if applicable, and vector mark VERBATIM. And then DO something with it. Just copying it down perfectly isn't enough. It is necessary, but not sufficient. You also have to attempt to answer the question **using** it.
- **"give a physical reason"** you need to either refer to a physical object or a physical relationship. You can't just say "there exists a force" or "the electric field changes" or "there are other things around". You have to give a clear example of what type of object could be causing the force. You must explain the way the field changes and what causes it to change. Does it double?

Reverse? Decrease? HOW does it change, and WHY does it change like that? Knowing two things are related and saying one of them changes the other is not going to cut it. You have to know what the thing is that could be affecting your results. Situations where an ideal approximation is used are prime suspects for physical reasons measurements are different from expected. You need to specifically mention what might be non- ideal and how. For instance, stretching a spring to near its elastic limit will give you data that increases the k-value above an expected value. Saying "there's something wrong with the spring" or "the spring is faulty" are not valid reasons for an error.

Pick up the treasure left on the ground. Practically every question has an easy point or two. Draw a free body diagram or a Gaussian surface or sketch a graph or identify a point or determine something (if it isn't expecting you to show work, it should be relatively easy to figure out). If someone left out 10 hundred dollar bills sitting out on the ground around your feet and another 35 to pick up here and there as you walk up a super steep set of stairs, which ones make the most sense to go after first? You don't have to do the questions in order, and you don't have to do the parts in order. Take a gander through the booklet and start working on the things that make the most sense to you. This will also let you see all the questions so your brain can begin mulling them over and dredging up some knowledge. There may even be 5 quick points on the third question that you'd never get to if you hang out stuck on 2.c for twenty minutes. Triage the points. There are dozens of released free response questions with rubrics available so you can get a feel for how points are distributed, and this will help you a lot in your practice.

These are the things I am going to articulate to my students first thing in the AP Classes. It is what I have gathered based on my experience. If you have more or different interpretations of the evidence you have seen, please let me know. I am not the final word or the ultimate authority on any of this, and I look forward to continuing to improve my understanding of the AP Exam.