

--Introduction to the Conceptual Questions--

Classical Mechanics  
and  
Electricity and Magnetism

In the last several years, there has been a considerable amount of harrumphing from university physics professors about high school students who enter college knowing all about math manipulation but seemingly nothing about how physics works on a conceptual level. As a consequence, there is a movement afoot to nudge high school and first year university courses toward emphasizing *concepts* over math.

I wholeheartedly agree that students need to understand what has become known as *conceptual physics*, but the fact remains that it is the math associated with more advanced elementary physics that usually gives students fits. For that reason, the original focus of *Physics With Calculus* was to make the math understandable. After all, it goes without saying that *being understandable* must include a comprehension of the concepts being modeled by the math--until now, I've dealt with that issue primarily during class time.

As *PwC* is now being used by students beyond the confines of my own classroom (who'da thought), it seems appropriate to include more conceptual material either within the text or as a supplement. That is what this is all about.

My original plan was to use one or two pages of conceptual questions as a kind of introduction to each chapter in the text. A student would run headlong into these mental jawbreakers first before anything was said about the material associated with the section, thereby peaking curiosity and hopefully motivating the student to begin thinking about the new ideas.

I ultimately decided that forcing students to use this approach had all the earmarks of a really bad idea. The impetus behind *PwC* has always been to provide students with a resource that makes learning physics easy or, at least, easier, so although I knew there would be students who would thrive on the approach suggested, I was equally certain that there would be students who would go glug glug. Given the trepidation and insecurity many feel about the subject, starting each chapter with a set of obscure, intimidating, mind-bending questions, no matter how fascinating, just didn't seem very intelligent.

Unfortunately, we still have to deal with conceptual questions. So, for my students, I've gathered this set of questions (solutions included) and placed

them in a single, separate manual. For students outside Poly, I've provided the questions and solutions in Xeroxable form to their teachers in the knowledge that the material will be used in whatever way is deemed best by the teacher involved.

This means, in short, that there are now two places associated with *Physics With Calculus* where one can find conceptual questions. One is in the multiple choice questions found at the end of each volume of the text, and the other is in the questions in this packet.

I still believe that the best way for students to use these questions is to read them before beginning a particular section. If you are bold enough to give that approach a try, the following is my advice to you.

**DON'T BE UPSET IF YOU HAVE NO IDEA HOW TO RESOLVE ON FIRST READING THE CONCEPTUAL QUESTIONS POSED FOR EACH CHAPTER.** Those questions were designed solely to give you, the student, something to think about as you romp through the material presented in lecture and in the book. That's all. They are not there to mock you, humiliate you, or in any other way make you feel intellectually inferior. Their whole reason for being is to give you something to muse about and, hopefully, untangle *as you proceed through the theory*. In short, this is not the anti-Christ's idea of a joke. There is an educational reason for the existence of these questions. Read them with the understanding that, though they may *not* be transparent the first time around, their mysteries will be resolved either by you or, if necessary, your teacher by the time your next test arrives.

In short, sit back and enjoy them. That's what they are there for (oh Lord, I've ended the sentence with *a preposition . . . bad teacher, bad teacher!*).