Physics 3  Final Evaluative Experience

Suppose that Dartmouth decided to offer Physics 3 as a “distance learning” course. Students registered for the course would read the text, watch video lectures, and do exercises to learn the material. Their homework assignments, quizzes, tests, and so forth would be conducted entirely through written communication. You, because of your obvious ability in written communication, and your stellar mastery of the concepts of physics, have been hired to serve as a teaching assistant. This means that you receive written questions from students and you answer them in written form.

Your task for this final evaluative experience is to write an answer to a question about physics as if you were replying to a question from a student of Physics 3. I would like you to answer a question that you find interesting, and that you can do a good job on, so you may choose your own question. To give you an idea of the sort of question I have in mind, I have included a list of samples. You are welcome to use one of them, or make up your own.

Here are the rules and a few hot tips:

1. Due Date. The assignment is due Saturday 23 August 2003 at 4:59 pm in my office (247 Wilder), or my physics department mailbox. I will not accept late papers.

2. Scope and Length. Answer only one question. Be sure to state the question before you answer it. Choose a question that will give you a chance to explain a concept or solve a problem of some substance. Length should be appropriate to the topic chosen and to the audience. A half page of scintillating, mind-expanding prose that answers the question would be wonderful—but unlikely. In general, I expect you will need about two pages. If you need more than three pages, it had better be especially gripping material, because three pages is about all I can usually stand.

3. Format. Please type your paper and print it out for submission. You may write in equations by hand, and you may draw figures by hand.

Please state your question at the beginning.

Please single space your text. Most professors ask for double-spacing partly because that’s the standard in submitting manuscripts, and partly because they want room to mark up your work. I find single spacing easier to read and it kills half as many trees. But whatever the motivation, I’m asking for single spacing.

Please use some species of Roman font (like this one), and use 12 point size.

Please put your name on the paper, number your pages, and bind with a single staple in the upper left corner. No title pages or fancy bindings, please.

4. Collaboration. Pay attention, here; this may be a little subtle. I want to encourage you to use any means available to grapple with the concepts and figure out what you want to write.
Collaborate with your study buddies; read books; consult the WWW (carefully and critically); even talk to me. I will even go so far as to say that you may team up with your study buddies to work on a single question. But when it comes time to write, make the writing be your own. My object is to get you to grapple with a concept and articulate your understanding of it. How you gain your understanding is up to you, no holds barred; but do your own writing.

If you use a reference, whether it be a person, a book, a website, or whatever, give a proper formal citation. I don't care what particular format you use; just be consistent, neat, and informative.

Endnotes or bibliography is fine for citations; and I'm not including this material in the two-page suggested length. A two-page paper would actually be three sheets of paper.

5. Expectations and grading standards. I will grade your essay on the correctness and clarity of expression of your explanation. Yes, I will look favorably on a more ambitious question, but clarity of expression comes first. It will be a much better strategy for you to choose a less abstract or complex question and do a good job on it, than to choose an esoteric topic and not do so well.

I want to see you incorporate mathematics into your writing. Use math to clarify and communicate concepts.

I want to see you incorporate figures into your presentation.

Examples are good.

There will be no mercy for misspelling, and very little for grammatical errors. Be precise.

Sample Questions

1. When an astronaut works outside the space shuttle, he is in very nearly the same orbit as the space shuttle itself. But the astronaut and the space shuttle have widely different masses. Why is it that even with two very different masses, the orbits are the same?

2. Why are the Earth and other planets round? Why are many asteroids not round?

3. What shape are raindrops, and why?

4. What causes the tides?

5. Why does the plane of oscillation of the pendulum in the lobby of Fairchild Hall rotate? (This is a tough one, but very interesting.)

6. How does Newton’s Cradle work?
7. Why is it that if I throw a rock from the top of Bartlett Tower, its speed hitting the ground depends only on the height of the tower and the throwing speed, but not on the direction I throw the rock?

8. Why does a plucked string on a musical instrument sound a particular note?

9. How do you derive the ideal gas law (for a monatomic gas) in a simple way? (Defining temperature is the average kinetic energy per particle.)

10. How could you experimentally determine the value of the absolute zero of temperature?

11. What is the “normal force” we refer to all the time? What determines its value?

12. According to my physics book, if I push on a wall, I do no work on the wall. If so, why is it such and effort? Am I doing work on something else? Am I using energy? If energy is conserved where is the energy I'm using going?

13. When I'm riding a bicycle, why do I have to lean into a turn? How much do I have to lean?

14. Arthur C. Clarke’s classic novel *Rendezvous with Rama* features a cylindrical spaceship that rotates about its axis so as to provide artificial gravity on the inside surface of the cylinder. A waterfall issues from one end wall of the cylinder. How does the water in this waterfall behave? Did Clarke get the physics right?

15. Your text contains hundreds of “Discussion Questions.” Many of these would be suitable. Similarly, many of the more challenging problems would be suitable.

16. Your question here. Please feel free to ask me if I like your question.