

## Final Exam

Advanced Physics for Teachers

Summer 2009

**DUE: 14 August 2009**

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**Answer each of the following questions.** Your answers should be based upon a synthesis of your experiences in the course, your reading of the text, and outside research and contemplation. I expect that about a page (typed) per question is adequate; more is just fine, but much less becomes suspect. If you have any questions or are looking for advice, contact me.

1. In this course and/or text, what is the most important concept or idea that you have encountered? Explain the idea and fully justify why it is so important. This importance can be for society, for physics, for science in general, or for you personally – just be sure to adequately justify your answer. (“Adequately justify” probably means something that is more than one paragraph in length, but less than two pages.)
2. Galileo showed that all objects, regardless of mass, fall with the same acceleration here on Earth.
  - a. Describe a method by which your class could determine this. Explain how this would be an appropriate activity for your specific group of students.
  - b. Newton came along and showed that Galileo’s observations are the result of gravity. However, the force of gravity depends on mass, something that Galileo showed to be irrelevant to falling motion! Explain/show/describe to one of your students how it is that the force of gravity depends on mass, but the falling motion of things does *not* depend on mass. Consider Newton’s Laws in your answer.
3. Conservation of energy is perhaps the most fundamental and important principle in all of physics, so you see it embedded into the state Core Curricula as well as national standards. Considering your own classroom, how do you:
  - a. Explain this concept to a student in your class, either in story-like fashion using analogies or some kind of conceptual exercise?
  - b. Get a student to experience this concept in an inquiry or laboratory experience?
4. An electron is *both* a particle and a wave. Describe a clear piece of evidence for *each* of these.
5. The *Force Concept Inventory* (FCI) is a tool used to look at learners’ conceptions about the nature of motion and forces. Pick out one item from the FCI, preferably one that you personally initially misunderstood. Write this question out and then,
  - a. Explain which of the answers is correct, and explain *why* this answer is correct.
  - b. Describe in detail what misconception this question is apt to reveal. (In other words, what preexisting idea would a typical student of physics have, and how does this inhibit their learning of physics?)

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Submit your final exam by doing one of the following:

- A. Email your exam (either as text, MS Word, rich text format, or similar) to Adam Johnston at [ajohnston@weber.edu](mailto:ajohnston@weber.edu).
- B. Print your exam and mail it to Adam Johnston at:  
Adam Johnston  
Department of Physics  
Weber State University  
2508 University Circle  
Ogden, UT 84408-2508
- C. Make some other arrangement before the due date.

Please feel free to ask questions or pose concerns at any time about this exam. For an understanding about how your responses will be graded, see the rubric on the reverse side.

### Grading rubric for exam questions

There are many levels of having a “right” answer. This rubric should give you an idea of what these different levels are and how they correspond to different grades for exam questions.

<b>Description:</b>	<b>Score:</b>	<b>Grade:</b>
This question was answered with an extraordinary amount of effort, insight, and clarity. Not only was the answer exactly correct, explained, and justified, it may have gone to a depth that was beyond what is normally expected for this course. This score is especially rare.	5	A+
This question was answered accurately and completely. Any errors in this answer are minor. Generally this score is received for answers that are clear, concise, and exactly accurate. Examples given in this response are so clear that the reader can picture exactly the scenario being described. An answer receiving this score is reflective and refers to specific details of the course and/or text and represents these details accurately. The answer has been explained in the student’s own words and would be understandable to a peer.	4	A
This answer represents a good answer to the question. It is complete, generally accurate and, though it might contain errors, the overall idea is correct. This answer shows a fair amount of thought and uses some relevant material from the course and/or text. Examples given in this answer are well thought out, even though they may leave out some detail that would be helpful. Even if there are some details that are left out, it is clear from this answer that the student has a good understanding of the question being answered.	3	B
This answer is mostly complete, but it missed an important point. The answer might be vague, even though it is addressing the question; or, this answer might reflect a misunderstanding of some concept, even though the answer is headed in the right direction. Examples given in this answer might have the basic idea, but are too vague to be judged. This answer is generally not as concise and focused as answers that receive higher scores.	2	C
This answer probably has some major flaws. The answer either shows a large misunderstanding or it is very unclear.	1	D
This question was not completed, or did not satisfy enough requirements to receive credit.	0	0