

## PHYSICS 116 FINAL EXAM

### Notes written on Thursday, 3/8/07, after lecture

The final exam for Physics 116 is scheduled for Thursday, March 15, at 8:30 am in Room PAA102, the same room as for the lectures. You have two hours to complete the exam (actually until 10:20 am).

The exam will be all multiple choice, with 30 questions worth 5 points each. Please bring a Standard Score sheet to run through the scanner with your answers. If you want to save time, write your name and student number in the bubbles, FINAL EXAM on the score sheet, and PHYS 116 and VILCHES in the other boxes. This will help us find any “problem” sheet, if we encounter one.

Although it is impossible to promise “not to use” something (for example Newton’s second law, Coulomb’s law, conservation of energy or momentum, definition of angular momentum...), the questions will be based on topics of chapters 14, 25, 26, 28 (all), 30 (sections 1, 2, 3, 5, 6), 31 (Sections 1, 2, 3, 4, 5, 6) and 32 (sections 1, 2 and 3 only), with most of the test on topics of the last four chapters listed. I will post my notes for Chapter 32, which is a brief summary of highlights of the “nuclear atom” sections we covered today and tomorrow.

My suggestion to review is that you look at the tests you have taken already, and the Tycho homework you have done. It would be good to know what you did not do right in one of the past tests!

I never wrote a multiple choice final for this course.... In Summer 1992 though I went close to where we will end this quarter, so I have posted some questions from the final that year, and also the cover pages with the “modern physics” equations in the cover sheet of the final. In Summer Quarter finals are one hour long, so the final was not comprehensive but it was “graded by hand” (by me....). I would think that the three cover pages from Exams 1, 2 and 3 you have taken and this cover page will convey all the information you will need for the final exam. If there are other constants or changing the nomenclature to agree with Walker’s text I’ll try to find those and make them. This quarter we did not calculate (or estimate) the energy of the first  $n=1, l=0$  (1s) electron in any atom other than hydrogen, so the question on the sample test about the 1s electron in Ne is not relevant to your final. The answer though is that if one has a nucleus with  $Z$  positive charges, the innermost electron ( $n = 1, l = 0$ ) is like a hydrogen atom except that the nucleus has a charge  $Z$ -times the one of hydrogen. Since  $Z$  enters as  $Z^2$  in Bohr’s equation, the energy of the innermost electron is  $-Z^2 \times 13.6 \text{ eV}$ , where 13.6 eV is the energy of the lowest energy state of the electron in the hydrogen atom. For Ne  $Z=10$  so  $Z^2 = 100$  and the energy is -1360 eV. This is the reason why X-rays are produced from Cu or Mo targets... For Cu,  $Z = 29$ , so the energy is -11KeV, which is roughly the energy (wavelength) of radiation used in X-ray machines... In an X-ray tube accelerated electrons knock off an innermost electron, and when a free electron occupies the “hole” left in the orbit radiation is emitted of this “characteristic” wavelength.

I'll probably add another note next week, especially about office hours. I am planning on holding office hours in the Study Center (it will be pretty empty, so I can use the boards), perhaps on Wednesday afternoon from about 2:30 pm until 4:30 pm. Check on course website for confirmation.