

Physics 135b  
Problem set number 3  
Due Wednesday, January 28, 2004

Course URL: <http://www.hep.caltech.edu/~fcp/ph135/>

Reading: Chapter 5 of the text, on bound states.

12. Problem 4.38 in text. The answers to the questions are not complicated, but you may have to think about them. I urge you to take the questions seriously. It may help to play with the possibilities for Feynman graphs.
13. Problem 5.16 in text. Note the discussion in section 5.6, where the connection between a cross section and a lifetime is made. You may wish to refer to the discussion on pp 245-6 for some further insight, which we'll get to soon enough. However, as we'll remark in class, Griffith's use of the term "luminosity" is a little unconventional, so be aware of the potential for confusion.
14. Problem 5.18 in text. Remember, a good summary of experimental results may be found at: [http://pdg.lbl.gov/2002/contents\\_tables.html](http://pdg.lbl.gov/2002/contents_tables.html). We'll discuss in class the reason why the  $\psi$  cannot decay into two gluons, as it doesn't follow so obviously from the positronium discussion.
15. Problem 5.23 in text. Note that the parenthetical remark in part (b) is no longer true, so there are some comparisons with experiment which you can do, and are now asked to do. Also, remember that what Griffiths calls the  $F$  meson is now called the  $D_s$  meson.
16. Problem 5.27 in text.
17. We discussed the subject of the luminosity of an experiment. What is the integrated luminosity of a hydrogen bubble chamber experiment with the following conditions: Fiducial region of chamber has length 1 m; 20 GeV pion beam with an average of 10 particles per pulse, and a pulse repetition rate of 1 Hz; Total effective running time of experiment of 6 months. Express your answer in sensible particle physics units.