

Physics 115C First Problem Set

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Office Hours Wednesdays 8:30-10:30am

due Thursday, October 3, 2002

1. Exercise 12.6.1, page 340 of text.
2. Exercise 12.6.9, page 349 of text. To do this problem, it is helpful to review page 7 of the class notes, or to work carefully through pages 346-359 of the text. For a successful $\ell = 0$ bound state, is the value of the full wave function $\psi_{E\ell}(0)$ zero or non zero? Compare and contrast the result of this problem with the result one obtains for a cubical well of depth V_0 , where the sides all have length r_0 . For the cubical well is it possible for $V_0 > 0$ to be sufficiently small that there is not even one bound state?
3. Consider the power-law potential that corresponds to the hydrogen atom, or $s = -1$ (refer to page 9 of the class notes): so $V_0 = -e^2$. The length scale, a , is not quite equal to the Bohr radius in this case. If one makes the substitution $r = a_0\rho$, where a_0 is now the Bohr radius, what form would *that* dimensionless Schrodinger equation take?
4. Consider a particle moving in a spherically symmetric potential of the form $V(r) = -V_0e^{-r/a}$. Will the number of bound states be finite or infinite?