6/2/08 Homework 8 Problems do not need to be turned in.

1. Shankar 9.4.3

2. Consider a particle in a 3d box:

$$V(\vec{x}) = \begin{cases} 0 & \text{if } 0 \le x \le L \text{ and } 0 \le y \le L \text{ and } 0 \le z \le L \\ \infty & \text{otherwise} \end{cases}$$

(a) Find the energy eigenvalues and the energy eigenstates (in position space).

(b) What is the groundstate energy? List the values of the lowest 7 energy values, and their degeneracies.

3. Shankar 10.2.2.

4. Shankar 12.3.4.

5. Shankar 12.5.13

6. Shankar 12.6.1.

7. An electron is in the Coulomb field of a proton, in a state described by the wavefunction

$$\frac{1}{6}\left(4\psi_{100}(\vec{x}) + 3\psi_{211}(\vec{x}) - \psi_{210}(\vec{x}) + \sqrt{10}\psi_{21-1}(\vec{x})\right).$$

(a) What possible energies can be measured, and with what probabilities?

(b) What is the expectation value of the energy?

(c) What possible values of $\vec{L}^2$ can be measured, and with what probabilities?

(d) What is the expectation value of $\vec{L}^2$?

(e) What values of $\vec{L}_z$ can be measured, and with what probabilities?