

## Homework II - PHYS652

1. shankar: 13.1.1
2. Given an electron in the ground state of the Hydrogen atom: - Calculate the expectation value  $\langle r \rangle$  and express it in terms of the Bohr radius - Calculate the electron's most probable value of  $r$  and express it in terms of the Bohr radius
3. shankar: 14.3.2
4. shankar: 14.3.4 (one way is enough)
5. shankar: 14.4.1
6. A spin 1/2 particle is in the state  $|\Psi \rangle = \Psi_+|up \rangle + \Psi_-|down \rangle$  in the basis of eigenstates of  $S_z$ , with  
$$\Psi_+(r, \theta, \Phi) = R(r)(Y_0^0 + \frac{1}{\sqrt{3}}Y_1^0) \text{ and } \Psi_-(r, \theta, \Phi) = \frac{R(r)}{\sqrt{3}}(Y_1^1 - Y_1^0).$$
  - a) What is the normalization condition for  $R(r)$ ?
  - b) What are the probabilities of finding  $\pm\hbar/2$  in measurements of  $S_z$  and  $S_x$ ?
  - c) What are the possible results for a measurement of  $L_z$ . Tell the corresponding probabilities.