

Problem Set 4
Physics 212: Spring 2008

Handed out: Tuesday, February 5, 2008
Due in class: Tuesday, February 12, 2008
Total Marks: 20

Problem 1: Selection rules in the Hydrogen atom

Assume that $|nlm\rangle$ are the eigenstates of the Hydrogen atom Hamiltonian. Some of the corresponding wave-functions are explicitly given in Eqs.(13.1.27) on page 357 in Shankar. Using the selection rules of matrix elements of spherical tensor operators determine the values of n, l, m such that $|\langle nlm|Z|100\rangle|^2$ is non-zero. Calculate the non-zero answer for the smallest possible value of n .

5 marks

Problem 2: Application of the Wigner Eckart-Theorem

Problem 15.3.4 in Shankar.

5 marks

Problem 3: Volume Effect of the Proton

Problem 17.2.3 in Shankar.

5 marks

Problem 4: Thomas-Reiche-Kuhn sum rule

Problem 17.2.4 in Shankar.

5 marks