

4. (a) Enumerate all the states of the hydrogen atom corresponding to the principle quantum number $n = 3$. (neglect the spin in this problem)
 (b) Give the spectroscopic designation for each state and the degeneracy of the level.
 (c) Calculate the energy of the electron in this level.

(a) $n = 3 \Rightarrow l = 0 \quad m_l = 0 \quad 3s \text{ state}$
 (b) $l = 1 \quad m_l = 1, 0, -1 \quad 3p \text{ state}$
 $l = 2 \quad m_l = 2, 1, 0, -1, -2 \quad 3d \text{ state}$

The degeneracy is $n^2 \Rightarrow (3)^2 = 9$

(c) $E_3 = -\frac{13.6}{9} = -1.51 \text{ eV}$