Tutorial Sheet- 8 (PHYSICS - I, 15B11PH111) Odd 2021

1. The electron in hydrogen atom makes a transition from n = 3 to n = 2 energy state. Find the wavelength and the frequency of the emitted photon. What type of the spectral line it is? What is the shortest and longest wavelength of this spectral series?

2. If atoms could contain electrons with principal quantum numbers up to and including n = 6 only, how many elements would there be in the periodic table?

3. Find the percentage difference between L and the maximum value of L_z for an atomic electron in p, d, and f states.

4. Consider a hydrogen atom 2 $^2P_{3/2}$ state. Find all possible orientation of L_z, S_z and J_z vector in space, where L, S and J respectively are orbital, spin and total angular momentum vectors.

5. How is it impossible for 2 $^2P_{5/2}$ and 2 $^2P_{7/2}$ to exist?

6. Write the designations of all excited singlet and triplet state of He up to n = 3.

7. Applying the split orbit coupling, find the total angular momentum of hydrogen atom in l = 2 state.

8. The spin-orbit effect splits the 3P $\longrightarrow$ 3S transition in sodium (which gives rise to the yellow light of sodium-vapor highway lamps) into two lines, 589.0 nm corresponding to $3P_{3/2} \longrightarrow 3S_{1/2}$ and 589.6 nm corresponding to $3P_{1/2} \longrightarrow 3S_{1/2}$. Use these wavelengths to calculate the effective magnetic field experienced by the outer electron in the sodium atom as a result of its orbital motion.

9. An element is placed in a 0.3 T magnetic field and suitably excited. How apart the Zeeman component of the 450 nm spectral lines of this element?

10. The Zeeman components of a 500 nm spectral line are 0.0323 nm apart. When the magnetic field is 5 T, find the **e/m** ration for the electron.