

Chapter 4

Q1 - An emission spectrum for hydrogen can be obtained by analyzing light from hydrogen gas that has been heated to very high temperatures (the heating populates many excited states of hydrogen). An absorption spectrum can be obtained by passing light from a broadband incandescent source through hydrogen gas. If the absorption spectrum is obtained at room temperature, when all atoms are in the ground state, the absorption spectrum will

1. be identical to the emission spectrum
2. contain some, but not all, of the lines appearing in the emission spectrum
3. contain all the lines seen in the emission spectrum, plus additional lines.
4. look nothing like the emission spectrum.

P1 (Tipler 4-15). Calculate the longest wavelengths in the Lyman series ($n_f = 1$) in nm, and indicate their position on a horizontal linear scale. Indicate the series limit (shortest wavelength) on this scale. Are any of these in the visible spectrum?

P2 (Tipler 4-24a). Calculate the energies of the three lowest states of positronium.

Questions 2-4 (6-8 from Tipler)

Q2. If an electron moves in an orbit of greater radius, does its total energy increase or decrease? Does its Kinetic Energy increase or decrease?

Q3. What is the energy of the shortest wavelength photon that can be emitted from hydrogen?

Q4. How would you characterize the motion and location of an electron with $E=0$ and $n \rightarrow \infty$ in Figure 4-16.

P 3 (Tipler 4-29) What is the approximate radius of the $n = 1$ orbit of gold ($Z = 79$). Compare this with the radius of the gold nucleus – about 7.1 fm.

Ex 4 (Tipler 4-37) If one could fill the Franck-Hertz tube with positronium, what cathode grid voltage would be needed to reach the 2nd current decrease?