Physics 2403, Fall 2000

Physics 2403 Notes 5: Chapter 37

Nils Bohr proposed an *ad hoc* quantization condition on the angular momentum of an orbital electron in a hydrogen atom. The condition is that allowed values of angular momentum are quantized in units of $nh/(2\pi)$, where n is a positive integer.

1. Write down the equation for angular momentum for an electron in a circular orbit as a function of the electron mass, the electron velocity and the orbital radius.

2. Now express the same angular momentum as a function of the energy of the electron and as many other quantities as you need.

3. Set this orbital angular momentum equal to $nh/(2\pi)$. Now solve the equation you determined in part 2 above for the energy E.

4. Find the energy difference for two energy levels, one with quantum number n_1 and the other with quantum number n_2.

5. Write this energy difference in a similar form to the Rydberg equation. Remember that $E=hf=hc/\lambda$. In other words, $1/\lambda = \Delta E/hc$, where ΔE is the difference that you worked out in part 4 above. What combination of fundamental constants such as h,c,e, etc. form the Rydberg constant? How different are the numerical values between these constants and the Rydberg constant.