Bohr hydrogen atom

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January 2016

1 Bohr's background description

Niels Bohr's is a danish physicists in late 1800s and early 1900s, born in 1885 and pass away at 1962. In 1913, he is the one who manage to explain the spectrum of atomic hydrogen.

2 Atom

In the hydrogen atom, the nucleus in the center is a very small section of the atom, but it is the majority of the mass because it made up from protons and neutrons. The electron occupies a lot of space in the atom but the effect of the total mass doesn't significantly change. Rutherford is a person who created the model of the structure inside of an atom, where Niels Bohr's put further investigation into the electrons.

3 Explaination

In 1913 Bohr proposed his quantized shell model of the atom to explain how electrons can have stable orbits around the nucleus. The motion of the electrons in the Rutherford model was unstable because, according to classical mechanics and electromagnetic theory, any charged particle moving on a curved path emits electromagnetic radiation; thus, the electrons would lose energy and spiral into the nucleus. To remedy the stability problem, Bohr modified the Rutherford model by requiring that the electrons move in orbits of fixed size and energy. The energy of an electron depends on the size of the orbit and is lower for smaller orbits. Radiation can occur only when the electron jumps from one orbit to another. The atom will be completely stable in the state with the smallest orbit, since there is no orbit of lower energy into which the electron can jump.

4 Information

$$L = \frac{nh}{2\pi} = n\hbar = rP = rmV$$

$$r = \frac{n^2\hbar}{e^2km}$$

$$En = \frac{-e^2k}{2rn} = \frac{-e^2k^2m}{2\hbar^2}$$

$$h = 6.63 \times 10^{-34}Js$$

$$\hbar = \frac{h}{2\pi} = 1.06 \times 10^{-34}$$

$$rn = n^2a$$

$$a0 = 0.53 \times 10^{-10}$$

$$a0 - \frac{\hbar^2}{me^2k}$$

5 Data

We use formulation and then we can get the results.

$$E1 = -2.17 \times 10^{-18} J$$

$$E2 = -5.425 \times 10^{-19} J$$

$$E3 = -2.41 \times 10^{-19} J$$

$$E4 = -1.356 \times 10^{-19} J$$

$$E5 = -8.68 \times 10^{-20} J$$

$$E6 = -6.027 \times 10^{-20} J$$

$$\Delta E = E(final) - E(initial)$$

Relaxation	$\Delta E \times 10^{-18}$	λ
E2-E1	1.63	122nm
E3-E1	1.929	103nm
E4-E1	2.034	98nm
E5-E1	2.0832	96nm
E6-E1	2.1097	94nm
E$\infty - E1$	2.17	92nm
E3-E2	0.299	665nm
E4-E2	0.404	492nm
E5-E2	0.453	439nm
E6-E2	0.48	414nm
E$\infty - E2$	0.54	368nm
E4-E3	0.105	1895nm
E5-E3	0.1542	1290nm
E6-E3	0.1807	1101nm
E$\infty - E3$	0.241	825nm
E5-E4	0.0492	4044nm
E6-E4	0.0757	2628nm
E$\infty - E4$	0.136	2292nm
E6-E5	0.0265	7506nm
E$\infty - E5$	0.0868	2292nm
E$\infty - E6$	0.0603	3300nm

The wavelength of visible light for human is between 400 to 700. As table shows there are some situation that we can see. E3,E4,E5 and E6-E2 we can see. And the further electron moved, the more energy they will lose and the longer wavelength they will be.

6 Additional information

The wavelength for Bohr model called ionization wavelength. This is similar to ionization energy. Ionization means that electron move to other shells. And there is not only hydrogen atom can use in Bohr model.

$$E = \frac{Z^2 E1}{n^2}$$

$$Z = protonnumbe$$

$$n = thenumberofshell$$

$$En = \frac{1}{n^2} E1$$

For Li atom which has only one electron. And we used the function which we told before, and then we get the followiung data.

$$E1 = -1.953 \times 10^{-17}$$

$$E2 = -0.480 \times 10^{-17}$$

$$E3 = -0.217 \times 10^{-17}$$

$$E4 = -0.122 \times 10^{-17}$$

$$E5 = -0.07812 \times 10^{-17}$$

$$E6 = -0.05425 \times 10^{-17}$$