Answer on Question #47490 - Chemistry - Inorganic Chemistry

What is the ratio of energy difference between Bohr's first orbit and second orbit, and that of between third and second orbit ?

Answer:

The energy of an electron in Bohr's orbit of hydrogen atom is given by the expression:

$$E_n = -\frac{2\pi^2 me^4 Z^2}{n^2 h^2 (4\pi\varepsilon_0)^2} = -13.6\frac{Z^2}{n^2}\,eV$$

As an example when it is an atom of hydrogen Z = 1 for hydrogen and above equation can be further simplified to:

$E_n = -13.6/n^2$ eV

The energies of electrons in the Bohr's orbits of hydrogen atom expressed in eV are:

Orbit	Energy
1	$-13.6/1^2 = -13.6$ eV
2	$-13.6/2^2 = -3.4$ eV
3	$-13.6/3^2 = -1.51$ eV
4	$-13.6/4^2 = -0.85$ eV

Excited state(s) represent n = 2, 3, 4 ..... (greater than 1).

The ratio of energy of electrons in the orbits of hydrogen atom is:

$E_1 : E_2 : E_3 : E_4$ ..... $= 1/1^2 : 1/2^2 : 1/3^2 : 1/4^2$ ..... $= 1 : 1/4 : 1/9 : 1/16$ .....