Orbital angular momentum. 1. In Bohr's theory, quantisation of angular momentum was introduced as a postulate without giving any justification, but in quantum mechanics quantisation of angular momentum appears as a result of the condition that the solution of the component function $\Theta(\theta)$ of the variable θ should be finite. The orbital quantum number also defines the shape of the electron orbit. The semi-minor axis of the ellipse is given by $b_n = a_n \frac{l+1}{n}$.

2. In Bohr's theory, the same quantum number n is involved in the expression for angular momentum and energy, but in quantum mechanics angular momentum is represented by a quantum number different from that used for the expression of total energy.

3. In Bohr's theory, n is not equal to *zero i.e.* the angular momentum can never be zero, because zero angular momentum in the theory means no motion of the electron and its consequent collapse into the nucleus. But in quantum mechanics, angular momentum can have zero value when $l = 0$. Physically it means that the wave function ψ does not change with θ for these states for which $l = 0$.

4. In Bohr' theory, the electron in the nth quantum state has only one value of angular momentum $= n\hbar$, but in quantum mechanics, there are n such values for $l = (n-1)(n-2) \ldots 2, 1, 0$. The maximum value of $L = \hbar\sqrt{l(l+1)} = \hbar\sqrt{(n-1)\,n}$ which is less than $n\hbar$ the value given by Bohr's theory. The spectroscopic data are in complete agreement with quantum mechanical values.

5. According to quantum mechanics, the radius of the first Bohr orbit gives the distance at which the probability of finding the electron is maximum. Similarly the radii of other Bohr orbits are also the distances at which the probability of finding the electron is maximum. Thus the quantum mechanics deals with the radii of the electronic orbits in terms of probability density.

6. Bohr's theory introduces only one quantum number n, whereas quantum mechanics introduces three quantum numbers n, l and m_l. Bohr's theory does not give the selection rules, according to which the electron can jump from one energy level to another. These are correctly predicted by quantum mechanics, which also sets the condition for allowed and forbidden transitions.

Energy. In quantum model as well as in Bohr's theory the energy of the electron in hydrogen atom is the same and equal to $\frac{-13.6 \text{ eV}}{n^2}$.

According to Bohr's theory

$$E_n = \frac{-2\pi^2 k^2 Z^2 me^4}{h^2} \cdot \frac{1}{n^2}$$

where $k = \frac{1}{4\pi\varepsilon_0}$ and for hydrogen Z = 1. Substituting we get

$$E_n = -2\pi^2 \frac{1}{(4\pi\varepsilon_0)^2} \frac{me^4}{h^2} \frac{1}{n^2}$$

$$= -\frac{me^4}{32\pi^2 \varepsilon_0^2 h^2} \cdot \frac{1}{n^2} = -\frac{13.6 \text{ eV}}{n^2}$$

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