

CL23_Q1. Electrons in hydrogen are described by four numbers, n , l , m and m_s . What restrictions (if any) are there on these four numbers?

Answer

The principal quantum number n is a positive integer, $n=1,2,3,\dots$. The integer l is a non-negative integer smaller than n , so $l=0,1,2,\dots,n-1$. The integer m is one of magnitude no greater than l , so $m=-l, -l+1, -l+2, \dots, l$. Finally, m_s takes on the values $m_s = \pm \frac{1}{2}$.

CL23_Q2. In the analysis of Schrodinger's equation for a hydrogen atom using spherical polar coordinates, elaborate the azimuthal and polar. Also comment on the possible values of magnetic quantum number.

Answer

Azimuthal wave equation, $\frac{d^2\Phi}{d\phi^2} + m_\ell^2\Phi = 0$

Polar wave equation, $\frac{1}{\sin\theta} \frac{d}{d\theta} \left(\sin\theta \frac{d\Theta}{d\theta} \right) + \left[\ell(\ell+1) - \frac{m_\ell^2}{\sin^2\theta} \right] \Theta = 0$

Φ , the component of the complete wave function ψ must obey that it has a single value at a given point in space. The solution will satisfy this only when, magnetic quantum number m_ℓ is zero or a positive or negative integer.