4.PHYSICAL SIGNIFICANCE OF WAVE FUNCTION

WAVE FUNCTION : In the context of matter waves, a physical quantity that changes periodically is referred to as wave function.

- It is denoted by $\psi(x,t)$, which should be finite, continuous and single valued for all x (position) and t (time).
- A wave function may be used to describe the probability of finding electrons or particles within matter waves.

Physical significance:

- Even Though ψ has no physical significance,

  →The product of ψ and its complex conjugate ψ^* i.e., $|\psi\psi^*|=|\psi|^2$ is a real and positive quantity which gives the probability of finding the atomic particle in a particular region.

  → $\psi = \psi_0 e^{-i\omega t}$ gives particle behavior.

  → Normalization condition shows $\int |\psi|^2 dv = 1$, in the interval $-\infty$ to $+\infty$ is probability of finding particles in a space.

Conditions to be satisfied by wave function:

- An acceptable wave function

  (i)ψ must be normalized:

  Normalization condition shows $\int |\psi|^2 dv = 1$. in the interval $-\infty$ to $+\infty$ to be satisfied by wave function.

  (ii)ψ must be finite:

  The wave function must be finite for all values of x, y, z. If ψ is infinite, it would imply an infinitely large probability of finding the particle at that point.

  (iii)ψ must be single valued:

  Any physical quantity can have only one value at a point.

  (iv)ψ must be continuous:

  Since ψ is related to a physical quantity, its space derivatives $\partial\psi/\partial x$, $\partial\psi/\partial y$ & $\partial\psi/\partial z$ must be continuous at any point.

- The wave function satisfying the above mathematical conditions is called a well-behaved wave function.