CL11_Q1. Give physical interpretation of the wave function.

Answer

The wave function $\psi(x, y, z, t)$is a probability amplitude and the intensity of the wave (the point at which the energy of the wave is likely to be concentrated) is the square of the probability amplitude. Since the wave function can be a real or an imaginary function, it is evident that the square of the wave function $|\psi^2| = \psi^*.\psi$. ψ^* is the complex conjugate of the wave function. Thus the product is representative of the intensity of the wave or the probability of finding the particle at any point in the wave packet and is called the probability density.

CL11_Q2. Prove that ψ*(x,t) ψ(x,t) is necessarily real and either positive or zero.

Answer

As we know that wave functions are usually complex in nature, it consists of real and imaginary parts. But the probability must be a real and positive quantity.

Let ψ(x,t) = A+iB, then its complex conjugate is ψ*(x,t) = A-iB

$\psi^*(x,t)\ \psi(x,t) = \psi^2$

$\psi 2 = \psi^*\psi = (A-iB)\ (A+iB) = A^2 - i^2B^2$

$\psi 2 = \psi^*\psi = A^2 + B^2$ Hence the proof.

CL11_Q3. Mention important properties of wave function.

Answer

1. ψ must be finite, continuous and single valued in the regions of interest
2. The derivatives of the wave function must be finite, continuous and single valued
   in the regions of interest.
3. The wave function ψ must be normalisable. i.e.. $\int_{-\infty}^{+\infty} \psi * \psi \, dV = 1$