operators.

2.25 POSTULATES OF QUANTUM MECHANICS

A number of postulates of quantum mechanics have been introduced as they have been needed.

1. The state of a quantum mechanical system is fully described by a wave function $\Psi(x, y, z, t)$ or $\Psi(r, t)$ that is the function of the coordinates of particle and time. It contains all the informations known about the system.

2. The wave function $\Psi(x, t)$ and its first and second derivatives $\frac{\partial\Psi(x, t)}{\partial x}$ and $\frac{\partial^2\Psi(x, t)}{\partial x^2}$ must be continuous finite, and single valued for all values of x.

3. Every physical property (observable) A of a system can be characterised in quantum mechanics by a linear operator $\hat{A}$ or Hermitian operator $\hat{A}$. This operator satisfies the following condition for any pair of functions Ψ_1 and Ψ_2 which describes physical states of system.

$$\int \Psi_1^* \hat{A} \Psi_2 dx = \int \Psi_2 (\hat{A}\Psi_1)^* dx$$

4. The only possible values which a measurement of the property A can yield are the eigen values a_i of the equation.

$$\hat{A}\Psi_i = a_i \Psi_i$$

where $\hat{A}$ is the operator corresponding with the observable.

5. Average value of the property A associated with the operator $\hat{A}$ is given by

$$\langle A \rangle = \int_{-\infty}^{+\infty} \Psi^* \hat{A} \Psi d\tau$$

where Ψ is the normalized wave function for the state.

or $$\langle A \rangle = \frac{\int_{-\infty}^{+\infty} \Psi^* \hat{A} \Psi \, d\tau}{\int_{-\infty}^{+\infty} \Psi^* \Psi \, d\tau}$$

where Ψ is the system, state function.

6. The wave function of a system changes with time according to time-dependent Schrodinger wave equation.

$$-\frac{ih}{2\pi}\frac{\partial\Psi(x, y, z, t)}{\partial t} = \hat{H}\Psi(x, y, z, t)$$

These postulates cannot be proved or derived, we can treat these postulates in the same light as the acceptance of Newton's second law of motion. This classical law is accepted without proof on the strength of its agreement with experimental results. Thus the entire justification of postulatory basis of Quantum Mechanics lies ultimately in the agreement of theoretical results with experimental ones.