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Topic :- Elementary Quantum mechanics

Heisenberg's Uncertainty Principle :-

According to this principle it is not possible to determine precisely both the position and the momentum (velocity) of a small moving particle.

Let us consider a Photon incident on a Particle. If the Particle is of reasonable size, its position and velocity will not be changed by the impact of light Photons. Hence it will be possible to know both the position and velocity of the Particle.

But this cannot be so when the Particle is extremely minute such as an electron. It will suffer a change in its velocity and Path due to the impact of even a single Photon of light used to observe it. The Path and velocity of an electron, after the impact of light Photons may be quite different from the original Path and velocity.

In view of the Heisenberg Uncertainty Principle, the Bohr model in which electrons are considered as Particles revolving in definite orbits ie in well defined Path cannot hold good. It is more correct to say, therefore, that an electron is associated with definite energy ie it belongs to a definite energy level and not that it belongs to a Partical orbit.

The Heisenberg Uncertainty Principle is expressed mathematically as

$$\Delta x \cdot \Delta p \geq \frac{h}{4\pi}$$

Where Δx is Uncertainty with regard to the Position and Δp is Uncertainty with regard to the momentum of the electron.

Evidently If Δx is very small ie the position of the Particle is known more or less exactly Δp would be large ie Uncertainty with regards to momentum will be Large. and Vice-versa.