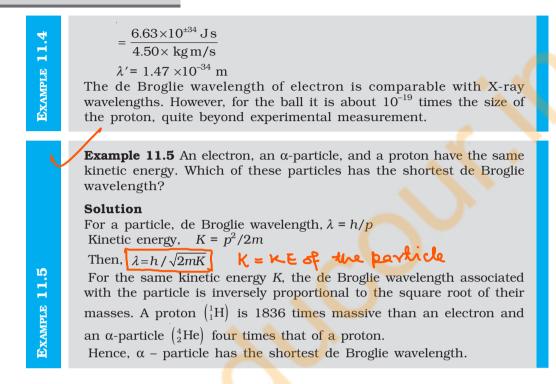
## Physics



## **PROBABILITY INTERPRETATION TO MATTER WAVES**

It is worth pausing here to reflect on just what a matter wave associated with a particle, say, an electron, means. Actually, a truly satisfactory physical understanding of the dual nature of matter and radiation has not emerged so far. The great founders of quantum mechanics (Niels Bohr, Albert Einstein, and many others) struggled with this and related concepts for long. Still the deep physical interpretation of quantum mechanics continues to be an area of active research. Despite this, the concept of matter wave has been mathematically introduced in modern quantum mechanics with great success. An important milestone in this connection was when Max Born (1882-1970) suggested a probability interpretation to the matter wave at a point determines the probability density of the particle at that point. Probability means probability per unit volume. Thus, if *A* is the amplitude of the wave at a point,  $|A|^2 \Delta V$  is the probability of the particle being found in a small volume  $\Delta V$  around that point. Thus, if the intensity of matter wave is large in a certain region, there is a greater probability of the particle being found there the intensity is small.

**Example 11.6** A particle is moving three times as fast as an electron. The ratio of the de Broglie wavelength of the particle to that of the electron is  $1.813 \times 10^{-4}$ . Calculate the particle's mass and identify the particle.

## Solution

EXAMPLE 11.6

de Broglie wavelength of a moving particle, having mass m and velocity v: