## Problem 50.27 (RHK)

We have to find the uncertainty in the location of a particle, in terms of its de Broglie wavelength  $\lambda$ , so that the uncertainty in its velocity is equal to its velocity.

## **Solution:**

Let the mass of the particle be m and its velocity be v. It is given that the uncertainty in the velocity is equal to the velocity. Therefore, the uncertainty in the momentum of

 $\Delta p = m\Delta v = mv.$ 

the particle will be

From the Heisenberg's uncertainty principle we expect that the uncertainty in the position of the particle will be of the order of

$$\Delta x = \frac{h}{2\pi \,\Delta p} = \frac{h}{2\pi \times (mv)} = \frac{\lambda}{2\pi},$$

where we have used that the de Broglie wavelength

$$\lambda = \frac{h}{p} = \frac{h}{mv}.$$

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