

Example 1: The uncertainty in the momentum Δp of a ball travelling at 20 m/s is 1×10^{-6} of its momentum. Calculate the uncertainty in position Δx ? Mass of the ball is given as 0.5 kg.

Answer:

Known numerics are,

$$v = 20 \text{ m/s,}$$

$$m = 0.5 \text{ kg,}$$

$$h = 6.62607004 \times 10^{-34} \text{ m}^2 \text{ kg / s}$$

$$\Delta p = p \times 1 \times 10^{-6}$$

As we know that,

$$P = m \times v = 0.5 \times 20 = 10 \text{ kg m/s}$$

$$\Delta p = 10 \times 1 \times 10^{-6}$$

$$\Delta p = 10^{-5}$$

Heisenberg Uncertainty principle formula is given as,

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

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

$$\Delta x \geq \frac{6.626 \times 10^{-34}}{4 \times 3.14 \times 10^{-5}} = 0.527 \times 10^{-29} \text{ m}$$