Assignment

1. Calculate the mass of a photon with wavelength 3.6 Å.

Answer

$$\frac{hc}{\lambda} = mc^2$$

$$m = \frac{h}{\lambda c}$$

$$= \frac{6.626 \times 10^{-34}}{3.6 \times 10^{-10} \times 3 \times 10^{8}}$$

$$= \frac{6.626}{3.6 \times 3} \times 10^{-32}$$

$$= 0.61 \times 10^{-32} kg$$

A golf ball has a mass of 40g, and a speed of 45 m/s. If the speed can be measured within accuracy of 2%, calculate the uncertainty in the position.

Answer

Use Heisenberg's uncertainty principle.

For example $[\Delta x = \frac{h}{4\pi m \Delta v}]$

Here, Δx is the uncertainty in the position.

Δv is the uncertainty in velocity

m is the mass of Particle.

Given, $m = 40g = 0.04kg$

$$\Delta v = 2\% of v = 2 \times \frac{45}{100} = 0.9 m/s$$

$$h = 6.626 \times 10^{-34} J.s$$

$$\text{Now, } \Delta x = \frac{6.626 \times 10^{-34}}{(4 \times 3.14 \times 0.04 \times 0.9)}$$

$$= 1.4654 \times 10^{-33} m$$