

PH-105 QM Sheet 1

Vipul Singh

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5. A 200MeV photon strikes a stationary proton. If the photon is back scattered, what is the kinetic energy of the recoiling proton?

Solution :

Use the Compton scattering formula

$$\lambda' - \lambda = \frac{h}{m_0 c}(1 - \cos\theta)$$

where θ = angle of scattering = π

m_0 = mass of stationary proton

Writing the equation in terms of energies of the incoming and scattered photons, we get

$$\frac{hc}{E'} - \frac{hc}{E} = \frac{2h}{m_0 c}$$

$E = 200\text{MeV}$. Solving, we get $E' = 140.22\text{MeV}$. Using the principle of energy conservation, kinetic energy of proton = energy lost by photon = $200 - 140.22 = 59.78\text{MeV}$.