

# PH-105 QM Sheet 1

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11. Find the energy of the incident x-ray if the maximum kinetic energy of the Compton electron is  $m_0c^2/2.5$ ?

**Solution :**

The Compton electron will have maximum kinetic energy when the energy lost by the photon is maximum. That will be the case when the increase in wavelength is maximum. A look at the Compton scattering formula

$$\lambda' - \lambda = \frac{h}{m_0c}(1 - \cos\theta)$$

tells us that this occurs at  $\theta = \pi$ . So, we have  $\theta = \pi$  and  $E - E' = 0.4m_0c^2$ .

$\frac{hc}{E'} - \frac{hc}{E} = \frac{2h}{m_0c}$ . Replace  $E'$  by  $E - 0.4m_0c^2$  and solve for E.

It reduces to  $5E^2 - 2E - 1 = 0$  which implies that  $E = 0.69m_0c^2$ .