159(2): Electron Velocity in the Compton Effect.

The electron momentum after collision is:

$$p'^2 = \frac{\hbar^2}{c^4}\left(\omega^2 v^2 + \omega'^2 v'^2 - 2\omega\omega' v v' \cos\theta\right) \quad -(1)$$

where v and v' have been given in UFT 158 and note 159(1).

In the usual theory:

$$v = v' = ? \, c \quad -(2)$$

so

$$p'^2 \sim \frac{\hbar^2}{c^2}\left(\omega^2 + \omega'^2 - 2\omega\omega'\cos\theta\right).$$

i.e.

$$p' \sim \frac{\hbar}{c}\left(\omega^2 + \omega'^2 - 2\omega\omega'\cos\theta\right)^{1/2} \quad -(3)$$

and

$$\boxed{v' = \frac{\hbar}{mc}\left(\omega^2 + \omega'^2 - 2\omega\omega'\cos\theta\right)^{1/2}} \quad -(4)$$

Here v' is the velocity of the electron after collision with the photon, the electron being initially at rest. Here

$$\frac{\hbar}{mc} = \frac{1}{2\pi}\frac{h}{mc} = \frac{2.426309 \times 10^{-12}}{2\pi} \text{ metres}$$

$$= 3.86159 \times 10^{-13} \text{ metres} \quad -(5)$$

For gamma rays: $\omega \sim \omega' \sim 10^{20}$ radians per second $-(6)$

$\omega \sim \omega' \sim$ $\boxed{v' \sim 10^7 \text{ metres per second}}$