

48. Referring to Sample Problem 39-4, we see that the fractional change in photon energy is

$$\frac{E - E'}{E} = \frac{\Delta\lambda}{\lambda + \Delta\lambda} = \frac{h/mc(1 - \cos\phi)}{(hc/E) + (h/mc(1 - \cos\phi))} .$$

Energy conservation demands that  $E - E' = K$ , the kinetic energy of the electron. In the maximal case,  $\phi = 180^\circ$ , and we find

$$\frac{K}{E} = \frac{h/mc(1 - \cos 180^\circ)}{(hc/E) + (h/mc(1 - \cos 180^\circ))} = \frac{h/mc(2)}{(hc/E) + (h/mc(2))} .$$

Multiplying both sides by  $E$  and simplifying the fraction on the right-hand side leads to

$$K = E \left( \frac{2/mc}{c/E + 2/mc} \right) = \frac{E^2}{mc^2/2 + E} .$$