P#L

Ch 29

$E_{\gamma} = 1.02\ MeV = 1.02 \times 10^{6}\ eV$

$m_{Al} = 4.48 \times 10^{-26}\ kg$

a) $E = \frac{hc}{\lambda}$ so $1.02 \times 10^{6}\ eV = \frac{1240\ eV \cdot nm}{\lambda}$

$\lambda = .00122\ nm \cdot \frac{10^{-9}\ m}{1\ nm}$

$\boxed{\lambda = 1.22 \times 10^{-12}\ m}$

b) $E_{\gamma} = 1.02 \times 10^{6}\ eV \cdot \left(\frac{1.602 \times 10^{-19}\ J}{1\ eV}\right) = 1.63 \times 10^{-13}\ J$

$E = p \cdot c$ so $1.63 \times 10^{-13}\ J = p \cdot (3 \times 10^{8}\ m/s)$

$\boxed{p = 5.4 \times 10^{-22}\ kg \cdot m/s}$

c) $m_{Al} = 4.48 \times 10^{-26}\ kg$
$p_{\gamma} = 5.4 \times 10^{-22}\ kg \cdot m/s$

$p_{\gamma} + p_{Al} = p'_{\gamma} + p'_{Al}$

$0 + 0 = (5.4 \times 10^{-22}\ kg \cdot m/s) + (4.48 \times 10^{-26}\ kg) \cdot v'_{Al}$

$\boxed{v'_{Al} = 12{,}160\ m/s}$

d) $KE_{Al} = \frac{1}{2} \cdot m_{Al} \cdot v_{Al}^{2}$

$= \frac{1}{2}(4.48 \times 10^{-26}\ kg) \cdot (12{,}160\ m/s)^{2}$

$\boxed{KE = 3.3 \times 10^{-18}\ J}$