p189 31-34 all

(31) $m_1 v_1 + \cancel{m_p v_p} = (m_1 + m_p) v'$

$\frac{1}{2}(\cancel{m_1 + m_p}) v_1'^2 = (\cancel{m_1 + m_p}) gh$

$v_1' = \sqrt{2gh}$

$V_1 = \frac{(m_1 + m_p)\sqrt{2gh_1}}{m_1}$ for projectile 1

$V_2 = \frac{(m_1 + m_p)\sqrt{2gh_2}}{m_1}$ for projectile 2

$\frac{V_1}{V_2} = \frac{\frac{(\cancel{m_1 + m_p})\sqrt{2gh_1}}{\cancel{m_1}}}{\frac{(\cancel{m_1 + m_p})\sqrt{2gh_2}}{\cancel{m_1}}}$

$\frac{V_1}{V_2} = \frac{\sqrt{h_1}}{\sqrt{h_2}} = \sqrt{\frac{h_1}{h_2}} = \sqrt{\frac{0.026\ m}{0.052\ m}} = 0.707$

$V_2 = 1.41 V_1$

projectile 2 is 1.41 times faster than projectile 1

(32)

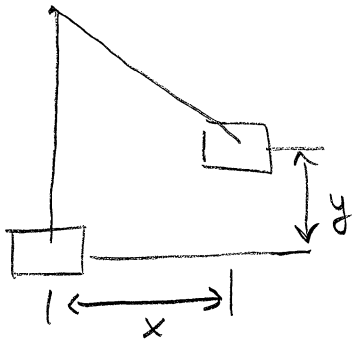
$$m_b v_b + m_p v_p = (m_b + m_p) v'$$

$$v' = \frac{m_b v_b}{(m_b + m_p)} = \frac{(0.028\,kg)(230\,ms^{-1})}{(0.028\,kg + 3.6\,kg)} = 1.78\,ms^{-1}$$

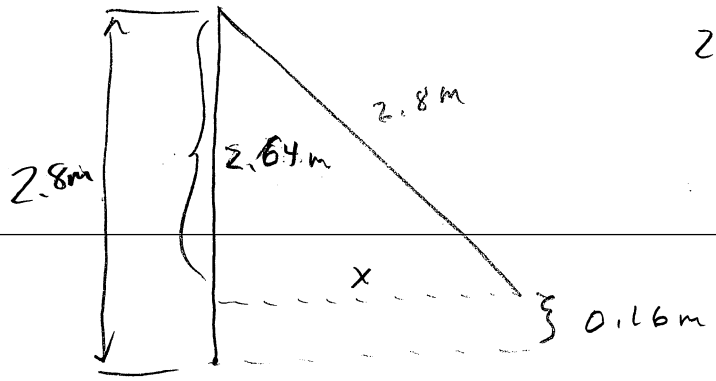
$$E_{before} = E_{after}$$

$$\frac{1}{2} m v^2 = mgh$$

$$h = \frac{v^2}{2g} = \frac{(1.78\,ms^{-1})^2}{2(9.81\,ms^{-2})} = 0.16$$



$y = 0.16\,m$



$$2.8^2 = 2.64^2 + x^2$$

$$x^2 = 2.8^2 - 2.64^2$$

$x = 0.93\,m$

(33) (a) $\frac{\Delta KE}{KE} = \frac{\frac{1}{2}(m+M)v'^2 - \frac{1}{2}mv^2}{\frac{1}{2}mv^2}$

$$v = \left(\frac{m+M}{m}\right)v'$$

$$v' = \left(\frac{m}{m+M}\right)v$$

$$= \frac{(m+M)\left(\frac{m}{m+M}\right)^2 v^2 - mv^2}{mv^2}$$

$$= \frac{\frac{m^2}{m+M} - m}{m}$$

$$= \frac{m}{m+M} - 1$$

$$= \frac{m}{m+M} - \left(\frac{m+M}{m+M}\right)$$

$$\frac{\Delta KE}{KE} = \frac{-M}{m+M}$$

(b) $\frac{\Delta KE}{KE} = \frac{-(0.380\,kg)}{(.014\,kg + 0.380\,kg)} = -0.96$

(34) $0 = m_1 v_1 + m_2 v_2$ $\qquad m_2 = 1.5\, m_1$

$0 = m_1 v_1 + 1.5 m_1 v_2$

$v_1 = 1.5 v_2$ $\qquad m_1 = \frac{m_2}{1.5}$

$\frac{1}{2} m_1 v_1^2 + \frac{1}{2} m_2 v_2^2 = 7500\,J$

$\frac{1}{2}\left(\frac{m_2}{1.5}\right)(1.5)^2 v_2^2 + \frac{1}{2} m_2 v_2^2 = 7500\,J$

$1.5\left(\frac{1}{2} m_2 v_2^2\right) + \frac{1}{2} m_2 v_2^2 = 7500\,J$

$1.5\, E_{k_2} + E_{k_2} = 7500\,J$

$2.5\, E_{k_2} = 7500\,J$

$E_{k_2} = 3000\,J$

$E_{k_1} + E_{k_2} = 7500\,J$

$E_{k_1} = 7500\,J - E_{k_2} = 7500\,J - 3000\,J$

$E_{k_1} = 4500\,J$