

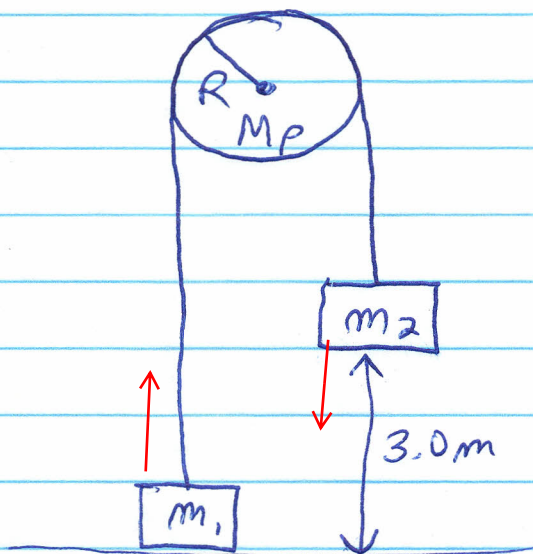
Giancoli Ch. 8 #54 (randomized numbers)

$$m_1 = 18 \text{ kg}$$

$$m_2 = 26.5 \text{ kg}$$

$$R = 0.26 \text{ m}$$

$$M_p = 7.50 \text{ kg}$$



Release from rest

$$y_{1i} = 0$$

$$y_{2i} = 3 \text{ m} \quad \text{initial}$$

$$v_{1i} = 0$$

$$v_{2i} = 0$$

$$w = 0$$

$$y_{1f} = 3 \text{ m} \quad \text{final}$$

$$y_{2f} = 0$$

$$v_{2f} = ?$$

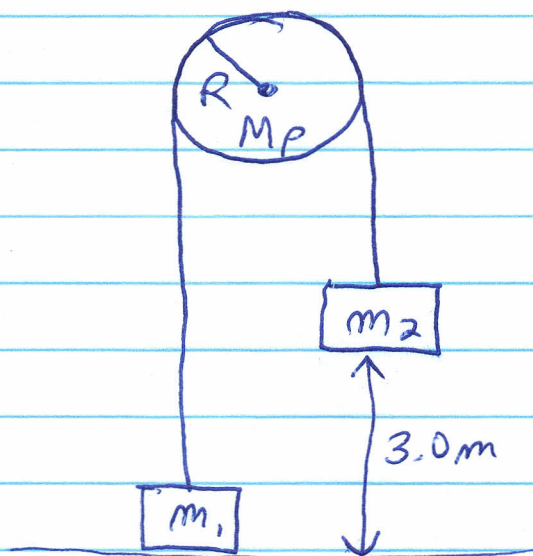
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$$\omega = 0$$

$$y_{1f} = 3 \text{ m} \quad \text{final}$$

$$y_{2f} = 0$$

$$v_{2f} = ?$$

$$E_i = E_f$$

$$U_i + K_i = U_f + K_f$$

$$U_{1i} + U_{2i} + U_{pi} + K_{1i} + K_{2i} + K_{pi} =$$

$$U_{1f} + U_{2f} + U_{pf} + K_{1f} + K_{2f} + K_{pf}$$

$$m_1 g y_{1i} + m_2 g y_{2i} + M g y_{pi} + 0 + 0 + 0$$

← same.

$$= m_1 g y_{1f} + m_2 g y_{2f} + M g y_{pf}$$

$$+ \frac{1}{2} m_1 v_{1f}^2 + \frac{1}{2} m_2 v_{2f}^2 + \frac{1}{2} I_p \omega_f^2$$

a lot of regrouping: all v 's same, $\omega = v/R$.

$$m_1 g [y_{1i} - y_{1f}] + m_2 g [y_{2i} - y_{2f}] \\ + \frac{1}{2} m_1 v_{1f}^2 + \frac{1}{2} m_2 v_{2f}^2 + \frac{1}{2} I_p \left(\frac{v_{2f}}{R} \right)^2$$

$$(18)(9.8)(0-3) + 26.5(9.8)(3-0) =$$

$$+ \left[\frac{1}{2}(18) + \frac{1}{2}(26.5) + \frac{7.50}{4} M_p \right] v_f^2$$

$$I_p = \frac{1}{2} M_p R^2$$

$$\text{so } \frac{1}{2} I_p \frac{v_{2f}^2}{R^2} = \frac{1}{2} \left(\frac{1}{2} M_p R^2 \right) \frac{v_{2f}^2}{R^2} = \frac{1}{4} M_p v_f^2$$

$$249.9 = 24.125 v_f^2$$

$$3.22 \text{ m/s} = v_f$$