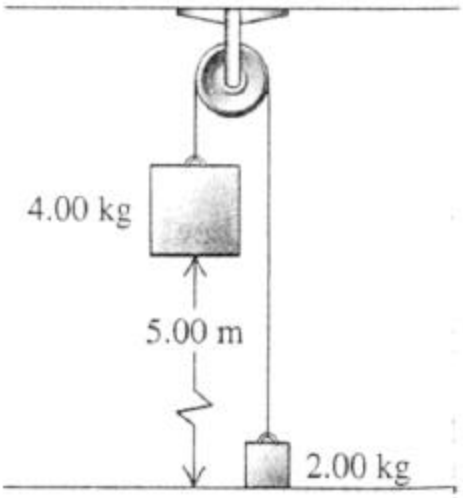
9.86 The pulley in Fig. 9.31 has radius 0.160 m and a moment of inertia 0.480 kg · m^2. The rope does not slip on the pulley rim. Use energy methods to calculate the speed of the 4.00-kg block just before it strikes the floor.



9.86: The gravitational potential energy which has become kinetic energy is $K = (4.00\ \text{kg} - 2.00\ \text{kg})(9.80\ \text{m/s}^2)(5.00\ \text{m}) = 98.0$ J. In terms of the common speed v of the blocks, the kinetic energy of the system is

$$K = \frac{1}{2}(m_1 + m_2)v^2 + \frac{1}{2}I\left(\frac{v}{R}\right)^2$$
$$= v^2\frac{1}{2}\left(4.00\ \text{kg} + 2.00\ \text{kg} + \frac{(0.480\ \text{kg}\cdot\text{m}^2)}{(0.160\ \text{m})^2}\right) = v^2(12.4\ \text{kg}).$$

Solving for v gives $v = \sqrt{\frac{98.0\ \text{J}}{12.4\ \text{kg}}} = 2.81$ m/s.