11-86 Using conservation of energy

\[ mgh = \frac{1}{2}mv^2 + \frac{1}{2}I_\text{pulley} \omega_p^2 = \frac{1}{2}I_\text{sphere} \omega^2 \]

\[ = \frac{1}{2}mv^2 + \frac{1}{2} \left( \frac{2}{3}MR^2 \right) \frac{v^2}{R} + \frac{1}{2} \frac{I}{R^2} \]

solve for \( v = \sqrt{\frac{mgh}{\frac{1}{2}m + \frac{1}{3}M + \frac{1}{2} \frac{I}{R^2}}} \)

12-1

\[ \text{translational KE} = \frac{1}{2}mv^2 \quad \text{rotational KE} = \frac{1}{2}I\omega^2 \]

\[ = \frac{1}{2} \left( \frac{2}{3}MR^2 \right) \frac{v^2}{R} \]

\[ = \frac{\frac{2}{3}Mv^2}{\frac{1}{2}Mv^2} = 1 \]

12-7 (a) In order to find the acceleration of a sphere down a ramp, follow sample problem 12-4 on page 273 down to equation (12-12), then use \( I = \frac{2}{5}MR^2 \rightarrow a = \frac{g \sin \theta}{1 + \frac{4}{5}} = 0.1 \ g \]

\( \theta = \sin^{-1} (0.14) = 8.0^\circ \)

(b) For a block sliding down a ramp, \( a = g \sin \theta = 0.14 \ g \) (for an \( 8^\circ \) ramp). We solved this in chapter 5.