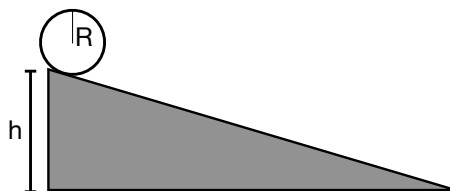


Quiz 6

On the surface of the Earth, a ball with radius R , mass M , and moment of inertia I starts from rest at the top of a ramp of height h and rolls to the bottom without slipping. If you ignore friction and air resistance, what is the speed of the ball at the bottom of the ramp, in terms of m , g , h , R , and I ?



$$\Delta E_{\text{sys}} = 0$$

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}I\omega^2$$

$$\omega = \frac{v}{R}$$

$$mgh = \frac{1}{2}mv^2 + \frac{1}{2}I\frac{v^2}{R^2}$$

$$mgh = \frac{1}{2}\left(m + \frac{I}{R^2}\right)v^2$$

$$v^2 = \frac{2mgh}{m + \frac{I}{R^2}} = \frac{2gh}{1 + \frac{I}{mR^2}}$$

$$v = \left(\frac{2gh}{1 + \frac{I}{mR^2}} \right)^{1/2}$$