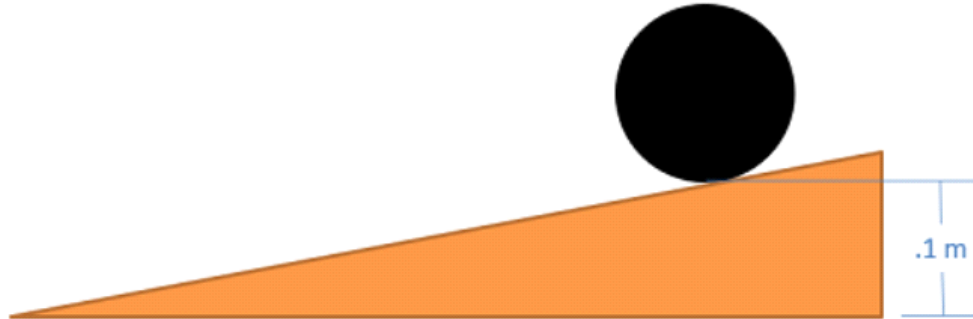


Problem 3

A 5 kg spherical ball with a radius of 5 cm is placed on a ramp as shown below. If the ball rolls without slipping, what is the expected velocity of the ball at the bottom of the ramp?



$$W = \Delta KE + \Delta PE$$

$$0 = \frac{1}{2} I \omega_f^2 + \frac{1}{2} m v_f^2 + m g \Delta h$$

rolling without slipping

$$v = -r\omega \rightarrow \omega = \frac{-v}{.05}$$

$$0 = \frac{1}{2} \left(\frac{2}{5} (5 \text{ kg}) (.05 \text{ m})^2 \right) \left(\frac{-v}{.05} \right)^2 + \frac{1}{2} (5 \text{ kg}) v^2 + (5 \text{ kg}) \left(9.81 \frac{\text{m}}{\text{s}^2} \right) (-.1 \text{ m})$$

$$0 = v^2 + 2.5 v^2 - 4.905$$

$$\boxed{v = 1.18 \text{ m/s}}$$