

22. A thin ring of mass  $M$  and radius  $R$  rolls (without slipping) at speed  $v_0 = 2.0 \text{ m/s}$  along a level floor, and then up a ramp of vertical height  $h = 0.15 \text{ m}$ . What is the speed  $v$  of the ring when it reaches the top of the ramp?



$$E_i = E_f \quad ; \quad K = \frac{1}{2} M v^2 + \frac{1}{2} (M R^2) \omega^2$$

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

$$= M v^2$$

$$E_i = K_i, \quad E_f = M g h + K_f$$

$$\Rightarrow M v_0^2 = M g h + M v_f^2$$

$$\Rightarrow v_f = \sqrt{v_0^2 - g h} = \underline{\underline{1.59 \text{ m/s}}}$$

answer

1.6 m/s