

1 | 5)

Using Energy Approach:

1.1 | Finding v_f

We know that the object starts at height h and eventually ends up at the bottom of the ramp, i.e. height 0. We know that in this case, $\Delta PE = -\Delta KE$. We know the initial height, and we know that it is initially stationary. We know that at the bottom of the ramp, the height is 0 and we know that it has a velocity. As such, we know that the following is true:

$$\begin{aligned}\Delta PE &= -\Delta KE \\ PE_i - PE_f &= KE_f - KE_i \\ (mgh) - (0) &= \left(\frac{1}{2}mv_f^2 + \frac{1}{2}I_0\omega_f^2 \right) - (0) \\ mgh &= \frac{1}{2}mv_f^2 + \frac{1}{2}I_0\omega_f^2 \\ 2mgh &= mv_f^2 + I_0\omega_f^2\end{aligned}$$

1.2 | Finding