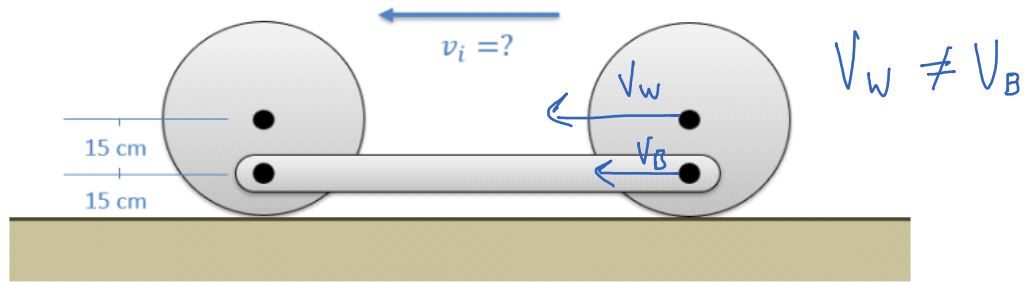


Problem 5

A mechanism consists of two, 3 kilogram wheels connected to a 2 kilogram bar as shown below. Based on the dimensions in the diagram, what is the minimum required initial velocity for the wheels to ensure the mechanism makes it all the way through one rotation without rocking backwards?



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

$$0 = \underbrace{0 - \left(2 \left(\frac{1}{2} m v_w^2 \right) + \frac{1}{2} m v_B^2 + 2 \left(\frac{1}{2} I \omega^2 \right) \right)}_{\Delta KE} + \underbrace{\frac{m g \Delta h}{\Delta PE}}$$

$$v_w = -r \omega = 2 v_B$$

$$0 = -(2) \left(\frac{1}{2} \right) (3) (v_w)^2 - \frac{1}{2} (2) \left(\frac{v_w}{2} \right)^2 - (2) \left(\frac{1}{2} \right) \left(\frac{1}{2} (3) (.3)^2 \right) \left(\frac{-v_w}{.3} \right)^2 + (2) (9.81) (.3)$$

$$0 = -3 v_w^2 - \frac{1}{4} v_w^2 - 1.5 v_w^2 + 5.886$$

$$\boxed{v_w = 1.011 \text{ m/s}}$$