Mass Dropping While Wheel Turns



Conservation of energy: mgh = $mv^2/2 + I\omega^2/2$ Need to find v, I, and ω in order to determine m Kinematic equations: $h = at^2/2$ (h = 1.5 m, t = 2 s) $a = 2h/t^2 = 0.75 m/s^2$, v = at = 1.5 m/s $\omega = v/R = 1.5/0.4 = 3.75 \text{ rad/s}$, $\alpha = a/R = 1.875 \text{ rad/s}^2$ Dynamics equation: $\tau = TR = I\alpha$ gives I = $(TR)/\alpha$ $I = (20*0.4)/1.875 = 4.27 \text{ kg}\text{-m}^2$ Now have numerical values for v, I, and ω , so can get m $m = I\omega^2/(2gh - v^2) = 2.2 kg$