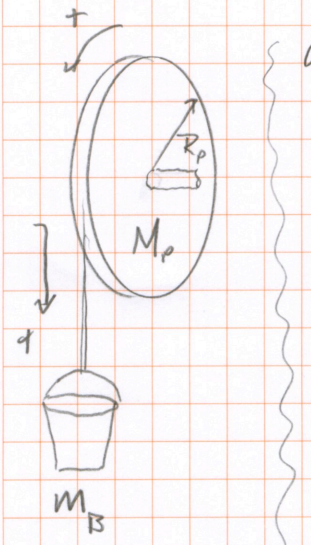
HW Set 4

1) ADD WINDLASS - A BUCKET IS LOWERED INTO A WELL FROM REST
a) SHOW THE ACCELERATION OF THE BUCKET IS

$$a_B = g\left(\frac{m_B}{m_B + \frac{1}{2}m_p}\right)$$

b) IF $m_B = 3\,kg$, $M_p = 5\,kg$ AND $t_{FALL} = 4$ SEC SHOW $y_{FALL} = 42.8\,m$ & FIND α FOR $R_p = 0.6\,m$.



a) APPLY NSL:

m_B: $\sum F_{BUCKET} = ma_{BUCKET}$

$$m_B g - T = m_B a_B$$

$$T = m_B g - m_B a_B$$

M_p: $\sum \tau_{\star} = I_p \alpha_p$

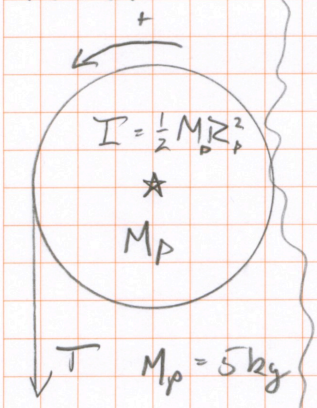
$$TR = \left(\tfrac{1}{2} M_p R_p^2\right)\left(\frac{a_B}{R_p}\right)$$

$$T = \tfrac{1}{2} M_p a_B$$

EQUATE T's & SOLVE FOR a

$$m_B g - m_B a_B = \tfrac{1}{2} M_p a_B$$

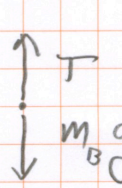
$$\boxed{a_B = \left(\frac{m_B}{m_B + \frac{1}{2}M_p}\right) g}$$



b) FIND DISTANCE IN $t = 4\,s$

$$y = y_0 + v_{0y} t + \tfrac{1}{2} a_B t^2 = \tfrac{1}{2}\left(\frac{3}{3 + \frac{1}{2}(5)}\right)(9.8)(4)^2$$

$$\boxed{y = 42.8\,m}$$



FIND $\alpha_p = \frac{a_B}{R} = \frac{\left(\frac{m_B}{m_B + \frac{1}{2}M_p}\right) g}{R} = \frac{\left(\frac{3}{5.5}\right)(9.8)}{0.6}$

$$\boxed{\alpha_p = 8.9\ \frac{rad}{s}}$$