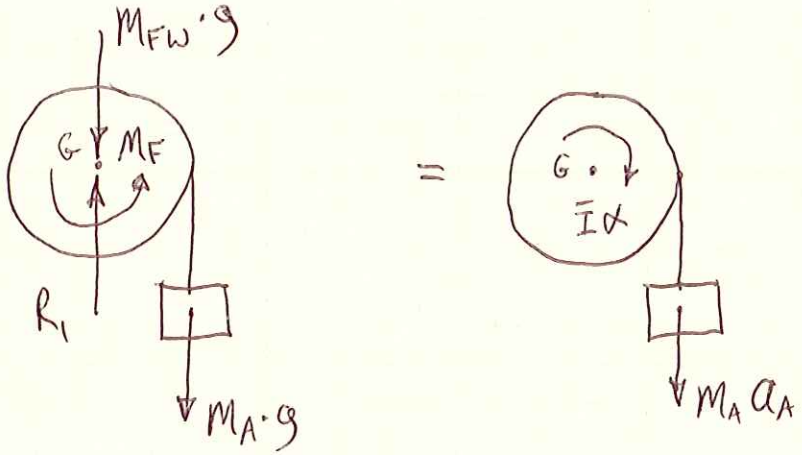
PROB. 16-33

$r = 0.6^{m}$, $m_A = 12^{kg}$, $v_{A,0} = 0$, $(x_A - x_{A,0}) = 3^{m}$, $t = 4.6^{s}$,

$m_B = 24^{kg}$, $(x_B - x_{B,0}) = 3^{m}$, $t = 3.1^{s}$, $v_{B,0} = 0$

ASSUMING THAT THE COUPLE DUE TO FRICTION IS CONSTANT, FIND $\bar{I}_{FW}$.

BLOCK A:



$\Sigma \vec{M}_G = \Sigma (\vec{M}_G)_{EFF}$ $+\circlearrowleft$:

$M_F - r m_A g = -\bar{I}\alpha - r m_A a_A$, $M_F = -\bar{I}\alpha + r m_A (g - a_A)$

$a_A = r\alpha$, $\alpha = \frac{a_A}{r}$

$M_F = -\bar{I}\left(\frac{a_A}{r}\right) + r m_A (g - a_A)$

BLOCK B:

$M_F = -\bar{I}\left(\frac{a_B}{r}\right) + r m_B (g - a_B)$

$-\bar{I}\left(\frac{a_A}{r}\right) + r m_A (g - a_A) = -\bar{I}\left(\frac{a_B}{r}\right) + r m_B (g - a_B)$

PROB. 16-33 CONT.

$$\bar{I}\left(\frac{a_B - a_A}{r}\right) = r\left[m_B(g - a_B) - m_A(g - a_A)\right]$$

$$\bar{I} = \frac{r^2\left[m_B(g - a_B) - m_A(g - a_A)\right]}{(a_B - a_A)}$$

$$X = X_0 + v_0 t + \frac{1}{2}at^2 \;;\; X_0 = 0,\; v_0 = 0$$

$$X = \frac{1}{2}at^2, \quad a = \frac{2X}{t^2}$$

$$a_A = \frac{2X_A}{t_A^2} = \frac{2(3^m)}{(4.6^s)^2} = 0.2835\ \frac{m}{s^2}$$

$$a_B = \frac{2X_B}{t_B^2} = \frac{2(3^m)}{(3.1^s)^2} = 0.6243\ \frac{m}{s^2}$$

$$\bar{I} = \frac{(0.6^m)^2\left[(24^{kg})(9.81 - 0.6243\ \frac{m}{s^2}) - (12^{kg})(9.81 - 0.2835\ \frac{m}{s^2})\right]}{(0.6243 - 0.2835\ \frac{m}{s^2})}$$

$$\boxed{\bar{I} = 112.1\ kg \cdot m^2}$$