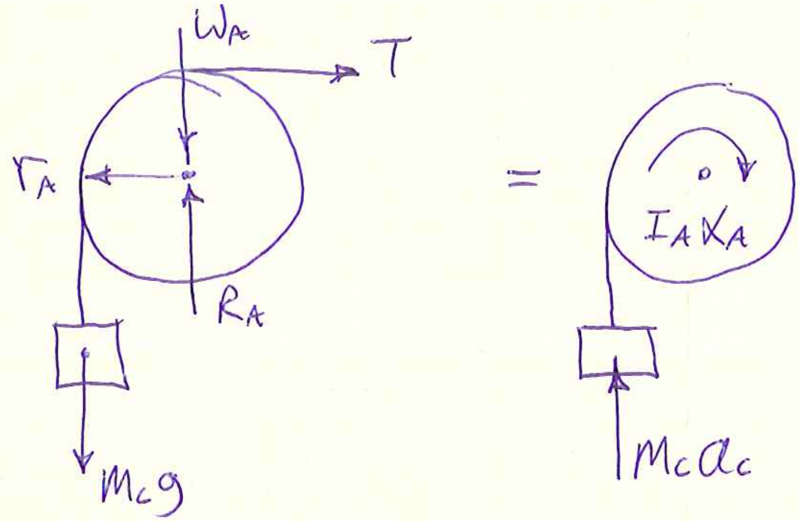
## PROB. 16-38

$W_A = 20^{LB}$, $W_B = 12^{LB}$, $W_C = 15^{LB}$, $W_D = 18^{LB}$




$$\sum \vec{M}_G = \sum (\vec{M}_G)_{EFF} \quad +\circlearrowright:$$

$$r_A m_C g - r_A \cdot T = -r_A m_C a_C - I_A \alpha_A$$

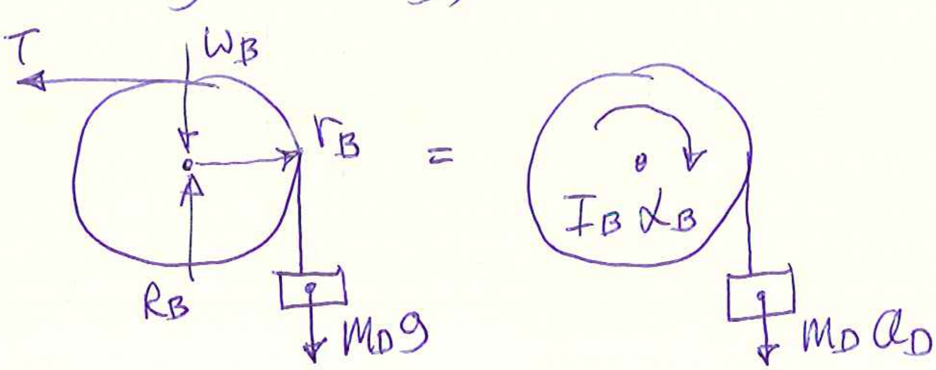
$$T = m_C g + m_C a_C + \frac{I_A \alpha_A}{r_A}$$

TANGENTIAL ACCELERATION: $a_C = r_A \alpha_A$, $\alpha_A = \frac{a_C}{r_A}$

MASS MOMENT OF INERTIA: $I_A = \frac{1}{2} r_A^2 m_A$

$$T = W_C + \left(\frac{W_C}{g}\right) a_C + \frac{\left[\frac{1}{2} m_A r_A^2\right]\left(\frac{a_C}{r_A}\right)}{r_A}$$

$$T = W_C + \frac{W_C}{g} a_C + \frac{1}{2}\left(\frac{W_A}{g}\right) a_C$$



PROB. 16-38 CONT.

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

$$r_B T - r_B M_D g = -r_B M_D a_D - I_B \alpha_B$$

$$T = W_D - \left(\frac{W_D}{g}\right)a_D - \frac{I_B \alpha_B}{r_B}$$

$$a_D = r_B \alpha_B \;,\quad \alpha_B = \frac{a_D}{\cancel{a_B}\, r_B}$$

$$I_B = \frac{1}{2}\left(\frac{W_B}{g}\right) r_B^2$$

$$T = W_D - \left(\frac{W_D}{g}\right)a_D - \frac{\left[\frac{1}{2}\left(\frac{W_B}{g}\right) r_B^2\right]\left(\frac{a_D}{r_B}\right)}{r_B}$$

$$T = W_D - \left(\frac{W_D}{g}\right)a_D - \frac{1}{2}\left(\frac{W_B}{g}\right)a_D$$

$$W_C + \left(\frac{W_C}{g}\right)a_C + \frac{1}{2}\left(\frac{W_A}{g}\right)a_C = W_D - \left(\frac{W_D}{g}\right)a_D - \frac{1}{2}\left(\frac{W_B}{g}\right)a_D$$

$a_C = a_D$ SAME ACCELERATION

$$W_C + \left(\frac{W_C}{g}\right)a_D + \frac{1}{2}\left(\frac{W_A}{g}\right)a_D = W_D - \left(\frac{W_D}{g}\right)a_D - \frac{1}{2}\left(\frac{W_B}{g}\right)a_D$$

$$a_D\left[\left(\frac{W_C}{g}\right) + \frac{1}{2}\left(\frac{W_A}{g}\right) + \left(\frac{W_D}{g}\right) + \frac{1}{2}\left(\frac{W_B}{g}\right)\right] = W_D - W_C$$

$$a_D = \frac{g(W_D - W_C)}{\left[W_C + W_D + \frac{1}{2}W_A + \frac{1}{2}W_B\right]}$$

$$a_D = \frac{(32.2 \frac{ft}{s^2})(18 - 15^{LB})}{\left[15^{LB} + 18^{LB} + \frac{1}{2}(20^{LB}) + \frac{1}{2}(12^{LB})\right]} \boxed{= 1.971 \frac{ft}{s^2} \downarrow}$$

$$\boxed{a_C = 1.971 \frac{ft}{s^2} \uparrow}$$