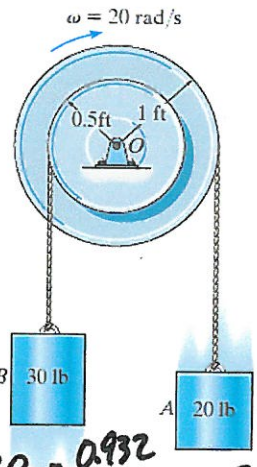
18–7.

The double pulley consists of two parts that are attached to one another. It has a weight of 50 lb and a radius of gyration about its center of $k_O = 0.6$ ft. If it rotates with an angular velocity of 20 rad/s clockwise, determine the kinetic energy of the system. Assume that neither cable slips on the pulley.



$$I_O = mk^2 = \frac{50}{32.2}(.6)^2 = 0.559$$

$$V_A = \omega r_A = 20(1.0) = 20$$

$$V_B = \omega r_B = 20(0.5) = 10$$

$$m_B = \frac{30}{32.2} = 0.932 \qquad m_A = \frac{20}{32.2} = 0.621$$

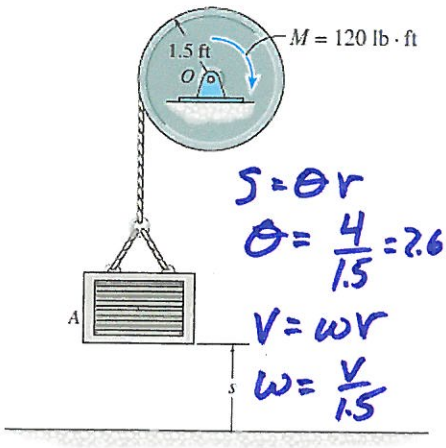
$$T_1 = \frac{1}{2} I_O \omega_O^2 + \frac{1}{2} m_A V_A^2 + \frac{1}{2} m_B V_B^2$$

$$= \frac{1}{2}(0.559)(20)^2 + \frac{1}{2}(0.621)(20)^2 + \frac{1}{2}(0.932)(10)^2$$

$$= 203 \text{ Ft·lb}$$

18–29.

A motor supplies a constant torque or twist of $M = 120\ \text{lb}\cdot\text{ft}$ to the drum. If the drum has a weight of 30 lb and a radius of gyration of $k_O = 0.8$ ft, determine the speed of the 15-lb crate A after it rises $s = 4$ ft starting from rest. Neglect the mass of the cord.



$s = \theta r$

$\theta = \frac{4}{1.5} = 2.667 \text{ rad}$

$v = \omega r$

$\omega = \frac{v}{1.5}$

CLASSIFY MOTION

DRUM - RAFA

CRATE - TRANS

PROPERTIES

$W_{DRUM} = 30\ \text{lb} \qquad m_{DRUM} = \frac{30}{32.2} = 0.932 \text{ SLUG}$

$I_G = mk^2 = 0.932(0.8)^2 = 0.596 \text{ SLUG-FT}^2$

$W_{CRATE} = 15\ \text{lb} \qquad m_{CRATE} = \frac{15}{32.2} = 0.466 \text{ SLUG}$

$T_1 + \Sigma U_{1-2} = T_2$

WORK

MOMENT $\quad U = M\theta = 120(2.667) = 320 \text{ FT-LB}$

WEIGHT $\quad U = -Wh = -15(4') = -60 \text{ FT-LB}$

ENERGY

$T_2 = \frac{1}{2}mv_2^2 + \frac{1}{2}I_G\omega_2^2 = \frac{1}{2}(0.466)v_2^2 + \frac{1}{2}(0.596)\left(\frac{v_2}{1.5}\right)^2$

$= 0.365v_2^2$

$0 + 320 - 60 = 0.365v_2^2$

$v_2 = 26.7 \text{ FT/S} \uparrow$