

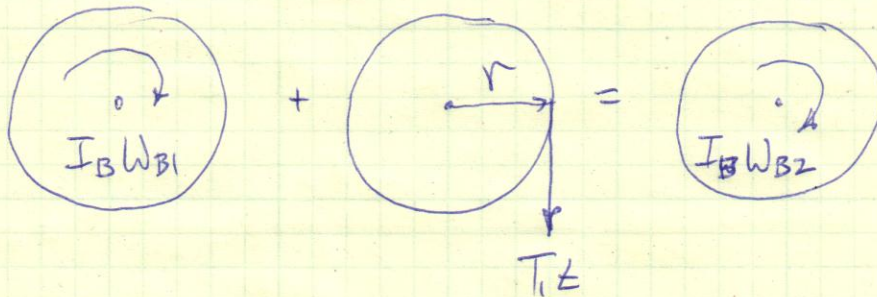
17-74

①

$$M = 6 \text{ kg}, \quad r = 0.125 \text{ m}, \quad \omega_{A1} = 0 = \omega_{B1}, \quad t = 3 \text{ s}$$

FIND v_{A2} , T

CYLINDER B:

ANG. MOM. : \uparrow

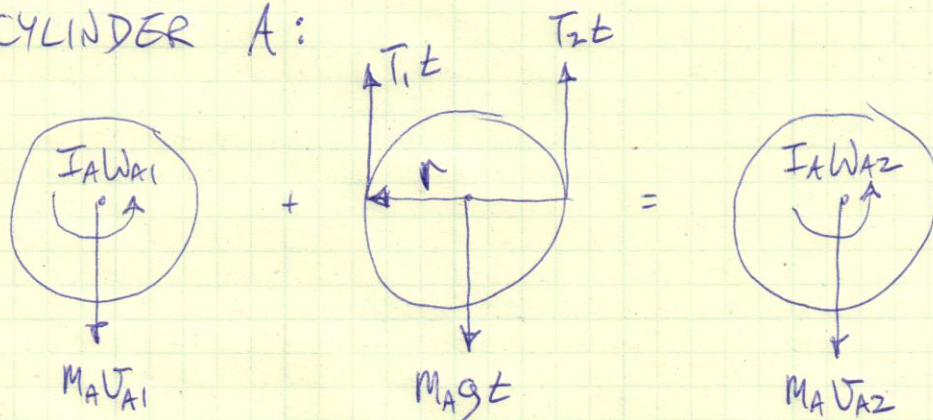
$$-I_B \omega_{B1} - T_1 t \cdot r = -I_B \omega_{B2}$$

$$T_1 t = \frac{1}{r} \cdot I_B \omega_{B2}$$

$$I_B = \frac{1}{2} M_B r^2$$

$$T_1 t = \frac{1}{2} M_B r \omega_{B2} \quad \text{①}$$

CYLINDER A:



Y-DIR. MOM. $\downarrow +$:

$$M_A \cancel{V_{A1}} + M_A g t - T_1 t - T_2 t = M_A V_{A2}$$

$$T_1 t = M_A g t - T_2 t - M_A V_{A2} \quad (2)$$

ANG. MOM. $\uparrow +$:

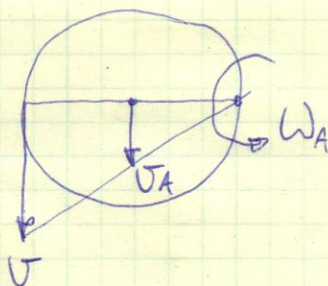
$$I_A \cancel{\omega_{A1}} - T_1 t \cdot r + T_2 t \cdot r = I_A \omega_{A2}$$

$$T_1 t = T_2 t - \frac{1}{r} \cdot I_A \omega_{A2}$$

$$I_A = \frac{1}{2} M_A r^2$$

$$T_1 t = T_2 t - \frac{1}{2} M_A r \omega_{A2} \quad (3)$$

KINEMATICS:



$$v = r \omega_{B2}$$

$$v_A = \frac{1}{2} v = \frac{1}{2} r \omega_{B2}$$

$$\omega_{B2} = \frac{2 v_{A2}}{r}$$

$$v_{A2} = r \omega_{A2}$$

$$\omega_{A2} = \frac{v_{A2}}{r}$$

$$T_1 t = \frac{1}{2} M_B r \left(\frac{2v_{A2}}{r} \right) = M_B v_{A2} \quad (1)$$

$$T_1 t = M_A g t - T_2 t - M_A v_{A2} \quad (2)$$

$$T_1 t = T_2 t - \frac{1}{2} M_A r \left(\frac{v_{A2}}{r} \right)$$

$$T_1 t = T_2 t - \frac{1}{2} M_A v_{A2} \quad (3)$$

$$(2) + (3):$$

$$2T_1 t = M_A g t - M_A v_{A2} - \frac{1}{2} M_A v_{A2}$$

$$T_1 t = \frac{1}{2} M_A g t - \frac{3}{4} M_A v_{A2} \quad (4)$$

$$\text{SET } (1) = (4):$$

$$M_B v_{A2} = \frac{1}{2} M_A g t - \frac{3}{4} M_A v_{A2}$$

$$v_{A2} = \frac{M_A g t}{2(M_B + \frac{3}{4} M_A)}$$

$$v_{A2} = \frac{(6 \text{ kg}) (9.81 \frac{\text{m}}{\text{s}^2}) (3 \text{ s})}{2 \left[(6 \text{ kg}) + \frac{3}{4} (6 \text{ kg}) \right]}$$

$$v_{A2} = 8.408 \frac{\text{m}}{\text{s}}$$

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EQN. ①:

$$T_1 t = M_B v_{A2}$$

$$T_1 = \frac{M_B v_{A2}}{t}$$

$$T_1 = \frac{(6 \text{ kg}) \left(8.408 \frac{\text{m}}{\text{s}} \right)}{(3 \text{ s})}$$

$$T_1 = 16.82 \text{ N}$$