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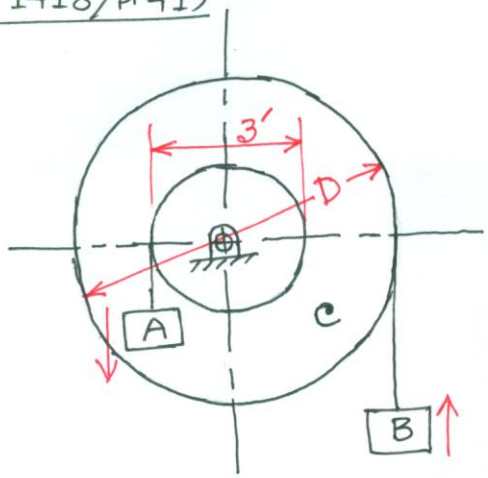

$W_A = 500$ lb
$W_B = 150$ lb
$D = 9$ ft
$W_C = 600$ lb
$\bar{k}_C = 3$ ft

(a) $S_B = 10$ ft $\quad v_{AO} = 0$
$\omega_{CO} = 0 \quad v_{BO} = 0$
$v_{Af} = ? \quad v_{Bf} = ?$
(b) $a_A = ? \quad a_B = ? \quad \alpha_C = ?$
(c) $\Delta PE = ?$

Soln ↶ moment produced by A $= 500 \times 1.5 = 750$ ft-lb
↷ " " " B $= 150 \times 4.5 = 675$ ft-lb

Since ↶ moment is larger, A moves down & B moves up.

$$\Delta KE = \frac{W_A}{2g}\left(v_{Af}^2 - v_{AO}^2\right) + \frac{W_B}{2g}\left(v_{Bf}^2 - v_{BO}^2\right) + \frac{\bar{I}_C}{2}\left(\omega_{Cf}^2 - \omega_{CO}^2\right)$$

$$\frac{v_{Af}}{v_{Bf}} = \frac{r_A}{r_B} = \frac{1.5}{4.5} = \frac{1}{3} \quad \Rightarrow v_{Bf} = 3v_{Af}$$

$$\omega_{Cf} = \frac{v_{Bf}}{r_B} = \frac{3v_{Af}}{4.5} = \frac{2v_{Af}}{3}$$

$$\bar{I}_C = \bar{k}_C^2 m_C = 3^2 \times \frac{600}{32.2} = 167.7 \text{ slug-ft}^2$$

$$\therefore \Delta KE = \frac{500}{2\times 32.2} v_{Af}^2 + \frac{150}{2\times 32.2} \times 9 v_{Af}^2 + \frac{167.7}{2} \times \left(\frac{2}{3} v_{Af}\right)^2$$

$$= 66.37\, v_{Af}^2$$

$$U_{net} = W_A \times S_A - W_B \times S_B$$
$$= 500 \times 3.33 - 150 \times 10$$
$$= 165 \text{ lb-ft}$$

$S_B = 10$ ft

$$\theta = \frac{S_B}{r_B} = \frac{S_A}{r_A}$$

$$\therefore S_A = S_B \times \frac{r_B}{r_A}$$
$$= 10 \times \frac{1.5}{4.5}$$
$$= 3.33 \text{ ft}.$$

According to the principles of work an energy, $U_{net} = \Delta KE$

$$\Rightarrow 165 = 66.37\, v_{Af}^2$$

$$\therefore v_{Af} = \boxed{1.58 \text{ fps}} \text{ Ans.}$$

$$\therefore v_{Bf} = 3 \times 1.58 = \boxed{4.74 \text{ fps.}} \text{ Ans.}$$

Contd....

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(b) $v_{Af}^2 = 2 a_A S_A$

$\Rightarrow 1.58^2 = 2 \times a_A \times 3.33$

$\therefore a_A = \boxed{0.375 \text{ fps}^2}$ Ans.

$v_{Bf}^2 = 2 a_B S_B$

$\Rightarrow 4.74^2 = 2 a_B \times 10$

$\therefore a_B = \boxed{1.123 \text{ fps}^2}$ Ans.

$\omega_{cf} = \frac{2 v_{Af}}{3} = \frac{2}{3} \times 1.58 = 1.059$ rad/sec.

$\omega_{cf}^2 = \omega_{co}^2 + 2 \alpha_c \theta$

$\Rightarrow 1.059^2 = 0 + 2 \times \alpha_c \times 2.22$

$\therefore \alpha_c = \boxed{0.252 \text{ rad/sec}^2}$ Ans.

$\theta = \frac{S_B}{r_B} = \frac{10}{4.5} = 2.22$ rad.

(c) Change in potential energy,

$\Delta PE = W_B S_B - W_A S_A$

$= 150 \times 10 - 500 \times 3.33$

$= \boxed{-165 \text{ lb-ft}, \text{ -ve sign implies decrease}}$ Ans.