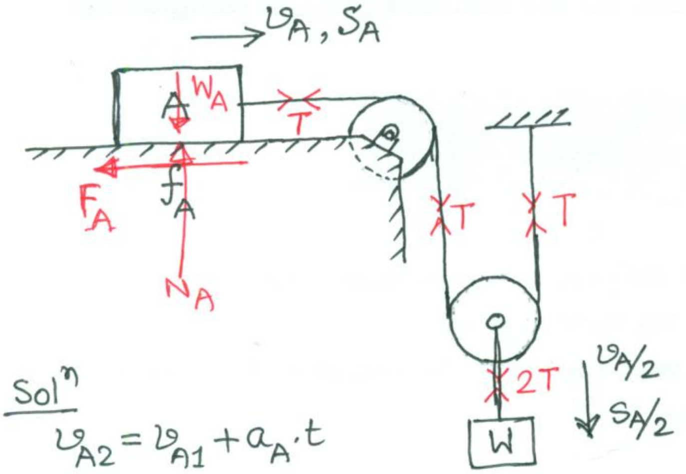
#1136/P.327 (Using Energy Principle)



$W_A = 966$ lb

$f_A = \frac{1}{3}$

$v_{A1} = 10$ fps, $v_{A2} = 35$ fps; $\Delta t = 25$ s.

(a) W = ?
(b) S_W = ?
(c) T = ?

Weightless cable, weightless and frictionless pulleys.

Sol^n

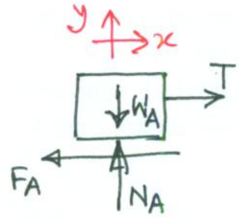
$v_{A2} = v_{A1} + a_A \cdot t$

$\Rightarrow 35 = 10 + a_A \cdot 25$

$\therefore a_A = 1 \text{ fps}^2$

$\therefore S_A = v_{A1} t + \frac{1}{2} a_A t^2 = 10 \times 25 + \frac{1}{2} \times 1 \times 25^2 = 562.5$ ft

$\therefore S_W = \frac{S_A}{2} = \frac{562.5}{2} = \boxed{281.25 \text{ ft}}$ Ans.



From the freebody of A, $\Sigma F_y = 0 \uparrow +ve$ gives

$N_A - W_A = 0 \quad \therefore N_A = W_A = 966$ lb

$\therefore F_A = N_A \cdot f_A = 966 \times \frac{1}{3} = 322$ lb

From the freebody of the whole system

$$\Delta KE = \frac{1}{2} \frac{W_A}{g} \left(v_{A2}^2 - v_{A1}^2\right) + \frac{1}{2} \cdot \frac{W}{g} \left(\frac{v_{A2}^2}{4} - \frac{v_{A1}^2}{4}\right)$$

$$= \frac{1}{2} \times \frac{966}{32.2} \left(35^2 - 10^2\right) + \frac{1}{2} \cdot \frac{W}{32.2} \left(\frac{35^2}{4} - \frac{10^2}{4}\right)$$

$$= 16875 + 4.37W$$

$$U_{net} = -F_A \cdot S_A + W \cdot S_W$$

$$= -322 \times 562.5 + W \times 281.25$$

$$= -181125 + 281.25W$$

Now $U_{net} = \Delta KE$

$\Rightarrow -181125 + 281.25W = 16875 + 4.37W$

$\Rightarrow 276.88W = 198000$

$\therefore W = \boxed{715.11 \text{ lb}}$ Ans

From the freebody of A, taking $\Sigma F_x = ma \rightarrow +ve$

$T - F_A = \frac{W_A}{g} \cdot a_A$

$\Rightarrow T - 322 = \frac{966}{32.1} \times 1 \qquad \therefore T = \boxed{352 \text{ lb}}$ Ans