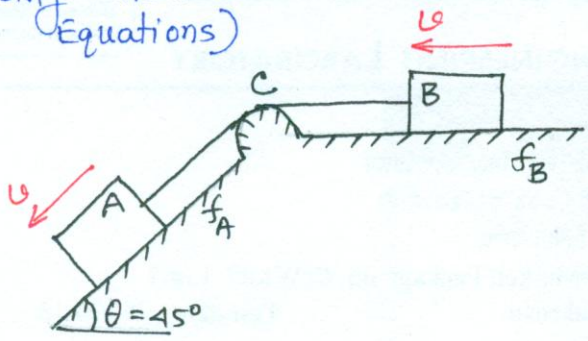
#1399/P.417

(Using Kinematic Equations)

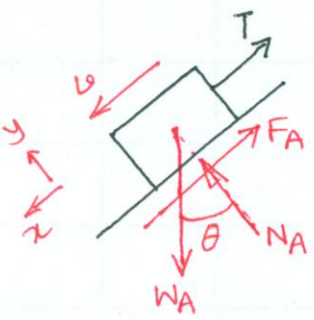


$W_A = 1000$ lb
$f_A = 0.15$
$f_B = 0.6$
$v_0 = 20$ fps (to left)
$S = 160$ ft
$v_f = 10$ fps

(a) $W_B = ?$
(b) $T_{BC} = T_{AC} = T = ?$
(c) $\Delta PE = ?$

Soln

$$v_f^2 = v_0^2 + 2aS$$
$$\Rightarrow 10^2 = 20^2 + 2 \times a \times 160$$
$$\therefore a = -0.938 \text{ fps}^2$$

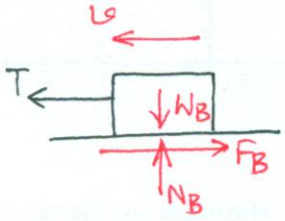


From the freebody of A, $\Sigma F_y = 0$ gives

$$N_A = W_A \cos\theta = 1000 \cos 45^\circ = 707.11 \text{ lb}$$
$$\therefore F_A = N_A \cdot f_A = 707.11 \times 0.15 = 106.07 \text{ lb}$$

Now $\Sigma F_x = m_A a$, down the plane +ve

$$W_A \sin\theta - T - F_A = \frac{W_A}{g} \cdot a$$
$$\Rightarrow 1000 \sin 45^\circ - T - 106.07 = \frac{1000}{32.2} \times (-0.938)$$
$$\therefore T = \boxed{630.17 \text{ lb}} \quad \text{Ans.}$$



From the freebody of B

$$\Sigma F_h = m_B \cdot a \leftarrow +\text{ve}$$
$$\Rightarrow T - F_B = \frac{W_B}{g} \cdot a$$
$$\Rightarrow 630.17 - 0.6 W_B = \frac{W_B}{32.2} \times (-0.938)$$
$$\Rightarrow 0.57 W_B = 630.17$$
$$\therefore W_B = \boxed{1103.8 \text{ lb}} \quad \text{Ans.}$$

$\Sigma F_V = 0$ gives
$N_B = W_B$
$F_B = N_B \cdot f_B$
$= W_B \times 0.6$
$= 0.6 W_B$

$$\Delta PE = -W_A \times S \cdot \sin\theta$$
$$= -1000 \times 160 \sin 45^\circ$$
$$= \boxed{-113137.09 \text{ lb-ft, -ve sign means decrease in PE.}} \quad \text{Ans.}$$