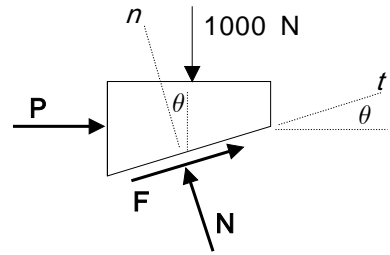


<8.1~8.4 >

8.1 $F_n = 0;$
 $N - (1000 \text{ N}) \cos\theta - P \sin\theta = 0$
 $N = (1000 \text{ N}) \cos 30^\circ + (200 \text{ N}) \sin 30^\circ$
 $= 966.0 \text{ N}$
 $F_t = 0;$
 $F - (1000 \text{ N}) \sin\theta + P \cos\theta = 0$
 $F = (1000 \text{ N}) \sin 30^\circ - (200 \text{ N}) \cos 30^\circ$
 $= 326.8 \text{ N}$
 $F_{\max} = \mu_s N = (0.30)(966.0 \text{ N}) = 289.8 \text{ N}$
 $F > F_{\max}$ \uparrow
 $F = \mu_k N = (0.20)(966.0 \text{ N}) = 193.2 \text{ N}$

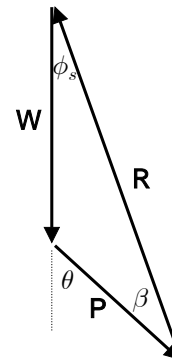
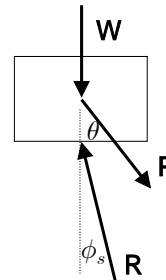


$$F = 193.2 \text{ N}$$

8.7 $\phi_s = \tan^{-1} \mu_s = \tan^{-1}(0.25) = 14.036^\circ$
 $\beta = \theta - \phi_s$
 $\frac{P}{\sin \phi_s} = \frac{W}{\sin \beta}$
 $\sin \beta = \frac{W}{P} \sin \phi_s$

(a) $W = (30 \text{ kg})(9.81 \text{ m/s}^2) = 294.3 \text{ m/s}^2$
 $\sin \beta = \frac{294.3 \text{ N}}{120 \text{ N}} \sin 14.036^\circ = 0.5948$
 $\beta = \sin^{-1} 0.5948 = 36.50^\circ$
 $\theta = \phi_s + \beta = 14.036^\circ + 36.50^\circ = 50.5^\circ$

(b) $W = (40 \text{ kg})(9.81 \text{ m/s}^2) = 392.4 \text{ m/s}^2$
 $\sin \beta = \frac{392.4 \text{ N}}{120 \text{ N}} \sin 14.036^\circ = 0.7931$
 $\beta = \sin^{-1} 0.7931 = 52.47^\circ$
 $\theta = \phi_s + \beta = 14.036^\circ + 52.47^\circ = 66.5^\circ$



$$8.12 \quad W_1 = (18 \text{ kg})(9.81 \text{ m/s}^2) = 176.58 \text{ N}$$

$$W_2 = (27 \text{ kg})(9.81 \text{ m/s}^2) = 264.87 \text{ N}$$

(a)

$$F_y = 0 ; \quad N_1 - W_1 = 0 \quad N_1 = W_1 = 176.58 \text{ N}$$

$$F_1 = \mu_s N_1 = (0.40)(176.58 \text{ N}) = 70.632 \text{ N}$$

$$F_y = 0 ; \quad N_2 - N_1 - W_2 = 0$$

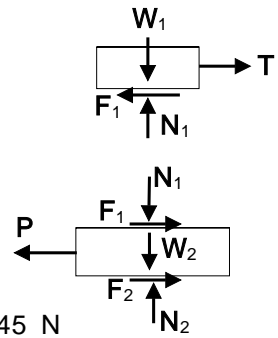
$$N_2 = N_1 + W_2 = (176.58 \text{ N}) + (264.87 \text{ N}) = 441.45 \text{ N}$$

$$F_2 = \mu_s N_2 = (0.40)(441.45 \text{ N}) = 176.56 \text{ N}$$

$$F_x = 0 ; \quad F_1 + F_2 - P = 0$$

$$P = F_1 + F_2 = (70.632 \text{ N}) + (176.56 \text{ N}) = 247.2 \text{ N}$$

$$\mathbf{P} = 247 \text{ N}$$



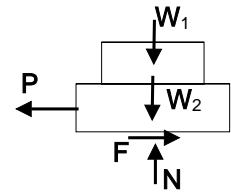
(b) $F_y = 0 ; \quad N - (W_1 + W_2) = 0$

$$N = W_1 + W_2 = (176.58 \text{ N}) + (264.87 \text{ N}) = 441.45 \text{ N}$$

$$F_x = 0 ; \quad F - P = 0$$

$$P = F = \mu_s N = (0.40)(441.45 \text{ N}) = 176.58 \text{ N}$$

$$\mathbf{P} = 176.6 \text{ N}$$



8.21

$$, \quad F_A = \mu_s N_A, \quad F_B = \mu_s N_B$$

$$F_x = 0 ; \quad F_A - N_B = 0 \quad N_B = F_A = \mu_s N_A$$

$$F_B = \mu_s N_B = \mu_s (\mu_s N_A) = \mu_s^2 N_A$$

$$F_y = 0 ; \quad N_A + F_B - W = 0$$

$$N_A + \mu_s^2 N_A - W = 0$$

$$(1 + \mu_s^2) N_A = W$$

$$\uparrow M_O = 0 ; \quad b N_B + \frac{a}{2} W - a N_A = 0$$

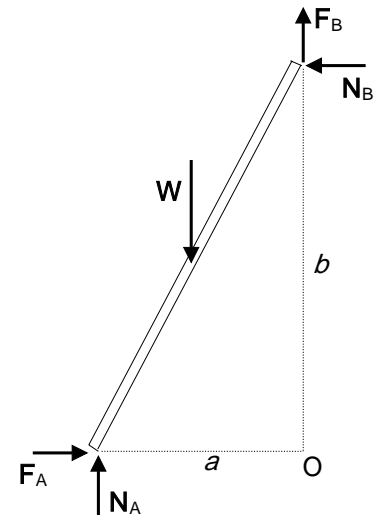
$$b (\mu_s N_A) + \frac{a}{2} (1 + \mu_s^2) N_A - a N_A = 0$$

$$\mu_s^2 + 2 \frac{b}{a} \mu_s - 1 = 0$$

$$\frac{b}{a} = \frac{5.4 \text{ m}}{2.25 \text{ m}} = 2.4$$

$$\mu_s = -(2.4) \pm \sqrt{(2.4)^2 + 1} = 0.2, -5.0$$

$$\mu_s = 0.200$$



8.32 $W = (25 \text{ kg})(9.81 \text{ m/s}^2) = 245.25 \text{ N}$

(a) $P = 0$

$\uparrow M_A = 0 ; (0.7 \text{ m}) N_D - (1 \text{ m}) W = 0$

$$N_D = \frac{10}{7} W$$

$F_x = 0 ; N_D - N_A = 0$

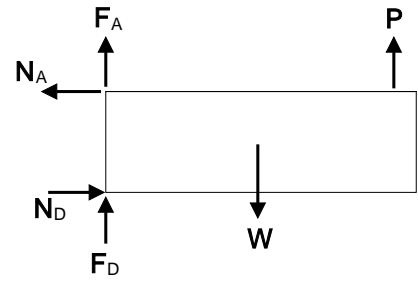
$$N_A = N_D = \frac{10}{7} W$$

$(F_A)_{\max} = \mu_s N_A, (F_D)_{\max} = \mu_s N_D$

$(F_A)_{\max} + (F_D)_{\max} = \mu_s N_A + \mu_s N_D = \mu_s (N_A + N_D) = (0.40) \frac{20}{7} W = 1.1429 W$

$F_y = 0 ; F_A + F_D - W = 0 \qquad F_A + F_D = W$

$F_A + F_D < (F_A)_{\max} + (F_D)_{\max}$



(b) $P = 80 \text{ N}$

$\uparrow M_A = 0 ; (0.7 \text{ m}) N_D - (1 \text{ m}) W + (1.75 \text{ m}) P = 0$

$$N_D = \frac{10W - 17.5P}{7}$$

$F_x = 0 ; N_D - N_A = 0 \qquad N_A = N_D = \frac{10W - 17.5P}{7}$

$(F_A)_{\max} = \mu_s N_A, (F_D)_{\max} = \mu_s N_D$

$(F_A)_{\max} + (F_D)_{\max} = \mu_s N_A + \mu_s N_D = \mu_s (N_A + N_D) = (0.40) \frac{2(10W - 17.5P)}{7}$

$= (0.40) \frac{2[10(245.25 \text{ N}) - 17.5(80 \text{ N})]}{7} = 120.286 \text{ N}$

$F_y = 0 ; F_A + F_D + P - W = 0$

$F_A + F_D = W - P = (245.25 \text{ N}) - (80 \text{ N}) = 165.25 \text{ N}$

$F_A + F_D > (F_A)_{\max} + (F_D)_{\max} \qquad \text{가}$