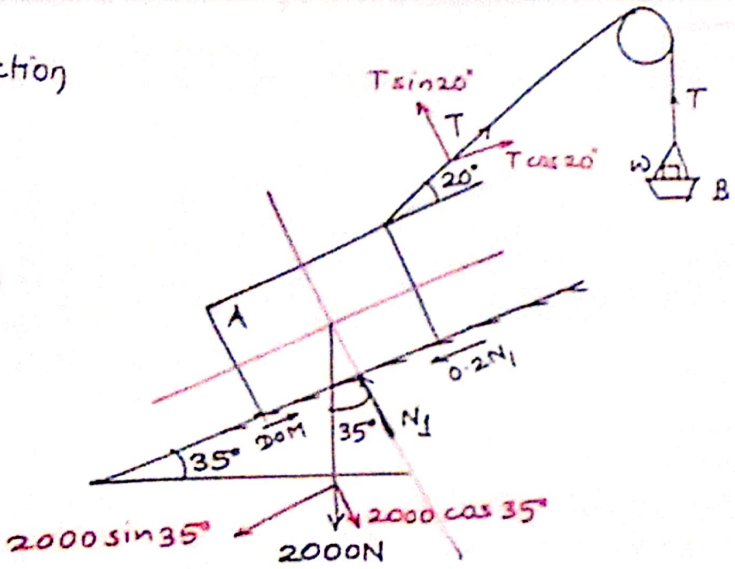
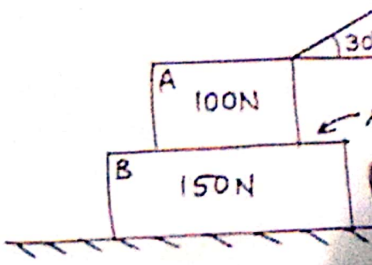
ent of friction
Reaction

Friction

Pg-89, 9.1 c)





$$\Sigma F_x = T\cos 20^\circ - 0.2N_1 - 2000\sin 35^\circ = 0$$

$$T\cos 20^\circ - 0.2N_1 = 2000\sin 35^\circ$$

$$\Sigma F_y = T\sin 20^\circ + N_1 - 2000\cos 35^\circ = 0$$

$$T\sin 20^\circ + N_1 = 2000\cos 35^\circ$$

$$T = 1462.96\ N$$

$$N_1 = 1137.93N$$

Friction

1) Frictional force

$F = \mu N$

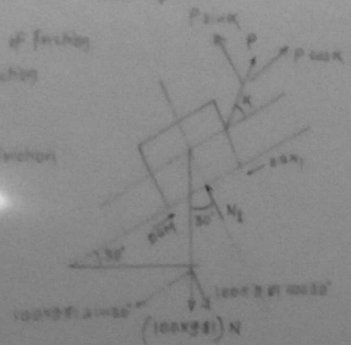
μ → Co-efficient of friction

N → Normal Reaction

2) $\tan\phi = \mu$

Angle of Friction

98 Pg-25



$\Sigma F_x = P\cos\alpha - 0.2N_1 - 981\sin 30° = 0$

$\Sigma F_y = P\sin\alpha + N_1 - 981\cos 30° = 0$

$N_1 = 981\cos 30° - P\sin\alpha$

$P\cos\alpha - 0.2(981\cos 30° - P\sin\alpha) - 981\sin 30° = 0$

$P\cos\alpha - 169.91 + 0.2P\sin\alpha - 981\sin 30° = 0$

$P\cos\alpha + 0.2P\sin\alpha = 660.41$

$P(\cos\alpha + 0.2\sin\alpha) = 660.41$

$P = \dfrac{660.41}{\cos\alpha + 0.2\sin\alpha}$ — ①

$\dfrac{d}{d\alpha}(\cos\alpha + 0.2\sin\alpha) = 0$

$-\sin\alpha + 0.2\cos\alpha = 0$

$0.2\cos\alpha = \sin\alpha$

$0.2 = \tan\alpha$

$\alpha = 11.3°$

from eqn ①

$P = \dfrac{660.41}{\cos(11.3°) + 0.2\sin(11.3°)}$

$P = 647.59\ N$

$$\Sigma f_x = 0.25N_1\cos 60^\circ + N_1\cos 30^\circ - N_2\cos 75^\circ - 0.25N_2\cos 15^\circ = 0$$

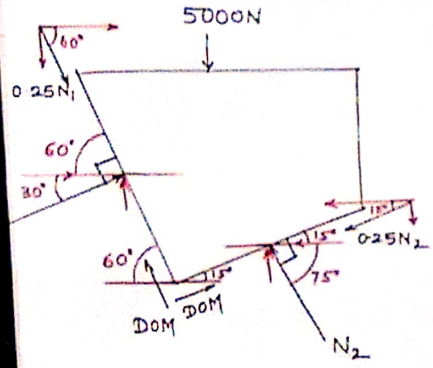
$$(0.25\cos 60^\circ + \cos 30^\circ)N_1 + (-\cos 75^\circ - 0.25\cos 15^\circ)N_2 = 0 \quad \text{—(I)}$$

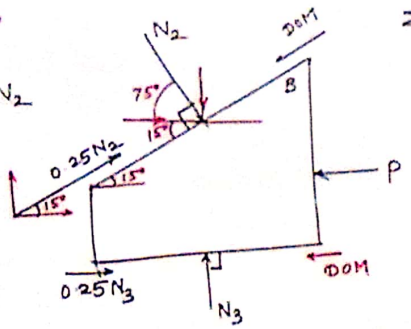
$$\Sigma f_y = -0.25N_1\sin 60^\circ + N_1\sin 30^\circ + N_2\sin 75^\circ - 0.25N_2\sin 15^\circ - 5000 = 0$$

$$(-0.25\sin 60^\circ + \sin 30^\circ)N_1 + (\sin 75^\circ - 0.25\sin 15^\circ)N_2 = 5000 \quad \text{—(II)}$$

$N_1 = 2416.98\ N$

$N_2 = 4787.72\ N$





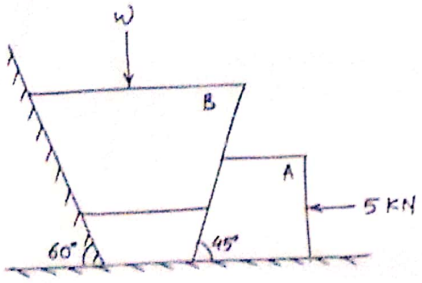
$$\Sigma f_y = -N_2\sin 75^\circ + 0.25N_2\sin 15^\circ + N_3 = 0$$

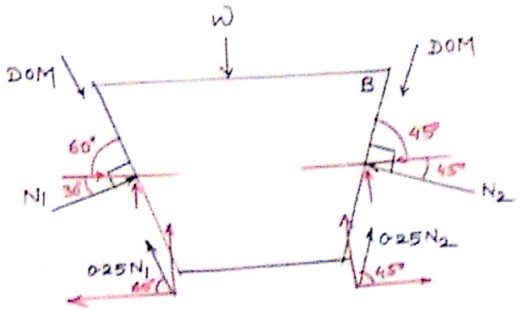
$N_3 = 4314.79\ N$

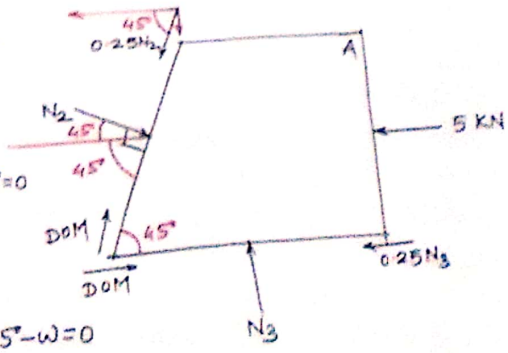
$$\Sigma f_x = N_2\cos 75^\circ + 0.25N_2\cos 15^\circ + 0.25N_3 - P = 0$$

$$\boxed{P = 3474\ N}$$

$\mu = 0.25$







$\Sigma F_x = N_1 \cos 30° - 0.25 N_1 \cos 60° + N_2 \sin 45° + 0.25 N_2 \sin 45° = 0$

$(\cos 30° - 0.25 \cos 60°) N_1 + (\sin 45° + 0.25 \sin 45°) N_2 = 0$

$N_1 = 11.56$ KN

$\Sigma F_y = N_1 \sin 30° + 0.25 N_1 \sin 60° + N_2 \sin 45° + 0.25 N_2 \sin 45° - W = 0$

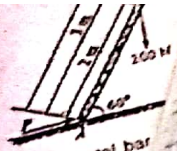
$W = 22.56$ KN

$\Sigma F_x = -0.25 N_2 \cos 45° + N_2$

$(-0.25 \cos 45° +$

$\Sigma F_y = -0.25 N_2 \sin 45°$

$(-0.25 \sin 45°$



33) A heavy metal bar
coefficient of frictio
friction μ_w. If the f
respectively,
horizontal wi

$\theta = \tan^{-1}$

[Ans.:

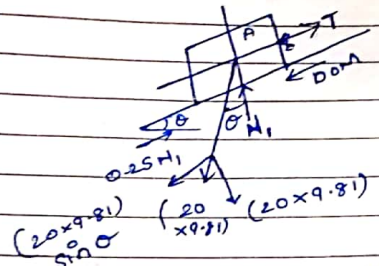
34) A hr
fric
we

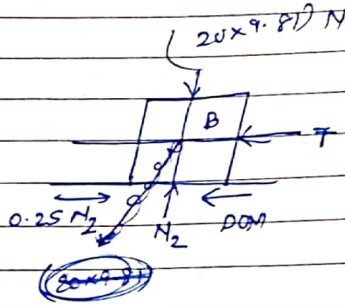
$\Sigma F_x = -0.25N_2 \cos 45° + N_2 \cos 45° - 0.25N_2 - S = 0$

$(-0.25\cos 45 + \cos 45)N_2 - 0.25N_2 = S$ — (1)

Pg 30

30)





For Block B

$\Sigma F_y = 0$

$N_2 - 20\times9.81 = 0$

$N_2 = 196.2$ N

$\Sigma F_x = 0$

$-T + 0.25N_2 = 0$

$T = 0.25 \times 19.62$

$\boxed{T = 49.05}$

For block A

$\Sigma F_y = 0$

$N_1 - (20\times9.81)\cos\theta = 0$

$N_1 = (20\times9.81)\cos\theta$

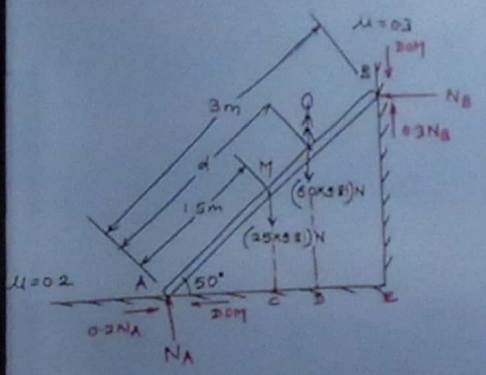
$\Sigma F_x = 0$

$T + 0.25N_1 - (20\times9.81)\sin\theta = 0$

$T + 0.25[(20\times9.81)\cos\theta] - (20\times9.81)\sin\theta = 0$

$49.05 +$

$\boxed{\theta = 28.07°}$



$\cos 50^\circ = \frac{AC}{1.5}$ | $\cos 50^\circ = \frac{AD}{d}$ | $\cos 50^\circ = \frac{AE}{3}$

$AC = 0.964\,m$ | $AD = d\cos 50^\circ$ | $AE = 1.928\,m$

$\sin 50^\circ = \frac{BE}{3}$

$BE = 2.298\,m$

$$\Sigma M_A = -(25\times9.81\times0.964) - (60\times9.81\times d\cos 50) + (0.3N_B\times1.928) + (N_B\times2.298) = 0$$

$d = 0.571\,m$

$\cos\theta = \frac{AC}{1.5}$ | $\cos\theta = \frac{AE}{3}$ | $\sin\theta = \frac{BE}{3}$

$AC = 1.5\cos\theta$ | $AE = 3\cos\theta$ | $BE = 3\sin\theta$

$$\Sigma M_A = -(25\times9.81\times1.5\cos\theta) - (60\times9.81\times3\cos\theta) + (0.3N_B\times3\cos\theta) + (N_B\times3\sin\theta) = 0$$

$\theta = 76.67^\circ$

$$\Sigma F_x = 0.2N_A - N_B = 0$$

$$\Sigma F_y = N_A + 0.3N_B - (25\times9.81) - (60\times9.81) = 0$$

$$N_A + 0.3N_B = 833.85$$

$N_A = 786.65\,N$

$N_B = 157.33\,N$

Force

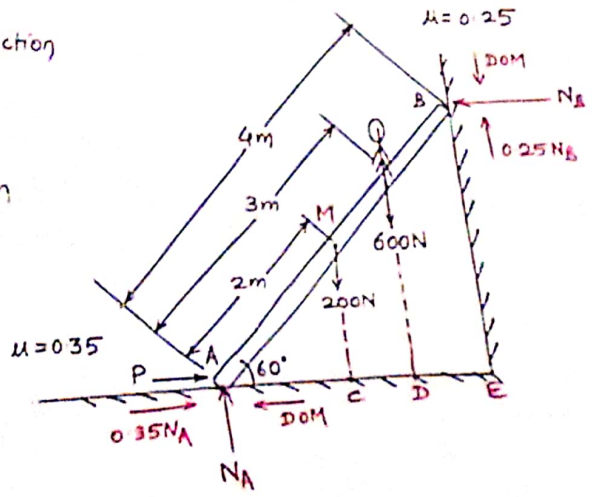
I

cient of friction

Reaction

μ

of friction



$$\Sigma M_A = -(200 \times 2\cos 60^\circ) - (600 \times 3\cos 60^\circ) + (0.25 N_B \times 4\cos 60^\circ) + (N_B \times 4\sin 60^\circ) = 0$$

$$\boxed{N_B = 277.49\ N}$$

$$\Sigma f_y = N_A - 200 - 600 + 0.25 N_B = 0$$

$$\boxed{N_A = 730.63\ N}$$

$$\Sigma f_x = P + 0.35 N_A - N_B = 0$$

$$\boxed{P = 217.9\ N}$$