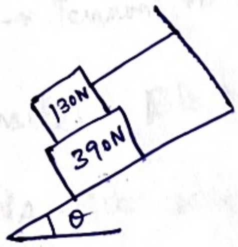
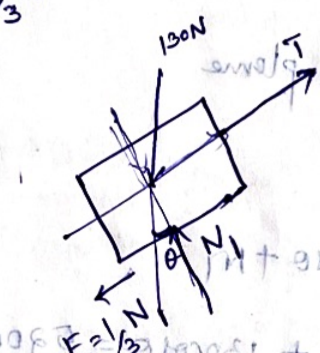
$\tan \alpha_m = \tan \phi \qquad \alpha_m = \phi$

Angle of respose = angle of static friction.

Body on rough inclined plane

Q. What should be the value of the angle θ so that motion of 390N block impends down the plane? The coefficient of friction $\mu = \frac{1}{3}$.





FBD of upper block

FBD of lower block

FBD of upper block

$T \rightarrow$ tension of cable.

Resolving forces along plane

$$T - 130\sin\theta - F_1 = 0$$

$$T - 130\sin\theta - \mu N_1 = 0$$

$$T - 130\sin\theta + \frac{1}{3}N_1 \rightarrow (1)$$

Resolving the force normal to plane

$$N_1 = 130\cos\theta \rightarrow (2)$$

put (2) in (1)

$$T = 130\sin\theta + \frac{1}{3}(130\cos\theta)$$

$$T = 130\sin\theta + 43.33\cos\theta \rightarrow (3)$$

Consider FBD of lower block

Resolving forces along plane

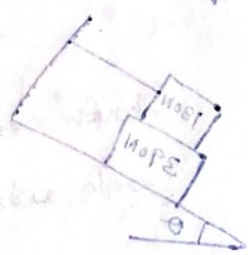
$$F_1 + F_2 - 390\sin\theta = 0$$

$$F_1 + F_2 = 390\sin\theta$$

$$\mu N_1 + \mu N_2 = 390\sin\theta$$

$$390\sin\theta = \tfrac{1}{3}(130\cos\theta + N_2) \rightarrow (4)$$

Resolving forces normal to plane



$$N_2 - N_1 - 390\cos\theta = 0$$

$$N_2 = 390\cos\theta + N_1$$

$$N_2 = 390\cos\theta + 130\cos\theta = 520\cos\theta$$

Sub N_2 in eqn (4)

$$390\sin\theta = \tfrac{1}{3}(130\cos\theta + 520\cos\theta)$$

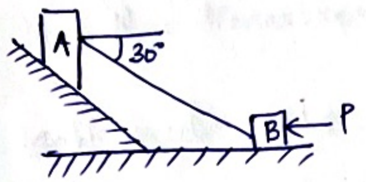
$$390\sin\theta = \tfrac{1}{3}(650\cos\theta)$$

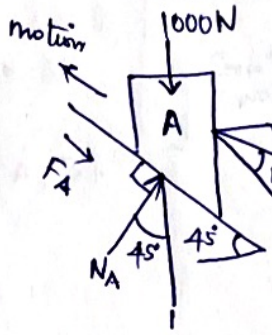
$$390\sin\theta = 216.67\cos\theta$$

$$\tan\theta = 216.67/390$$

$$\theta = \tan^{-1}\left(\frac{216.67}{390}\right) = 29^\circ$$

(P) Block A weighing 100N rests on a rough inclined plane whose inclination to the horizontal is 45°. It is connected to another block B, weighing 3000N rests on rough horizontal plane by a weightless rigid bar inclined at an angle of 30° to the horizontal as shown; Find the horizontal force required to be applied to the block B just to move block A in upward direction. Assume angle angle of friction as 15° at all surfaces where there is sliding.

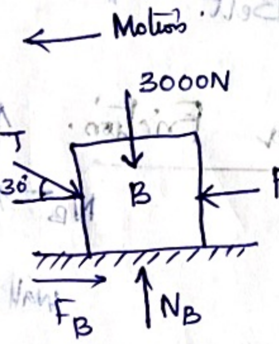




Given

$\phi = 15°$ $\mu = \tan\phi$ $\mu = 0.268$

$T \rightarrow$ Tension in rod,



consider Block A (FBD)

$\Sigma V = 0$

$N_A - 1000\cos 45° + T\sin 15 = 0$

$N_A + 0.259T = 707.1 \rightarrow (1)$

$T\cos 15 + F_A + 1000\sin 45° = 0$ $\Sigma H = 0$

$T\cos 15 + (\mu N_A) + 1000\sin 45 = 0$

$0.966T + 0.268 N_A = -707.1 \rightarrow (2)$

solve (1) & (2) $T = -1000\ N$ $N_A = 448.1\ N$

-ve sign indicates rod is compressive.

Consider FBD (Block B)

$\Sigma V = 0$ $N_B - 3000 - T\sin 30 = 0$

$N_B = 3500N$

$\Sigma H = 0$

$T\cos 30 + F_B - P = 0$

$P = 1804\ N$