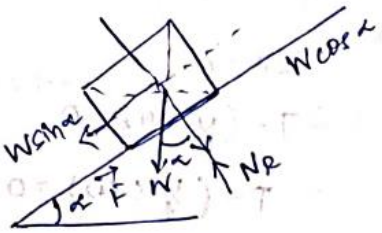


Normal reaction $N_R = W\cos\alpha$

Frictional force $F = \mu N_R$

$= \mu W\cos\alpha$

When $\mu W\cos\alpha > W\sin\alpha$ → Block is at rest

$\mu W\cos\alpha < W\sin\alpha$, the impending motion takes place downwards.

When the angle of plane with horizontal α, is increased, $W\sin\alpha$ will be more than $\mu W\cos\alpha$ and sliding takes place.

⇒ "The angle of the inclined plane, at which the body tends to slide down, known as angle of repose. denoted by α_m.

$\mu W\cos\alpha_m \leq W\sin\alpha_m$

$\mu W\cos\alpha_m = W\sin\alpha_m$

$$\mu = \frac{W\sin\alpha_m}{W\cos\alpha_m}$$

$= \tan\alpha_m \rightarrow (1)$

$\mu = \tan\phi \rightarrow (2)$.

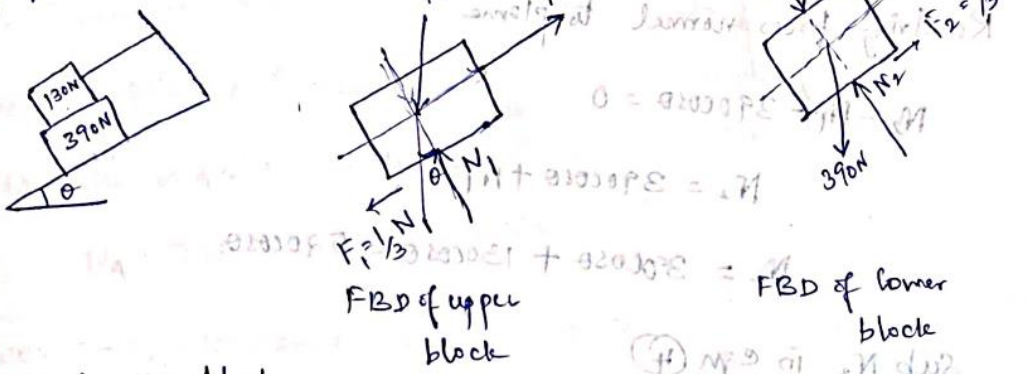
ϕ ⇒ angle of static friction.

$\tan \alpha_m = \tan \phi$ $\quad \alpha_m = \phi$

Angle of respose = angle of static friction.

Body on rough inclined plane

(P) What should be the value of the angle θ so that motion of 390N block impends down the plane ?. The coefficient of friction $\mu = 1/3$.



FBD of upper block $\quad$ FBD of lower block

FBD of upper block

T → tension of cable.

Resolving forces along plane

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

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

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

Resolving the force normal to plane

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

put (2) in (1)

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

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

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)

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

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

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

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

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