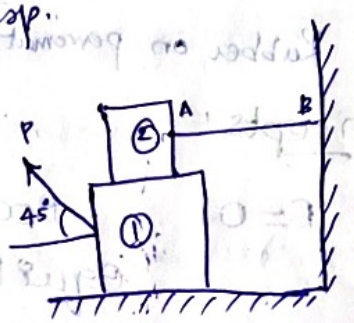
Problem ①.

Block 2 rest on block 1 and Ps attach by a horizontal rope AB to the wall as shown in ~~fig~~ diagram. What force P is necessary to cause motion of impend block (1) to impend? The coefficient of friction b/w the blocks is 1/4 and between the floor and block (1) is 1/3. Wts of blocks (1) and (2) are 14kg and 9kg resp.




Soln:

Weight of block (1) $W_1 = 14 \times 9.81$

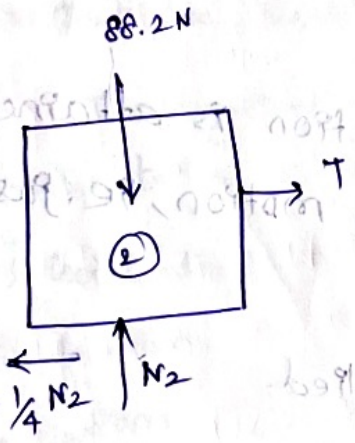
$= 137.2\ N$

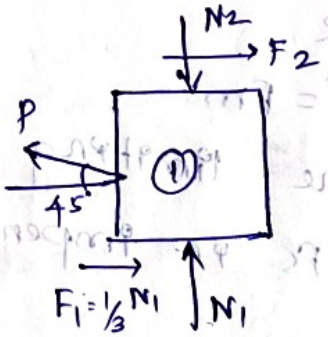
Weight of block (2) $W_2 = 9 \times 9.81$

$= 88.2\ N$

$\mu_1 = 1/3 \quad \mu_2 = 1/4$

T → Tension in cable AB




Block (1) moves towards left

Block (2) " " right.

Consider FBD of block (2)

$\Sigma V = 0$

$N_2 - 88.2 = 0$

$N_2 = 88.2\,N$

$F_2 = \mu_2 N_2 = \frac{1}{4} \times 88.2$

$= 22.05\,N$

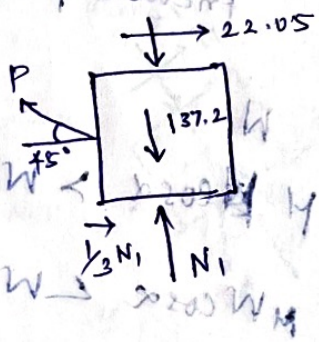
$\Sigma H = 0$

$T - (\mu_2 \cdot N_2) = 0$

$T - \left(\frac{1}{4} \times N_2\right) = 0$

$T = 0.25\,N_2$

Consider FBD of block (1)




$\Sigma_H = 0$

$22.05 + \left(\frac{1}{3} N_1\right) - P\cos 45 = 0$

$P\cos 45 = 22.05 + 0.333\,N_1$

$\Sigma V = 0$ (↑+)

$N_1 + P\sin 45 - 88.2 - 137.2 = 0$

$P\sin 45 = 225.4 - N_1$

$\frac{P\sin 45}{P\cos 45} = \frac{225.4 - N_1}{22.05 + 0.333 N_1}$

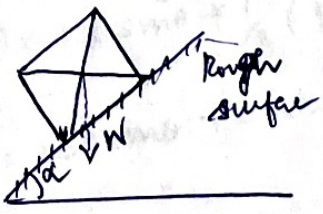
(2) ÷ (1)

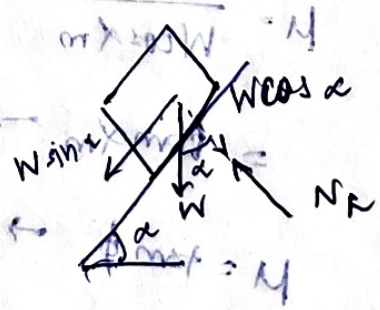
$\tan 45 = 1 = \frac{225.4 - N_1}{22.05 + 0.333 N_1}$

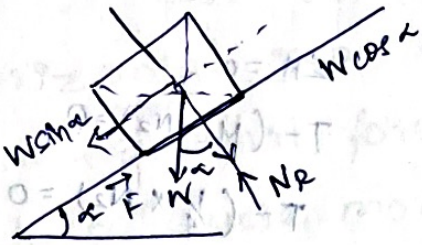
$\boxed{N_1 = 152.55\,N}$

$\boxed{P = 103\,N}$

## Angle of Repose:



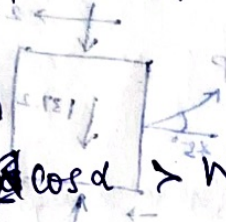






Normal reaction $N_R = W\cos\alpha$

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 $\alpha$, 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 $\alpha_m$.

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

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

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

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

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

$\phi \Rightarrow$ angle of static friction.