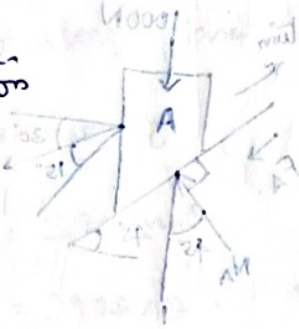
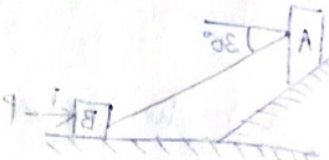
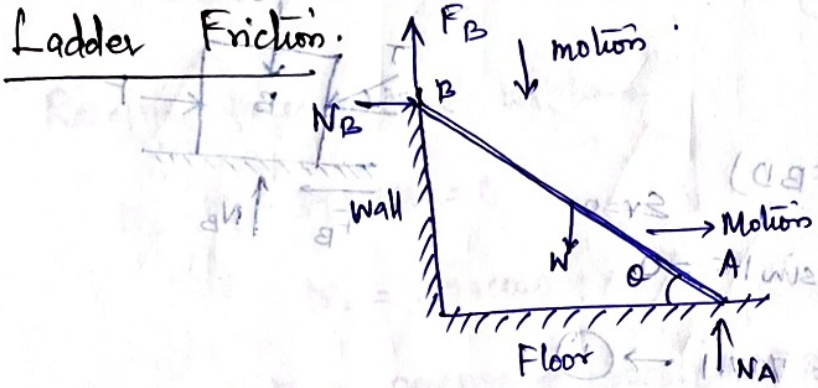
Simple Contact Friction:

(1) Ladder Friction
(2) Wedge "
(3) Screw "
(4) Belt "





Ladder Friction:



Ladder length = l

$\theta \Rightarrow$ angle of friction

Frictional force at B, F_B will act upwards

$$\mu_B = \frac{F_B}{N_B} \quad \text{or} \quad F_B = \mu_B N_B$$

$$\mu_A = \frac{F_A}{N_A}$$

For impending motion of ladder, the equilibrium eqn $\Sigma H = 0$, $\Sigma V = 0$, $\Sigma m = 0$ and $F = \mu N$.

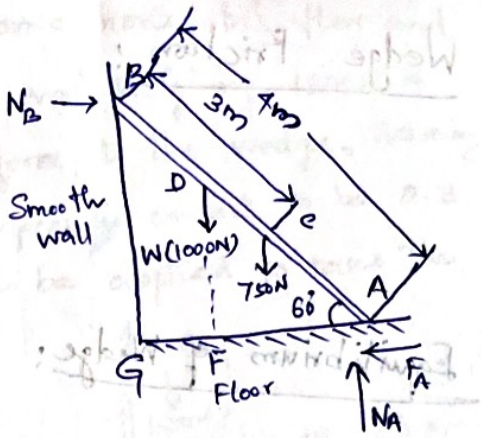
(P) A uniform ladder of weight 1000 N and of length 4 m rests on a horizontal ground and leans against a smooth vertical wall. The ladder makes an angle of 60° with horizontal. When a man of weight 750 N stands on ladder at a distance 3 m from the top of the ladder, the ladder is at the point of sliding. Determine the coefficient of friction between the ladder and the floor.

F_A = Friction force at A = $\mu_A N_A$

$F_B = 0$ (due to smooth wall)

μ_A = coefficient of friction at A

N_A, N_B = Normal reaction at A, B.



Self weight, W = 1000N

weight of man = 750N

Applying $\Sigma V = 0$ (↑+)

$N_A - 1000 - 750 = 0$

$N_A = 1750\,N$

$\Sigma H = 0$ (→+)

$N_B - F_A = 0$

$N_B - \mu_A N_A = 0$

$N_B = \mu_A N_A = \mu_A \times 1750 \rightarrow (1)$

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$\Sigma M_A = 0$ (↻+) ⇒ Taking moment of all forces about A

$(N_B \times BG) - (1000 \times AF) - (750 \times AE) = 0$

$BG = 4 \sin 60 = 3.464\,m$

$AF = 2 \cos 60 = 1\,m$

$AE = 1 \cos 60 = 0.5\,m$

$(N_B \times 3.464) - (1000 \times 1) - (750 \times 0.5) = 0$

$N_B = 396.9\,N$

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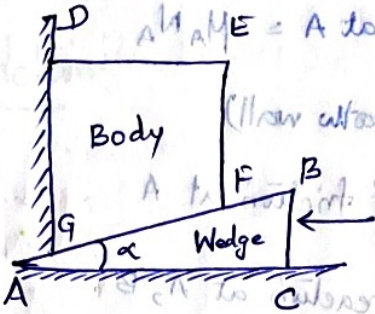
sub N_B in (1)

$N_B = \mu_A \times 1750$

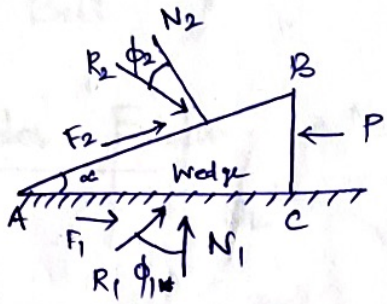
$\mu_A = \frac{N_B}{1750} = \frac{396.9}{1750} = 0.226$

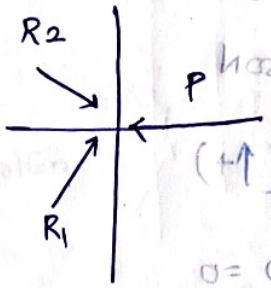
Coefficient of friction b/w ladder & floor = 0.226 //

Wedge Friction:



Equilibrium of Wedge:





$F_2 = \mu_2 N_2$ $\quad F_1 = \mu_1 N_1$

single Resultant $R = \sqrt{F_R^2 + N_R^2}$

R_1 and R_2 are drawn on wedges

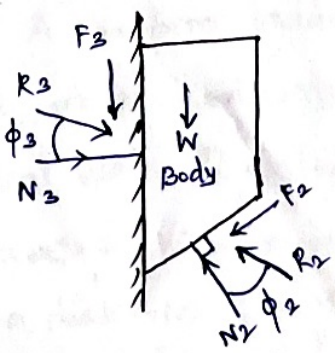
$R_1 = \sqrt{F_1^2 + N_1^2}$ $\quad R_2 = \sqrt{F_2^2 + N_2^2}$

F_1 and F_2 → limiting friction

R_1 and R_2 makes the angles ϕ_1 and ϕ_2 called angle of friction with line of action of respective normal reactions N_1 and N_2.

R_1, R_2, P → coplanar concurrent forces in equilibrium.

Equilibrium of body



R_2, R_3 and self weight W are coplanar concurrent forces in equilibrium.