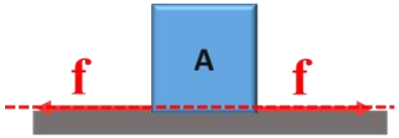
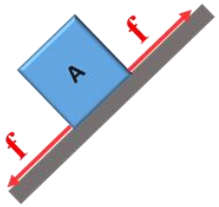
MIND MAP

Friction

Friction does not oppose motion instead it opposes Relative Motion to the surface applying friction force.

Friction acts along the surface in contact.

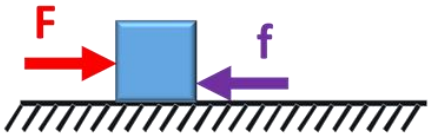


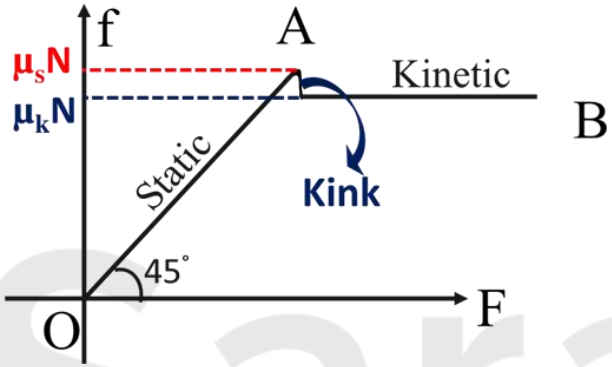


Static Friction

If there is a tendency of relative slipping (only tendency and not actual) between two surfaces in contact then the friction force acting between them is called Static Friction force.

It is a variable force whose value is equal to requirement to stop relative slipping till it reaches its limiting value known as Limiting Friction.





Laws Of Static Friction

1) Maximum value of static friction (Limiting friction) is directly proportional to Normal force acting between the two surfaces in contact.

2) Static friction force acting between two surfaces in contact does not depend on area of contact.

$(f_s)_{max} = \mu_s N$ — coefficient of static friction

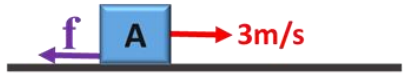
Limiting friction

$f_s \leq \mu_s N$

Kinetic Friction

Kinetic friction comes into picture when relative slipping occurs

It acts in direction opposite to relative velocity.



Laws Of Kinetic Friction

1) Value of kinetic friction is directly proportional to Normal force acting between the two surfaces in contact

2) Kinetic friction force acting between two surfaces in contact does not depend on area of contact.

$f_k = \mu_k N$ — coefficient of kinetic friction

Kinetic friction

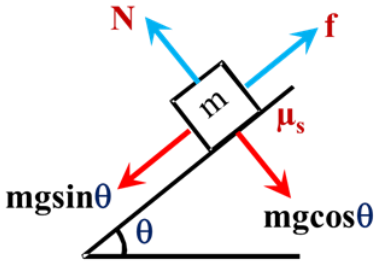
Generally $\mu_k < \mu_s$
(from experimental observation)

Value of μ_s and μ_k depends on nature of surfaces in contact.

MIND MAP

Friction

Angle of Repose

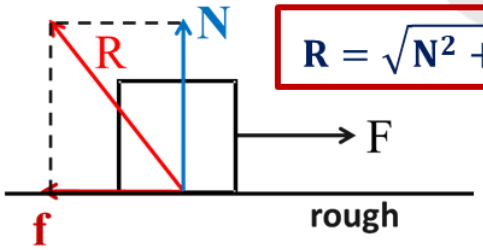


At some angle of inclination θ the body starts sliding down the plane due to gravity. This angle of inclination is called angle of repose (θ).

$\theta = \tan^{-1}(\mu_s)$ is angle of repose.

$f_{min} = 0$	$\leq$	f	$\leq$	$f_{max} = \mu N$
$R_{min} = N$	$\leq$	R	$\leq$	$R_{max.} = N\sqrt{1+\mu^2}$
$\tan\phi = 0$	$\leq$	$\tan\phi$	$\leq$	$\tan\phi = \mu$
$\phi_{min.} = 0$	$\leq$	ϕ	$\leq$	$\phi_{max.} = \tan^{-1}(\mu)$

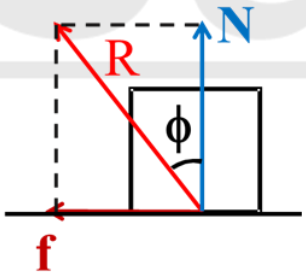
Net Contact Force:



$R = \sqrt{N^2 + f^2}$

Resultant of Normal and Friction force is the Net Contact Force.

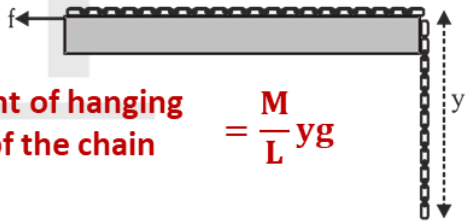
Angle of Friction



$\tan\phi = \frac{f}{N}$

The Angle of Friction (ϕ) is the angle between Net Contact Force and Normal Reaction

$\phi = 0$ for smooth surface



Weight of hanging part of the chain $= \frac{M}{L} yg$

For equilibrium with maximum portion hanging:
limiting friction = weight of hanging part of the chain

$$y = \frac{\mu L}{1+\mu}$$