EngineeringRise

Friction

Formulas and units, JEE Main. Status: Reviewed on 2026-11-20.

Result	Formula	Units or note
Limiting static friction	f_s(max) = mu_s N Valid when: surfaces about to slide; N is the normal force	N
Kinetic friction	f_k = mu_k N Valid when: surfaces sliding; N is the normal force	N
Angle of repose	tan(theta) = mu_s Valid when: block just about to slip on a rough incline	degrees (mu_s is dimensionless)
Down a rough incline	a = g (sin(theta) - mu_k cos(theta)) Valid when: block sliding down a rough incline, kinetic friction	m/s^2
Up a rough incline (deceleration)	a = g (sin(theta) + mu_k cos(theta)) Valid when: block sliding up a rough incline, kinetic friction	m/s^2
Force to just hold on an incline (parallel)	F = m g (sin(theta) - mu_s cos(theta)) Valid when: block about to slide down, force parallel to incline pushing up	N
Minimum pull at an angle (derived application of the laws of friction)	F_min = mu m g/sqrt(1 + mu^2), at tan(phi) = mu Valid when: horizontal floor, pull at best angle above horizontal, block just starting to move	N
Stacked blocks, force on the lower block	F_max = mu g (m + M), with m the upper block, M the lower block, mu between the blocks and a smooth floor Valid when: force on lower block, smooth floor, friction coefficient mu between the blocks	N
Block pressed on a wall	F_min = m g/mu Valid when: block just held against a vertical wall, horizontal push F	N
Box on an accelerating truck bed	a_max = mu_s g Valid when: box not slipping on a horizontal truck bed	m/s^2

Full lesson with worked examples: https://www.engineeringrise.in/learn/learn/jee-main/physics/laws-of-motion/friction

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