EngineeringRise

Pulleys and constrained motion

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

Result	Formula	Units or note
Atwood machine, acceleration	a = (m1 - m2) g/(m1 + m2) Valid when: light inextensible string, smooth light fixed pulley, m1 > m2	m/s^2
Atwood machine, tension	T = 2 m1 m2 g/(m1 + m2) Valid when: light inextensible string, smooth light fixed pulley	N
Force on the pulley support (light pulley)	F = 2T = 4 m1 m2 g/(m1 + m2) Valid when: light smooth fixed pulley supported at its axle, string vertical on both sides	N
Table (smooth) and hanging block	a = m2 g/(m1 + m2); T = m1 m2 g/(m1 + m2) Valid when: smooth table, light string and pulley; m1 on table, m2 hanging	m/s^2 (N)
Table with kinetic friction mu	a = (m2 - mu m1) g/(m1 + m2) Valid when: rough table, light string and pulley; m1 on table, m2 hanging, block moving	m/s^2
Block on smooth incline and hanging block	a = (m1 sin(theta) - m2) g/(m1 + m2) Valid when: smooth incline, light string and pulley; m1 on incline, m2 hanging, m1 sliding down	m/s^2
Chain of blocks on a smooth table (pulled by a hanging load)	a = (hanging weight)/(total mass); T of each string = (mass pulled by that string) x a Valid when: smooth table, light inextensible strings and pulley, all blocks moving together	m/s^2 (N)
String-length constraint (movable pulley, two segments)	a_free end = 2 a_pulley Valid when: light string over a movable pulley with two vertical segments	m/s^2
Light movable pulley	sum of string pulls = pull of the load: 2T = M (g - a_B) Valid when: light movable pulley carrying a load M; strings vertical	N

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

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