EngineeringRise

Work, kinetic energy and power

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

Result	Formula	Units or note
Work, constant force	W = F d cos(theta) = F.d Valid when: constant force, straight-line displacement; theta is angle between F and d	J (N m)
Work, variable force on a line	W = integral of F dx = area under F-x graph (signed) Valid when: force varying along a straight line; areas below the axis count negative	J
Kinetic energy	K = 0.5 m v^2 = p^2/(2m) Valid when: speed much less than light speed; translational kinetic energy of a particle	J
Work-energy theorem	W_net = 0.5 m v^2 - 0.5 m u^2 Valid when: W_net is the work of all forces on a particle, speeds much below light speed	J
Average power	P_avg = W/t Valid when: average over the time interval t in which work W is done	W (J/s)
Instantaneous power	P = F.v = F v cos(theta) Valid when: at one instant; theta is angle between force and velocity	W
Top speed at constant power	v_max = P/f (f = constant resistance) Valid when: engine power constant and resistance constant; net force zero at top speed	m/s
Energy unit conversion	1 kW h = 3.6 x 10^6 J	J
Lifting at constant speed	W_hand = m g h; W_gravity = -m g h Valid when: lifting at constant speed (slowly); g constant, h is the height gained	J

Full lesson with worked examples:
https://www.engineeringrise.in/learn/learn/jee-main/physics/work-energy-and-power/work-kinetic-energy-and-power

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