

COLLEGE BOARD · AP PHYSICS 1

AP Physics 1 Formula Sheet

The 2025 AP Physics 1 reference equations for mechanics and fluids.

1 Kinematics, forces and gravitation

Linear motion and forces from the Mechanics and Fluids table.

Velocity	$v_x = v_{x0} + a_x t$
Position	$x = x_0 + v_{x0} t + \frac{1}{2} a_x t^2$
Velocity squared	$v_x^2 = v_{x0}^2 + 2a_x(x - x_0)$
Centre of mass	$x_{cm} = \frac{\sum m_i x_i}{\sum m_i}$
Newton's second law (system)	$a_{sys} = \frac{\Sigma F}{m_{sys}} = \frac{F_{net}}{m_{sys}}$
Gravitational force	$ F_g = G \frac{m_1 m_2}{r^2}$
Friction	$ F_f \leq \mu F_N $
Spring force	$F_s = -k\Delta x$
Centripetal acceleration	$a_c = \frac{v^2}{r}$

2 Energy, power and momentum

Work, energy, impulse and momentum.

Kinetic energy	$K = \frac{1}{2} mv^2$
Work	$W = F\ d = Fd \cos \theta$
Work–energy	$\Delta K = \Sigma W_i = \Sigma F\ _i d_i$
Spring potential energy	$U_s = \frac{1}{2} k(\Delta x)^2$
Gravitational potential energy	$U_G = -\frac{Gm_1 m_2}{r}, \Delta U_g = mg\Delta y$
Power	$P_{avg} = \frac{W}{\Delta t} = \frac{\Delta E}{\Delta t}, P_{inst} = F\ v = Fv \cos \theta$
Momentum	$p = mv$
Net force and momentum	$F_{net} = \frac{\Delta p}{\Delta t} = m \frac{\Delta v}{\Delta t} = ma$
Impulse	$J = F_{avg} \Delta t = \Delta p$
Velocity of centre of mass	$v_{cm} = \frac{\Sigma p_i}{\Sigma m_i} = \frac{\Sigma m_i v_i}{\Sigma m_i}$

3 Rotation

Rotational kinematics, torque and angular momentum.

Angular velocity	$\omega = \omega_0 + \alpha t$
Angular position	$\theta = \theta_0 + \omega_0 t + \frac{1}{2} \alpha t^2$
Angular velocity squared	$\omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$
Linear and angular	$v = r\omega, a_T = r\alpha$
Torque	$\tau = r\perp F = rF \sin \theta$
Rotational inertia	$I = \Sigma m_i r_i^2, I' = I_{cm} + Md^2$
Angular acceleration	$\alpha_{sys} = \frac{\Sigma \tau}{I_{sys}} = \frac{\tau_{net}}{I_{sys}}$
Rotational kinetic energy and work	$K = \frac{1}{2} I\omega^2, W = \tau\Delta\theta$
Angular momentum	$L = I\omega, L = rmv \sin \theta, \Delta L = \tau\Delta t$
Rolling	$\Delta x_{cm} = r\Delta\theta$

Period	$T = \frac{1}{f}$
Spring and pendulum	$T_s = 2\pi\sqrt{\left(\frac{m}{k}\right)}, T_p = 2\pi\sqrt{\left(\frac{\ell}{g}\right)}$
Simple harmonic motion	$x = A \cos(2\pi ft), x = A \sin(2\pi ft)$
Density and pressure	$\rho = \frac{m}{V}, P = \frac{F_{\perp}}{A}$
Pressure at depth	$P = P_0 + \rho gh, P_{\text{gauge}} = \rho gh$
Buoyant force	$F_b = \rho Vg$
Continuity	$A_1 v_1 = A_2 v_2$
Bernoulli's equation	$P_1 + \rho gy_1 + \frac{1}{2}\rho v_1^2 = P_2 + \rho gy_2 + \frac{1}{2}\rho v_2^2$

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