AP Physics 1 Equation Sheet: Formulas and How to Use Them

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A useful physics equation sheet helps you recognize a relationship, identify the variables and check whether its assumptions fit the problem. It cannot replace a diagram or an explanation of why the relationship applies.

Use the current official reference for exam preparation.

Our recovered 2025 PDF is a historical supplementary handout. It includes a circuits section and does not fully cover the current AP Physics 1 framework. Use College Board's current course description and official exam reference information for current coverage and exam-day materials.

Start with a simple motion problem

A cart starts from rest and accelerates uniformly at 2 m/s^2 for 3 seconds. The question asks for its final velocity. "Uniformly" tells us acceleration is constant, so v = v0 + at applies.

1. Choose forward as positive.
2. Identify v0 = 0 m/s, a = 2 m/s^2 and t = 3 s.
3. Calculate v = 0 + (2)(3) = 6 m/s.
4. Interpret the result: the cart is moving forward at 6 meters per second after 3 seconds.

Know the symbols before substituting

The symbol Delta means "final minus initial." Position x is measured in meters (m), velocity v in m/s, acceleration a in m/s^2, time t in seconds (s), mass m in kilograms (kg), force F in newtons (N), and energy or work in joules (J). A subscript 0 denotes an initial value.

Common relationships and their conditions

Idea	Relationship	When to use it
Constant acceleration	v = v0 + at ; Delta x = v0t + 1/2at^2 ; v^2 = v0^2 + 2aDelta x	One axis with constant acceleration. Keep signs consistent.
Net force	Sum F = ma	Add all force components along the chosen axis; F means net force here.
Friction	fk = mukN ; 0 ≤ fs ≤ musN	Kinetic friction for sliding; static friction adjusts up to a maximum. N is normal-force magnitude.
Energy	K = 1/2mv^2 ; Delta U(gravity) = mgDelta h ; U(spring) = 1/2kx^2	Near Earth use approximately constant g; for an ideal spring x is displacement from equilibrium.
Work	W = Fd cos θ ; Wnet = Delta K	The first expression assumes a constant force. θ is the angle between force and displacement.
Momentum and impulse	p = mv ; J = Delta p = Fnet,avg Delta t	Momentum is a vector. A system's total momentum stays constant only when external impulse is zero or negligible.
Circular motion	a(radial) = v^2/r	Radial acceleration points toward the center. "Centripetal force" describes the net inward force, not an extra force to add.
Rotation	tau = rF sin θ ; Sum tau = Ialpha ; Krot = 1/2Iomega^2	Define the axis. I is rotational inertia, alpha angular acceleration and omega angular speed.
Oscillations	T = 2πsqrt(m/k) ; T = 2πsqrt(L/g)	Ideal mass-spring system; simple pendulum at small angles, respectively.
Fluids	ρ = m/V ; P = P0 + ρgh ; F(buoyant) = ρfluid Vdisplaced g	Density, pressure at depth in a uniform stationary fluid, and buoyant force. Current course coverage includes fluids.

Three common mistakes

• Mixing force pairs: Newton's third-law forces act on different objects; they do not cancel on one object's force diagram.

• Calling energy “lost”: in an inelastic collision, some kinetic energy becomes internal energy or other forms. Total energy is still conserved.

• Choosing a formula before the system: first decide which objects belong to your system and what crosses its boundary.

Practice with a reason

A 2 kg cart’s velocity changes from 1 m/s to 4 m/s in the positive direction. Find its change in momentum.

Practice: Check the reasoning

Delta p = m(vfinal - vinitial) = 2(4 - 1) = 6 kg·m/s, positive. The net impulse has the same value, 6 N·s.

Next, explain why knowing the time interval would let you calculate the average net force. Continue through our AP Physics 1 lessons and practice .

References

https://apcentral.collegeboard.org/courses/ap-physics-1

https://apcentral.collegeboard.org/exam-administration-ordering-scores/administering-exams/subject-specific/reference-information

Read the companion article: https://refreshkid.com/blog/your-go-to-ap-physics-1-equation-sheet-free-pdf-download/