

AP Physics 1 Formula and Strategy Guide

All 8 AP Physics 1 units: kinematics, forces, work/energy/power, momentum, rotation, oscillations, and fluids — algebra-based, with the modeling and reasoning AP free response rewards.

SECTIONS	7	WORKED EXAMPLES	1	FORMAT	Print friendly
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How to use this guide

A formula you cannot place is not knowledge yet. Work the recall drill below before the questions.

- Draw a diagram (free-body, motion graph, or system) before writing an equation — AP scoring rewards the model, not just the number.
- State the principle you're using (Newton's laws, energy conservation, momentum conservation) before applying it.
- Check units and reasonableness at the end of every calculation.

Unit 1: Kinematics

NAME	FORMULA	WHEN TO USE
$v = v_0 + at$	final velocity under constant acceleration	Time is known, displacement is not needed.
$d = v_0 t + \frac{1}{2} a t^2$	displacement under constant acceleration	Finding position given time.
$v^2 = v_0^2 + 2ad$	final velocity without needing time	Time is unknown but displacement is known.
Free fall	$a = -g = -9.8 \text{ m/s}^2$ (downward)	An object in projectile or free-fall motion.

Unit 2: Force and translational dynamics

NAME	FORMULA	WHEN TO USE
Newton's second law	$F_{\text{net}} = ma$	Relating net force, mass, and acceleration.
Weight	$W = mg$	The gravitational force on an object's mass.
Friction	$f = \mu \times N$	Resistance to sliding between surfaces.
Free-body diagram	shows all forces acting on one object	Setting up any dynamics problem correctly.

Unit 3: Work, energy, and power

NAME	FORMULA	WHEN TO USE
Work	$W = F \times d \times \cos(\theta)$	Energy transferred by a force over a displacement.
Kinetic energy	$KE = \frac{1}{2} m v^2$	Energy of motion.

NAME	FORMULA	WHEN TO USE
Gravitational PE	$PE = mgh$	Stored energy due to height.
Conservation of energy	total mechanical energy is constant without friction	Relating energy at two points in a system.
Power	$P = W/t = Fv$	The rate energy is transferred.

Unit 4: Linear momentum

NAME	FORMULA	WHEN TO USE
Momentum	$p = mv$	A moving object's quantity of motion.
Impulse	$J = F \times t = \text{change in momentum}$	Relating force, time, and momentum change.
Conservation of momentum	total momentum before = total momentum after	Analyzing any collision or explosion.

Unit 5-6: Torque, rotation, and rotational energy

NAME	FORMULA	WHEN TO USE
Torque	$\tau = F \times r \times \sin(\theta)$	The rotational effect of a force.
Rotational equilibrium	sum of torques = 0	An object is not rotating (or rotating at constant rate).
Rotational kinetic energy	$KE_{\text{rot}} = 1/2 I \omega^2$	Energy of a spinning object.
Angular momentum	$L = I \omega$	A rotating object's quantity of rotational motion.

Unit 7: Oscillations

NAME	FORMULA	WHEN TO USE
Simple harmonic motion	restoring force proportional to displacement	Identifying SHM (springs, pendulums).
Period of a spring	$T = 2\pi \sqrt{m/k}$	Time for one oscillation of a mass on a spring.
Period of a pendulum	$T = 2\pi \sqrt{L/g}$	Time for one oscillation of a simple pendulum.

Unit 8: Fluids

NAME	FORMULA	WHEN TO USE
Density	$\rho = \text{mass/volume}$	Comparing how tightly packed a substance's mass is.
Pressure	$P = F/A$	Force distributed over an area.
Pressure with depth	$P = P_0 + \rho \times g \times h$	Pressure increases with depth in a fluid.
Buoyant force	$F_b = \rho_{\text{fluid}} \times V_{\text{displaced}} \times g$	Explaining why objects float or sink.

NAME	FORMULA	WHEN TO USE
Continuity equation	$A_1 \times v_1 = A_2 \times v_2$	Fluid speed changes as pipe cross-section changes.

WORKED EXAMPLE

Water flows through a pipe that narrows from area 4 cm^2 to 2 cm^2 . If the initial speed is 3 m/s , find the speed in the narrow section.

1. $A_1 v_1 = A_2 v_2$
2. $4(3) = 2(v_2)$
3. $v_2 = 12/2 = 6 \text{ m/s}$

Check: A narrower pipe means faster flow, consistent with continuity.

Notes and tutor hand-off

Bring this page to your next session so the tutor can start from what actually blocked you.

Which unit needs another pass: kinematics, dynamics, energy, momentum, rotation, oscillations, or fluids?

One free-body diagram or energy bar chart you want to redraw from memory:

Worksheet question numbers to review with a tutor:
