EXAM PREP GUIDE

AP Physics 1

Annotated Equation Sheet

A premium comprehensive reference guide for core formulas, variable definitions, and strategic solving tips.

REFERENCE INDEX

Units 1 — 4

Units 5 — 8

UNIT 1: KINEMATICS

Velocity Function

$$v_x = v_{x0} + a_x t$$

PRO TIP

Slope of v-t graph = acceleration. Intercept = initial velocity.

Position Function

$$x = x_0 + v_{x0} t + \frac{1}{2} a_x t^2$$

Relates displacement to constant acceleration and time.

Core Variables

x, x_0 : Position, Initial Position (m)

v_x, v_{x0} : Velocity, Initial Velocity (m/s)

a_x : Acceleration (m/s²)

t : Time elapsed (s)

g : Acceleration due to gravity (9.8 m/s²)

UNIT 2: DYNAMICS

Newton's Second Law

$$a = \frac{\sum F}{m}$$

IMPORTANT

Always start with a Free Body Diagram. F is the vector sum.

Friction Force

$$|F_f| \leq \mu |F_n|$$

Static: inequality (up to max). Kinetic: Fk = μkFn.

Key Symbols

F : Force vector (N)

m : Mass (kg)

μ : Coefficient of friction (unitless)

F_n : Normal Force (N)

ΣF : Net Force (vector sum)

UNIT 3: WORK, ENERGY & POWER

Kinetic Energy & Work

$$K = \frac{1}{2}mv^2 \quad , \quad W = Fd\cos\theta$$

PRO TIP

Only the force component parallel to displacement does work.

Potential Energy (Gravity)

$$\Delta U_g = mg\Delta y$$

Set y=0 at the lowest point of the system for simplicity.

Energy Variables

K : Translational Kinetic Energy (J)

U : Potential Energy (J)

W : Work done (J)

P : Power (Watts, J/s)

ΔE : Change in total energy

UNIT 4: MOMENTUM & IMPULSE

Linear Momentum

$$p = mv$$

VECTORS

Momentum is a vector! Direction is critical for collisions.

Impulse-Momentum Theorem

$$\Delta p = J = F_{avg} \Delta t$$

Impulse is the area under a force-time graph.

Key Insights

Conservation : Total p of isolated system is constant.

J : Impulse (N·s or kg·m/s).

Safety : Airbags increase Δt to reduce average Force.

Elastic : K is conserved.

Inelastic : K is lost (thermal/sound).

UNIT 5: CIRCULAR MOTION & ROTATION

Centripetal Acceleration

$$a_c = \frac{v^2}{r}$$

FORCE

Fc is not a new force! It's the net force toward center.

Torque Definition

$$\tau = rF\sin\theta$$

Maximize with long lever arms and perpendicular pushes.

Rotational Quantities

θ : Angular Position (rad)

ω : Angular Velocity (rad/s)

α : Angular Acceleration (rad/s²)

τ : Torque (N·m)

r : Radius or lever arm (m)

UNIT 5: ROTATIONAL DYNAMICS

Newton's 2nd Law (Rotational)

$$\sum \tau = I\alpha$$

INERTIA

I depends on mass distribution: mass far from axis = larger I.

Angular Momentum

$$L = I\omega \ , \quad K_{rot} = \frac{1}{2}I\omega^2$$

Conservation of L: Skater pulls arms in to spin faster.

Key Insights

I : Rotational Inertia (kg·m²)

L : Angular Momentum (kg·m²/s)

Translation vs Rotation : Linear formulas have rotational analogs.

v = ωr : Link between linear and angular velocity.

UNIT 6: HARMONIC MOTION

Hooke's Law & Spring Energy

$$F_s = -kx, \quad U_s = \frac{1}{2}kx^2$$

NOTE

Force varies with stretch. Use Energy, NOT Kinematics.

Periods of Oscillation

$$T_s = 2\pi\sqrt{\frac{m}{k}}, \quad T_p = 2\pi\sqrt{\frac{l}{g}}$$

Amplitude does NOT affect period in ideal SHM!

SHM Constants

T : Period (s) - Time for 1 cycle

f : Frequency (Hz) - 1/T

k : Spring Constant (N/m)

A : Amplitude (m) - Max displacement

l : Length of pendulum (m)

UNIT 7: GRAVITATION

Universal Gravitation

$$F_g = G\frac{m_1 m_2}{r^2}$$

INVERSE SQUARE

Double the distance (r) and the force quarters (1/4).

Gravitational Potential Energy

$$U_G = -\frac{Gm_1 m_2}{r}$$

Negative Energy Well: zero at infinity, decreases as objects closer.

Universal Gravity

G : 6.67 × 10^{-11} N·m^2/kg^2

r : Center-to-center distance

m_1, m_2 : Masses of the two bodies

Orbital v : Derived by setting Fg = Fc.

UNIT 8: FLUIDS STATICS

Density & Pressure

$$\rho = \frac{m}{V}, \quad P = \frac{F}{A}$$

HYDROSTATIC

Pressure at depth: $P = P_0 + \rho gh$.

Buoyant Force (Archimedes)

$$F_b = \rho_{fluid} V_{disp} g$$

Use density of FLUID, not object! Weight of displaced fluid.

Fluid Variables

ρ (rho) : Density (kg/m³)

P : Pressure (Pa, N/m²)

1 atm : 1.013×10^5 Pa

V_disp : Volume of fluid moved

h : Depth below surface (m)

UNIT 8: FLUID DYNAMICS

Continuity Equation

$$A_1 v_1 = A_2 v_2$$

FLOW

Narrower pipe section = faster flow (mass conservation).

Bernoulli's Equation

$$P_1 + \rho g y_1 + \frac{1}{2}\rho v_1^2 = \text{const}$$

Energy conservation for flowing fluids. High v = Low P.

Key Insights

Torricelli : v = √(2gh) for open tanks.

Laminar : Smooth flow (assumed for AP).

Viscosity : Internal friction (usually ignored).

Incompressible : Density remains constant.

READY TO EXCEL?

Good Luck on the Exam!

Consistency is the key to mastery. Practice applying these equations to multiple scenarios to build physical intuition.

Website
www.quantabble.com

Support
support@quantabble.com