

ADVANCED PLACEMENT PHYSICS 1 TABLE OF INFORMATION

CONSTANTS AND CONVERSION FACTORS

Universal gravitational constant, $G = 6.67 \times 10^{-11} \text{ m}^3/(\text{kg} \cdot \text{s}^2) = 6.67 \times 10^{-11} \text{ N} \cdot \text{m}^2/\text{kg}^2$ 1 atmosphere of pressure, $1 \text{ atm} = 1.0 \times 10^5 \text{ N/m}^2 = 1.0 \times 10^5 \text{ Pa}$	Magnitude of the acceleration due to gravity at Earth's surface, $g = 9.8 \text{ m/s}^2$ Magnitude of the gravitational field strength at Earth's surface, $g = 9.8 \text{ N/kg}$
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PREFIXES

Factor	Prefix	Symbol
10^{12}	tera	T
10^9	giga	G
10^6	mega	M
10^3	kilo	k
10^{-2}	centi	c
10^{-3}	milli	m
10^{-6}	micro	μ
10^{-9}	nano	n
10^{-12}	pico	p

UNIT SYMBOLS

hertz, Hz	newton, N
joule, J	pascal, Pa
kilogram, kg	second, s
meter, m	watt, W

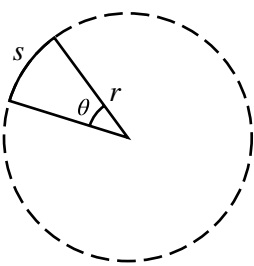
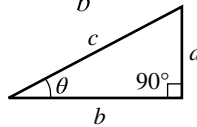
VALUES OF TRIGONOMETRIC FUNCTIONS FOR COMMON ANGLES

θ	0°	30°	37°	45°	53°	60°	90°
$\sin \theta$	0	$1/2$	$3/5$	$\sqrt{2}/2$	$4/5$	$\sqrt{3}/2$	1
$\cos \theta$	1	$\sqrt{3}/2$	$4/5$	$\sqrt{2}/2$	$3/5$	$1/2$	0
$\tan \theta$	0	$\sqrt{3}/3$	$3/4$	1	$4/3$	$\sqrt{3}$	∞

The following conventions are used in this exam:

- The frame of reference of any problem is assumed to be inertial unless otherwise stated.
- Air resistance is assumed to be negligible unless otherwise stated.
- Springs and strings are assumed to be ideal unless otherwise stated.
- Fluids are assumed to be ideal, and pipes are assumed to be completely filled by fluid, unless otherwise stated.

GEOMETRY AND TRIGONOMETRY

Rectangle $A = bh$ Triangle $A = \frac{1}{2}bh$ Circle $A = \pi r^2$ $C = 2\pi r$ $s = r\theta$	Rectangular Solid $V = \ell wh$ Cylinder $V = \pi r^2 \ell$ $S = 2\pi r \ell + 2\pi r^2$ Sphere $V = \frac{4}{3}\pi r^3$ $S = 4\pi r^2$	 $A = \text{area}$ $b = \text{base}$ $C = \text{circumference}$ $h = \text{height}$ $\ell = \text{length}$ $r = \text{radius}$ $s = \text{arc length}$ $S = \text{surface area}$ $V = \text{volume}$ $w = \text{width}$ $\theta = \text{angle}$	Right Triangle $a^2 + b^2 = c^2$ $\sin \theta = \frac{a}{c}$ $\cos \theta = \frac{b}{c}$ $\tan \theta = \frac{a}{b}$ 
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MECHANICS AND FLUIDS

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

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

$$v_x^2 = v_{x0}^2 + 2a_x (x - x_0)$$

$$\bar{x}_{\text{cm}} = \frac{\sum m_i \bar{x}_i}{\sum m_i}$$

$$\vec{a}_{\text{sys}} = \frac{\sum \vec{F}}{m_{\text{sys}}} = \frac{\vec{F}_{\text{net}}}{m_{\text{sys}}}$$

$$|\vec{F}_g| = G \frac{m_1 m_2}{r^2}$$

$$|\vec{F}_f| \leq |\mu \vec{F}_N|$$

$$\vec{F}_s = -k \Delta \vec{x}$$

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

$$K = \frac{1}{2} m v^2$$

$$W = F_{\parallel} d = F d \cos \theta$$

$$\Delta K = \sum W_i = \sum F_{\parallel, i} d_i$$

$$U_s = \frac{1}{2} k (\Delta x)^2$$

$$U_G = -\frac{G m_1 m_2}{r}$$

$$\Delta U_g = m g \Delta y$$

$$P_{\text{avg}} = \frac{W}{\Delta t} = \frac{\Delta E}{\Delta t}$$

$$P_{\text{inst}} = F_{\parallel} v = F v \cos \theta$$

$$\vec{p} = m \vec{v}$$

$$\vec{F}_{\text{net}} = \frac{\Delta \vec{p}}{\Delta t} = m \frac{\Delta \vec{v}}{\Delta t} = m \vec{a}$$

$$\vec{J} = \vec{F}_{\text{avg}} \Delta t = \Delta \vec{p}$$

$$\vec{v}_{\text{cm}} = \frac{\sum \vec{p}_i}{\sum m_i} = \frac{\sum m_i \vec{v}_i}{\sum m_i}$$

a = acceleration
 d = distance
 E = energy
 F = force
 J = impulse
 k = spring constant
 K = kinetic energy
 m = mass
 p = momentum
 P = power
 r = radius or distance
 t = time
 U = potential energy
 v = velocity or speed
 W = work
 x = position
 y = vertical position
 θ = angle
 μ = coefficient of friction

$$\omega = \omega_0 + \alpha t$$

$$\theta = \theta_0 + \omega_0 t + \frac{1}{2} \alpha t^2$$

$$\omega^2 = \omega_0^2 + 2\alpha (\theta - \theta_0)$$

$$v = r \omega$$

$$a_r = r \alpha$$

$$\tau = r_{\perp} F = r F \sin \theta$$

$$I = \sum m_i r_i^2$$

$$I' = I_{\text{cm}} + M d^2$$

$$\alpha_{\text{sys}} = \frac{\sum \tau}{I_{\text{sys}}} = \frac{\tau_{\text{net}}}{I_{\text{sys}}}$$

$$K = \frac{1}{2} I \omega^2$$

$$W = \tau \Delta \theta$$

$$L = I \omega$$

$$L = r m v \sin \theta$$

$$\Delta L = \tau \Delta t$$

$$\Delta x_{\text{cm}} = r \Delta \theta$$

$$T = \frac{1}{f}$$

$$T_s = 2\pi \sqrt{\frac{m}{k}}$$

$$T_p = 2\pi \sqrt{\frac{\ell}{g}}$$

$$x = A \cos(2\pi f t)$$

$$x = A \sin(2\pi f t)$$

$$\rho = \frac{m}{V}$$

$$P = \frac{F_{\perp}}{A}$$

$$P = P_0 + \rho g h$$

$$P_{\text{gauge}} = \rho g h$$

$$F_b = \rho V g$$

$$A_1 v_1 = A_2 v_2$$

$$P_1 + \rho g y_1 + \frac{1}{2} \rho v_1^2 = P_2 + \rho g y_2 + \frac{1}{2} \rho v_2^2$$

a = acceleration
 A = amplitude or area
 d = distance
 f = frequency
 F = force
 h = height
 I = rotational inertia
 k = spring constant
 K = kinetic energy
 ℓ = length
 L = angular momentum
 m = mass
 M = mass
 P = pressure
 r = radius or distance
 t = time
 T = period
 v = velocity or speed
 V = volume
 W = work
 x = position
 y = vertical position
 α = angular acceleration
 θ = angle or angular position
 ρ = density
 τ = torque
 ω = angular speed