

## 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, $1 \text{ atm} = 1.0 \times 10^5 \text{ N/m}^2 = 1.0 \times 10^5 \text{ Pa}$	Acceleration due to gravity at Earth's surface, $g = 9.8 \text{ m/s}^2$ Magnitude of the gravitational field strength at the 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	$\mu$
$10^{-9}$	nano	n
$10^{-12}$	pico	p

#### UNIT SYMBOLS

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

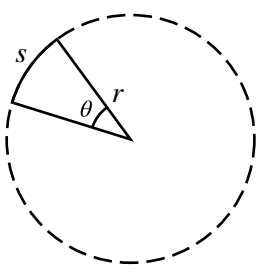
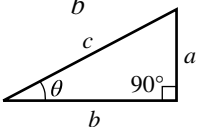
#### VALUES OF TRIGONOMETRIC FUNCTIONS FOR COMMON ANGLES

$\theta$	$0^\circ$	$30^\circ$	$37^\circ$	$45^\circ$	$53^\circ$	$60^\circ$	$90^\circ$
$\sin \theta$	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	$\sqrt{3}$	$\infty$

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

MECHANICS AND FLUIDS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

$a$  = acceleration

$d$  = distance

$E$  = energy

$F$  = force

$J$  = impulse

$k$  = spring constant

$K$  = kinetic energy

$m$  = mass

$p$  = momentum

$P$  = power

$r$  = radius, distance, or position

$t$  = time

$U$  = potential energy

$v$  = velocity or speed

$W$  = work

$x$  = position

$y$  = height

$\theta$  = angle

$\mu$  = 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

$\ell$  = length

$L$  = angular momentum

$m$  = mass

$M$  = mass

$P$  = pressure

$r$  = radius, distance, or position

$t$  = time

$T$  = period

$v$  = velocity or speed

$V$  = volume

$W$  = work

$x$  = position

$y$  = vertical position

$\alpha$  = angular acceleration

$\theta$  = angle

$\rho$  = density

$\tau$  = torque

$\omega$  = angular speed