ADVANCED PLACEMENT PHYSICS 1 TABLE OF INFORMATION

CONSTANTS AND CONVERSION FACTORS	
Universal gravitational constant, $G = 6.67 \times 10^{-11}\ \text{m}^3/(\text{kg}\cdot\text{s}^2) = 6.67 \times 10^{-11}\ \text{N}\cdot\text{m}^2/\text{kg}^2$	Acceleration due to gravity at Earth's surface, $g = 9.8\ \text{m/s}^2$
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 gravitational field strength at the Earth's surface, $g = 9.8\ \text{N/kg}$

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
$A = bh$

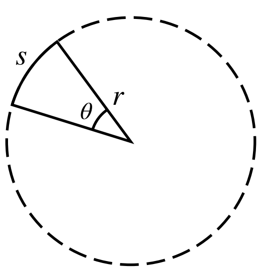
Triangle
$A = \frac{1}{2}bh$

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
$V = \frac{4}{3}\pi r^3$
$S = 4\pi r^2$



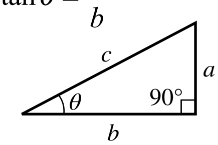
A = area
b = base
C = circumference
h = height
ℓ = length
r = radius
s = arc length
S = surface area
V = volume
w = width
θ = angle

Right Triangle
$a^2 + b^2 = c^2$

$\sin\theta = \frac{a}{c}$

$\cos\theta = \frac{b}{c}$

$\tan\theta = \frac{a}{b}$



MECHANICS AND FLUIDS			
$v_x = v_{x0} + a_x t$ $x = x_0 + v_{x0}t + \frac{1}{2}a_x t^2$ $v_x^2 = v_{x0}^2 + 2a_x(x - x_0)$ $\vec{x}_{cm} = \frac{\sum m_i \vec{x}_i}{\sum m_i}$ $\vec{a}_{sys} = \frac{\sum \vec{F}}{m_{sys}} = \frac{\vec{F}_{net}}{m_{sys}}$ $\lvert \vec{F}_g \rvert = G\frac{m_1 m_2}{r^2}$ $\lvert \vec{F}_f \rvert \le \lvert \mu \vec{F}_n \rvert$ $\vec{F}_s = -k\Delta\vec{x}$ $a_c = \frac{v^2}{r}$ $K = \frac{1}{2}mv^2$ $W = F_{\parallel}d = Fd\cos\theta$ $\Delta K = \sum W_i = \sum F_{\parallel,i}d_i$ $\Delta U_s = \frac{1}{2}k(\Delta x)^2$ $U_G = -\frac{Gm_1 m_2}{r}$ $\Delta U_g = mg\Delta y$ $P_{avg} = \frac{W}{\Delta t} = \frac{\Delta E}{\Delta t}$ $P_{inst} = F_{\parallel}v = Fv\cos\theta$ $\vec{p} = m\vec{v}$ $\vec{F}_{net} = \frac{\Delta\vec{p}}{\Delta t} = m\frac{\Delta\vec{v}}{\Delta t} = m\vec{a}$ $\vec{J} = \vec{F}_{avg}\Delta t = \Delta\vec{p}$ $\vec{v}_{cm} = \frac{\sum \vec{p}_i}{\sum m_i} = \frac{\sum m_i \vec{v}_i}{\sum m_i}$	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 θ = angle μ = coefficient of friction	$\omega = \omega_0 + \alpha t$ $\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$ $\omega^2 = \omega_0^2 + 2\alpha(\theta - \theta_0)$ $v = r\omega$ $a_T = r\alpha$ $\tau = r_{\perp}F = rF\sin\theta$ $I = \sum m_i r_i^2$ $I' = I_{cm} + Md^2$ $\alpha_{sys} = \frac{\Sigma\tau}{I_{sys}} = \frac{\tau_{net}}{I_{sys}}$ $K = \frac{1}{2}I\omega^2$ $W = \tau\Delta\theta$ $L = I\omega$ $L = rmv\sin\theta$ $\Delta L = \tau\Delta t$ $\Delta x_{cm} = r\Delta\theta$ $T = \frac{1}{f}$ $T_s = 2\pi\sqrt{\frac{m}{k}}$ $T_p = 2\pi\sqrt{\frac{\ell}{g}}$ $x = A\cos(2\pi ft)$ $x = A\sin(2\pi ft)$ $\rho = \frac{m}{V}$ $P = \frac{F_{\perp}}{A}$ $P = P_0 + \rho gh$ $P_{gauge} = \rho gh$ $F_b = \rho Vg$ $A_1 v_1 = A_2 v_2$ $P_1 + \rho g y_1 + \frac{1}{2}\rho v_1^2 = P_2 + \rho g y_2 + \frac{1}{2}\rho v_2^2$	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, distance, or position t = time T = period v = velocity or speed V = volume W = work x = position y = vertical position α = angular acceleration θ = angle ρ = density τ = torque ω = angular speed