Appendix: AP® Physics 1 Equation Tables

ADVANCED PLACEMENT PHYSICS 1 TABLE OF INFORMATION (2024)

CONSTANTS AND CONVERSION FACTORS	
Universal gravitational constant, $G = 6.67\times10^{-11}\ \text{m}^3/(\text{kg}\cdot\text{s}^2) = 6.67\times10^{-11}\ \text{N}\cdot\text{m}^2/\text{kg}^2$	Acceleration due to gravity at Earth's surface, $g = 9.8\ \text{m/s}^2$
1 atmosphere of pressure, $1\ \text{atm} = 1.0\times10^5\ \text{N/m}^2 = 1.0\times10^5\ \text{Pa}$	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	½	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
$A = bh$

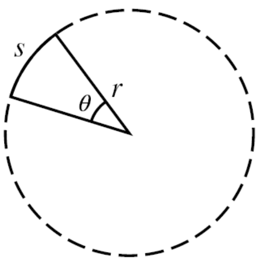
Rectangular Solid
$V = \ell wh$

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



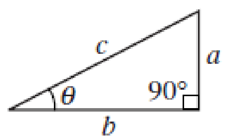
A = area
b = base
C = circumference
h = height
ℓ = length
r = radius
s = arc length
S = surface area
V = volume
w = width
θ = angle

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

$v_x = v_{xo} + a_x t$

$x = x_o + v_{xo}t + \frac{1}{2}a_x t^2$

$v_x^2 = v_{xo}^2 + 2a_x(x - x_o)$

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

$\vec{a}_{sys} = \frac{\Sigma \vec{F}}{m_{sys}}$

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

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

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

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

$K = \frac{1}{2}mv^2$

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

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

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

$\Delta U_g = mg\Delta y$

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

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

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

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

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

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

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

$\omega = \omega_o + \alpha t$

$\theta = \theta_o + \omega_o t + \frac{1}{2}\alpha t^2$

$\omega^2 = \omega_o^2 + 2\alpha(\theta - \theta_o)$

$v = r\omega$

$a_T = r\alpha$

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

$I = \sum m_i r_i^2$

$I' = I_{cm} + Md^2$

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

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

$W = \tau\Delta\theta$

$L = I\omega = rmv\sin\theta$

$\Delta L = \tau\Delta t$

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

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

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

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

$x = A\cos(2\pi ft)$

$x = A\sin(2\pi ft)$

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

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

$P = P_o + \rho gh$

$P_{gauge} = \rho gh$

$F_b = \rho Vg$

$A_1 v_1 = A_2 v_2$

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

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