

TABLE OF INFORMATION DEVELOPED FOR 2012 (see note on cover page)

CONSTANTS AND CONVERSION FACTORS	
Proton mass, $m_p = 1.67 \times 10^{-27}$ kg	Electron charge magnitude, $e = 1.60 \times 10^{-19}$ C
Neutron mass, $m_n = 1.67 \times 10^{-27}$ kg	1 electron volt, $1 \text{ eV} = 1.60 \times 10^{-19}$ J
Electron mass, $m_e = 9.11 \times 10^{-31}$ kg	Speed of light, $c = 3.00 \times 10^8$ m/s
Avogadro's number, $N_0 = 6.02 \times 10^{23}$ mol ⁻¹	Universal gravitational constant, $G = 6.67 \times 10^{-11}$ m ³ /kg·s ²
Universal gas constant, $R = 8.31$ J/(mol·K)	Acceleration due to gravity at Earth's surface, $g = 9.8$ m/s ²
Boltzmann's constant, $k_B = 1.38 \times 10^{-23}$ J/K	
1 unified atomic mass unit,	$1 \text{ u} = 1.66 \times 10^{-27}$ kg = 931 MeV/c ²
Planck's constant,	$h = 6.63 \times 10^{-34}$ J·s = 4.14×10^{-15} eV·s
	$hc = 1.99 \times 10^{-25}$ J·m = 1.24×10^3 eV·nm
Vacuum permittivity,	$\epsilon_0 = 8.85 \times 10^{-12}$ C ² /N·m ²
Coulomb's law constant, $k = 1/4\pi\epsilon_0 = 9.0 \times 10^9$ N·m ² /C ²	
Vacuum permeability,	$\mu_0 = 4\pi \times 10^{-7}$ (T·m)/A
Magnetic constant, $k' = \mu_0/4\pi = 1 \times 10^{-7}$ (T·m)/A	
1 atmosphere pressure,	$1 \text{ atm} = 1.0 \times 10^5$ N/m ² = 1.0×10^5 Pa

UNIT SYMBOLS	meter,	m	mole,	mol	watt,	W	farad,	F
	kilogram,	kg	hertz,	Hz	coulomb,	C	tesla,	T
	second,	s	newton,	N	volt,	V	degree Celsius,	°C
	ampere,	A	pascal,	Pa	ohm,	Ω	electron-volt,	eV
	kelvin,	K	joule,	J	henry,	H		

PREFIXES		
Factor	Prefix	Symbol
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

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.

- I. Unless otherwise stated, the frame of reference of any problem is assumed to be inertial.
- II. The direction of any electric current is the direction of flow of positive charge (conventional current).
- III. For any isolated electric charge, the electric potential is defined as zero at an infinite distance from the charge.
- *IV. For mechanics and thermodynamics equations, W represents the work done on a system.

*Not on the Table of Information for Physics C, since Thermodynamics is not a Physics C topic.

ADVANCED PLACEMENT PHYSICS C EQUATIONS DEVELOPED FOR 2012

MECHANICS

$v = v_0 + at$	$a = \text{acceleration}$
$x = x_0 + v_0t + \frac{1}{2}at^2$	$F = \text{force}$
$v^2 = v_0^2 + 2a(x - x_0)$	$f = \text{frequency}$
$\Sigma \mathbf{F} = \mathbf{F}_{net} = m\mathbf{a}$	$h = \text{height}$
$\mathbf{F} = \frac{d\mathbf{p}}{dt}$	$I = \text{rotational inertia}$
$\mathbf{J} = \int \mathbf{F} dt = \Delta \mathbf{p}$	$J = \text{impulse}$
$\mathbf{p} = m\mathbf{v}$	$K = \text{kinetic energy}$
$F_{fric} \leq \mu N$	$k = \text{spring constant}$
$W = \int \mathbf{F} \cdot d\mathbf{r}$	$\ell = \text{length}$
$K = \frac{1}{2}mv^2$	$L = \text{angular momentum}$
$P = \frac{dW}{dt}$	$m = \text{mass}$
$P = \mathbf{F} \cdot \mathbf{v}$	$N = \text{normal force}$
$\Delta U_g = mgh$	$P = \text{power}$
$a_c = \frac{v^2}{r} = \omega^2 r$	$p = \text{momentum}$
$\boldsymbol{\tau} = \mathbf{r} \times \mathbf{F}$	$r = \text{radius or distance}$
$\Sigma \boldsymbol{\tau} = \boldsymbol{\tau}_{net} = I\boldsymbol{\alpha}$	$\mathbf{r} = \text{position vector}$
$I = \int r^2 dm = \Sigma mr^2$	$T = \text{period}$
$\mathbf{r}_{cm} = \Sigma m\mathbf{r} / \Sigma m$	$t = \text{time}$
$v = r\omega$	$U = \text{potential energy}$
$\mathbf{L} = \mathbf{r} \times \mathbf{p} = I\boldsymbol{\omega}$	$v = \text{velocity or speed}$
$K = \frac{1}{2}I\omega^2$	$W = \text{work done on a system}$
$\omega = \omega_0 + \alpha t$	$x = \text{position}$
$\theta = \theta_0 + \omega_0 t + \frac{1}{2}\alpha t^2$	$\mu = \text{coefficient of friction}$
	$\theta = \text{angle}$
	$\tau = \text{torque}$
	$\omega = \text{angular speed}$
	$\alpha = \text{angular acceleration}$
	$\phi = \text{phase angle}$
	$\mathbf{F}_s = -k\mathbf{x}$
	$U_s = \frac{1}{2}kx^2$
	$x = x_{max} \cos(\omega t + \phi)$
	$T = \frac{2\pi}{\omega} = \frac{1}{f}$
	$T_s = 2\pi\sqrt{\frac{m}{k}}$
	$T_p = 2\pi\sqrt{\frac{\ell}{g}}$
	$\mathbf{F}_G = -\frac{Gm_1m_2}{r^2}\hat{\mathbf{r}}$
	$U_G = -\frac{Gm_1m_2}{r}$

ELECTRICITY AND MAGNETISM

$F = \frac{1}{4\pi\epsilon_0} \frac{q_1q_2}{r^2}$	$A = \text{area}$
$\mathbf{E} = \frac{\mathbf{F}}{q}$	$B = \text{magnetic field}$
$\oint \mathbf{E} \cdot d\mathbf{A} = \frac{Q}{\epsilon_0}$	$C = \text{capacitance}$
$E = -\frac{dV}{dr}$	$d = \text{distance}$
$V = \frac{1}{4\pi\epsilon_0} \sum_i \frac{q_i}{r_i}$	$E = \text{electric field}$
$U_E = qV = \frac{1}{4\pi\epsilon_0} \frac{q_1q_2}{r}$	$\mathcal{E} = \text{emf}$
$C = \frac{Q}{V}$	$F = \text{force}$
$C = \frac{\kappa\epsilon_0 A}{d}$	$I = \text{current}$
$C_p = \sum_i C_i$	$J = \text{current density}$
$\frac{1}{C_s} = \sum_i \frac{1}{C_i}$	$L = \text{inductance}$
$I = \frac{dQ}{dt}$	$\ell = \text{length}$
$U_c = \frac{1}{2}QV = \frac{1}{2}CV^2$	$n = \text{number of loops of wire per unit length}$
$R = \frac{\rho\ell}{A}$	$N = \text{number of charge carriers per unit volume}$
$\mathbf{E} = \rho\mathbf{J}$	$P = \text{power}$
$I = Nev_d A$	$Q = \text{charge}$
$V = IR$	$q = \text{point charge}$
$R_s = \sum_i R_i$	$R = \text{resistance}$
$\frac{1}{R_p} = \sum_i \frac{1}{R_i}$	$r = \text{distance}$
$P = IV$	$t = \text{time}$
$\mathbf{F}_M = q\mathbf{v} \times \mathbf{B}$	$U = \text{potential or stored energy}$
	$V = \text{electric potential}$
	$v = \text{velocity or speed}$
	$\rho = \text{resistivity}$
	$\phi_m = \text{magnetic flux}$
	$\kappa = \text{dielectric constant}$
	$\oint \mathbf{B} \cdot d\boldsymbol{\ell} = \mu_0 I$
	$d\mathbf{B} = \frac{\mu_0 I d\boldsymbol{\ell} \times \mathbf{r}}{4\pi r^3}$
	$\mathbf{F} = \int I d\boldsymbol{\ell} \times \mathbf{B}$
	$B_s = \mu_0 n I$
	$\phi_m = \int \mathbf{B} \cdot d\mathbf{A}$
	$\boldsymbol{\mathcal{E}} = \oint \mathbf{E} \cdot d\boldsymbol{\ell} = -\frac{d\phi_m}{dt}$
	$\boldsymbol{\mathcal{E}} = -L \frac{dI}{dt}$
	$U_L = \frac{1}{2}LI^2$

ADVANCED PLACEMENT PHYSICS C EQUATIONS DEVELOPED FOR 2012

GEOMETRY AND TRIGONOMETRY

Rectangle

$$A = bh$$

Triangle

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

Circle

$$A = \pi r^2$$

$$C = 2\pi r$$

Rectangular Solid

$$V = \ell wh$$

Cylinder

$$V = \pi r^2 \ell$$

$$S = 2\pi r \ell + 2\pi r^2$$

Sphere

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

$$S = 4\pi r^2$$

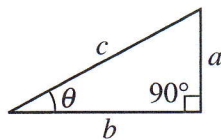
Right Triangle

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

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

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

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



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

CALCULUS

$$\frac{df}{dx} = \frac{df}{du} \frac{du}{dx}$$

$$\frac{d}{dx}(x^n) = nx^{n-1}$$

$$\frac{d}{dx}(e^x) = e^x$$

$$\frac{d}{dx}(\ln x) = \frac{1}{x}$$

$$\frac{d}{dx}(\sin x) = \cos x$$

$$\frac{d}{dx}(\cos x) = -\sin x$$

$$\int x^n dx = \frac{1}{n+1}x^{n+1}, n \neq -1$$

$$\int e^x dx = e^x$$

$$\int \frac{dx}{x} = \ln|x|$$

$$\int \cos x dx = \sin x$$

$$\int \sin x dx = -\cos x$$