# Constants

## AP® PHYSICS 1 TABLE OF INFORMATION

| 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 | Coulomb's law constant, | $k = 1/4\pi\varepsilon_0 = 9.0 \times 10^9$ N•m$^2$/C$^2$ |
| Electron mass, | $m_e = 9.11 \times 10^{-31}$ kg | Universal gravitational constant, | $G = 6.67 \times 10^{-11}$ m$^3$/kg•s$^2$ |
| Speed of light, | $c = 3.00 \times 10^8$ m/s | Acceleration due to gravity at Earth's surface, | $g = 9.8$ m/s$^2$ |

| UNIT SYMBOLS | | | | | | | |
|---|---|---|---|---|---|---|---|
| | meter, | m | kelvin, | K | watt, | W | degree Celsius, °C |
| | kilogram, | kg | hertz, | Hz | coulomb, | C | |
| | second, | s | newton, | N | volt, | V | |
| | ampere, | A | joule, | J | ohm, | Ω | |

# Units

| 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 |

# Metric Units Stuff

| VALUES OF TRIGONOMETRIC FUNCTIONS FOR COMMON ANGLES | | | | | | | |
|---|---|---|---|---|---|---|---|
| $\theta$ | 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. The frame of reference of any problem is assumed to be inertial unless otherwise stated.
II. Assume air resistance is negligible unless otherwise stated.
III. In all situations, positive work is defined as work done on a system.
IV. The direction of current is conventional current: the direction in which positive charge would drift.
V. Assume all batteries and meters are ideal unless otherwise stated.

**READ THIS STUFF!!!**

# AP® PHYSICS 1 EQUATIONS

## MECHANICS

**A**

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

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

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

**B**

4) $\vec{a} = \frac{\sum \vec{F}}{m} = \frac{\vec{F}_{net}}{m}$

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

**C**

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

**D**

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

8) $\Delta\vec{p} = \vec{F}\,\Delta t$

**E**

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

10) $\Delta E = W = F_{\parallel} d = Fd\cos\theta$

11) $P = \frac{\Delta E}{\Delta t}$

**F**

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

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

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

**G**

15) $\vec{\alpha} = \frac{\sum \vec{\tau}}{I} = \frac{\vec{\tau}_{net}}{I}$

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

**H**

17) $L = I\omega$

18) $\Delta L = \tau\,\Delta t$

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

**I**

20) $|\vec{F}_s| = k|\vec{x}|$

21) $U_s = \frac{1}{2}kx^2$

**J**

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

$a$ = acceleration
$A$ = amplitude
$d$ = distance
$E$ = energy
$f$ = frequency
$F$ = force
$I$ = rotational inertia
$K$ = kinetic energy
$k$ = spring constant
$L$ = angular momentum
$\ell$ = length
$m$ = mass
$P$ = power
$p$ = momentum
$r$ = radius or separation
$T$ = period
$t$ = time
$U$ = potential energy
$V$ = volume
$v$ = speed
$W$ = work done on a system
$x$ = position
$y$ = height
$\alpha$ = angular acceleration
$\mu$ = coefficient of friction
$\theta$ = angle
$\rho$ = density
$\tau$ = torque
$\omega$ = angular speed

**K**

23) $\Delta U_g = mg\,\Delta y$

**L**

24) $T = \frac{2\pi}{\omega} = \frac{1}{f}$

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

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

**M**

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

28) $\vec{g} = \frac{\vec{F}_g}{m}$

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

## ELECTRICITY

**N**

30) $|\vec{F}_E| = k\left|\frac{q_1 q_2}{r^2}\right|$

**O**

31) $I = \frac{\Delta q}{\Delta t}$

32) $R = \frac{\rho\ell}{A}$

**P**

33) $I = \frac{\Delta V}{R}$

34) $P = I\,\Delta V$

35) $R_s = \sum_i R_i$

36) $\frac{1}{R_p} = \sum_i \frac{1}{R_i}$

$A$ = area
$F$ = force
$I$ = current
$\ell$ = length
$P$ = power
$q$ = charge
$R$ = resistance
$r$ = separation
$t$ = time
$V$ = electric potential
$\rho$ = resistivity!

## WAVES

**Q**

37) $\lambda = \frac{v}{f}$

$f$ = frequency
$v$ = speed
$\lambda$ = wavelength

## GEOMETRY AND TRIGONOMETRY

**R**

Rectangle
$A = bh$

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

Circle
$A = \pi r^2$
$C = 2\pi r$

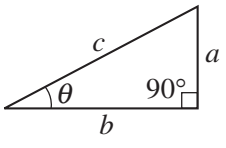
Rectangular solid
$V = \ell wh$

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

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

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

Right triangle
$c^2 = a^2 + b^2$
$\sin\theta = \frac{a}{c}$
$\cos\theta = \frac{b}{c}$
$\tan\theta = \frac{a}{b}$



**A = Kinematic Equations (Accelerated Motion)**

**B = Newton's 2nd Law & Friction**

**C = Centripetal Acceleration**

**D = Momentum & Impulse (Pi = Pf)**

**E = Kinetic Energy, Work, & Power**

**F = Circular Accelerated Motion / Simple Harmonic Motion**

**G = Angular Acceleration / Torque**

**H = Angular Momentum / Kinetic Rotational Motion**

**I = Force of a Spring / Potential Energy of Spring**

**J = Density**

**K = Gravitational Potential Energy (Version 1)**

**L = Period (Time for 1 cycle) / Frequency, Period of Spring, Period of Pendulum**

**M = Newton's Universal Gravity Law, Fg, Gravitational Potential Energy (Version 2)**

N = Coulomb's Law (Force between 2 charged objects)

**O = Electrical Current / Resistance of an Object**

**P = Circuits (Current - Ohm's Law, Power, Resistance Series, Resistance Parallel)**

**Q = Wavelength vs Frequency Relationship**

**R = Fundemental Math Relationships in AP Physics 1**