

Conceptual Physics Equation Sheet

NEWTONIAN MECHANICS

$$v_2 = v_1 + at$$

$$x_2 = x_1 + v_1t + \frac{1}{2}at^2$$

$$v_2^2 = v_1^2 + 2a(x_2 - x_1)$$

$$R = \frac{v_1^2 \sin 2\theta}{g}$$

$$F = ma$$

$$Pr = \frac{F}{A}$$

$$p = mv$$

$$J = Ft$$

$$J = \Delta p$$

$$m_a v_{1a} + m_b v_{1b} = m_a v_{2a} + m_b v_{2b} \quad p = \text{momentum}$$

$$m_a v_{1a} + m_b v_{1b} = (m_a + m_b)v_2 \quad PE = \text{potential energy}$$

$$W = Fd$$

$$P = \frac{W}{t}$$

$$PE = mgh$$

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

$$TME = PE + KE$$

$$W = \Delta E$$

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

$$F_c = ma_c$$

$$F_G = \frac{Gm_1m_2}{d^2}$$

A = area

a = acceleration

a_c = centripetal acceleration

d = distance

E = energy

F = force

F_c = centripetal force

F_G = gravitational force

G = Universal gravitational constant

g = acceleration due to gravity

h = height

J = impulse

KE = kinetic energy

m = mass

P = power

p = momentum

PE = potential energy

Pr = pressure

r = radius

R = range

t = time

TME = total mechanical energy

v = velocity

v_1 = initial velocity

v_2 = final velocity

W = work

x_1 = initial position

x_2 = final position

θ = angle

Δ = delta means "change in"

WAVES AND OPTICS

$$T = 2\pi\sqrt{\frac{L}{g}}$$

$$f = \frac{1}{2\pi}\sqrt{\frac{g}{L}}$$

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

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

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

$$v = 332 + .6T$$

$$f_o = f_s \left(\frac{v}{v \pm v_s} \right)$$

$$\text{beat frequency} = |f_1 - f_2|$$

$$c = \frac{d}{t}$$

$$n = \frac{c}{v}$$

$$n_1 \sin \theta_1 = n_2 \sin \theta_2$$

$$\sin \theta_c = \frac{n_2}{n_1}$$

$$\frac{1}{d_i} + \frac{1}{d_o} = \frac{1}{f}$$

$$M = \frac{h_i}{h_o} = -\frac{d_i}{d_o}$$

$$f = \frac{R}{2}$$

c = speed of light

d = distance

d_i = image distance

d_o = object distance

f = frequency or focal length

f_s = frequency of source

f_o = frequency observed

g = acceleration due to gravity

h_i = image height

h_o = object height

L = length of pendulum

M = magnification

n = index of refraction

R = radius of curvature

T = period or temperature

t = time

v = speed of wave

v_s = speed of source

θ_1 = angle of incidence

θ_2 = angle of refraction

θ_c = critical angle

Conceptual Physics Equation Sheet

ELECTRICITY AND MAGNETISM

$$F = \frac{kq_1q_2}{d^2}$$

C = capacitance

E = electric field

F = force

$$E = \frac{F}{q}$$

I = current

k = Coulomb's law constant

$$V = \frac{PE_E}{q}$$

P = power

PE_E = electrical potential energy

Q = charge

$$PE_E = \frac{kq_1q_2}{d}$$

q = point charge

R = resistance

$$I = \frac{V}{R}$$

R_p = parallel resistance equivalent

R_s = series resistance equivalent

$$P = IV$$

V = voltage or potential difference

$$C = \frac{Q}{V}$$

$$R_s = R_1 + R_2 + \dots$$

$$\frac{1}{R_p} = \frac{1}{R_1} + \frac{1}{R_2} + \dots$$

CONSTANTS AND CONVERSION FACTORS

Acceleration due to gravity
at Earth's surface: $g = 9.8 \text{ m/s}^2$

Universal gravitational
Constant: $G = 6.67 \times 10^{-11} \text{ Nm}^2/\text{kg}^2$

Speed of light in a vacuum: $c = 3.00 \times 10^8 \text{ m/s}$

Coulomb's law constant: $k = 9.0 \times 10^9 \text{ Nm}^2/\text{C}^2$

Electron charge magnitude: $e = 1.60 \times 10^{-19} \text{ C}$

1 meter = 39.37 inches = 3.28 feet = 1.094 yards

1 kilometer = 0.62 miles

1 kilogram = 2.205 pounds (on Earth) = 9.8 Newtons (on Earth)

1 hour = 60 minutes = 3600 seconds

1 Earth year = 52.18 weeks = 365.25 days = 31557600 seconds

1 m/s = 3.6 km/h = 2.24 miles per hour

GEOMETRY AND TRIGONOMETRY

Rectangle

A = area

$$A = bh$$

b = base

Triangle

C = circumference

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

h = height

l = length

Circle

r = radius

$$A = \pi r^2$$

S = surface area

$$C = 2\pi r$$

V = volume

w = width

Parallelepiped

θ = angle

$$V = lwh$$

Cylinder

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

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

Sphere

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

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

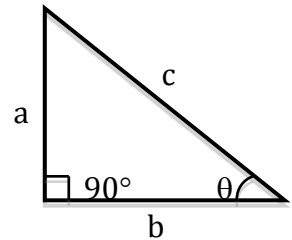
Right Triangle

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

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

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

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



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