Honors Physics
Equation Sheet

GravityKills.net

Fall Semester

Constant Motion

$$\Delta d = v_c t$$

Changing Motion

$$\Delta d = v_{avg} t$$

$$v_f = v_i + at$$

$$\Delta d = v_i t + \frac{1}{2} a t^2$$

$$v_f^2 = v_i^2 + 2a\Delta d$$

Newton's Laws

$$\Sigma F = F_{net} = ma$$

$$F_g = mg \text{ (weight)}$$

$$F_{friction} \le \mu F_N$$

$$F_{spring} = -kx$$

2D Motion

$$v_x = v\cos\theta$$

$$v_y = v\sin\theta$$

UCM and Gravity

(Uniform Circular Motion)

$$F_g = \frac{Gm_1m_2}{r^2} \text{ or } \frac{Gm_1m_2}{d^2}$$

$$\tau = rF\sin\theta$$

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

$$v = \frac{2\pi r}{T}$$

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

Work and Energy

$$W = F\Delta d\cos\theta$$

$$W_{net} = \Delta KE$$

$$W = \Delta E$$

$$PE_{gravity} = mgh$$

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

$$PE_i + KE_i = PE_f + KE_f$$

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

$$PE_{spring} = \frac{1}{2}kx^2$$

$$Q = mc\Delta T$$

Graph Interpretation

Slope of a:
position vs. time = velocity
velocity vs. time = acceleration
momentum vs. time = force

Area Beneath the Curve of a:
velocity vs. time = displacement
acceleration vs. time = change in velocity
force vs. distance = work
force vs. time = impulse

Spring Semester

Impulse & Momentum

$$p = mv$$

$$m_1v_1 + m_2v_2 = m_1v_1' + m_2v_2'$$

$$J = F_{net}\Delta t = \Delta p = m\Delta v$$

Mechanical Waves

$$v = \lambda f$$

$$\lambda_n = \frac{2L}{n} \text{ or } \lambda_n = \frac{4L}{n}$$

$$f_n = nf_1$$

Electromagnetic Waves

$$c = \lambda f$$

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

$$n_i\sin\theta_i = n_r\sin\theta_r$$

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

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

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

Electrostatics

$$Q = Ne$$

$$F_E = \frac{kq_1q_2}{r^2} \text{ or } \frac{kq_1q_2}{d^2}$$

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

$$E = \frac{kQ}{r^2}$$

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

Circuits

$$V = iR$$

$$P = iV = i^2R = \frac{V^2}{R}$$

$$i = \frac{Q}{t}$$

$$R = \frac{\rho L}{A}$$

$$R_{series} = R_i + R_2 + \ldots$$

$$\frac{1}{R_{parallel}} = \frac{1}{R_i} + \frac{1}{R_2} + \ldots$$

Magnetism

$$F_B = qvB\sin\theta$$

$$F_B = BiL\sin\theta$$

F_B = palm; B = fingers
i or v = thumb
x = *Into;* • = *out of*
right hand is positive

$$B = \frac{\mu_o i}{2\pi r}$$

$$\frac{V_P}{V_S} = \frac{i_S}{i_P}$$

Modern

$$E = Pt$$

$$E = hf$$

$$W = hf_t$$

$$KE = E - W$$

$$KE = hf - hf_t$$

$$E_n = \frac{E_1}{n^2} \text{ (Hydrogen ONLY)}$$

$$\lambda = \frac{h}{p} = \frac{h}{mv}$$

$$E = mc^2$$

Working Equation - Algebraically manipulate your equation(s) solving for the unknown variable. The working equation may only have variables identified in the given.

Name	Variable	Unit
Acceleration	a	m/s^2
Acceleration due to Gravity	g	m/s^2
Average Velocity	v_{avg}	m/s
Average Speed	v_{avg}	m/s
Charge	q or Q	C, coulomb
Constant Velocity	v_c	m/s
Current	i or I	A, ampere
de Broglie Wavelength	λ	m, meter
Displacement	Δd or d	m, meter
Distance	Δd or d	m, meter
Electric Field	E	N/C
Electrostatic Force	F_E	N
Elementary Charge	e	C, coulomb
Energy	E	J, joule
Focal Length	f	m, meter
Force	F	N, newton
Frequency	f	1/s or Hz, hertz
Frictional Force	F_f	N, newton
Gravitational Force	F_g	N, newton
Image Distance	d_i	m, meter
Impulse	J	Ns
Instantaneous speed	v	m/s
Magnetic Field	B	T, tesla
Magnetic Force	F_B	N
Mass	m	kg, kilogram
Momentum	p	kgm/s
Net Force	F_{net} or ΣF	N, newton
Normal Force	F_N	N, newton
Number	N	no unit
Kinetic Energy	KE	J, joule
Object Distance	d_o	m, meter
Period	T	s, second
Pitch	f	1/s or Hz, hertz
Potential Difference	V	V, volt
Potential Energy		
Gravitational	PE_g	J, joule
Elastic	PE_E	J, joule
Power	P	W, watt
Radius	r	m, meter
Resistance	R	Ω, ohm
Speed	v	m/s
Spring Constant	k	N/m
Summation of Forces	F_{net} or ΣF	N, newton
Tangential Velocity/Speed	v_T	m/s
Tension Force	F_T	N, newton
Time	t	s, second
Velocity	v	m/s
Velocity (constant)	v_c	m/s
Velocity (average)	v_{avg}	m/s
Volts	V	V, volt
Voltage	V	V, volt
Wavelength	λ	m, meter
Wave Speed	v	m/s
Weight	F_g	N, newton
Work	W	J, joule
Work Function	W	J, joule

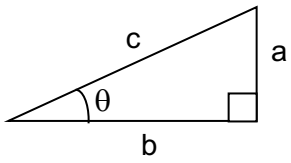
Right Triangle Trigonometry

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

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

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

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



Trigonometric Values

θ	sin θ	cos θ	tan θ
0°	0	1	0
30°	$1/2$	$\sqrt{3}/2$	$\sqrt{3}/3$
37°	$3/5$	$4/5$	$3/4$
45°	$\sqrt{2}/2$	$\sqrt{2}/2$	1
53°	$4/5$	$3/5$	$4/3$
60°	$\sqrt{3}/2$	$1/2$	$\sqrt{3}$
90°	1	0	Inf.

Ratio

A to B is $\frac{A}{B}$ **OR A:B is** $\frac{A}{B}$

Constants and Conversion Factors

Acceleration due to gravity ... $g = 9.8\ m/s^2$
Universal gravitational constant ... $G = 6.67 \times 10^{-11}\ Nm^2/kg^2$
Mass of the Earth ... 5.97×10^{24} kg
Radius of the Earth ... 6.37×10^{6} m
Mass of the Moon ... 7.36×10^{22} kg
Radius of the Moon ... 1.74×10^{6} m
Mass of the Sun ... 1.99×10^{30} kg
Distance between:
- Earth and Sun 1.5×10^{11} m
- Earth and Moon 3.82×10^{8} m

Index of refraction of air ... $n = 1$
Speed of sound in air ... $v = 343$ m/s
Speed of light in a vacuum ... $c = 3.00 \times 10^{8}$ m/s
Ludicrous speed ... $v > 3.00 \times 10^{8}$ m/s
Elementary charge ... $e = 1.60 \times 10^{-19}$ C
Coulomb's law constant ... $k = 9.0 \times 10^{9}\ Nm^2/C^2$
Vacuum permeability ... $\mu_o = 4\pi \times 10^{-7}$ Tm/A
Planck's constant ... $h = 4.14 \times 10^{-15}$ eVs
$h = 6.63 \times 10^{-34}$ Js
eV to Joule conversion ... $1\ eV = 1.6 \times 10^{-19}$ J
Proton mass ... $m_p = 1.67 \times 10^{-27}$ kg
Neutron mass ... $m_n = 1.67 \times 10^{-27}$ kg
Electron mass ... $m_e = 9.11 \times 10^{-31}$ kg
Avogadro's number ... $N_o = 6.02 \times 10^{23}\ mol^{-1}$