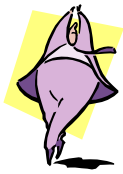
Wonderful, Wonderful Formulas!



Quantity	Variable	Unit	Unit Symbol
Length	l, d, r, Δx	meter	m
Mass	m	kilogram	kg
Time	t	second	s
Energy	E	Joule	J
Power	P	Watt	W
Thermodynamic temperature	T	kelvin	K
Electric current	I	ampere	A
Electric charge	q	Coulomb	C
Electric potential (voltage)	V, ΔV	Volt	V
Electric resistance	R	Ohm	Ω
Force	F	Newton	N
Pressure	P	pascal	Pa
Frequency	f	Hertz	Hz
Angles/Angular Displacement	$\Delta\theta$	radian	rad

Kinematic Equations

$\Delta x = x_f - x_0$

If not accelerating:

$v = {}^{\Delta x}/_{t}$

If accelerating:

$a = {}^{\Delta v}/_{t} = {}^{(v_f - v_0)}/_{t}$

$\Delta x = \frac{1}{2}(v_0 + v_f)t$

$\Delta x = v_0 t + \frac{1}{2} at^2$

$v_f = v_0 + at$

$v_f^2 = v_0^2 + 2a\Delta x$

Free Fall

$g = -9.81\ m/s^2$

Prefix	Symbol	Meaning	Value
giga	G	billion	$\times 10^9$
mega	M	million	$\times 10^6$
kilo	k	thousand	$\times 10^3$
centi	c	hundredth	$\times 10^{-2}$
milli	m	thousandth	$\times 10^{-3}$
micro	μ	millionth	$\times 10^{-6}$
nano	n	billionth	$\times 10^{-9}$

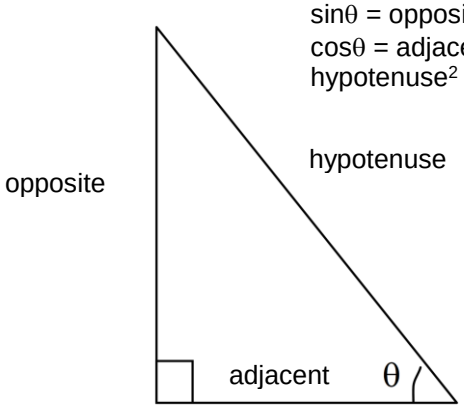
Trigonometry

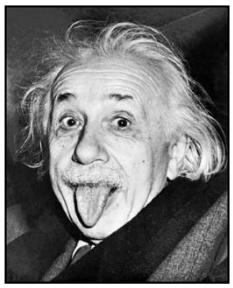
$\tan\theta$ = opposite/adjacent

$\sin\theta$ = opposite/hypotenuse

$\cos\theta$ = adjacent/hypotenuse

hypotenuse^2 = opposite^2 + adjacent^2





Dynamics Formulas

$F_G = mg$

Flat surface: $F_N = -F_G = -mg$

Inclined surface: $F_N = -F_G(\cos\theta) = -mg(\cos\theta)$

$F_{s,max} = \mu_s F_N$ $\quad F_k = \mu_k F_N$ $\quad F_{elastic} = -k\Delta x$

$F_{net} = ma$

Energy Formulas

$PE_g = mgh$ $\quad KE = \frac{1}{2} mv^2$ $\quad PE_e = \frac{1}{2} kx^2$

$W = F\Delta x(\cos\theta)$

$W = \Delta PE_g + \Delta PE_e + \Delta KE$

$W = mg(h_f - h_0) + \frac{1}{2}k(x_f^2 - x_0^2) + \frac{1}{2} m(v_f^2 - v_0^2)$

$PE_{g0} + PE_{e,0} + KE_0 = PE_{g,f} + PE_{e,f} + KE_f$

$mgh_0 + \frac{1}{2} kx_0^2 + \frac{1}{2} mv_0^2 = mgh_f + \frac{1}{2} kx_f^2 + \frac{1}{2} mv_f^2$

$Power = {}^{E}/_{t} = {}^{W}/_{t} = Fv$

Momentum Formulas

$p = mv$ $\quad Ft = \Delta p = m\Delta v$

$p_{total,intial} = p_{total,\ final}$

$m_a v_{a,0} + m_b v_{b,0} = m_a v_{af} + m_b v_{bf}$

$KE_{total,intial} = \frac{1}{2} m_1 v^2_{1,0} + \frac{1}{2} m_2 v^2_{2,0}$

$KE_{total,\ final} = \frac{1}{2} m_1 v^2_{1,f} + \frac{1}{2} m_2 v^2_{2,f}$

% lost = $[(KE_f - KE_0)/KE_0] \times 100$

Helpful Formulas page 2!

Rotational & Circular Kinematics

$f = 1/T$ and $T = 1/f$

$\theta_{radians} = \theta_{degrees}(\pi/180°)$

Rotational Motion

$\omega = \Delta\theta/t$

$\alpha = \Delta\omega/t$

The following only apply if the object is accelerating uniformly:

$\Delta\theta = ½ (\omega_i + \omega_f)t$

$\Delta\theta = \omega_i t + ½\alpha t^2$

$\omega_f^2 = \omega_i^2 + 2\alpha\Delta\theta$

$\omega_f = \omega_i + \alpha t$

Circular Motion & Gravity

Circumference $= 2\pi r$

$v_t = 2\pi r/T = r\omega$

$a_c = v_t^2/r = r\omega^2$

$F_c = ma_c$

$F_G = Gm_1m_2/r^2$

$G = 6.67 \times 10^{-11}\ N\bullet m^2/kg^2$

Triboelectric Series

Rabbit fur loses electrons to...
Glass loses electrons to...
Wool loses electrons to...
Cat fur loses electrons to...
Silk loses electrons to...
Cotton loses electrons to...
Wood loses electrons to...
Plastic loses electrons to...
Metal…

Electrostatics

1 electron $= -1.60 \times 10^{-19}C$ and 1 proton $= +1.60 \times 10^{-19}C$

$k = 9 \times 10^9\ Nm^2/C^2$

Coulomb's Law: $F_{electric} = k(q_1q_2)/r^2$

Electric Fields: $E = kq/r^2$ (q is the object creating the field.)

Electric Potential Energy: $PE_e = -qEd$ (q is the object in the field.)

Electric Potential:
$V = PE_e/q$ (q is the object with the PE_e) AND
$V = kq_1/r_1 + kq_2/r_2 + \ldots$ (q_1 & q_2 create the field.)

Potential Difference: $\Delta V = V_2 - V_1 = \Delta PE_e/q = -Ed$

Rotational Dynamics

$\tau = F\perp d$

$L = I\omega$

$L_i = L_f$

$I_i\omega_i = I_f\omega_f$

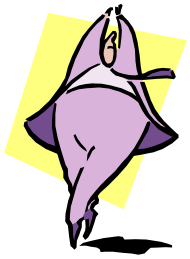
Moments of Inertia for different shapes:

Hoop: $I = mr^2$

Solid Disk: $I = ½\ mr^2$

Sphere: $I = {}^2/_5\ mr^2$

Electric Circuits



1 Ampere = 1 Coulomb/second
1 Volt = 1 Joule/Coulomb

$I = {}^V/_R$

Total Resistance:

☆ Series: $R_{total} = R_1 + R_2 + R_3 \ldots$

☆ Parallel: ${}^1/_{Rtotal} = {}^1/_{R1} + {}^1/_{R2} + {}^1/_{R3} \ldots$

Power $= I \times V = I^2R = V^2/R$

Zero Rules for Significant Figures

1. Zeros in the middle are significant.
   101 = 3 significant figures
2. Zeros to the left are never significant.
   0.01 = 1 significant figure
3. Zeros to the right are significant if there's a decimal after them.
   10. = 2 significant figures
4. Zeros to the right are significant if they are after a decimal.
   0.010 = 2 significant figures
5. Zeros to the right are significant if they are included in the coefficient of a number in scientific notation.
   1.0×10^4 = 2 significant figures