3U PHYSICS EQUATIONS

PREFIXES

$\eta = \times 10^{-9}$ $\mu = \times 10^{-6}$ $m = \times 10^{-3}$ $k = \times 10^{3}$ $M = \times 10^{6}$ $G = \times 10^{9}$

CONSTANTS

$1\ year = 3.16 \times 10^{7}\ s$

$1\ kW{\cdot}h = 3.6\ MJ$

$1\ m/s = 3.6\ km/h$

$g = 9.8\ m/s^{2}$

$c = 3.00 \times 10^{8}\ m/s$

$e = 1.60 \times 10^{-19}\ C$

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

$k = 9.00 \times 10^{9}\ N{\cdot}m^{2}/C^{2}$

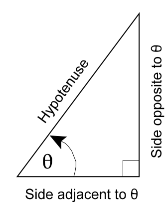
DERIVED UNITS

Coulomb	Joule	Newton	Resistance	Volt	Watt
$C = A{\cdot}s$	$J = kg{\cdot}m^2/s^2$	$N = kg{\cdot}m/s^2$	$\Omega = kg{\cdot}m^2/A^2{\cdot}s^3$	$V = kg{\cdot}m^2/A{\cdot}s^3$	$W = kg{\cdot}m^2/s^3$

TRIGONOMETRY

RIGHT TRIANGLE (SOHCAHTOA)

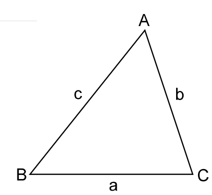
$$\sin\theta = \frac{opposite}{hypotenuse} \qquad \cos\theta = \frac{adjacent}{hypotenuse} \qquad \tan\theta = \frac{opposite}{adjacent}$$



NON-RIGHT TRIANGLE (SINE & COSINE LAW)

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

$$a^2 = b^2 + c^2 - 2 \cdot b \cdot c \cdot \cos A$$
$$b^2 = a^2 + c^2 - 2 \cdot a \cdot c \cdot \cos B$$
$$c^2 = a^2 + b^2 - 2 \cdot a \cdot b \cdot \cos C$$



ERROR

$$\%\ Error = \frac{|\ accepted - measured\ |}{accepted} \times 100\%$$

$$\%\ Difference = \frac{|\ value1 - value2\ |}{\left(\frac{value1 + value2}{2}\right)} \times 100\%$$

KINEMATICS

$$\vec{v}_{avg} = \frac{\Delta \vec{d}}{\Delta t} = \frac{\vec{d}_2 - \vec{d}_1}{t_2 - t_1}$$

$$\vec{v}_{avg} = \frac{\vec{v}_1 + \vec{v}_2}{2}$$

$$\vec{a}_{avg} = \frac{\Delta \vec{v}}{\Delta t} = \frac{\vec{v}_2 - \vec{v}_1}{t_2 - t_1}$$

$$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$$

$$\vec{v}_2^{\,2} = \vec{v}_1^{\,2} + 2\vec{a}\Delta\vec{d}$$

$$\Delta\vec{d} = \frac{(\vec{v}_1 + \vec{v}_2)}{2}\Delta t$$

$$\Delta\vec{d} = \vec{v}_1\Delta t + \tfrac{1}{2}\vec{a}(\Delta t)^2$$

$$\Delta\vec{d} = \vec{v}_2\Delta t - \tfrac{1}{2}\vec{a}(\Delta t)^2$$

PROJECTILE MOTION

*NOTE! You can **only** use the following formulas if the projectile is launched and lands on the same level. If not, you must look at the motion of the projectile in two directions - horizontal (a=0 so $d_x = v_x t$) and vertical ($a \neq 0$).*

$$R = \frac{v^2 \sin 2\theta}{g} \qquad H_{\max} = \frac{(v\sin\theta)^2}{2g} \qquad t = \frac{2v\sin\theta}{g}$$

DYNAMICS

$$\vec{F}_{net} = \sum Forces \qquad \vec{F}_g = m\vec{g} \qquad \vec{F}_G = \frac{Gm_1m_2}{\Delta d^2}$$

$$\vec{F}_{net} = m\vec{a} \qquad \vec{F}_f = \mu\vec{F}_N$$

ENERGY & HEAT

$$W = \Delta E = F\Delta d \qquad P = \frac{W}{\Delta t} = \frac{\Delta E}{\Delta t} = F \cdot v_{avg} \qquad Q = mc\Delta t$$

$$\Delta E_G = mg\Delta h \qquad Q_{lost} + Q_{gained} = 0$$

$$\Delta E_K = \frac{1}{2}m\Delta v^2 \qquad efficiency = \frac{E_{out}}{E_{in}} \times 100\,\% \qquad Q_f = mL_f \quad \& \quad Q_v = mL_v$$

$$E_T = E_G + E_K$$

WAVES & SOUND

$$f = \frac{N}{\Delta t} \qquad T = \frac{1}{f} \qquad f_{beat} = |f_2 - f_1| \qquad \frac{f_1}{f_2} = \frac{L_2}{L_1} = \frac{d_2}{d_1} = \frac{\sqrt{F_1}}{\sqrt{F_2}} = \frac{\sqrt{\rho_2}}{\sqrt{\rho_1}}$$

$$v = 332 + 0.59T$$

$$T = \frac{\Delta t}{N} \qquad v = f\lambda$$

ELECTRICITY

$$q = Ne = I\Delta t$$

$$W = E = qV = VI\Delta t$$

$$V = IR$$

$$P = IV = I^2R = \frac{V^2}{R}$$

$$P_{loss} = I^2R$$

SERIES CIRCUIT

$$V_T = V_1 + V_2 + \ldots$$

$$I_T = I_1 = I_2 = \ldots$$

$$R_T = R_1 + R_2 + \ldots$$

$$P_T = P_1 + P_2 + \ldots$$

PARALLEL CIRCUIT

$$V_T = V_1 = V_2 = \ldots$$

$$I_T = I_1 + I_2 + \ldots$$

$$\frac{1}{R_T} = \frac{1}{R_1} + \frac{1}{R_2} + \ldots$$

$$P_T = P_1 + P_2 + \ldots$$

ELECTROMAGNETISM

$$\frac{F_1}{F_2} = \frac{I_1}{I_2} = \frac{V_1}{V_2} = \frac{N_1}{N_2} \qquad \frac{N_p}{N_s} = \frac{V_p}{V_s} = \frac{I_s}{I_p}$$