

3U PHYSICS EQUATIONS

PREFIXES

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

CONSTANTS

$$1 \text{ year} = 3.16 \times 10^7 \text{ s} \quad 1 \text{ m/s} = 3.6 \text{ km/h} \quad c = 3.00 \times 10^8 \text{ m/s} \quad G = 6.67 \times 10^{-11} \text{ N}\cdot\text{m}^2/\text{kg}^2$$

$$1 \text{ kW}\cdot\text{h} = 3.6 \text{ MJ} \quad g = 9.8 \text{ m/s}^2 \quad e = 1.60 \times 10^{-19} \text{ C} \quad k = 9.00 \times 10^9 \text{ N}\cdot\text{m}^2/\text{C}^2$$

DERIVED UNITS

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

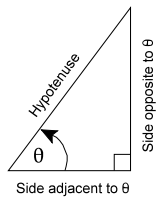
TRIGONOMETRY

RIGHT TRIANGLE (SOHCAHTOA)

$$\sin \theta = \frac{\textit{opposite}}{\textit{hypotenuse}}$$

$$\cos \theta = \frac{\textit{adjacent}}{\textit{hypotenuse}}$$

$$\tan \theta = \frac{\textit{opposite}}{\textit{adjacent}}$$



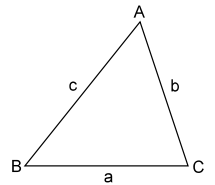
NON-RIGHT TRIANGLE (SINE & COSINE LAW)

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

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

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

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



ERROR

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

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

KINEMATICS

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

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

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

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

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

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

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

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

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 ($a \neq 0$).

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

DYNAMICS

$$\vec{F}_{\text{net}} = \sum \text{Forces}$$

$$\vec{F}_g = m\vec{g}$$

$$\vec{F}_G = \frac{Gm_1m_2}{\Delta d^2}$$

$$\vec{F}_{\text{net}} = m\vec{a}$$

$$\vec{F}_f = \mu \vec{F}_N$$

ENERGY & HEAT

$$W = \Delta E = F\Delta d$$

$$P = \frac{W}{\Delta t} = \frac{\Delta E}{\Delta t} = F \cdot v_{\text{avg}}$$

$$Q = mc\Delta t$$

$$\Delta E_G = mg\Delta h$$

$$Q_{\text{lost}} + Q_{\text{gained}} = 0$$

$$\Delta E_K = \frac{1}{2}m\Delta v^2$$

$$\text{efficiency} = \frac{E_{\text{out}}}{E_{\text{in}}} \times 100\%$$

$$Q_f = mL_f \quad \& \quad Q_v = mL_v$$

$$E_T = E_G + E_K$$

WAVES & SOUND

$$f = \frac{N}{\Delta t}$$

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

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

$$\frac{f_1}{f_2} = \frac{L_2}{L_1} = \frac{d_2}{d_1} = \frac{\sqrt{T_1}}{\sqrt{T_2}} = \frac{\sqrt{D_2}}{\sqrt{D_1}}$$

$$T = \frac{\Delta t}{N}$$

$$v = f\lambda$$

$$v = 331 + 0.60T$$

ELECTRICITY

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

SERIES CIRCUIT

PARALLEL CIRCUIT

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

$$V_T = V_1 + V_2 + \dots$$

$$V_T = V_1 = V_2 = \dots$$

$$V = IR$$

$$I_T = I_1 = I_2 = \dots$$

$$I_T = I_1 + I_2 + \dots$$

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

$$R_T = R_1 + R_2 + \dots$$

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

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

$$P_T = P_1 + P_2 + \dots$$

$$P_T = P_1 + P_2 + \dots$$

ELECTROMAGNETISM

$$\frac{F_1}{F_2} = \frac{I_1}{I_2} = \frac{V_1}{V_2} = \frac{N_1}{N_2}$$

$$\frac{N_p}{N_s} = \frac{V_p}{V_s} = \frac{I_s}{I_p}$$